ENGINEERING
TOMORROW

Programming Guide

VLT AutomationDrive FC 301/302

Software versions 9.12, 48.9X

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Contents

1 Introduction

1.1 Supported Software Versions

Supported software versions: 9.12 and 48.9X

This programming guide can be used for all FC 301 and FC 302 drives, and for VLT® Decentral Drive FCD 302. The software version number can be read from *parameter 15-43 Software Version*.

1.2 Integrated Motion Controller

The integrated motion controller (IMC) enables position control. For more information about IMC, refer to the *Chapter Integrated Motion Controller*.

2 Safety

2.1 Safety Precautions

⚠ W A R N I N G ⚠

LACK OF SAFETY AWARENESS

This guide provides important information on preventing injury and damage to the equipment or the system. Ignoring this information can lead to death, serious injury, or severe damage to the equipment.

- Make sure to fully understand the dangers and safety measures present in the application.
- Before performing any electrical work on the drive, lock out and tag out all power sources to the drive.

⚠ W A R N I N G ⚠

HAZARDOUS VOLTAGE

AC drives contain hazardous voltage when connected to AC mains or connected on the DC terminals. Failure to perform installation, start-up, and maintenance by qualified personnel can result in death or serious injury.

- Only qualified personnel must perform installation, start-up, and maintenance.

⚠ W A R N I N G ⚠

UNINTENDED START

When the drive is connected to AC mains, DC supply, or load sharing, the motor may start at any time, causing risk of death, serious injury, and equipment or property damage. The motor may start by activation of an external switch, a fieldbus command, an input reference signal from the LCP or LOP, via remote operation using MCT 10 Set-up software, or after a cleared fault condition.

- Press [Off] on the LCP before programming parameters.
- Disconnect the drive from the mains whenever personal safety considerations make it necessary to avoid unintended motor start.
- Check that the drive, motor, and any driven equipment are in operational readiness.

⚠ W A R N I N G ⚠

DISCHARGE TIME

The drive contains DC-link capacitors, which can remain charged even when the drive is not powered. High voltage can be present even when the warning indicator lights are off. Failure to wait the specified time after power has been removed before performing service or repair work can result in death or serious injury.

- Stop the motor.
- Disconnect all power sources, including permanent magnet type motors.
- Wait for capacitors to discharge fully. The discharge time is shown on the nameplate.
- Verify full discharge by measuring the voltage level.

⚠ WARNING ⚠

DISCHARGE TIME

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- Wait for capacitors to discharge fully. The discharge time is shown on the nameplate.
- Verify full discharge by measuring the voltage level.

NOTICE

USING THE SAFE TORQUE OFF

- When using the Safe Torque Off, always follow the instructions in VLT® Frequency Converters - Safe Torque Off Operating Instructions.

NOTICE

CONTROL SIGNALS

- Control signals from, or internally within, the drive may in rare cases be activated in error, be delayed, or fail to occur entirely. When used in situations where safety is critical, for example when controlling the electromagnetic brake function of a hoist application, do not rely on these control signals exclusively.

NOTICE

HAZARDOUS SITUATIONS

- Hazardous situations must be identified by the machine builder/integrator who is responsible for considering the necessary preventive means. More monitoring and protective devices may be included, always according to valid national safety regulations, for example law on mechanical tools and regulations for the prevention of accidents.

2.2 Safety Regulations

Crane, lifts, and hoists

The controlling of external brakes must always have a redundant system. The drive can in no circumstances be the primary safety circuit. Comply with relevant standards, for example:

- Hoists and cranes: IEC 60204-32
- Lifts: EN 81

Protection mode

Once a hardware limit on motor current or DC-link voltage is exceeded, the drive enters protection mode. Protection mode means a change of the PWM modulation strategy and a low switching frequency to minimize losses. This continues for 10 s after the last fault and increases the reliability and robustness of the drive while re-establishing full control of the motor.

In hoist applications, protection mode is not usable because the drive is unable to leave this mode again. Therefore it extends the time before activating the brake, which is not recommended. Protection mode can be disabled by setting *parameter 14-26 Trip Delay at Inverter Fault* to 0, which means that the drive trips immediately if 1 of the hardware limits is exceeded.

NOTICE

Disabling protection mode in hoisting applications is recommended.

3 Electrical Diagrams

3.1 Wiring Schematic

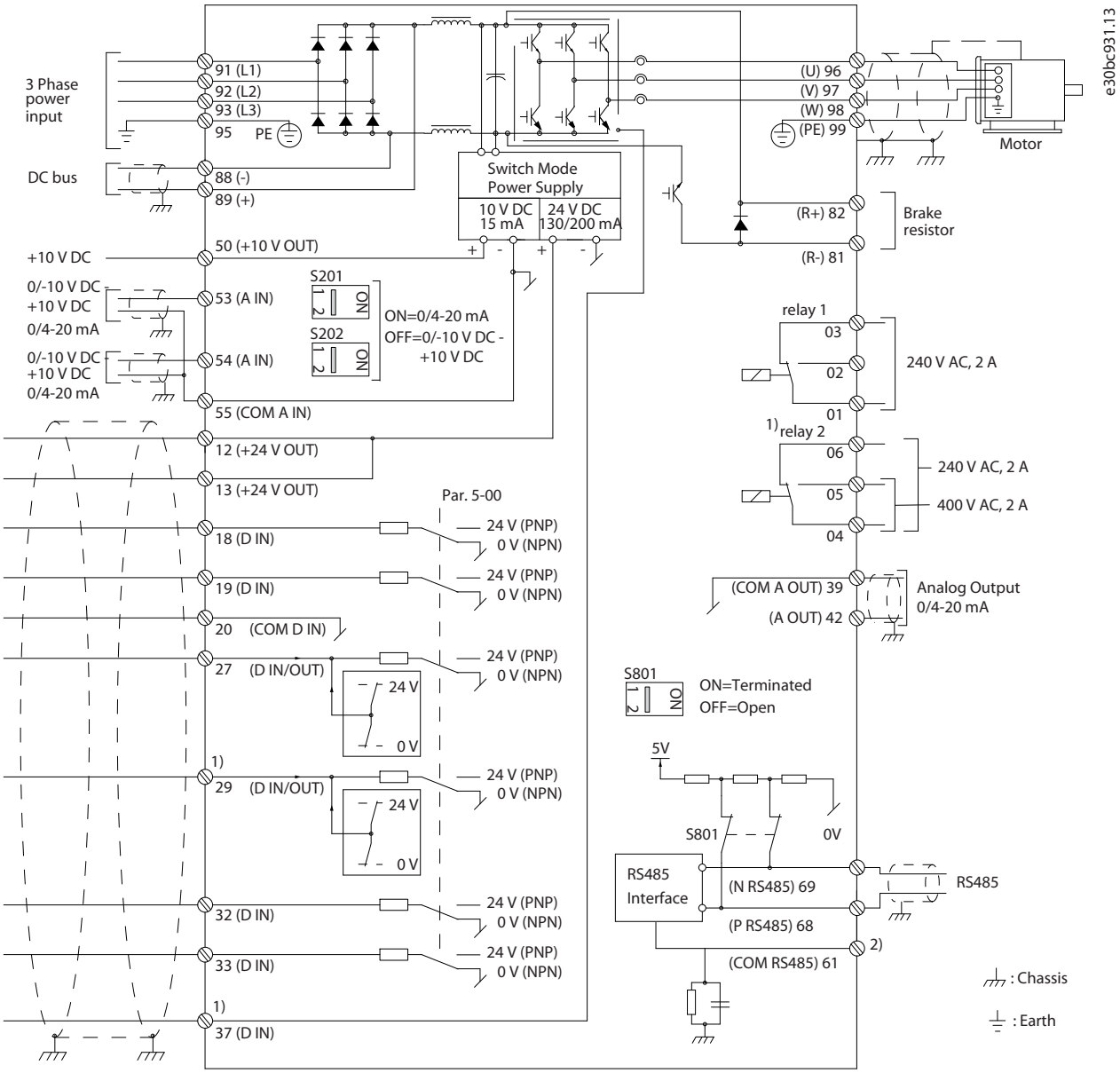


Illustration 1: Wiring Schematic

A=Analog, D=Digital

1) Do not connect cable shield.

Terminal 37 is used for Safe Torque Off (STO). For STO installation instructions, refer to the VLT® Frequency Converters - Safe Torque Off Operating Guide.

Long control cables and analog signals may in rare cases, depending on installation, result in 50/60 Hz ground loops due to noise from mains supply cables. If 50/60 Hz ground loops occur, consider breaking the shield or insert a 100 nF capacitor between shield and enclosure.

To avoid ground currents from both groups to affect other groups, connect the digital and analog inputs and outputs separately to the common inputs (terminals 20, 55, and 39) of the drive. For example, switching on the digital input may disturb the analog input signal.

Input polarity of control terminals

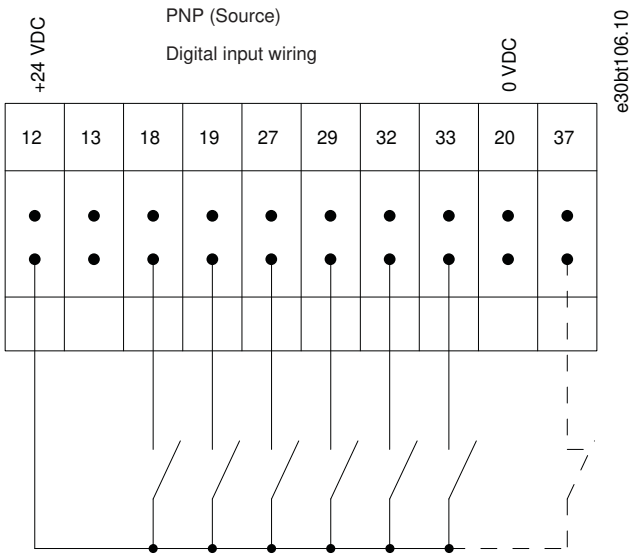


Illustration 2: PNP (Source)

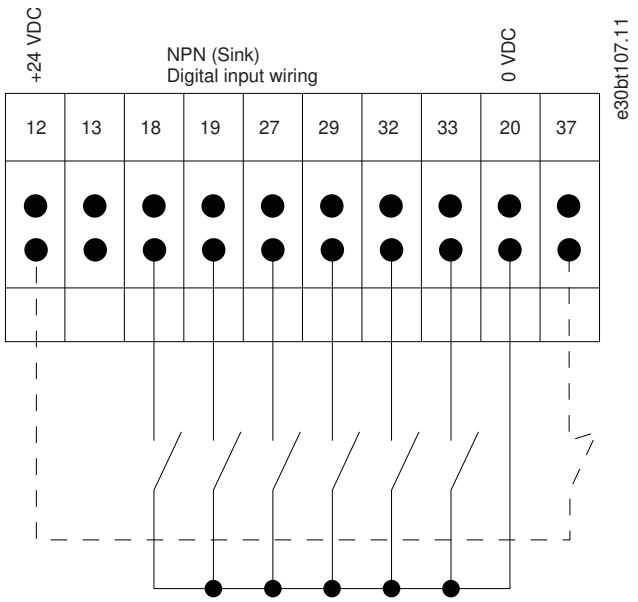


Illustration 3: NPN (Sink)

N O T I C E

Control cables must be shielded/armored.

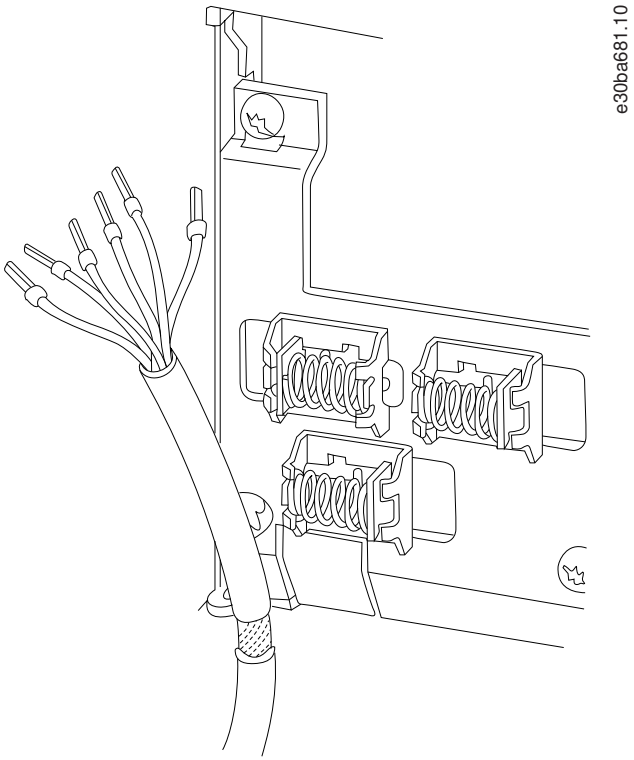


Illustration 4: Grounding of Shielded/Armored Control Cables

3.1.1 Start/Stop

Terminal 18 = *Parameter 5-10 Terminal 18 Digital Input [8] Start*.

Terminal 27 = *Parameter 5-12 Terminal 27 Digital Input [0] No operation* (Default *[2] Coast inverse*).

Terminal 37 = Safe Torque Off.

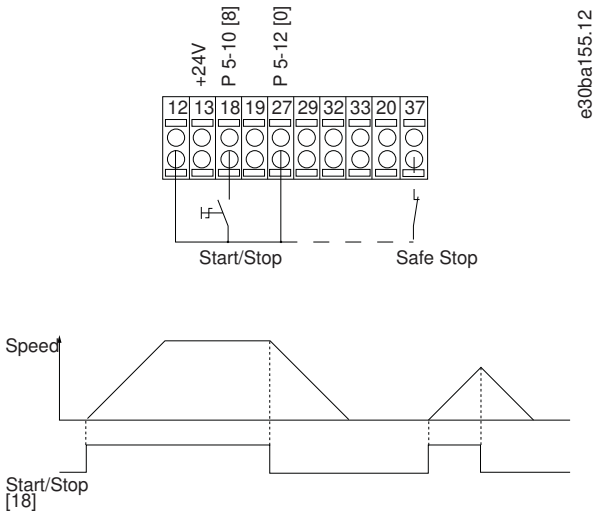


Illustration 5: Start/Stop

3.1.2 Pulse Start/Stop

Terminal 18 = *Parameter 5-10 Terminal 18 Digital Input [9] Latched start*.

Terminal 27 = *Parameter 5-12 Terminal 27 Digital Input [6] Stop inverse*.

Terminal 37 = Safe Torque Off.

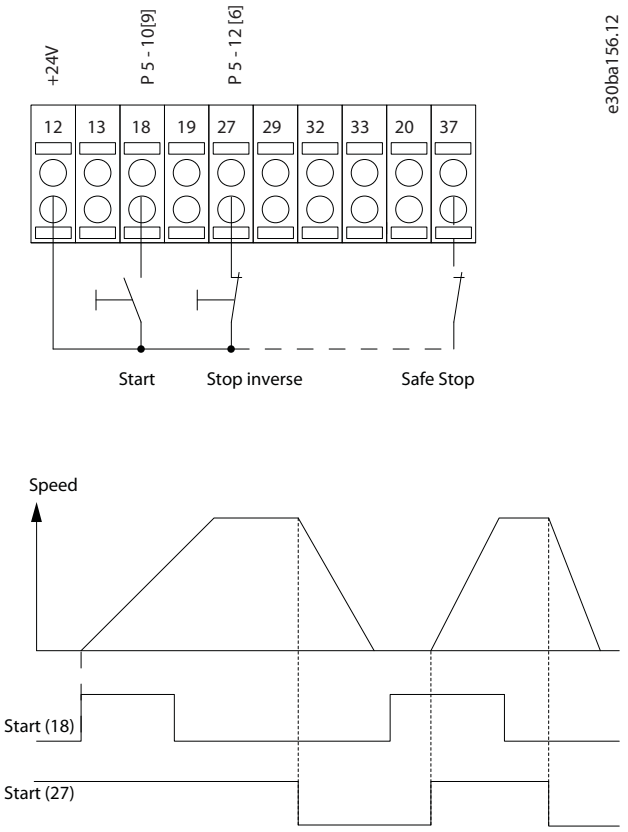


Illustration 6: Pulse Start/Stop

3.1.3 Speed Up/Speed Down

Terminal 18 = *Parameter 5-10 Terminal 18 Digital Input [8] Start*.

Terminal 27 = *Parameter 5-12 Terminal 27 Digital Input [19] Freeze reference*.

Terminal 37 = Safe Torque Off.

Terminal 29 = *Parameter 5-13 Terminal 29 Digital Input [21] Speed up*.

Terminal 32 = *Parameter 5-14 Terminal 32 Digital Input [22] Speed down*.

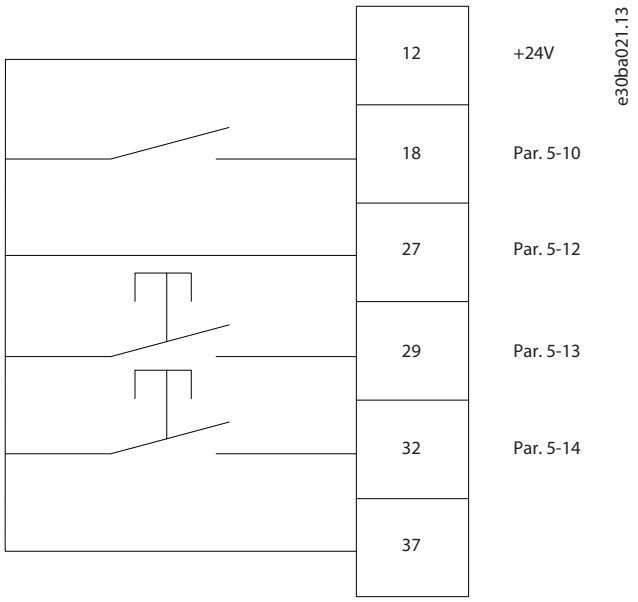


Illustration 7: Speed Up/Speed Down

3.1.4 Potentiometer Reference

Voltage reference via a potentiometer

Reference source 1 = [1] Analog input 53 (default).

Terminal 53, low voltage = 0 V.

Terminal 53, high voltage = 10 V.

Terminal 53, low reference/feedback = 0 RPM.

Terminal 53, high reference/feedback = 1500 RPM.

Switch S201 = OFF (U)

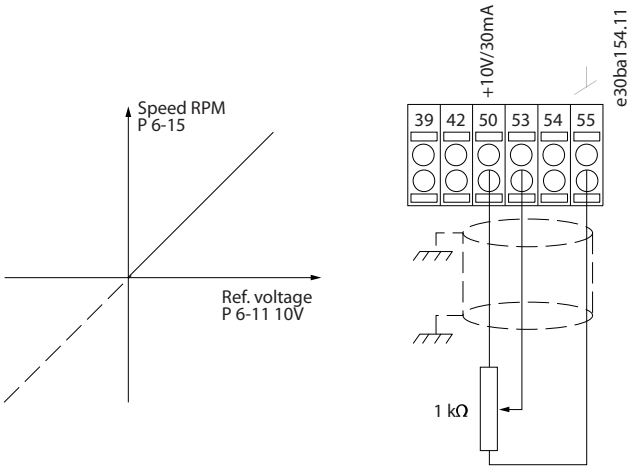


Illustration 8: Potentiometer Reference

4 How to Program

4.1 Local Control Panel

Easily program the drive via the local control panel (LCP).

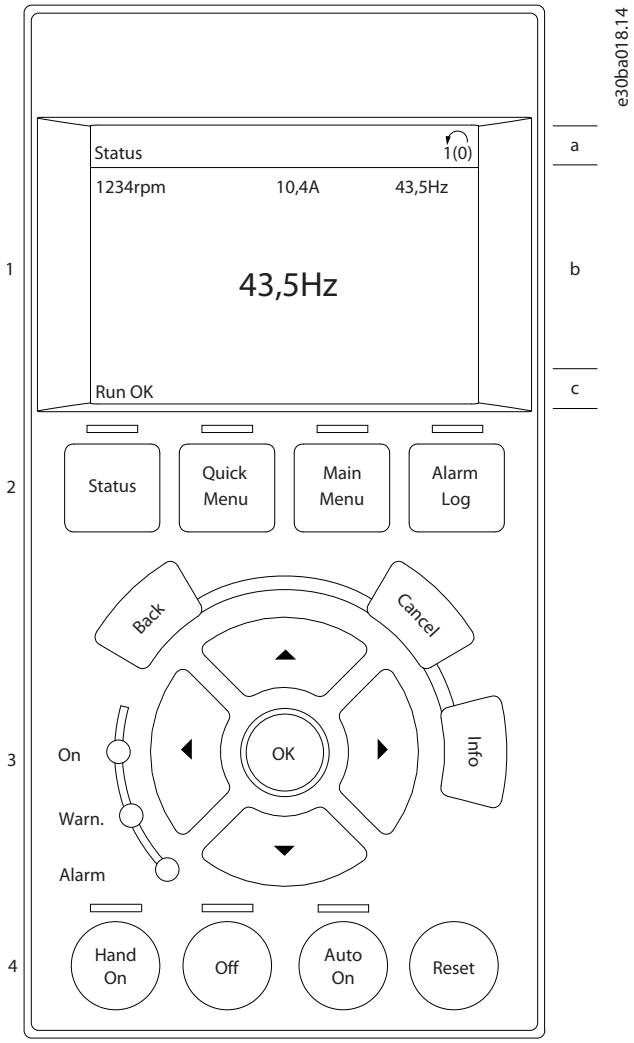


Illustration 9: LCP

1	Graphical display with status lines.	a	Status line: Status messages showing icons and graphics.
2	Menu keys and indicator lights - changing parameters and switching between display function.	b	Line 1–2: Operator data lines showing data defined or selected. Add up to 1 extra line by pressing [Status].
3	Navigation keys and indicator lights.	c	Status line: Status messages showing text.
4	Operation keys and indicator lights.		

The LCP display can show up to 5 items of operating data while showing *Status*.

N O T I C E

If start-up is delayed, the LCP shows the INITIALIZING message until it is ready. Adding or removing options can delay the start-up.

4.1.1 Quick Transfer of Parameter Settings between Multiple Drives

When the setup of a drive is completed, store the data in the LCP. Then connect the LCP to another drive and copy the parameter settings to the new drive.

4.1.1.1 Transferring Data from the Drive to the LCP

Procedure

1. Go to *parameter 0-50 LCP Copy*.
2. Press [OK].
3. Select *[1] All to LCP*.
4. Press [OK].

4.1.1.2 Transferring Data from the LCP to the Drive

Procedure

1. Go to *parameter 0-50 LCP Copy*.
2. Press [OK].
3. Select *[2] All from LCP*.
4. Press [OK].

4.1.2 Display Mode

In normal operation, up to 5 different operating variables can be indicated continuously in the middle section: 1.1, 1.2, and 1.3, as well as 2 and 3.

4.1.3 Display Mode - Selection of Readouts

It is possible to toggle between 3 status readout screens by pressing [Status].

Operating variables with different formatting are shown in each status view (status view I, status view II, status view III).

The following table shows the measurements that can be linked to each of the operating variables. When options are mounted, additional measurements are available.

Define the links via:

- *Parameter 0-20 Display Line 1.1 Small.*
- *Parameter 0-21 Display Line 1.2 Small.*
- *Parameter 0-22 Display Line 1.3 Small.*
- *Parameter 0-23 Display Line 2 Large.*
- *Parameter 0-24 Display Line 3 Large.*

Each readout parameter selected in *parameter 0-20 Display Line 1.1 Small* to *parameter 0-24 Display Line 3 Large* has its own scale and digits after a possible decimal point. The larger the numeric value of a parameter is, the fewer digits are shown after the decimal point.

Example: Current readout 5.25 A, 15.2 A, 105 A.

Table 1: Units

Operating variable	Unit
Parameter 16-00 Control Word	hex
Parameter 16-01 Reference [Unit]	[Unit]
Parameter 16-02 Reference [%]	%
Parameter 16-03 Status Word	hex
Parameter 16-05 Main Actual Value [%]	%
Parameter 16-06 Actual Position	
Parameter 16-09 Custom Readout	
Parameter 16-10 Power [kW]	[kW]

Operating variable	Unit
Parameter 16-11 Power [hp]	[hp]
Parameter 16-12 Motor Voltage	[V]
Parameter 16-13 Frequency	[Hz]
Parameter 16-14 Motor current	[A]
Parameter 16-15 Frequency [%]	%
Parameter 16-16 Torque [Nm]	Nm
Parameter 16-17 Speed [RPM]	[RPM]
Parameter 16-18 Motor Thermal	%
Parameter 16-20 Motor Angle	
Parameter 16-21 Torque [%] High Res.	%
Parameter 16-22 Torque [%]	%
Parameter 16-23 Motor Shaft Power [kW]	kW
Parameter 16-24 Calibrated Stator Resistance	Ω
Parameter 16-25 Torque [Nm] High	Nm
Parameter 16-30 DC Link Voltage	V
Parameter 16-32 Brake Energy /s	kW
Parameter 16-33 Brake Energy Average	kW
Parameter 16-34 Heatsink Temp.	°C
Parameter 16-35 Inverter Thermal	%
Parameter 16-36 Inv. Nom. Current	A
Parameter 16-37 Inv. Max. Current	A
Parameter 16-38 SL Controller State (This is an array parameter with the selections 16-38.0–16-38.3).	
Parameter 16-39 Control Card Temp.	°C
Parameter 16-40 Logging Buffer Full	
Parameter 16-42 Service Log Counter	
Parameter 16-43 Timed Actions Status	
Parameter 16-45 Motor Phase U Current	A
Parameter 16-46 Motor Phase V Current	A
Parameter 16-47 Motor Phase W Current	A
Parameter 16-48 Speed Ref. After Ramp [RPM]	RPM
Parameter 16-49 Current Fault Source	
Parameter 16-50 External Reference	

Operating variable	Unit
Parameter 16-51 Pulse Reference	
Parameter 16-52 Feedback[Unit]	[Unit]
Parameter 16-53 Digi Pot Reference	
Parameter 16-57 Feedback [RPM]	RPM
Parameter 16-60 Digital Input	bin
Parameter 16-61 Terminal 53 Switch Setting	V
Parameter 16-62 Analog Input 53	
Parameter 16-63 Terminal 54 Switch Setting	V
Parameter 16-64 Analog Input 54	
Parameter 16-65 Analog Output 42 [mA]	[mA]
Parameter 16-66 Digital Output [bin]	[bin]
Parameter 16-67 Pulse Input #29 [Hz]	[Hz]
Parameter 16-68 Freq. Input #33 [Hz]	[Hz]
Parameter 16-69 Pulse Output #27 [Hz]	[Hz]
Parameter 16-70 Pulse Output #29 [Hz]	[Hz]
Parameter 16-71 Relay Output [bin]	
Parameter 16-72 Counter A	
Parameter 16-73 Counter B	
Parameter 16-74 Prec. Stop Counter	
Parameter 16-80 Fieldbus CTW 1	hex
Parameter 16-82 Fieldbus REF 1	hex
Parameter 16-84 Comm. Option STW	hex
Parameter 16-85 FC Port CTW 1	hex
Parameter 16-86 FC Port REF 1	hex
Parameter 16-87 Bus Readout Alarm/Warning (This is an array parameter with the selections 16-87.0–16.87.2).	
Parameter 16-88 Fieldbus Torque FF.	
Parameter 16-89 Configurable Alarm/Warning Word	
Parameter 16-90 Alarm Word	hex
Parameter 16-92 Warning Word	hex
Parameter 16-93 Warning Word 2	hex
Parameter 16-94 Ext. Status Word	hex
Parameter 16-95 Ext. Status Word 2	hex

Operating variable	Unit
Parameter 16-96 Maintenance Word	hex
Parameter 16-97 Alarm Word 3	hex
Parameter 16-98 Warning Word 3	hex

4.1.3.1 Status View I

This readout state is standard after start-up or initialization. Press [Info] to obtain information about the units linked to the shown operating variables (1.1, 1.2, 1.3, 2 and 3). See the operating variables shown in the following illustration.

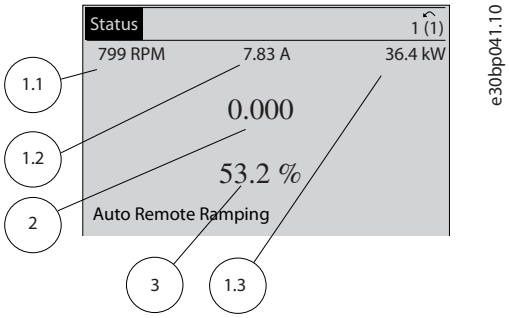


Illustration 10: Status View I

4.1.3.2 Status View II

See the operating variables (1.1, 1.2, 1.3, and 2) shown in the following illustration. In the example, speed, motor current, motor power, and frequency are selected as variables in the 1st and 2nd lines.

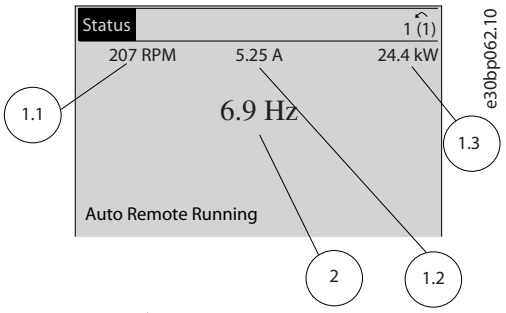


Illustration 11: Status View II

4.1.3.3 Status View III

This state shows the event and action of the smart logic control.

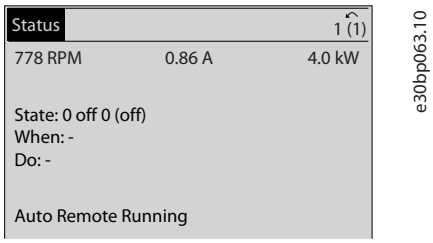


Illustration 12: Status View III

4.1.4 Parameter Setup

The drive can be used for practically all assignments. The drive offers 2 programming modes:

- Main menu mode
- Quick menu mode

Main menu provides access to all parameters.

Quick menu takes the user through a few parameters, making it possible to start operating the drive. Change a parameter in either main menu mode or quick menu mode.

4.1.5 Quick Menu Key Functions

Press [Quick Menu] to enter a list of different areas contained in the *Quick Menu*.

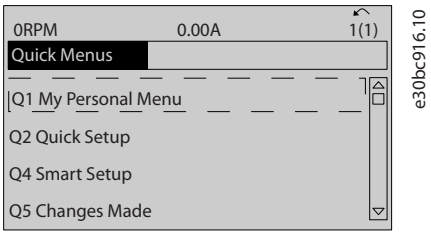


Illustration 13: Quick Menus

Select *Q1 My Personal Menu* to show the selected personal parameters. These parameters are selected in *parameter 0-25 My Personal Menu*. Up to 50 different parameters can be added in this menu.

Select *Q2 Quick Setup* to go through a selection of parameters to get the motor running almost optimally. The default settings for the other parameters consider the required control functions and the configuration of signal inputs/outputs (control terminals).

The parameter selection is effected with the navigation keys. The parameters in the following table are accessible.

Table 2: Selection of Parameter

Parameter	Setting
Parameter 0-01 Language	Select the language. Default is *[0] English*.
Parameter 1-20 Motor Power [kW]	[kW]
Parameter 1-22 Motor Voltage	[V]
Parameter 1-23 Motor Frequency	[Hz]
Parameter 1-24 Motor Current	[A]
Parameter 1-25 Motor Nominal Speed	[RPM]
Parameter 5-12 Terminal 27 Digital Input	*[0] No function*[1]
Parameter 1-29 Automatic Motor Adaptation (AMA)	*[1] Enable complete AMA*
Parameter 3-02 Minimum Reference	[RPM]
Parameter 3-03 Maximum Reference	[RPM]
Parameter 3-41 Ramp 1 Ramp Up Time	[s]
Parameter 3-42 Ramp 1 Ramp Down Time	[s]
Parameter 3-13 Reference Site	Select whether to control the drive via digital inputs, LCP, or remote control.

[1] If terminal 27 is set to *[0] No operation*, no connection to +24 V on terminal 27 is necessary.

Select *Changes made* to get information about:

- The last 10 changes. Use the [▵] [▿] navigation keys to scroll between the last 10 changed parameters.
- The changes made since default setting.

Select *Loggings* to get information about the shown line readouts. The information is shown as graphs. Only parameters selected in *parameter 0-20 Display Line 1.1 Small* and *parameter 0-24 Display Line 3 Large* can be viewed. It is possible to store up to 120 samples in the memory for later reference.

4.1.6 Initial Commissioning

The easiest way of carrying out the initial commissioning is by pressing [Quick Menu] and following the quick setup procedure using LCP 102 (read the following table from left to right). The example applies to open-loop applications.

Table 3: Quick Setup Procedure

Press				
Quick Menu	↓	Q2 Quick Menu.	OK	↓
Parameter 0-01 Language	OK	Set language.	↓	
Parameter 1-20 Motor Power [kW]	OK	Set motor nameplate power.	↓	
Parameter 1-22 Motor Voltage	OK	Set nameplate voltage.	↓	
Parameter 1-23 Motor Frequency	OK	Set nameplate frequency.	↓	
Parameter 1-24 Motor Current	OK	Set nameplate current.	↓	
Parameter 1-25 Motor Nominal Speed	OK	Set nameplate speed in RPM.	↓	
Parameter 5-12 Terminal 27 Digital Input	OK	If terminal default is *[2] Coast inverse*, it is possible to change this setting to *[0] No function*. No connection to terminal 27 is then needed for running AMA.	↓	

Parameter 1-29 Automatic Motor Adaptation (AMA)	OK	Set desired AMA function. Enable complete AMA is recommended.	↓	
Parameter 3-02 Minimum Reference	OK	Set the minimum speed of the motor shaft.	↓	
Parameter 3-03 Maximum Reference	OK	Set the maximum speed of the motor shaft.	↓	
Parameter 3-41 Ramp 1 Ramp Up Time	OK	Set the ramp-up time with reference to synchronous motor speed, n_s.	↓	↓
Parameter 3-42 Ramp 1 Ramp Down Time	OK	Set the ramp-down time with reference to synchronous motor speed, n_s.	↓	
Parameter 3-13 Reference Site	OK	Set the site from where the reference must work.	↓	

Another easy way of commissioning the drive is by using the smart application setup (SAS), which can also be found by pressing [Quick Menu]. To set up the applications listed, follow the instructions on the successive screens.

The [Info] key can be used throughout the SAS to see help information for various selections, settings, and messages. The following 3 applications are included:

- Mechanical brake.
- Conveyor.
- Pump/fan.

The following 4 fieldbusses can be selected:

- PROFIBUS.
- PROFINET.
- DeviceNet.
- EtherNet/IP.

N O T I C E

The drive ignores the start conditions when SAS is active.

N O T I C E

The smart setup runs automatically on the first power-up of the drive or after a reset to factory settings. If no action is taken, the SAS screen automatically disappears after 10 minutes.

4.1.7 Main Menu Mode

Press [Main Menu] to enter the main menu mode. The readout in the following illustration appears on the display. The middle and bottom sections in the display show a list of parameter groups, which can be selected by toggling the [▵] and [▿] keys.

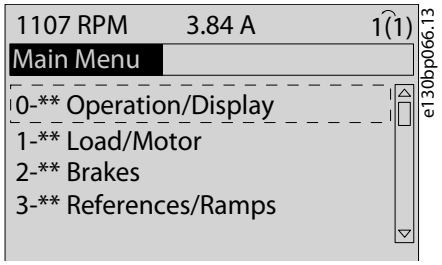


Illustration 14: Main Menu Mode

Each parameter has a name and number which remain the same regardless of the programming mode. In the main menu mode, the parameters are divided into groups. The first digit of the parameter number (from the left) indicates the parameter group number.

All parameters can be changed in the Main Menu. However, depending on the choice of configuration (*parameter 1-00 Configuration Mode*), some parameters can be hidden. For example, open loop hides all the PID parameters, and other enabled options make more parameter groups visible.

4.1.8 Parameter Selection

In the main menu mode, the parameters are divided into groups. Select a parameter group with the navigation keys.

After selecting a parameter group, select a parameter with the navigation keys.

The middle section on the display shows the parameter number and name, and the selected parameter value.

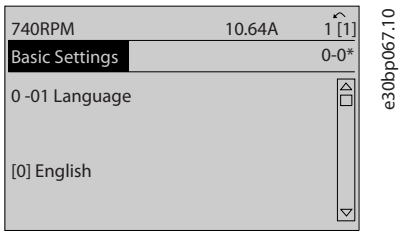


Illustration 15: Parameter Selection

4.1.9 Changing Data

The procedure for changing data in the quick menu mode and the main menu mode is the same. Press [OK] to change the selected parameter.

The procedure for changing data depends on whether the selected parameter represents a numeric data value or a text value.

4.1.10 Changing a Text Value

If the selected parameter is a text value, change the text value with the [▵] [▿] keys.

Place the cursor on the value to save and press [OK].

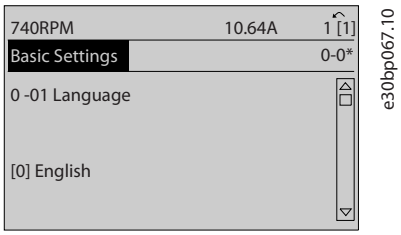


Illustration 16: Changing a Text Value

4.1.11 Changing a Data Value

If the selected parameter shows a numeric data value, change the selected data value with the [◂] [▸] and the [▵] [▿] navigation keys. Press the [◂] [▸] keys to move the cursor horizontally.

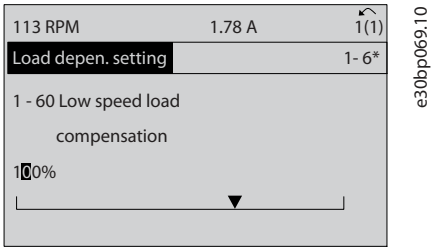


Illustration 17: Changing a Data Value

Press the [▵] [▿] keys to change the data value. [▵] increases the data value, and [▿] decreases the data value. Place the cursor on the value to save and press [OK].

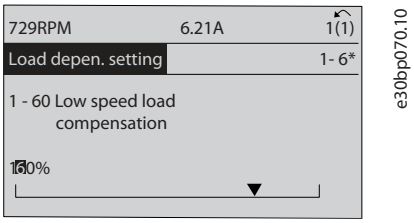


Illustration 18: Saving a Data Value

4.1.12 Infinitely Variable Change of Numeric Data Value

If the selected parameter shows a numeric data value, select a digit with [◂] [▸].

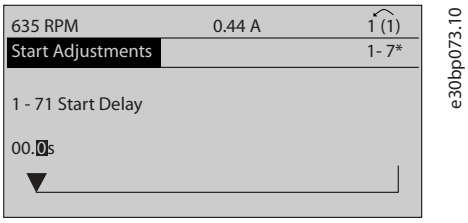


Illustration 19: Selecting a Digit

Change the selected digit infinitely variably with [▵] [▿]. The cursor indicates the selected digit. Place the cursor on the digit to save and press [OK].

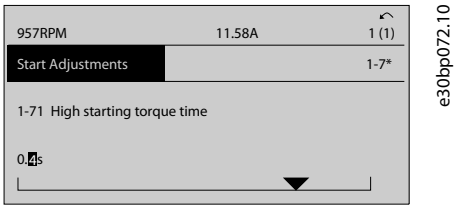


Illustration 20: Saving

4.1.13 Value, Step by Step

Certain parameters can be changed step by step. This applies to:

- *Parameter 1-20 Motor Power [kW].*
- *Parameter 1-22 Motor Voltage.*
- *Parameter 1-23 Motor Frequency.*

The parameters are changed both as a group of numeric data values and as numeric data values that are infinitely varying.

4.1.14 Readout and Programming of Indexed Parameters

Parameters are indexed when placed in a rolling stack. *Parameter 15-30 Fault Log: Error Code* to *parameter 15-32 Alarm Log: Time* contain a fault log, which can be read out. Select a parameter, press [OK], and press the [▵] [▿] keys to scroll through the value log.

4.1.14.1 Changing Values of Indexed Parameters

Change *parameter 3-10 Preset Reference* as an example.

Procedure

1. Select the parameter, press [OK], and press [▵] [▿] to scroll through the indexed values.
2. To change the parameter value, select the indexed value and press [OK].
3. Change the value by pressing [▵] [▿].
4. Press [OK] to accept the new setting.
5. Press [Cancel] to abort. Press [Back] to leave the parameter.

4.2 Numerical Local Control Panel

The following instructions are valid for the numerical LCP (LCP 101).

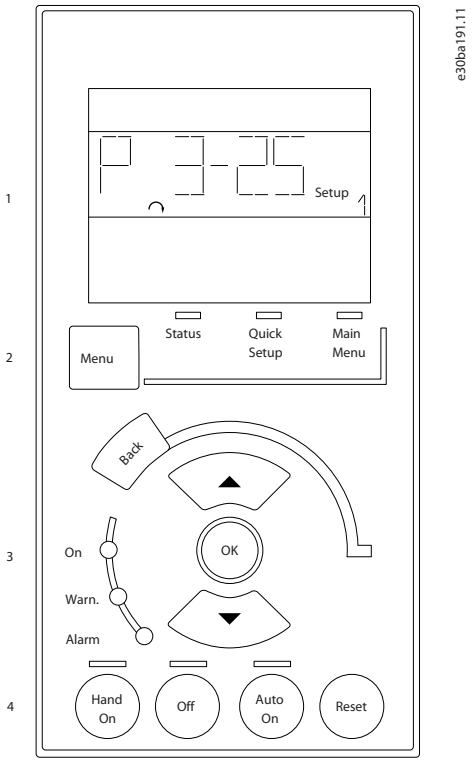


Illustration 21: NLCP

The NLCP is divided into 4 functional groups:

Table 4: Functional Groups of NLCP

1	Numerical display.
2	Menu keys and indicator lights - changing parameters and switching between display functions.
3	Navigation keys and indicator lights.
4	Operation keys and indicator lights.

Display line

Status messages showing icons and numeric value.

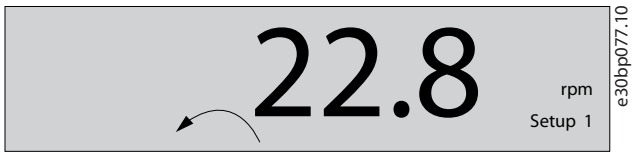
Indicator lights

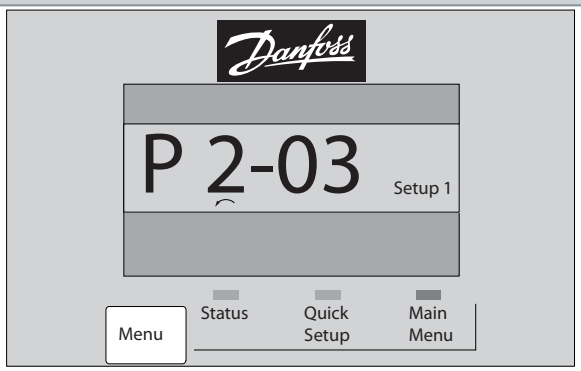
- Green LED/On: indicates if control section is on.
- Yellow LED/Wrn: indicates a warning.
- Flashing red LED/Alarm: indicates an alarm.

4.2.1 LCP Keys

The control keys are divided into functions. The keys below the display and indicator lights are used for parameter setup, including option of display indication during normal operation.

Table 5: LCP Keys and Description

LCP keys	Description
[Status]	Indicates the status of the drive and/or the motor. If an alarm occurs, the NLCP automatically switches to status mode. Several alarms can be shown. **N O T I C E** Parameter copy is not possible with LCP 101 numerical local control panel.  **Illustration 22: Status Mode**  **Illustration 23: Alarm**
[Quick Menu]/ [Main Menu]	Used for programming the parameters in the Quick Menu and Main Menu, respectively. When the value flashes, press [▲] or [▼] to change parameter values. Parameters with functional options show values such as [1], [2], and so on. For a description of the different options, see the individual parameter descriptions in 5 Parameter Descriptions.

LCP keys	Description
	 **Illustration 24: Main Menu/Quick Setup**
[Back]	Returns to the previous step or layer in the navigation structure.
Naviga-tion keys	The 2 navigation keys are used to navigate between the different options available in Quick Menu and Main Menu. Press the keys to move the cursor. **[OK]** Press to select a parameter marked by the cursor and to enable the change of a parameter.

Local control keys: Local control keys are at the bottom of the control panel.

Table 6: Local Control Keys and Description

LCP keys	Description
[Hand On]	Enables control of the drive via the LCP. [Hand On] also starts the motor, and it is now possible to enter the motor speed data with the navigation keys. The key can be selected as *[1] Enable* or *[0] Disable via parameter 0-40 [Hand on] Key on LCP*. External stop signals activated with control signals or a fieldbus override a start command via the LCP. The following control signals are still active when [Hand On] is activated: • [Hand On] - [Off] - [Auto On] • Reset • Coast stop inverse • Reversing • Setup select lsb - Setup select msb • Stop command from serial communication • Quick stop • DC brake
[Off]	Stops the connected motor. The key can be selected as *[1] Enable* or *[0] Disable via parameter 0-41 [Off] Key on LCP*. If the external stop function is not selected and the *[Off]* key is inactive, the motor can be stopped by disconnecting the voltage.
[Auto On]	Enables the drive to be controlled via the control terminals and/or serial communication. When a start signal is applied on the control terminals and/or the bus, the drive starts. The key can be selected as *[1] Enable* or *[0] Disable* via *parameter 0-42 [Auto on] Key on LCP*.

LCP keys	Description
	N O T I C E An active HAND-OFF-AUTO signal via the digital inputs has higher priority than the control keys [Hand On] – [Auto On].
[Reset]	Is used for resetting the drive after an alarm (trip). It can be selected as *[1] Enable* or *[0] Disable via parameter 0-43 [Reset] key on LCP*.

4.3 Restoring Factory Default Settings Using the Recommended Initialization

N O T I C E

LOSS OF DATA

Restoring default settings results in a loss of programming, motor data, localization, and monitoring records.

– To create a back-up, upload data to the LCP before initialization.

1. Press [Main Menu] twice to access parameters.
2. Go to *parameter 14-22 Operation Mode* and press [OK].

   Parameter 14-22 Operation Mode does not reset the following settings:
   - Running hours.
   - Serial communication options.
   - Personal menu settings.
   - Fault log, alarm log, and other monitoring functions.
3. Scroll to *Initialization* and press [OK].
4. Remove power to the unit and wait for the display to turn off.
5. Apply power to the unit. Default parameter settings are restored during start-up. Start-up takes slightly longer than normal.
6. After *alarm 80, Drive initialized* appears, press [Reset].

4.4 Restoring Factory Default Settings Using Manual Initialization

N O T I C E

LOSS OF DATA

Restoring default settings results in a loss of programming, motor data, localization, and monitoring records.

– To create a back-up, upload data to the LCP before initialization.

Procedure

1. Remove power to the unit and wait for the display to turn off.
2. Press and hold [Status], [Main Menu], and [OK] simultaneously while applying power to the unit (approximately 5 s or until an audible click sounds and the fan starts).

   Manually initializing does not reset the following parameter settings:
   - *Parameter 15-00 Operating Hours*
   - *Parameter 15-03 Power Up's*
   - *Parameter 15-04 Over Temp's*
   - *Parameter 15-05 Over Volt's*

   Start-up takes slightly longer than normal.

NOTICE

A manual initialization also resets serial communication, RFI filter settings, and fault log settings.

5 Parameter Descriptions

5.1 Parameter Group 0-** Operation and Display

Parameters related to the fundamental functions of the drive, function of the LCP keys, and configuration of the LCP display.

5.1.1 0-0* Basic Settings

Parameter 0-01 Language

Table 7: Parameter 0-01 Language

0-01 Language		
Default value: [0] English	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Defines the language to be used in the display. All languages are available in the drive. English cannot be erased or manipulated.

Option	Name	Description
[0]*	English	
[1]	Deutsch	
[2]	Français	
[3]	Dansk	
[4]	Español	
[5]	Italiano	
[6]	Svenska	
[7]	Nederlands	
[10]	Chinese	
[20]	Suomi	
[22]	English US	
[27]	Greek	
[28]	Bras. Port	
[36]	Slovenian	
[39]	Korean	
[40]	Japanese	
[41]	Turkish	
[42]	Trad.Chinese	
[43]	Bulgarian	
[44]	Srpski	
[45]	Romanian	
[46]	Magyar	
[47]	Czech	

Option	Name	Description
[48]	Polski	
[49]	Russian	
[50]	Thai	
[51]	Bahasa Indonesia	

Parameter 0-02 Motor Speed Unit

Table 8: Parameter 0-02 Motor Speed Unit

0-02 Motor Speed Unit		
Default value: [0] RPM	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: False

NOTICE

This parameter cannot be adjusted while the motor is running.

NOTICE

Changing the motor speed unit resets certain parameters to their initial value. Select the motor speed unit before modifying other parameters.

The information shown in the display depends on the settings in *parameter 0-02 Motor Speed Unit* and *parameter 0-03 Regional Settings*. The default settings of *parameter 0-02 Motor Speed Unit* and *parameter 0-03 Regional Settings* depend on the region to which the drive is supplied.

Option	Name	Description
[0]	RPM	Select to show motor speed variables and parameters using motor speed (RPM).
[1]	Hz	Select to show motor speed variables and parameters using output frequency (Hz).

Parameter 0-03 Regional Settings

Table 9: Parameter 0-03 Regional Settings

0-03 Regional Settings		
Default value: [0] International	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: False

NOTICE

This parameter cannot be adjusted while the motor is running.

Option	Name	Description
[0]	International	Activate *parameter 1-20 Motor Power [kW]* for setting the motor power in kW and set the default value of *parameter 1-23 Motor Frequency* to 50 Hz.
[1]	North America	Activate *parameter 1-20 Motor Power [kW]* for setting the motor power in hp and set the default value of *parameter 1-23 Motor Frequency* to 60 Hz.

Parameter 0-04 Operating State at Power-up (Hand)

Table 10: Parameter 0-04 Operating State at Power-up (Hand)

0-04 Operating State at Power-up (Hand)		
Default value: [1] Forced stop, ref=old	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the operating mode upon reconnection of the drive to mains voltage after power-down in hand-on mode.

Option	Name	Description
[0]	Resume	Restart the drive, maintaining the start/stop settings (applied by [Hand On]/[Off]) selected before the power-down of the drive.
[1]*	Forced stop, ref=old	Restart the drive with a saved local reference after mains voltage reappears and after pressing [Hand On].
[2]	Forced stop, ref=0	Reset the local reference to 0 when restarting the drive.

5.1.2 0-1* Set-up Operations

Define and control the individual parameter setups. The drive has 4 parameter setups that can be programmed independently of each other. This makes the drive very flexible and able to solve advanced control functionality problems, often saving the cost of external control equipment. Parameter setups can be used to program the drive to operate according to 1 control scheme in 1 setup (for example, motor 1 for horizontal movement) and another control scheme in another setup (for example, motor 2 for vertical movement). Alternatively, parameter setups can be used by an OEM machine builder to identically program all their factory-fitted drives for different machine types within a range to have the same parameters. During production/commissioning, simply select a specific setup depending on which machine the drive is installed on.

The active setup (that is the setup in which the drive is currently operating) can be selected in *parameter 0-10 Active Set-up* and is shown in the LCP. By using multi setup, it is possible to switch between setups with the drive running, or it can be stopped via digital input or serial communication commands. If it is necessary to change setups while the drive is running, ensure that *parameter 0-12 This Set-up Linked to* is programmed as required. By using *parameter 0-11 Edit Set-up*, it is possible to edit parameters within any of the setups while continuing the operation of the drive in its active setup, which can be a different setup to the 1 being edited. By using *parameter 0-51 Set-up Copy*, it is possible to copy parameter settings between the setups to enable quicker commissioning if similar parameter settings are required in different setups.

Use *parameter 0-51 Set-up Copy* to copy a setup to 1 or all other setups. Stop the drive before switching between setups where parameters marked not changeable during operation have different values. To avoid conflicting settings of the same parameter within 2 different setups, link the setups together using *parameter 0-12 This Set-up Linked to*. Parameters which are not changeable during operation are marked FALSE in the *Change during operation* field.

Parameter 0-10 Active Set-up

Table 11: Parameter 0-10 Active Set-up

0-10 Active Set-up		
Default value: [1] Set-up 1	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Select the setup to control the drive functions.

Option	Name	Description
[0]	Factory setup	Cannot be changed. It contains the Danfoss data set and can be used as a data source when returning the other setups to a known state.
[1]*	Set-up 1	*[1] Set-up 1* to *[4] Set-up 4* are the 4 separate parameter setups within which all parameters can be programmed.
[2]	Set-up 2	

Option	Name	Description
[3]	Set-up 3	
[4]	Set-up 4	
[9]	Multi Set-up	Remote setup selections using digital inputs and the serial communication port. This setup used the settings from *parameter 0-12 This Set-up Linked to*. Stop the drive before making changes to open-loop and closed-loop functions.

Parameter 0-11 Edit Set-up

Table 12: Parameter 0-11 Edit Set-up

0-11 Edit Set-up		
Default value: [1] Set-up 1	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the setup to be edited (programmed) during operation, either the active setup or 1 of the inactive setups.

Option	Name	Description
[0]	Factory setup	Cannot be edited, but it is useful as a data source to return the other setups to a known state.
[1]*	Set-up 1	*[1] Set-up 1* to *[4] Set-up 4* can be edited freely during operation, independently of the active setup.
[2]	Set-up 2	
[3]	Set-up 3	
[4]	Set-up 4	
[9]	Active Set-up	Can also be edited during operation. Edit the selected setup from a range of sources: LCP, FC RS485, FC USB, or up to 5 fieldbus sites.

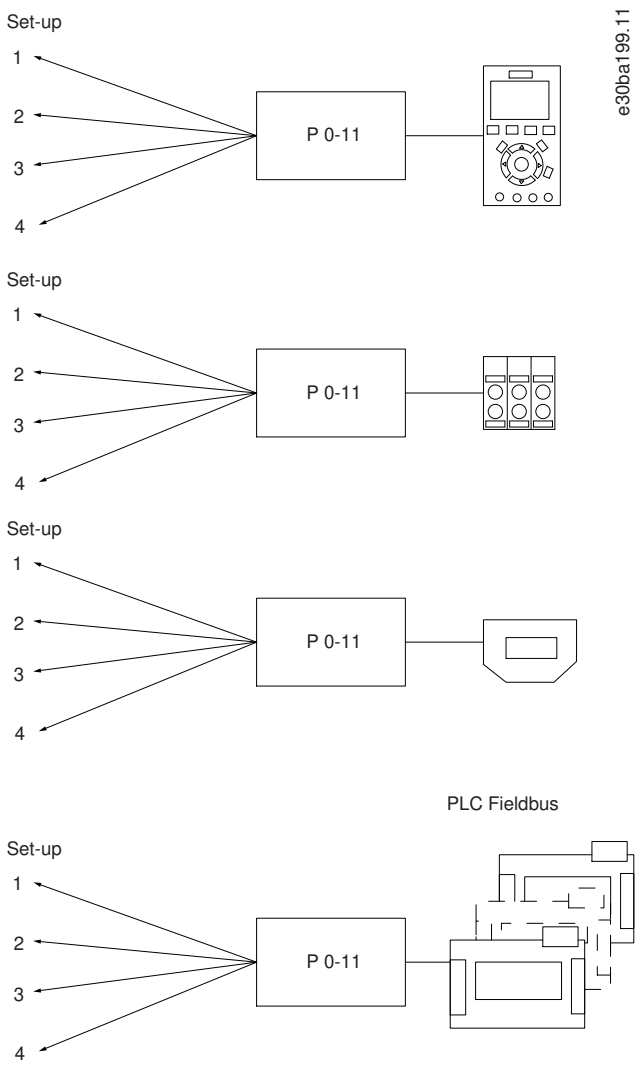


Illustration 25: Edit Setup

Parameter 0-12 This Set-up Linked to

Table 13: Parameter 0-12 This Set-up Linked to

0-12 This Set-up Linked to		
Default value: [0] Not linked	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

To enable conflict-free changes from 1 setup to another during operation, link setups containing parameters which are not changeable during operation. The link ensures synchronizing of the not changeable during operation-parameter values when moving from 1 setup to another during operation. Not changeable during operation-parameters can be identified by the label FALSE in the *Change during operation* field. *Parameter 0-12 This Set-up Linked to* is used by *[9] Multi set-up* in *parameter 0-10 Active Set-up*. Multi setup is used to move from 1 setup to another during operation.

Option	Name	Description
[0]*	Not linked	
[1]	Set-up 1	

Option	Name	Description
[2]	Set-up 2	
[3]	Set-up 3	
[4]	Set-up 4	

Example

Use multi set-up to shift from setup 1 to setup 2 while the motor is running. Program in setup 1 first, then ensure that setup 1 and setup 2 are synchronized (or linked). Synchronization can be performed in 2 ways:

- Select the following options:
  - *[2] Set-up 2* in *parameter 0-11 Edit Set-up*
  - Set *parameter 0-12 This Set-up Linked to* to *[1] Set-up 1*.

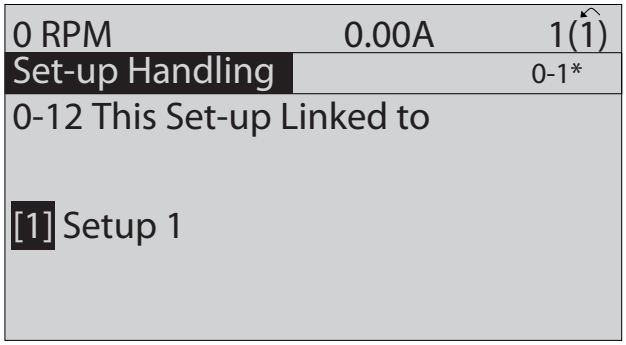


Illustration 26: Setup 1

- While still in setup 1, copy setup 1 to setup 2. Then set *parameter 0-12 This Set-up Linked to* to *[2] Set-up 2*.

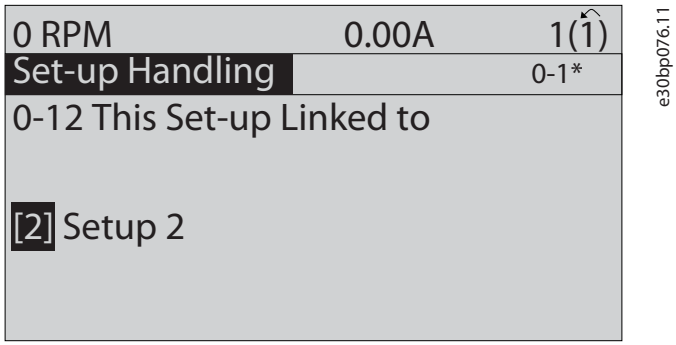


Illustration 27: Setup 2

Parameter 0-13 Readout: Linked Set-ups

Table 14: Parameter 0-13 Readout: Linked Set-ups

0-13 Readout: Linked Set-ups		
Default value: 0	Parameter type: Range, 0 – 255, Array [5]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View a list of all the setups linked by *parameter 0-12 This Set-up Linked to*. The parameter has 1 index for each parameter setup. The value for each index shows which setups are linked to that parameter setup.

Table 15: Setup Link Example

Index	LCP value
0	{0}
1	{1,2}
2	{1,2}
3	{3}
4	{4}

Parameter 0-14 Readout: Edit Set-ups/Channel

Table 16: Parameter 0-14 Readout: Edit Set-ups/Channel

0-14 Readout: Edit Set-ups/Channel		
Default value: 0	Parameter type: Range, -2147483648–2147483647	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: False

View the setting of *parameter 0-11 Edit Set-up* for each of the 4 different communication channels. When the number is shown as a hex number, as it is in the LCP, each number represents 1 channel. Numbers 1–4 represent a setup number; F means factory setting; and A means active setup. The channels are, from right to left: LCP, FC bus, USB, HPFB1-5.

Example

The number AAAAAA21h means the following:

- The drive received the setting of setup 2 via a fieldbus channel. The selection is reflected in *parameter 0-11 Edit Set-up*.
- A user selected setup 1 via the LCP.
- All other channels are using the active setup.

Parameter 0-15 Readout: Actual Set-up

Table 17: Parameter 0-15 Readout: Actual Set-up

0-15 Readout: Actual Set-up		
Default value: 0	Parameter type: Range, 0–255	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

Makes it possible to read out the active setup, also when *[9] Multi Set-up* is selected in *parameter 0-10 Active Set-up*.

5.1.3 0-2* LCP Display

Define the variables shown in the LCP.

For information on how to write display texts, refer to:

- Parameter 0-37 Display Text 1.
- Parameter 0-38 Display Text 2.
- Parameter 0-39 Display Text 3.

Parameter 0-20 Display Line 1.1 Small

Table 18: Parameter 0-20 Display Line 1.1 Small

0-20 Display Line 1.1 Small		
Default value: [1617] Speed RPM	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint16	Change during operation: True

Select a variable for display in line 1, left position.

Option	Name	Description
[0]	None	No display value selected.
[9]	Performance Monitor	
[15]	Readout: actual setup	
[37]	Display Text 1	Enables an individual text string to be written for showing in the LCP or to be read via serial communication.
[38]	Display Text 2	Enables an individual text string to be written for showing in the LCP or to be read via serial communication.
[39]	Display Text 3	Enables an individual text string to be written for showing in the LCP or to be read via serial communication.
[89]	Date and Time Readout	Shows the current date and time.
[748]	PCD Feed Forward	
[953]	PROFIBUS Warning Word	Shows the PROFIBUS communication warnings.
[1005]	Readout Transmit Error Counter	View the number of CAN control transmission errors since the last power-up.
[1006]	Readout Receive Error Counter	View the number of CAN control receipt errors since the last power-up.
[1007]	Readout Bus Off Counter	View the number of bus off-events since the last power-up.
[1013]	Warning Parameter	View a DeviceNet-specific warning word. One separate bit is assigned to every warning.
[1230]	Warning Parameter	
[1397]	Alert Alarm Word	
[1398]	Alert Warning Word	
[1399]	Alert Status Word	
[1472]	Legacy Alarm Word	
[1473]	Legacy Warning Word	
[1474]	Leg. Ext. Status Word	
[1500]	Operating Hours	
[1501]	Running Hours	View the number of running hours of the motor.
[1502]	kWh Counter	View the mains power consumption in kWh.
[1580]	Fan Running Hours	
[1587]	kWh Counter Hires	
[1600]	Control Word	View the control word sent from the drive via the serial communication port in hex code.
[1601]	Reference [Unit]	Total reference (sum of digital/analog/preset/bus/freeze reference/catch up and slow down) in selected unit.
[1602]	Reference %	Total reference (sum of digital/analog/preset/bus/freeze reference/catch up and slow down) in percent.
[1603]	Status Word	Present status word.

Option	Name	Description
[1605]	Main Actual Value [%]	View the 2-byte word sent with the status word to the bus master reporting the main actual value in %.
[1606]	Actual Position	Actual position in position units selected in *parameter 17-70 Position Unit*.
[1607]	Target Position	Active target position in position units selected in *parameter 17-70 Position Unit*.
[1608]	Position Error	Actual position PI error in position units selected in *parameter 17-70 Position Unit*.
[1609]	Custom Readout	View the user-defined readouts as defined in: • *Parameter 0-30 Custom Readout Unit* • *Parameter 0-31 Custom Readout Min Value* • *Parameter 0-32 Custom Readout Max Value*
[1610]	Power [kW]	Actual power consumed by the motor in kW.
[1611]	Power [hp]	Actual power consumed by the motor in hp.
[1612]	Motor Voltage	Voltage supplied to the motor.
[1613]	Frequency	Motor frequency, that is, the output frequency from the drive in Hz.
[1614]	Motor Current	Phase curent of the motor measured as effective value.
[1615]	Frequency [%]	Motor frequency, that is, the output frequency from the drive in percent.
[1616]	Torque [Nm]	Actual motor torque in Nm.
[1617]*	Speed [RPM]	Speed in RPM (revolutions per minute), that is, the motor shaft speed in closed loop.
[1618]	Motor Thermal	Thermal load on the motor calculated by the ETR function.
[1619]	Thermistor Sensor Temperature	
[1620]	Motor Angle	
[1621]	Torque [%] High Res.	
[1622]	Torque [%]	Present motor load as a percentage of the rated motor torque.
[1623]	Motor Shaft Power [kW]	
[1624]	Calibrated Stator Resistance	
[1625]	Torque [Nm] High	
[1628]	Angle Error	
[1630]	DC Link Voltage	DC-link voltage in the drive.
[1631]	System Temp.	
[1632]	Brake Energy /s	Present brake power transferred to an external brake resistor. Stated as an instant value.
[1633]	Brake Energy Average	Brake power transferred to an external brake resistor. The mean power is calculated continuously for the most recent 120 s.
[1634]	Heatsink Temp.	Present heat sink temperature of the drive. The cutout limit is 95 ±5 °C (203 ±9 °F); cutting back in occurs at 70 ±5 °C (158 ±9 °F).
[1635]	Inverter Thermal	Percentage load of the inverters.

Option	Name	Description
[1636]	Inv. Nom. Current	Nominal current of the inverter.
[1637]	Inv. Max. Current	Maximum current of the inverter.
[1638]	SL Controller State	State of the event executed by the control.
[1639]	Control Card Temp.	Temperature of the control card.
[1642]	Service Log Counter	
[1643]	Timed Actions Status	See *parameter group 23-0* Timed Actions*.
[1644]	Speed Error [RPM]	
[1645]	Motor Phase U Current	
[1646]	Motor Phase V Current	
[1647]	Motor Phase W Current	
[1648]	Speed. Ref. After Ramp [RPM]	
[1650]	External Reference	Sum of the external reference as a percentage, that is, the sum of analog/pulse/bus.
[1651]	Pulse Reference	Frequency in Hz connected to the digital inputs (18, 19 or 32, 33).
[1652]	Feedback[Unit]	Reference value from programmed digital inputs.
[1653]	Digi Pot Reference	View the contribution of the digital potentiometer to the actual refernece feedback.
[1657]	Feedback [RPM]	
[1660]	Digital Input	Signal states from the 6 digital terminals (18, 19, 27, 29, 32, and 33). There are 16 bits in total, but only 6 of them are used. Input 18 corresponds to the far left of the used bits. Signal log=0; Signal high=1.
[1661]	Terminal 53 Switch Setting	Setting of input terminal 53. Current=0; Voltage=1.
[1662]	Analog Input 53	Actual value at input 53 either as a reference or protection value.
[1663]	Terminal 54 Switch Setting	Setting of input terminal 54. Current=0; Voltage=1.
[1664]	Analog Input 54	Actual value at input 54 either as reference or protection value.
[1665]	Analog Output 42 [mA]	Actual value at output 42 in mA. Use *parameter 6-50 Terminal 42 Output* to select the value to be shown.
[1666]	Digital Output [bin]	Binary value of all digital outputs.
[1667]	Freq. Input #29 [Hz]	Actual value of the frequency applied at terminal 29 as an impulse input.
[1668]	Freq. Input #33 [Hz]	Actual value of the frequency applied at terminal 33 as an impulse input.
[1669]	Pulse Output #27 [Hz]	Actual value of impulses applied to terminal 27 in digital output mode.
[1670]	Pulse Output #29 [Hz]	Actual value of impulses applied to terminal 29 in digital output mode.
[1671]	Relay Output [bin]	View the settings of all relays.
[1672]	Counter A	Application-dependent (for example, SLC control).
[1673]	Counter B	Application-dependent(for example, SLC control).
[1674]	Prec. Stop Counter	Shows the actual value of the counter.

Option	Name	Description
[1675]	Analog In X30/11	Actual value at input X30/11 either as reference or protection value.
[1676]	Analog In X30/12	Actual value at input X30/12 either as reference or protection value.
[1677]	Analog Out X30/8 [mA]	Actual value at output X30/8 in mA. Use *parameter 6-60 Terminal X30/8 Output* to select the value to be shown.
[1678]	Analog Out X45/1 [mA]	
[1679]	Analog Out X45/3 [mA]	
[1680]	Fieldbus CTW 1	Control word (CTW) received from the bus master.
[1681]	Fieldbus Sync. REF	
[1682]	Fieldbus REF 1	Mains reference value sent with control word from the bus master.
[1683]	Fielbus Pos. REF	
[1684]	Comm. Option STW	Extended fieldbus communication option status word.
[1685]	FC Port CTW 1	Control word (CTW) received from the bus master.
[1686]	FC Port REF 1	Status word (STW) sent to the bus master.
[1687]	Bus Readout Alarm/Warning	
[1688]	Fieldbus Torque FF	
[1689]	Configurable Alarm/Warning Word	
[1690]	Alarm Word	One or more alarms in a hex code.
[1691]	Alarm Word 2	One or more alarms in a hex code.
[1692]	Warning Word	One or more warnings in a hex code.
[1693]	Warning Word 2	One or more warnings in a hex code.
[1694]	Ext. Status Word	One or more status conditions in a hex code.
[1695]	Ext. Status Word 2	One or more status conditions in a hex code.
[1696]	Maintenance Word	The bits reflect the status for the programmed preventice maintenance events in *parameter group 23-1* Maintenance*.
[1697]	Alarm Word 3	
[1698]	Warning Word 3	
[1804]	Mech Brake Count	
[1820]	Commanded Position	
[1821]	Master Position	
[1823]	Virtual Master Pos.	
[1827]	Safe Opt. Est. Speed	
[1828]	Safe Opt. Meas. Speed	
[1829]	Safe Opt. Speed Error	

Option	Name	Description
[1836]	Analog Input X48/2 [mA]	
[1837]	Temp. Input X48/4	
[1838]	Temp. Input X48/7	
[1839]	Temp. Input X48/10	
[1840]	Analog Input X49/1	
[1841]	Analog Input X49/3	
[1842]	Analog Input X49/5	
[1843]	Analog Out X49/7	
[1844]	Analog Out X49/9	
[1845]	Analog Out X49/11	
[1846]	X49 Digital Output [bin]	
[1860]	Digital Input 2	
[1870]	Mains Voltage	
[1871]	Mains Frequency	
[1872]	Mains Imbalance	
[1873]	Worst Inrush	
[1874]	Inrush Mode	
[1875]	Rectifier DC Volt.	
[1876]	Mains Voltage2	
[1877]	Mains Frequency2	
[1878]	Mains Imbalance2	
[1879]	Rectifier DC Volt.2	
[1890]	Process PID Error	
[1891]	Process PID Output	
[1892]	Process PID Clamped Output	
[1893]	Process PID Gain Scaled Output	
[1899]	Speed PID Torque FF. [Nm]	
[2316]	Maintenance Text	
[3019]	Wobble Delta Freq. Scaled	
[3110]	Bypass Status Word	
[3111]	Bypass Running Hours	
[3401]	PCD 1 Write to MCO	

Option	Name	Description
[3402]	PCD 2 Write to MCO	
[3403]	PCD 3 Write to MCO	
[3404]	PCD 4 Write to MCO	
[3405]	PCD 5 Write to MCO	
[3406]	PCD 6 Write to MCO	
[3407]	PCD 7 Write to MCO	
[3408]	PCD 8 Write to MCO	
[3409]	PCD 9 Write to MCO	
[3410]	PCD 10 Write to MCO	
[3421]	PCD 1 Read from MCO	
[3422]	PCD 2 Read from MCO	
[3423]	PCD 3 Read from MCO	
[3424]	PCD 4 Read from MCO	
[3425]	PCD 5 Read from MCO	
[3426]	PCD 6 Read from MCO	
[3427]	PCD 7 Read from MCO	
[3428]	PCD 8 Read from MCO	
[3429]	PCD 9 Read from MCO	
[3430]	PCD 10 Read from MCO	
[3440]	Digital Inputs	
[3441]	Digital Outputs	
[3450]	Actual Position	
[3451]	Commanded Position	
[3452]	Actual Master Position	
[3453]	Slave Index Position	
[3454]	Master Index Position	
[3455]	Curve Position	
[3456]	Track Error	
[3457]	Synchronizing Error	
[3458]	Actual Velocity	
[3459]	Actual Master Velocity	
[3460]	Synchronizing Status	

Option	Name	Description
[3461]	Axis Status	
[3462]	Program Status	
[3464]	MCO 302 Status	
[3465]	MCO 302 Control	
[3466]	SPI Error Counter	
[3470]	MCO Alarm Word 1	
[3471]	MCO Alarm Word 2	
[4029]	B-EMF Protection Log Readout	
[4235]	S-CRC Value	
[4282]	Safe Control Word	
[4283]	Safe Status Word	
[4285]	Active Safe Func.	
[4286]	Safe Option Info	
[4521]	Status	
[4522]	Progress	
[4523]	Baseline Failure	
[4590]	Stator [%]	
[4591]	Load [%]	
[4592]	Sensor 1 [%]	
[4593]	Sensor 1 [unit]	
[4594]	Sensor 2 [%]	
[4595]	Sensor 2 [unit]	
[4596]	Sensor 3 [%]	
[4597]	Sensor 3 [unit]	
[4598]	Sensor 4 [%]	
[4599]	Sensor 4 [unit]	
[9913]	Idle Time	
[9914]	Paramdb requests in queue	
[9917]	tCon1 time	
[9918]	tCon2 time	
[9919]	Time Optimize Measure	
[9920]	Fan Ctrl deltaT	

Option	Name	Description
[9921]	Fan Ctrl Tmean	
[9922]	Fan Ctrl NTC Cmd	
[9923]	Fan Ctrl I-term	
[9924]	Rectifier Current	
[9952]	PC Debug 0	
[9953]	PC Debug 1	
[9954]	PC Debug 2	
[9961]	FPC Debug 0	
[9962]	FPC Debug 1	
[9963]	FPC Debug 2	
[9964]	FPC Debug 3	
[9965]	FPC Debug 4	
[9970]	Thread Time Fast	

Parameter 0-21 Display Line 1.2 Small
The options are the same as those listed for *parameter 0-20 Display Line 1.1 Small*.

Parameter 0-22 Display Line 1.3 Small
The options are the same as those listed for *parameter 0-20 Display Line 1.1 Small*.

Parameter 0-23 Display Line 2 Large
The options are the same as those listed for *parameter 0-20 Display Line 1.1 Small*.

Parameter 0-24 Display Line 3 Large
The options are the same as those listed for *parameter 0-20 Display Line 1.1 Small*.

Parameter 0-25 My Personal Menu

Table 19: Parameter 0-25 My Personal Menu

0-25 My Personal Menu		
Default value: Size related	Parameter type: Range, 0 - 9999, Array [50]	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

Define up to 50 parameters to appear in the *Q1 Personal Menu*, accessible via the [Quick Menu] key on the LCP. The parameters are shown in the *Q1 Personal Menu* in the order they are programmed into this array parameter. Delete parameters by setting the value to 0000. For example, this can be used to provide quick, simple access to just 1 or up to 50 parameters, which require changing on a regular basis (for example, for plant maintenance reasons) or by an OEM to enable simple commissioning of their equipment.

5.1.4 0-3* LCP Custom Readout
It is possible to customize the display elements for various purposes:

- Custom readout. Value proportional to speed (linear, squared, or cubed depending on the unit selected in *parameter 0-30 Custom Readout Unit*).
- Display text. Text string stored in a parameter.

Custom reaout
The calculated value to be shown is based on the settings in:

- *Parameter 0-30 Custom Readout Unit*.
- *Parameter 0-31 Custom Readout Min Value* (linear only).

- *Parameter 0-32 Custom Readout Max Value*.
- *Parameter 4-13 Motor Speed High Limit [RPM]*.
- *Parameter 4-14 Motor Speed High Limit [Hz]*.
- Actual speed.

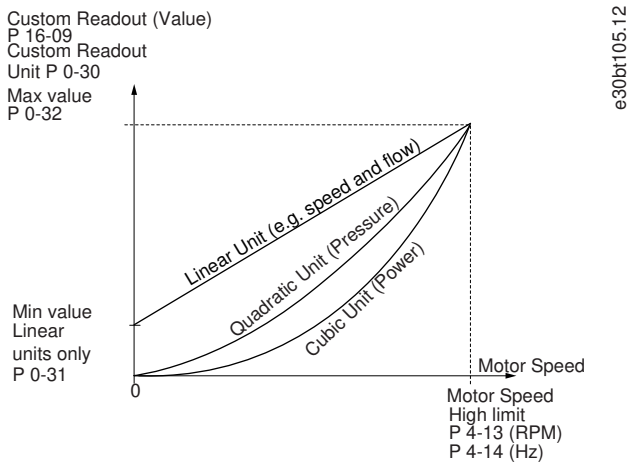


Illustration 28: Custom Readout

The relation depends on the type of unit selected in *parameter 0-30 Custom Readout Unit*.

Table 20: Speed Relations for Different Unit Types

Unit type	Speed relation
Dimensionless	Linear
Speed	
Flow, volume	
Flow, mass	
Velocity	
Length	
Temperature	
Pressure	Quadratic
Power	Cubic

Parameter 0-30 Unit for User-defined Readout

Table 21: Parameter 0-30 Unit for User-defined Readout

0-30 Unit for User-defined Readout		
Default value: [0] None	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

It is possible to program a value to be shown in the display of the LCP. The value has a linear, squared, or cubed relation to speed. This relation depends on the unit type selected. The actual calculated value can be read in *parameter 16-09 Custom Readout*, and/or shown in the display by selecting *[16-09] Custom Readout* in *parameter 0-20 Display Line 1.1 Small* to *parameter 0-24 Display Line 3 Large*.

Option	Name	Description
[0]*	None	
[1]	%	
[5]	PPM	
[10]	1/min	
[11]	rpm	
[12]	Pulse/s	
[20]	l/s	
[21]	l/min	
[22]	l/h	
[23]	m^3/s	
[24]	m^3/min	
[25]	m^3/h	
[30]	kg/s	
[31]	kg/min	
[32]	kg/h	
[33]	t/min	
[34]	t/h	
[40]	m/s	
[41]	m/min	
[45]	m	
[60]	°C	
[70]	mbar	
[71]	bar	
[72]	Pa	
[73]	kPa	
[74]	m WG	
[80]	kW	
[120]	GPM	
[121]	gal/s	
[122]	gal/min	
[123]	gal/h	
[124]	CFM	

Option	Name	Description
[125]	ft^3/s	
[126]	ft^3/min	
[127]	ft^3/h	
[130]	lb/s	
[131]	lb/min	
[132]	lb/h	
[140]	ft/s	
[141]	ft/min	
[145]	ft	
[160]	°F	
[170]	psi	
[171]	lb/in^2	
[172]	in WG	
[173]	ft WG	
[176]	kpsi	
[177]	MPa	
[178]	kBar	
[180]	hp	

Parameter 0-31 Min Value of User-defined Readout

Table 22: Parameter 0-31 Min Value of User-defined Readout

0-31 Min Value of User-defined Readout		
Default value: 0 CustomReadoutUnit	Parameter type: Range, -999999.99 CustomReadoutUnit - par. 0-32	Setup: All setups
Conversion index: -2	Data type: Int32	Change during operation: True

This parameter sets the minimum value of the custom-defined readout (occurs at 0 speed). Only possible to set different from 0 when selecting a linear unit in *parameter 0-30 Unit for User-defined Readout*. For quadratic and cubic units, the minimum value is 0.

Parameter 0-32 Max Value of User-defined Readout

Table 23: Parameter 0-32 Max Value of User-defined Readout

0-32 Max Value of User-defined Readout		
Default value: 100 CustomReadoutUnit	Parameter type: Range, par. 0-31 -999999.99 Custom-ReadoutUnit	Setup: All setups
Conversion index: -2	Data type: Int32	Change during operation: True

This parameter sets the maximum value to be shown when the speed of the motor has reached the set value for *parameter 4-13 Motor Speed High Limit [RPM]* or *parameter 4-14 Motor Speed High Limit [Hz]* (depends on setting in *parameter 0-02 Motor Speed Unit*).

Parameter 0-33 Source for User-defined Readout

Table 24: Parameter 0-33 Source of User-defined Readout

0-33 Source of User-defined Readout		
Default value: [240] Default Source	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Enter the source of the user-defined readout.

Option	Name	Description
[105]	Torque related to rated	
[143]	PID Clamped Output 4–20mA	
[240]*	Default Source	

Parameter 0-37 Display Text 1

Table 25: Parameter 0-37 Display Text 1

0-37 Display Text 1		
Default value: 0	Parameter type: Range, 0–25	Setup: 1 setup
Conversion index: 0	Data type: VisStr[25]	Change during operation: True

Enter a text which can be viewed in the graphical display by selecting *[37] Display Text 1* in

- *Parameter 0-20 Display Line 1 Small*
- *Parameter 0-21 Display Line 1.2 Small*
- *Parameter 0-22 Display Line 1.3 Small*
- *Parameter 0-23 Display Line 2 Large*
- *Parameter 0-24 Display Line 3 Large*

Parameter 0-38 Display Text 2

Table 26: Parameter 0-38 Display Text 2

0-38 Display Text 2		
Default value: 0	Parameter type: Range, 0–25	Setup: 1 setup
Conversion index: 0	Data type: VisStr[25]	Change during operation: True

Enter a text which can be viewed in the graphical display by selecting *[38] Display Text 2* in

- *Parameter 0-20 Display Line 1 Small*
- *Parameter 0-21 Display Line 1.2 Small*
- *Parameter 0-22 Display Line 1.3 Small*
- *Parameter 0-23 Display Line 2 Large*
- *Parameter 0-24 Display Line 3 Large*

Parameter 0-39 Display Text 3

Table 27: Parameter 0-39 Display Text 3

0-39 Display Text 3		
Default value: 0	Parameter type: Range, 0–25	Setup: 1 setup
Conversion index: 0	Data type: VisStr[25]	Change during operation: True

Enter a text which can be viewed in the graphical display by selecting *[39] Display Text 3* in

- *Parameter 0-20 Display Line 1 Small*
- *Parameter 0-21 Display Line 1.2 Small*
- *Parameter 0-22 Display Line 1.3 Small*
- *Parameter 0-23 Display Line 2 Large*
- *Parameter 0-24 Display Line 3 Large*

5.1.5 0-4* LCP Keypad

Enable, disable, and password protect individual keys on the LCP.

Parameter 0-40 [Hand On] Key on LCP

Table 28: Parameter 0-40 [Hand On] Key on LCP

0-40 [Hand On] Key on LCP		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	Disabled	No effect when [Hand On] is pressed. Select *[0] Disabled* to avoid accidental start of the drive in hand-on mode.
[1]*	Enabled	The LCP switches to hand-on mode directly when [Hand On] is pressed.
[2]	Password	After pressing [Hand On] a password is required. If *parameter 0-40 [Hand on] Key on LCP* is included in *My Personal Menu*, define the password in *parameter 0-65 Personal Menu Password*. Otherwise define the password in *parameter 0-60 Main Menu Password*.
[3]	Hand Off/On	When [Hand On] is pressed once, the LCP switches to Off mode. When pressed again, the LCP switches to hand-on mode.
[4]	Hand Off/On w. Passw.	Same as option *[3] Hand Off/On* but a password is required (see option *[2] Password*).
[9]	Enabled, ref=0	

Parameter 0-41 [Off] Key on LCP

Table 29: Parameter 0-41 [Off] Key on LCP

0-41 [Off] Key on LCP		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	Disabled	Avoids accidental stop of the drive.
[1]*	Enabled	
[2]	Password	Avoids unauthorized stop. If *parameter 0-41 [Off] Key on LCP* is included in the Quick Menu, then define the password in *parameter 0-65 Personal Menu Password*.

Parameter 0-42 [Auto On] Key on LCP

Table 30: Parameter 0-42 [Auto On] Key on LCP

0-42 [Auto On] Key on LCP		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	Disabled	Avoids accidental stop of the drive in auto-on mode.
[1]*	Enabled	
[2]	Password	Avoids unauthorized start in auto-on mode. If *parameter 0-42 [Auto on] Key on LCP* is included in the Quick Menu, then define the password in *parameter 0-65 Personal Menu Password*.

Parameter 0-43 [Reset] Key on LCP

Table 31: Parameter 0-43 [Reset] Key on LCP

0-43 [Reset] Key on LCP		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	Disabled	No effect when [Reset] is pressed. Avoids accidental alarm reset.
[1]	Enabled	
[2]	Password	Avoids unauthorized start in auto-on mode. If *parameter 0-43 [Reset] Key on LCP* is included in the Quick Menu, then define the password in *parameter 0-65 Personal Menu Password*.
[7]	Enabled without OFF	Resets the drive without setting it in Off mode.
[8]	Password without OFF	Resets the drive without setting it in Off mode. A password is required when pressing [Reset] (see option *[2] Password*).

Parameter 0-44 [Off/Reset] Key on LCP

Table 32: Parameter 0-44 [Off/Reset] Key on LCP

0-44 [Off/Reset] Key on LCP		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Enable or disable the [Off/Reset] key.

Option	Name	Description
[0]	Disabled	
[1]*	Enabled	
[2]	Password	

Parameter 0-45 [Drive Bypass] Key on LCP

Table 33: Parameter 0-45 [Drive Bypass] Key on LCP

0-45 [Drive Bypass] Key on LCP		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Press [Off] and select *[0] Disabled* to avoid unintended stop of the drive. Press [Off] and select *[2] Password* to avoid unauthorized bypass of the drive. If *parameter 0-45 [Drive Bypass] Key on LCP* is included in the Quick Menu, define the password in *parameter 0-65 Personal Menu Password*.

Option	Name	Description
[0]	Disabled	Disables the key.
[1]*	Enabled	
[2]	Password	

5.1.6 0-5* Copy/Save

Copy parameters from and to the LCP. Use these parameters for saving and copying setups from 1 drive to another.

Parameter 0-50 LCP Copy

Table 34: Parameter 0-50 LCP Copy

0-50 LCP Copy		
Default value: [0] No copy	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

Option	Name	Description
[0]*	No copy	
[1]	All to LCP	Copies all parameters in all setups from the drive memory to the LCP memory.
[2]	All from LCP	Copies all parameters in all setups from the LCP memory to the drive memory.
[3]	Size indep. from LCP	Copy only the parameters that are independent of the motor size. This selection can be used to program several drives with the same function without disturbing motor data.
[4]	File from MCO to LCP	
[5]	File from LCP to MCO	
[6]	Data from DYN to LCP	
[7]	Data from LCP to DYN	
[9]	Safety Par. from LCP	
[10]	Delete LCP copy data	Use to delete the copy after the transfer is complete.

Parameter 0-51 Set-up Copy

Table 35: Parameter 0-51 Set-up Copy

0-51 Set-up Copy		
Default value: [0] No copy	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

Option	Name	Description
[0]*	No copy	No function.
[1]	Copy to set-up 1	Copies all parameters in the present programming setup (defined in *parameter 0-11 Edit Set-up*) to set-up 1.
[2]	Copy to set-up 2	Copies all parameters in the present programming setup (defined in *parameter 0-11 Edit Set-up*) to set-up 2.
[3]	Copy to set-up 3	Copies all parameters in the present programming setup (defined in *parameter 0-11 Edit Set-up*) to set-up 3.
[4]	Copy to set-up 4	Copies all parameters in the present programming setup (defined in *parameter 0-11 Edit Set-up*) to set-up 4.
[9]	Copy to all	Copies the parameters in the present setup to each of the setups 1 to 4.

5.1.7 0-6* Password

Parameter 0-60 Main Menu Password

Table 36: Parameter 0-60 Main Menu Password

0-60 Main Menu Password		
Default value: 100	Parameter type: Range, -9999 - 9999	Setup: 1 setup
Conversion index: 0	Data type: Int16	Change during operation: True

Define the password for access to the Main Menu via the [Main Menu] key. If *parameter 0-61 Access to Main Menu w/o Password* is set to *[0] Full access*, this parameter is ignored.

Parameter 0-61 Access to Main Menu w/o Password

Table 37: Parameter 0-61 Access to Main Menu w/o Password

0-61 Access to Main Menu w/o Password		
Default value: [0] Full access	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Full access	Disables password defined in *parameter 0-60 Main Menu Password*.
[1]	LCP: Read only	Prevent unauthorized editing of Main Menu parameters.
[2]	LCP: No access	Prevent unauthorized viewing and editing of Main Menu parameters.
[3]	Bus: Read only	Read-only functions for parameters on fieldbus and/or FC standard bus.

Option	Name	Description
[4]	Bus: No access	No access to parameters is allowed via fieldbus and/or FC standard bus.
[5]	All: Read only	Read-only function for parameters on LCP, fieldbus, or FC standard bus.
[6]	All: No access	No access from LCP, fieldbus, or FC standard bus is allowed.

If *[0] Full access* is selected, *parameter 0-60 Main Menu Password*, *parameter 0-65 Personal Menu Password*, and *parameter 0-66 Access to Personal Menu w/o Password* are ignored.

N O T I C E

A more complex password protection is available for OEMs upon request.

Parameter 0-65 Personal Menu Password

Table 38: Parameter 0-65 Personal Menu Password

0-65 Personal Menu Password		
Default value: 200	Parameter type: Range, -9999 - 9999	Setup: 1 setup
Conversion index: 0	Data type: Int16	Change during operation: True

Define the password for access to the Quick Menu via the [Quick Menu] key. If *parameter 0-66 Access to Personal Menu w/o Password* is set to *[0] Full access*, this parameter is ignored.

Parameter 0-66 Access to Personal Menu w/o Password

Table 39: Parameter 0-66 Access to Personal Menu w/o Password

0-66 Access to Personal Menu w/o Password		
Default value: [0] Full access	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

If *parameter 0-61 Access to Main Menu w/o Password* is set to *[0] Full access*, then this parameter is ignored.

Option	Name	Description
[0]*	Full access	Disables password defined in *parameter 0-65 Personal Menu Password*.
[1]	LCP: Read only	Prevent unauthorized editing of Quick Menu parameters.
[3]	Bus: Read only	Read-only functions for Quick Menu parameters on fieldbus and/or FC standard bus.
[5]	All: Read only	Read-only function for Quick Menu parameters on LCP, fieldbus, or FC standard bus.

Parameter 0-67 Bus Password Access

Table 40: Parameter 0-67 Bus Password Access

0-67 Bus Password Access		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Use this parameter to unlock the drive via fieldbus or VLT® Motion Control Tool MCT 10.

Parameter 0-68 Safety Parameter Password

Table 41: Parameter 0-68 Safety Parameters Password

0-68 Safety Parameters Password		
Default value: 300	Parameter type: Range, 0 - 9999	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the password for the safety parameters access. If *parameter 0-69 Password Protection of Safety Parameters* is set to *[0] Disabled*, this parameter is ignored.

Parameter 0-69 Password Protection of Safety Parameters

Table 42: Parameter 0-69 Password Protection of Safety Parameters

0-69 Password Protection of Safety Parameters		
Default value: [0] Disabled	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Disabled	
[1]	Enabled	

5.1.8 0-7* Clock Settings

Parameter 0-70 Date and Time

Table 43: Parameter 0-70 Date and Time

0-70 Date and Time		
Default value: Size related	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: TimeOfDay	Change during operation: True

Sets the date and time of the internal clock. The format to be used is set in *parameter 0-71 Date Format* and *parameter 0-72 Time Format*. When using the VLT® Real-time Clock MCB 117 option, the time is synchronized at 15:00 every day.

Parameter 0-71 Date Format

Table 44: Parameter 0-71 Date Format

0-71 Date Format		
Default value: [1] DD-MM-YYYY	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	YYYY-MM-DD	
[1]*	DD-MM-YY	
[2]	MM/DD/YYYY	

Parameter 0-72 Time Format

Table 45: Parameter 0-72 Time Format

0-72 Time Format		
Default value: [0] 24 h	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	24 h	
[1]	12 h	

Parameter 0-73 Time Zone Offset

Table 46: Parameter 0-73 Time Zone Offset

0-73 Time Zone Offset		
Default value: 0 min	Parameter type: Range, -780 - 780 min	Setup: 2 setups
Conversion index: 70	Data type: Int16	Change during operation: False

Enter the time zone offset relative to UTC. This parameter is required for the automatic daylight saving time adjustment.

Parameter 0-74 DST/Summertime

Table 47: Parameter 0-74 DST/Summertime

0-74 DST/Summertime		
Default value: [0] Off	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Select how to handle daylight saving time/summer time. For manual setting of DST/summer time, enter the start date and end date in *parameter 0-76 DST/Summertime Start* and *parameter 0-77 DST/Summertime End*.

Option	Name	Description
[0]*	Off	
[2]	Manual	

Parameter 0-76 DST/Summertime Start

Table 48: Parameter 0-76 DST/Summertime Start

0-76 DST/Summertime Start		
Default value: Size related	Parameter type: Range, 0 - 0	Setup: 1 setup
Conversion index: 0	Data type: TimeOfDay	Change during operation: True

Sets the date and time when DST/ summer time starts. The date is programmed in the format selected in *parameter 0-71 Date Format*.

Parameter 0-77 DST/Summertime End

Table 49: Parameter 0-77 DST/Summertime End

0-77 DST/Summertime End		
Default value: Size related	Parameter type: Range, 0 - 0	Setup: 1 setup
Conversion index: 0	Data type: TimeOfDay	Change during operation: True

Sets the date and time when DST/summer time ends. The date is programmed in the format selected in *parameter 0-71 Date Format*.

Parameter 0-79 Clock Fault

Table 50: Parameter 0-79 Clock Fault

0-79 Clock Fault		
Default value: [0] Disabled	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Enables or disables the clock warning when the clock has not been set, or has been reset due to a power-down and no back-up is installed. If VLT® Analog I/O Option MCB 109 is installed, *[1] Enabled* is default.

Option	Name	Description
[0]*	Disabled	
[1]	Enabled	

Parameter 0-81 Working Days

Table 51: Parameter 0-81 Working Days

0-81 Working Days		
Default value: Depending on the selected array element	Parameter type: Option, Array [7]	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Array with 7 elements [0]–[6] shown below the parameter number in the display. Press [OK] and step between elements with [▵] and [▿]. Set for each weekday if it is a working day or a non-working day. The first element of the array is Monday. The working days are used for timed actions.

Option	Name	Description
[0]	No	
[1]	Yes	

Parameter 0-82 Additional Working Days

Table 52: Parameter 0-82 Additional Working Days

0-82 Additional Working Days		
Default value: Size related	Parameter type: Range, 0 - 0, Array [5]	Setup: 1 setup
Conversion index: 0	Data type: TimeOfDay	Change during operation: True

Array with 5 elements [0]–[4] shown below the parameter number in the display. Press [OK] and step between elements with [▵] and [▿]. Defines dates for additional working days that would normally be non-working days according to *parameter 0-81 Working Days*.

Parameter 0-83 Additional Non-working Days

Table 53: Parameter 0-83 Additional Non-working Days

0-83 Additional Non-working Days		
Default value: Size related	Parameter type: Range, 0 - 0, Array [15]	Setup: 1 setup
Conversion index: 0	Data type: TimeOfDay	Change during operation: True

Array with 15 elements [0]–[14] shown below the parameter number in the display. Press [OK] and step between elements with [▵] and [▿]. Defines dates for additional working days that would normally be non-working days according to *parameter 0-81 Working Days*.

Parameter 0-84 Time for Fieldbus

Table 54: Parameter 0-84 Time for Fieldbus

0-84 Time for Fieldbus		
Default value: 0	Parameter type: Range, 0 - 4294967295, Array [2]	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Shows the time for fieldbus.

Parameter 0-85 Summer Time Start for Fieldbus

Table 55: Parameter 0-85 Summer Time Start for Fieldbus

0-85 Summer Time Start for Fieldbus		
Default value: 0	Parameter type: Range, 0 - 4294967295, Array [2]	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Shows the summer time start for fieldbus.

Parameter 0-86 Summer Time End for Fieldbus

Table 56: Parameter 0-86 Summer Time End for Fieldbus

0-86 Summer Time End for Fieldbus		
Default value: 0	Parameter type: Range, 0 - 4294967295, Array [2]	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Shows the summer time end for fieldbus.

Parameter 0-89 Date and Time Readout

Table 57: Parameter 0-89 Date and Time Readout

0-89 Date and Time Readout		
Default value: 0	Parameter type: Range, 0 - 25	Setup: All setups
Conversion index: 0	Data type: VisStr 25	Change during operation: True

Shows the current date and time. The date and time is updated continuously. The clock does not begin counting until a setting different from default has been made in *parameter 0-70 Date and Time*.

5.2 Parameter Group 1-** Load and Motor

5.2.1 1-0* General Settings

Define whether the drive operates in speed mode or torque mode, and whether the internal PID control should be active or not.

NOTICE

The following parameters are only available in FC 302:

- *Parameter 1-02 Flux Motor Feedback Source*
- *Parameter 1-07 Motor Angle Offset Adjust*

Parameter 1-00 Configuration Mode

Table 58: Parameter 1-00 Configuration Mode

1-00 Configuration Mode		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the application control principle to be used when a remote reference (that is via analog input or fieldbus) is active. A remote reference can only be active when *parameter 3-13 Reference Site* is set to *[0] Linked to Hand/Auto* or *[1] Remote*.

Option	Name	Description
[0]	Speed open loop	Enables speed control (without feedback signal from motor) with automatic slip compensation for almost constant speed at varying loads. Compensations are active, but can be disabled in *parameter group 1-** Load and Motor*. Set the speed control parameters in *parameter group 7-0* Speed PID Ctrl*.
[1]	Speed closed loop	Enables speed closed-loop control with feedback. Obtain full holding torque at 0 RPM. For increased speed accuracy, provide a feedback signal and set the speed PID control. Set the speed control parameters in *parameter group 7-0* Speed PID Ctrl*.
[2]	Torque	**NOTICE** This option is only available in FC 302. Enables torque closed-loop control with feedback. Only possible when *parameter 1-01 Motor Control Principle* is set to *[3] Flux w/motor feedb*.
[3]	Process	Enables the use of process control in the drive. Set the process control parameters in *parameter groups 7-2* Process Ctrl. Feedb.* and *7-3* Process PID Ctrl*.
[4]	Torque open loop	Enables the use of torque open-loop mode (*parameter 1-01 Motor Control Principle*). Set the torque PID parameters in *parameter group 7-1* Torque PI Control*.
[5]	Wobble	Enables the wobble functionality in *parameter 30-00 Wobble Mode* to *parameter 30-19 Wobble Delta Freq. Scaled*.
[6]	Surface winder	Enables the surface winder control-specific parameters in *parameter groups 7-2* Process Ctrl. Feedb.* and *7-3* Process PID Ctrl.*
[7]	Extended PID speed OL	Specific parameters in *parameter groups 7-2* Process Ctrl. Feedb.* to *7-5* Ext. Process PID Ctrl.*
[8]	Extended PID speed CL	Specific parameters in *parameter groups 7-2* Process Ctrl. Feedb.* to *7-5* Ext. Process PID Ctrl.*
[9]	Positioning	**NOTICE** This option is only available with software version 48.XX. Activates positioning mode.

Option	Name	Description
[10]	Synchronization	**NOTICE** This option is only available with software version 48.XX. Activates synchronization mode.
[11]	Cyclic sync. position	Activates cyclic synchronous position mode.
[12]	Cyclic sync. velocity	Activates cyclic synchronous velocity mode.
[15]	Mode of operation DS402	DS 402 operation modes are selected by *parameter 1-09 Mode of Operation*. With this selection, *parameter 8-10 Control Word Profile* is automatically set to *[7] CANopen DSP 402* and the control word bits are used according to the DS 402 profile based on the selection in *parameter 1-09 Mode of Operation*.

Parameter 1-01 Motor Control Principle

Table 59: Parameter 1-01 Motor Control Principle

1-01 Motor Control Principle		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

Select which motor control principle to employ.

Option	Name	Description
[0]	U/f	Special motor mode, for parallel-connected motors in special motor applications. When U/f is selected, the characteristic of the control principle can be edited in *parameter 1-55 U/f Characteristic - U* and *parameter 1-56 U/f Characteristic - F*.
[1]	VVC+	Voltage vector control principle is suitable for most applications. The main benefit of VVC+ operation is that it uses a robust motor model.
[2]	Flux sensorless	**NOTICE** This option is only available in FC 302. Flux vector control without encoder feedback, for simple installation and robustness against sudden load changes.
[3]	Flux w/ motor	**NOTICE** This option is only available in FC 302. High accuracy speed and torque control, suitable for the most demanding applications.

The best shaft performance is normally achieved using either of the 2 flux vector control modes *[2] Flux sensorless* and *[3] Flux with encoder feedback*.

Parameter 1-02 Flux Motor Feedback Source

Table 60: Parameter 1-02 Flux Motor Feedback Source

1-02 Flux Motor Feedback Source		
Default value: 24V encoder	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

NOTICE

This parameter cannot be adjusted while the motor is running.

NOTICE

The options 12 and 13 are only available for software version 48.XX.

Select the source of the feedback for flux closed-loop motor control. Set *parameter 1-01 Motor Control Principle* to *[3] Flux with motor feedback option*. The feedback device is typically mounted directly on the motor shaft. The feedback device can also be mounted in the application, provided that the gear ratio between motor and encoder is fixed and accurate. Configure the gear ratio between motor and encoder in *parameter 7-94 Position PI Feedback Scale Numerator* and *parameter 7-95 Position PI Feedback Scale Denominator* without any rounding error.

Option	Name	Description
[1]*	24V encoder 32/33	Single signal generated from 24 V High Threshold Logic (HTL) encoder connected to terminals 32 and 33. Configure the 24 V encoder interface in *parameter group 5.7* 24 V Encoder Input*. Program terminals 32/33 to *[0] No operation*.
[2]	MCB 102	This option is only available for VLT® Encoder Option MCB 102. Configure the encoder interface in *parameter groups 17-0*, 17-1*,* and *17-2**.
[3]	MCB 103	This option is only available for VLT® Resolver Option MCB 103. Configure the resolver interface in *parameter group 17-5**.
[4]	MCO Encoder 1 X56	The MCO encoder 1 X56 is only available with motion control options MCO 305, MCO 350 and MCO 351. Configure the encoder interface in *parameter group 32-3* Encoder 1*.
[5]	MCO Encoder 2 X55	The MCO encoder 1 X56 is only available with motion control options MCO 305, MCO 350 and MCO 351. Configure the encoder interface in *parameter group 32-0* Encoder 2*.
[6]	Analog input 53	
[7]	Analog input 54	
[8]	Frequency input 29	
[9]	Frequency input 33	
[11]	MCB 15X	
[12]	MCB 102 Absolute	The option is only available for VLT® Encoder Option MCB 102 with version 4.00 and higher and when *parameter 17-00 Encoders Connected* is set to *[1] Two Encoders*.
[13]	24V encoder 27/29	Single-signal HTL encoder connected to digital inputs 27 and 29. 24 V encoder is configured in *parameter group 5.7* 24V Encoder Input*. Program terminals 27/29 to *[0] No operation*.

Parameter 1-03 Torque Characteristics

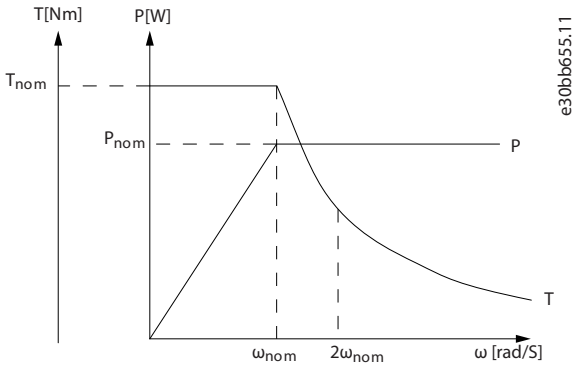
Table 61: Parameter 1-03 Torque Characteristics

1-03 Torque Characteristics		
Default value: [0] Constant torque	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

N O T I C E

This parameter cannot be adjusted while the motor is running.

Select the torque characteristic required. VT and AEO are both energy-saving operations.

Option	Name	Description
[0]*	Constant torque	Motor shaft output provides constant torque under variable speed control.
[1]	Variable torque	Motor shaft output provides variable torque under variable speed control. Set the variable torque level in *parameter 14-40 VT Level*.
[2]	Auto energy optim.	Automatically optimizes energy consumption by minimizing magnetization and frequency via *parameter 14-41 AEO Minimum Magnetisation* and *parameter 14-42 Minimum AEO Frequency*.
[5]	Constant power	The function provides a constant power in the field weakening area. The torque shape of motor mode is used as a limit in the generator mode. This is done to limit the power in generator mode that otherwise becomes considerably larger than in motor mode, due to the high DC-link voltage available in generator mode. $P_{shaft}[W] = \omega_{mech}[rad/s] \times T[Nm]$  **Illustration 29: Relationship with Constant Power**

Parameter 1-04 Overload Mode

Table 62: Parameter 1-04 Overload Mode

1-04 Overload Mode		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

Use this parameter to configure the drive for either high or normal overload. When selecting the drive size, always review the technical data in the Operating Guide or the Design Guide to know the available output current.

Option	Name	Description
[0]	High torque	Allows up to 160% overtorque.
[1]	Normal torque	For oversized motor. Allows up to 110% overtorque.

Parameter 1-05 Local Mode Configuration

Table 63: Parameter 1-05 Local Mode Configuration

1-05 Local Mode Configuration		
Default value: [2] As mode par. 1-00	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select which application configuration mode (*parameter 1-00 Configuration Mode*), that is application control principle, to use when a local (LCP) reference is active. A local reference can be active only when *parameter 3-13 Reference Site* is set to *[0] Linked to Hand/Auto* or *[2] Local*. By default the local reference is active in hand-on mode only.

Option	Name	Description
[0]	Speed open loop	Allows up to 160% overtorque.
[1]	Speed closed loop	
[2]*	As mode par. 1-00	
[4]	Positioning	

Parameter 1-06 Clockwise Direction

Table 64: Parameter 1-06 Clockwise Direction

1-06 Clockwise Direction		
Default value: [0] Normal	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

This parameter defines the term clockwise corresponding to the LCP direction arrow. Used for easy change of direction of shaft rotation without swapping motor wires.

Option	Name	Description
[0]*	Normal	The motor shaft turns in clockwise direction when the drive is connected U⇒U, V⇒V, and W⇒W to the motor.
[1]	Inverse	The motor shaft turns in counterclockwise direction when the drive is connected U⇒U, V⇒V, and W⇒W to the motor.
[2]	Inverse all	

Parameter 1-07 Motor Angle Offset Adjust

Table 65: Parameter 1-07 Motor Angle Offset Adjust

1-07 Motor Angle Offset Adjust		
Default value: [0] Manual	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

N O T I C E

This parameter is only valid in combination with a PM motor with feedback.

Option	Name	Description
[0]*	Manual	The functionality of this option depends on the type of the feedback device. This option sets the drive to use the motor angle offset entered in *parameter 1-41 Motor Angle Offset*, if an absolute feedback device is used. If an incremental feedback device is selected, the drive automatically adjusts the motor angle offset on the 1st start after power-up, or when the motor data is changed.
[1]	Auto	The drive adjusts the motor angle offset automatically on the 1st start after power-up, or when the motor data is changed no matter what feedback device is selected. This means that the options *[1] Manual* and *[2] Auto* are identical for the incremental encoder.
[2]	Auto every start	The drive adjusts the motor angle offset automatically on every start, or when the motor data is changed.
[3]	Off	Selecting this option turns the automatic offset adjustment off.
[4]	Once with store	This option updates *parameter 1-41 Motor Angle Offset* automatically when the angle value is 0. This option is valid only for absolute feedback devices. The function uses rotor detection and then applies DC hold to make the offset adjustment more accurate.
[5]	Auto Every Start & Run	Rotor angle offset is adjusted at every start and when reducing speed below *parameter 1-53 Model Shift Frequency*. Motor control is sensorless above *parameter 1-53 Model Shift Frequency* using the estimated rotor position as feedback. Below *parameter 1-53 Model Shift Frequency* the encoder is used as feedback.

Parameter 1-09 Mode of Operation

Table 66: Parameter 1-09 Mode of Operation

1-09 Mode of Operation		
Default value: [0] No mode change	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

N O T I C E

This parameter is only available with software version 48.8X and newer.

Select mode of operation according to CANopen DS402. This parameter is only active when *parameter 1-00 Configuration Mode* is set to *[15] Mode of operation*.

Option	Name	Description
[0]*	No mode change	No mode of operation selected. Active mode of operation is velocity mode.
[1]	Profile position mode	Basic positioning mode where the drive profile generator calculates the speed profile based on set target position, speed and ramps.

Option	Name	Description
[2]	Velocity mode (vl)	Basic speed mode using the set speed and ramps.
[6]	Homing mode	Activates the homing function selected in *parameter 17-80 Homing Function*.
[8]	Cyclic sync position mode	The drive controls the position based on cyclic position reference from an external controller. Speed/ramp profile must be calculated/handled by the external controller.
[9]	Cyclic sync velocity mode	The drive controls the speed based on cyclic speed reference from an external controller. Acceleration/deceleration must be handled by the external controller.
[249]	Gear mode	The drive is synchronizing to the provided master positions using the set gear ratio.
[250]	Cam mode	The drive is synchronizing to the provided master positions according to the set Cam table.

5.2.2 Motor Setups

5.2.2.1 Asynchronous Motor Setup

Enter the following motor data. Find the information on the motor nameplate.

- *Parameter 1-20 Motor Power [kW]* or *parameter 1-21 Motor Power [HP]*.
- *Parameter 1-22 Motor Voltage*.
- *Parameter 1-23 Motor Frequency*.
- *Parameter 1-24 Motor Current*.
- *Parameter 1-25 Motor Nominal Speed*.

When running in flux control principle, or for optimum performance in VVC+ mode, extra motor data is required to set up the following parameters. Find the data in the motor datasheet (this data is typically not available on the motor nameplate). Run a complete automatic motor adaptation (AMA) using *parameter 1-29 Automatic Motor Adaptation (AMA) [1] Enable Complete AMA* or enter the parameters manually. *Parameter 1-36 Iron Loss Resistance (Rfe)* is always entered manually.

- *Parameter 1-30 Stator Resistance (Rs)*.
- *Parameter 1-31 Rotor Resistance (Rr)*.
- *Parameter 1-33 Stator Leakage Reactance (X1)*.
- *Parameter 1-34 Rotor Leakage Reactance (X2)*.
- *Parameter 1-35 Main Reactance (Xh)*.
- *Parameter 1-36 Iron Loss Resistance (Rfe)*.

Application-specific adjustment when running VVC+

VVC+ is the most robust control mode. In most situations, it provides optimum performance without further adjustments. Run a complete AMA for best performance.

Application-specific adjustment when running flux

Flux control principle is the preferred control principle for optimum shaft performance in dynamic applications. Perform an AMA since this control mode requires precise motor data. Depending on the application, further adjustments may be required.

Table 67: Recommendations for Flux Applications

Application	Settings
Low-inertia applications	Keep calculated values.
High-inertia applications	*Parameter 1-66 Min. Current at Low Speed*. Increase current to a value between default and maximum depending on the application. Set ramp times matching the application. Too fast ramp up causes an overcurrent or overtorque. Too fast ramp down causes an overvoltage trip.

Application	Settings
High load at low speed	*Parameter 1-66 Min. Current at Low Speed*. Increase current to a value between default and maximum depending on the application
No-load application	Adjust *parameter 1-18 Min. Current at No Load* to achieve smoother motor operation by reducing torque ripple and vibration.
Flux sensorless control principle only	Adjust *parameter 1-53 Model Shift Frequency*. Example 1: If the motor oscillates at 5 Hz, and dynamics performance is required at 15 Hz, set *parameter 1-53 Model Shift Frequency* to 10 Hz. Example 2: If the application involves dynamic load changes at low speed, reduce *parameter 1-53 Model Shift Frequency*. Observe the motor behavior to make sure that the model shift frequency is not reduced too much. Symptoms of inappropriate model shift frequency are motor oscillations or drive tripping.

5.2.2.2 PM Motor Setup

N O T I C E

PM motor setup is only available in FC 302.

This section describes how to set up a PM motor. Danfoss offers 2 types of PM motors: [1] Non-salient PM and [3] Salient PM. The following example covers a non-salient PM motor.

Initial programming steps

1. To activate PM motor operation, select *[1] PM, non-salient SPM* in *parameter 1-10 Motor Construction*.

Programming motor data

After selecting a PM motor, the PM motor-related parameters in *parameter groups 1-2* Motor Data*, *1-3* Adv. Motor Data*, and *1-4* Adv. Motor Data II* are active. The necessary data is on the motor nameplate and on the motor datasheet.

Program the following parameters in the order listed:

1. *Parameter 1-24 Motor Current*.
2. *Parameter 1-25 Motor Nominal Speed*.
3. *Parameter 1-26 Motor Cont. Rated Torque*.
4. *Parameter 1-39 Motor Poles*.

Run a complete AMA using *parameter 1-29 Automatic Motor Adaptation (AMA) [1] Enable Complete AMA*.

If a complete AMA is not performed, configure the following parameters manually:

1. *Parameter 1-30 Stator Resistance (Rs)* Enter the line-to-common stator winding resistance (Rs). If only line-line data is available, divide the line-line value by 2 to get the line-common value.
2. *Parameter 1-37 d-axis Inductance (Ld)* Enter the line-to-common direct axis inductance of the PM motor. If only line-line data is available, divide the line-line value by 2 to get the line-common value.
3. *Parameter 1-40 Back EMF at 1000 RPM*. Enter the line-to-line back EMF of the PM Motor at 1000 RPM (RMS value). Back EMF is the voltage generated by a PM motor when no drive is connected and the shaft is turned externally. It is normally specified for nominal motor speed or for 1000 RPM measured between 2 lines. If the value is not available for a motor speed of 1000 RPM, calculate the correct value as follows: If back EMF is, for example, 320 V at 1800 RPM, it can be calculated at 1000 RPM as follows: Back EMF = (Voltage/RPM)x1000 = (320/1800)x1000 = 178.

Test motor operation

1. Start the motor at low speed (100–200 RPM). If the motor does not turn, check the installation, general programming, and motor data.
2. Check if the start function in *parameter 1-70 Start Mode* fits the application requirements.

5.2.2.2.1 PM Rotor Detection

This function is the recommended selection for applications where the motor starts from standstill, for example pumps or conveyors. On some motors, a sound is heard when the drive performs the rotor detection. This does not harm the motor.

To activate the rotor detection function, select *[0] Rotor detection* in *parameter 1-70 Start Mode*.

5.2.2.2.2 PM Parking

This function is the recommended selection for applications where the motor is rotating at slow speed, for example windmilling in fan applications. *Parameter 2-06 Parking Current* and *parameter 2-07 Parking Time* can be adjusted. Increase the factory setting of these parameters for applications with high inertia.

To activate parking, select *[1] Parking* in *parameter 1-70 Start Mode*.

5.2.2.2.3 Application-specific Adjustment when Running VVC+ with PM Motors

VVC+ is the most robust control mode. In most situations, it provides optimum performance without further adjustments. Run a complete AMA for best performance.

Start the motor at nominal speed. If the application does not run well, check the VVC+ PM settings. See recommendations for various applications in Table 68.

Table 68: Recommendations for Various Applications

Application	Settings
Low-inertia applications $I_{Load}/I_{Motor}<5$	Increase *parameter 1-17 Voltage Filter Time Const.* by factor 5–10. Reduce *parameter 1-14 Damping Gain*. Reduce *parameter 1-66 Min.Current at Low Speed* (<100%).
Low-inertia applications $50>I_{Load}/I_{Motor}>5$	Keep the default values.
High-inertia applications $I_{Load}/I_{Motor}>50$	Increase *parameter 1-14 Damping Gain*, *parameter 1-15 Low Speed Filter Time Const.*, and *parameter 1-16 High Speed Filter Time Const*.
High load at low speed <30% (rated speed)	Increase *parameter 1-17 Voltage filter time const*. Increase *parameter 1-66 Min. Current at Low Speed* to adjust the starting torque. 100% current provides nominal torque as starting torque. This parameter is independent of *parameter 30-20 High Starting Torque Time [s]* and *parameter 30-21 High Starting Torque Current [%]*). Working at a current level higher than 100% for a prolonged time can cause the motor to overheat.

If the motor starts oscillating at a certain speed, increase *parameter 1-14 Damping Gain*. Increase the value in small steps. Depending on the motor, this parameter can be set to 10–100% higher than the default value.

Application-specific adjustment when running flux

Flux control principle is the preferred control principle for optimum shaft performance in dynamic applications. Perform an AMA because this control mode requires precise motor data. Depending on the application, further adjustments may be required.

See 5.2.2.1 Asynchronous Motor Setup for application-specific recommendations.

5.2.2.3 SynRM Motor Setup with VVC+

This section describes how to set up a SynRM motor with VVC+.

NOTICE

The SmartStart wizard covers the basic configuration of SynRM motors.

5.2.2.3.1 SynRM Initial Programming

Procedure

1. Select *[5] Sync. Reluctance* in *parameter 1-10 Motor Construction* to activate SynRM motor operation.

5.2.2.3.2 SynRM Programming Motor Data

After performing the initial programming steps, the SynRM motor-related parameters in *parameter groups 1-2* Motor Data*, *1-3* Adv. Motor Data*, and *1-4* Adv. Motor Data II* are active. Find the required motor data on the motor nameplate and in the motor data sheet.

Procedure

1. Program in the following order:
   -

   - **a.** *Parameter 1-23 Motor Frequency*.
   - **b.** *Parameter 1-24 Motor Current*.
   - **c.** *Parameter 1-25 Motor Nominal Speed*.
   - **d.** *Parameter 1-26 Motor Cont. Rated Torque*.
2. Run a complete AMA.
   - Select *[1] Enable Complete AMA* in *parameter 1-29 Automatic Motor Adaptation (AMA)*, or
   - Enter the following manually:

     Parameter 1-30 Stator Resistance (Rs).

     Parameter 1-37 d-axis Inductance (Ld).

     Parameter 1-44 d-axis Inductance Sat. (LdSat).

     Parameter 1-45 q-axis Inductance Sat. (LqSat).

     Parameter 1-48 Inductance Sat. Point.

5.2.2.3.3 Application-specific Adjustment when Running VVC+ with SynRM Motors

Start the motor at nominal speed. If the application does not run well, check the VVC+ SynRM settings.

Application	Settings
Low-inertia applications $I_{Load}/I_{Motor}<5$	Increase *parameter 1-17 Voltage filter time const.* by factor 5–10. Reduce *parameter 1-14 Damping Gain*. Reduce *parameter 1-66 Min. Current at Low Speed* (<100%).
Low-inertia applications $50>I_{Load}/I_{Motor}>5$	Keep the default values.
High-inertia applications $I_{Load}/I_{Motor}>50$	Increase *parameter 1-14 Damping Gain*, *parameter 1-15 Low Speed Filter Time Const.*, and *parameter 1-16 High Speed Filter Time Const*.
High-load at low speed <30% (rated speed)	Increase *parameter 1-17 Voltage filter time const*. Increase *parameter 1-66 Min. Current at Low Speed* to adjust the starting torque. 100% current provides nominal torque as starting torque. Working at a current level higher than 100% for a prolonged time can cause the motor to overheat.
Dynamic applications	Increase *parameter 14-41 AEO Minimum Magnetisation* for highly dynamic applications. Adjusting *parameter 14-41 AEO Minimum Magnetisation* ensures a good balance between energy efficiency and dynamics. Adjust *parameter 14-42 Minimum AEO Frequency* to specify the minimum frequency at which the drive should use minimum magnetization.
Motor sizes less than 18 kW (24 hp)	Avoid short ramp-down times.

If the motor starts oscillating at a certain speed, increase *parameter 1-14 Damping Gain*. Increase the damping gain value in small steps. Depending on the motor, this parameter can be set to 10–100% higher than the default value.

5.2.3 1-1* Special Settings

N O T I C E

The following parameter is only available in FC 302:

– *Parameter 1-11 Motor Model*

N O T I C E

The parameters within this parameter group cannot be adjusted while the motor is running.

Parameter 1-10 Motor Construction

Table 69: Parameter 1-10 Motor Construction

1-10 Motor Construction		
Default value: [0] Asynchron	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

Select the motor design type.

NOTICE

FC 301 allows only selection of induction motors.

Option	Name	Description
[0]*	Asynchron	Use for ASM/IM motors.
[1]	PM, non salient SPM	**NOTICE** This option is only available in FC 302. Use for SPM motors, surface-mounted magnet. PM motors are divided into 2 groups, with either surface-mounted (SPM)/non-salient magnets or interior-mounted (IPM)/ salient magnets.
[2]	PM, salient IPM	**NOTICE** This option is only available in FC 302. Use for IPM motors, interior-mounted magnet. PM motors are divided into 2 groups, with either surface-mounted (SPM)/non-salient magnets or interior-mounted (IPM)/ salient magnets.
[5]	SynRM	Use for SynRM, synchronous reluctance motors.
[6]	PMaSynRM	Use for PMaSynRM, Permanent Magnet assisted synchronous reluctance motors.

Parameter 1-11 Motor Model

Table 70: Parameter 1-11 Motor Model

1-11 Motor Model		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

Automatically sets the factory values for the selected motor. If the default value *[1] Std. Asynchron* is used, determine settings manually according to the selection in *parameter 1-10 Motor Construction*.

NOTICE

There are no models available for SynRM motors.

Option	Name	Description
[1]	Std. asynchron	Default motor model when *[0] Asynchron* is selected in *parameter 1-10 Motor Construction*.
[2]	Std. PM, non salient	Selectable when *[1] PM, non-salient SPM* is selected in *parameter 1-10 Motor Construction*.
[3]	Std. PM salient	
[10]	Danfoss OGD LA10	Selectable when *[1] PM, non-salient SPM* is selected in *parameter 1-10 Motor Construction*. Only available for T5 in 1.5–3 kW. Settings are loaded automatically for this specific motor.
[11]	Danfoss OGD V210	Selectable when *[1] PM, non-salient SPM* is selected in *parameter 1-10 Motor Construction*. Only available for T5 in 0.75–3 kW. Settings are loaded automatically for this specific motor.

Parameter 1-14 Damping Gain

Table 71: Parameter 1-14 Damping Gain

1-14 Damping Gain		
Default value: 140%	Parameter type: Range, 0 - 250%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

The damping gain stabilizes the PM machine to run smoothly and with stability. The value of damping gain controls the dynamic performance of the PM machine. High damping gain gives high dynamic performance and low damping gain gives low dynamic performance. The dynamic performance is related to the machine data and load type. If the damping gain is too high or low, the control becomes unstable.

Parameter 1-15 Low Speed Filter Time Const.

Table 72: Parameter 1-15 Low Speed Filter Time Const.

1-15 Low Speed Filter Time Const.		
Default value: Size related	Parameter type: Range, 0.01 - 20 s	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

The time constant is used below 10% rated speed. Obtain quick control through a short dampening time constant. However, if this value is too short, the control becomes unstable.

Parameter 1-16 High Speed Filter Time Const.

Table 73: Parameter 1-16 High Speed Filter Time Const.

1-16 High Speed Filter Time Const.		
Default value: Size related	Parameter type: Range, 0.01 - 20 s	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

The time constant is used above 10% rated speed. Obtain quick control through a short dampening time constant. However, if this value is too short, the control becomes unstable.

Parameter 1-17 Voltage Filter Time Const.

Table 74: Parameter 1-17 Voltage Filter Time Const.

1-17 Voltage Filter Time Const.		
Default value: Size related	Parameter type: Range, 0.001 - 2 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

Reduces the influence of high frequency ripple and system resonance in the calculation of supply voltage. Without this filter, the ripples in the currents can distort the calculated voltage and affect the stability of the system.

Parameter 1-18 Min. Current at No Load

Table 75: Parameter 1-18 Min. Current at No Load

1-18 Min. Current at No Load		
Default value: 0%	Parameter type: Range, 0 - 50%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Adjust this parameter to achieve a smoother motor operation.

5.2.4 1-2* Motor Data

This parameter group contains input data from the nameplate on the connected motor.

N O T I C E

Changing the value of these parameters affects the setting of other parameters.

N O T I C E

The following parameters have no effect when *parameter 1-10 Motor Construction* is set to *[1] PM, non-salient SPM*, *[2] PM, salient IPM*, *[5] Sync. Reluctance*:

- *Parameter 1-20 Motor Power [kW]*
- *Parameter 1-21 Motor Power [HP]*
- *Parameter 1-22 Motor Voltage*
- *Parameter 1-23 Motor Frequency*

Parameter 1-20 Motor Power [kW]

Table 76: Parameter 1-20 Motor Power [kW]

1-20 Motor Power [kW]		
Default value: Size related	Parameter type: Range, 0.09 - 3000.00 kW	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

Enter the nominal motor power in kW according to the motor nameplate data. The default value corresponds to the nominal rated output of the drive. This parameter is visible in the LCP if *parameter 0-03 Regional Settings* is set to *[0] International*.

Parameter 1-21 Motor Power [HP]

Table 77: Parameter 1-21 Motor Power [HP]

1-21 Motor Power [HP]		
Default value: Size related	Parameter type: Range, 0.09 - 3000.00 hp	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: False

Enter the nominal motor power in hp according to the motor nameplate data. The default value corresponds to the nominal rated output of the drive. This parameter is visible in the LCP if *parameter 0-03 Regional Settings* is set to *[1] North America*.

Parameter 1-22 Motor Voltage

Table 78: Parameter 1-22 Motor Voltage

1-22 Motor Voltage		
Default value: Size related	Parameter type: Range, 10 - 1000 V	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

NOTICE

Setting this parameter sets the following parameters to their default settings:

- *Parameter 1-15 Low Speed Filter Time Const.*
- *Parameter 1-16 High Speed Filter Time Const.*
- *Parameter 1-17 Voltage Filter Time Const.*
- *Parameter 1-24 motor Current*
- *Parameter 1-30 Stator Resistance (Rs)*
- *Parameter 1-31 Rotor Resistance (Rr)*
- *Parameter 1-33 Stator Leakage Reactance (X1)*
- *Parameter 1-34 Rotor Leakage Reactance (X2)*
- *Parameter 1-35 Main Reactance (Xh)*
- *Parameter 1-36 Iron Loss Resistance (Rfe)*
- *Parameter 4-18 Current Limit*
- *Parameter 14-31 Current Lim Ctrl, Integration Time*
- *Parameter 14-43 Motor Cosphi*
- *Parameter 16-36 Inv. Nom. Current*
- *Parameter 16-37 Inv. Max. Current*
- *Parameter 45-33 Alarm High*
- *Parameter 45-62 Load Threshold*

Enter the nominal motor voltage according to the motor nameplate data. The default value corresponds to the nominal rated output of the unit.

Parameter 1-23 Motor Frequency

Table 79: Parameter 1-23 Motor Frequency

1-23 Motor Frequency		
Default value: 50 Hz	Parameter type: Range, 20 - 1000 Hz	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

NOTICE

From software version 6.72 onwards, the output frequency of the drive is limited to 590 Hz.

N O T I C E

Setting this parameter sets the following parameters to their default settings:

- *Parameter 1-15 Low Speed Filter Time Const.*
- *Parameter 1-16 High Speed Filter Time Const.*
- *Parameter 1-17 Voltage Filter Time Const.*
- *Parameter 1-24 motor Current*
- *Parameter 1-30 Stator Resistance (Rs)*
- *Parameter 1-31 Rotor Resistance (Rr)*
- *Parameter 1-33 Stator Leakage Reactance (X1)*
- *Parameter 1-34 Rotor Leakage Reactance (X2)*
- *Parameter 1-35 Main Reactance (Xh)*
- *Parameter 1-36 Iron Loss Resistance (Rfe)*
- *Parameter 4-18 Current Limit*
- *Parameter 14-31 Current Lim Ctrl, Integration Time*
- *Parameter 14-43 Motor Cosphi*
- *Parameter 16-36 Inv. Nom. Current*
- *Parameter 16-37 Inv. Max. Current*
- *Parameter 45-33 Alarm High*
- *Parameter 45-62 Load Threshold*

Select the motor frequency value from the motor nameplate data. If a value other than 50 Hz or 60 Hz is selected, adapt the load-independent settings in *parameter 1-50 Motor Magnetisation at Zero Speed* to *parameter 1-53 Model Shift Frequency*. For 87 Hz operation with 230/400 V motors, set the nameplate data for 230 V/50 Hz. To run at 87 Hz, adapt *parameter 4-13 Motor Speed High Limit [RPM]* and *parameter 3-03 Maximum Reference*.

Parameter 1-24 Motor Current

Table 80: Parameter 1-24 Motor Current

1-24 Motor Current		
Default value: Size related	Parameter type: Range, 0.1 - 10000.00 A	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

N O T I C E

Setting this parameter sets the following parameters to their default settings:

- *Parameter 1-15 Low Speed Filter Time Const.*
- *Parameter 1-16 High Speed Filter Time Const.*
- *Parameter 1-17 Voltage Filter Time Const.*
- *Parameter 1-30 Stator Resistance (Rs)*
- *Parameter 1-31 Rotor Resistance (Rr)*
- *Parameter 1-33 Stator Leakage Reactance (X1)*
- *Parameter 1-34 Rotor Leakage Reactance (X2)*
- *Parameter 1-35 Main Reactance (Xh)*
- *Parameter 1-36 Iron Loss Resistance (Rfe)*
- *Parameter 4-18 Current Limit*
- *Parameter 14-31 Current Lim Ctrl, Integration Time*
- *Parameter 14-43 Motor Cosphi*
- *Parameter 45-33 Alarm High*
- *Parameter 45-62 Load Threshold*

Enter the nominal motor current value from the motor nameplate data. The data is used for calculating torque, motor overload protection, and so on.

Parameter 1-25 Motor Nominal Speed

Table 81: Parameter 1-25 Motor Nominal Speed

1-25 Motor Nominal Speed		
Default value: Size related	Parameter type: Range, 10 - 60000 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

N O T I C E

Changing this parameter will affect settings of other parameters.

Enter the nominal motor speed value from the motor nameplate data. The data is used for calculating motor compensations.

$n_{m,n} = n_s - n_{slip}$

Parameter 1-26 Motor Cont. Rated Torque

Table 82: Parameter 1-26 Motor Cont. Rated Torque

1-26 Motor Cont. Rated Torque		
Default value: Size related	Parameter type: Range, 0.1 - 10000.0 Nm	Setup: All setups
Conversion index: -1	Data type: Uint32	Change during operation: False

N O T I C E

Changing this parameter sets certain other parameters to their default settings.

Enter the value from the motor nameplate data. The default value corresponds to the nominal rated output. This parameter is available when *parameter 1-10 Motor Construction* is set to *[1] PM, non-salient SPM*, that is, the parameter is valid for PM and non-salient SPM motors only.

Parameter 1-29 Automatic Motor Adaptation

Table 83: Parameter 1-29 Automatic Motor Adaptation (AMA)

1-29 Automatic Motor Adaptation (AMA)		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

N O T I C E

This parameter cannot be adjsuted while the motor is running.

The AMA function optimizes dynamic motor performance by automatically optimizing the advanced motor parameters (*parameter 1-30 Stator Resistance (Rs)* to *parameter 1-35 Main Reactance (Xh))* on a cold motor at standstill. Activate the AMA function by pressing [Hand On] after selecting *[1] Enable Complete AMA* or *[2] Enable Reduced AMA*. If an LC filter is used between the drive and the motor, always select *[2] Enable Reduced AMA*. See also the *section Automatic Motor Adaptation* in the Design Guide. After a normal sequence, the display reads: *Press [OK] to finish AMA*. After pressing [OK], the drive is ready for operation.

N O T I C E

Ensure that a value is set in *parameter 14-43 Motor Cosphi* before running AMA II.

Option	Name	Description
[0]*	Off	
[1]	Enable complete AMA	Performs • AMA of the stator resistance R_s • The rotor resistance R_r • The stator leakage reactance X_1 • The rotor leakage reactance X_2, and • The main reactance X_h Do **not** select this option if an LC filter is used between the drive and the motor. For best performance, it is recommended to obtain the advanced motor data from the motor manufacturer to enter into *parameter 1-31 Rotor Resistance (Rr)* through *parameter 1-36 Iron Loss Resistance (Rfe)*. Complete AMA cannot be performed on permanent magnet motors.
[2]	Enable Reduced AMA	Performs a reduced AMA of the stator resistance R_s in the system only. This option is available for standard asynchronous motors and non-salient PM motors.
[3]	Enable reduced AMA II	Performs AMA of the stator resistance R_s, the rotor resistance R_r, the stator leakage reactance X_1, the rotor leakage reactance X_{21}, and the main reactance X_h.
[4]	Enable reduced AMA II	Performs a reduced AMA of the stator resistance R_s in the system only. Select this option if an LC filter is used between the drive and the motor. The AMA II is a variant of AMA, based on the principles of the torque calibration. It is recommended for special motors (for example S3) and high-power motors.
[5]	Enable rotating AMA II	Performs rotation with 60% of nominal speed in Flux Sensorless with soft PID independent of selection in *parameter 1-01 Motor Control Principle*. Measures Back EMF on PM motors and re-measures main reactance

Option	Name	Description
		(X_h) on induction motors. Ensure that the motor poles specified in *parameter 1-39 Motor Poles* are correct for accurate back EMF measurement.
[6]	Enable 360° turn OL	**Sensorless:** Performs a 360 degree test run in sensorless mode to verify the number of motor poles specified in *parameter 1-39 Motor Poles*. **Closed loop:** Performs a 360 degree test run in sensorless mode to test the encoder before running in closed loop. The speed is set in *parameter 3-19 Jog Speed [RPM]*. During the test run, the direction of rotation is verified and the number of pulses per revolution is verified to match the configuration in *parameter group 17-** Motor Feedb. Option* or *parameter group 5-** Digital In/Out* based on the selected encoder. After completing the 360 degree test run, either of the following messages are shown: • Encoder/Resolver OK • Encoder/Resolver Fail • Encoder/Resolver Inverted • Encoder/Resolver resolution/poles low • Encoder/Resolver resolution/poles high The *parameter 1-41 Motor Angle Offset* is automatically set when using PM motor and absolute encoder or resolver.
[7]	Enable inertia run	Use this option to ramp up in the mode as specified in *parameter 1-01 Motor Control Principle*. Measured inertia is set in *parameter 1-69 System Inertia* and *parameter 7-08 Speed PID Feed Forward Factor* is set to 90%.

N O T I C E

- For the best adaptation of the drive, run AMA on a cold motor.
- AMA cannot be performed while the motor is running
- AMA cannot run with a sine-wave filter connected.

N O T I C E

It is important to set *parameter group 1-2* Motor Data* correctly, since these form part of the AMA algorithm. Perform an AMA to achieve optimum dynamic motor performance. It may take up to 10 minutes, depending on the power rating of the motor.

N O T I C E

Avoid generating external torque during AMA.

N O T I C E

If 1 of the settings in *parameter 1-2* Motor Data* is changed, *parameter 1-30 Stator Resistance (Rs)* to *parameter 1-39 Motor Poles* return to default setting.

N O T I C E

AMA works problem-free on 1 motor size down, typically works on 2 motor sizes down, rarely works on 3 sizes down, and never works on 4 sizes down. Keep in mind that the accuracy of the measured motor data is poorer when operating on motors smaller than the nominal drive size.

5.2.5 1-3* Adv. Motor Data

N O T I C E

The following parameters are only available in FC 302:

- *Parameter 1-37 d-axis Inductance (Ld)*
- *Parameter 1-38 q-axis Inductance (Ld)*
- *Parameter 1-40 Back EMF at 1000 RPM*
- *Parameter 1-44 d-axis Inductance Sat. (LdSat)*
- *Parameter 1-45 q-axis Inductance Sat. (LqSat)*
- *Parameter 1-49 q-axis Inductance Sat. Point*

This parameter group contains parameters related to:

- Motor nameplate load compensations.
- Application load type.
- Electronic brake function for quick stop/hold of the motor.

Ensure that the motor data in *parameter 1-30 Stator Resistance (Rs)* to *parameter 1-39 Motor Poles* matches the motor. The default settings are based on standard motor values. If the motor parameters are not set correctly, a malfunction of the drive system may occur. If the motor data is unknown, running an AMA (automatic motor adaptation) is recommended. See *parameter 1-29 Automatic Motor Adaptation (AMA)*.

Parameter groups 1-3 Adv. Motor Data* and *1-4* Adv. Motor Data II* cannot be adjusted while the motor is running.

N O T I C E

A simple check of the $X_1 + X_h$ sum value is to divide the line-to-line motor voltage by the sqrt(3) and divide this value by the motor no load current. [VL-L/sqrt(3)]/INL = $X_1 + X_h$. These values are important to magnetize the motor properly. For high-pole motors, it is highly recommended to perform this check.

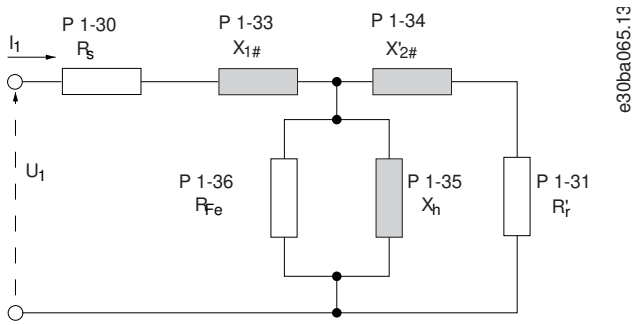


Illustration 30: Motor Equivalent Diagram of an Asynchronous Motor

Parameter 1-30 Stator Resistance (Rs)

Table 84: Parameter 1-30 Stator Resistance (Rs)

1-30 Stator Resistance (Rs)		
Default value: Size related	Parameter type: Range, 0.0140 - 140.0000 Ohm	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

Set the line-to-common stator resistance value. Enter the value from a motor datasheet or perform an AMA on a cold motor.

NOTICE

For salient PM motors: AMA is not available. If only line-line data is available, divide the line-line value by 2 to achieve the line-to-common (star point) value. Alternatively, measure the value with an ohmmeter. This also takes the resistance of the cable into account. Divide the measured value by 2 and enter the result.

NOTICE

The parameter value is updated after each torque calibration if option *[3] 1st start with store* or option *[4] Every start with store* is selected in *parameter 1-47 Torque Calibration*.

Parameter 1-31 Rotor Resistance (Rr)

Table 85: Parameter 1-31 Rotor Resistance (Rr)

1-31 Rotor Resistance (Rr)		
Default value: Size related	Parameter type: Range, 0.0100 - 100.0000 Ohm	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: False

NOTICE

Parameter 1-31 Rotor Resistance (Rr) has no effect when *parameter 1-10 Motor Construction* is set to *[1] PM, non-salient SPM*, *[5] SynRM*.

Set the rotor resistance value R_r to improve shaft performance using 1 of these methods:

- Run an AMA on a cold motor. The drive measures the value from the motor. All compensations are reset to 100%.
- Enter the R_r value manually. Obtain the value from the motor supplier.
- Use the R_r default setting. The drive establishes the setting based on the motor nameplate data.

Parameter 1-33 Stator Leakage Reactance (X1)

Table 86: Parameter 1-33 Stator Leakage Reactance (X1)

1-33 Stator Leakage Reactance (X1)		
Default value: Size related	Parameter type: Range, 0.0400 - 400.0000 Ohm	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: False

NOTICE

This parameter is only relevant for asynchronous motors.

Set the stator leakage reactance of the motor using 1 of these methods:

- Run an AMA on a cold motor. The drive measures the value from the motor.
- Enter the X_1 value manually. Obtain the value from the motor supplier.
- Use the X_1 default setting. The drive establishes the setting based on the motor nameplate data.

NOTICE

The parameter value is updated after each torque calibration if option *[3] 1st start with store* or option *[4] Every start with store* is selected in *parameter 1-47 Torque Calibration*.

Parameter 1-34 Rotor Leakage Reactance (X2)

Table 87: Parameter 1-34 Rotor Leakage Reactance (X2)

1-34 Rotor Leakage Reactance (X2)		
Default value: Size related	Parameter type: Range, 0.0400 - 400.0000 Ohm	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: False

NOTICE

This parameter is only relevant for asynchronous motors.

Set the rotor leakage reactance of the motor using 1 of these methods:

- Run an AMA on a cold motor. The drive measures the value from the motor.
- Enter the X_2 value manually. Obtain the value from the motor supplier.
- Use the X_2 default setting. The drive establishes the setting based on the motor nameplate data.

NOTICE

The parameter value is updated after each torque calibration if option *[3] 1st start with store* or option *[4] Every start with store* is selected in *parameter 1-47 Torque Calibration*.

Parameter 1-35 Main Reactance (Xh)

Table 88: Parameter 1-35 Main Reactance (Xh)

1-35 Main Reactance (Xh)		
Default value: Size related	Parameter type: Range, 1.0000 - 10000.0000 Ohm]	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: False

NOTICE

This parameter cannot be adjusted while the motor is running.

NOTICE

Parameter 1-35 Main Reactance (Xh) does not have effect when *parameter 1-10 Motor Construction* is set to *[1] PM, non-salient SPM*.

Set the main reactance of the motor using 1 of these methods:

- Run an AMA on a cold motor. The drive measures the value from the motor.
- Enter the X_h value manually. Obtain the value from the motor supplier.
- Use the X_h default setting. The drive establishes the setting based on the motor nameplate data.

NOTICE

The parameter value is updated after each torque calibration if option *[3] 1st start with store* or option *[4] Every start with store* is selected in *parameter 1-47 Torque Calibration*.

Parameter 1-36 Iron Loss Resistance (Rfe)

Table 89: Parameter 1-36 Iron Loss Resistance (Rfe)

1-36 Iron Loss Resistance (Rfe)		
Default value: Size related	Parameter type: Range, 0 - 10000.000 Ohm]	Setup: All setups
Conversion index: -3	Data type: Uint32	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

Enter the equivalent iron loss resistance (R_{Fe}) value to compensate for iron loss in the motor. The R_{Fe} value cannot be found by performing an AMA. The R_{Fe} value is especially important in torque control applications. If R_{Fe} is unknown, leave *parameter 1-36 Iron Loss Resistance (Rfe)* on default setting.

Parameter 1-37 d-axis Inductance (Ld)

For induction motors, stator resistance and d-axis inductance values are normally described technical specifications as between line and common (starpoint). For PM motors, they are typically described in technical specifications as between line-to-line. PM motors are typically built for start connection.

Table 90: Parameters Related to PM Motors

Parameter	Function
Parameter 1-30 Stator Resistance (Rs) (line to common).	This parameter gives stator winding resistance (R_s) similar to asynchronous motor stator resistance. The stator resistance is defined for line-to-common measurement. For line-line data, where stator resistance is measured between any 2 lines, divide by 2.
Parameter 1-37 d-axis Inductance (Ld) (line to common).	This parameter gives direct axis inductance of the PM motor. The daxis inductance is defined for phase-to-common measurement. For lineline data, where stator resistance is measured between any 2 lines, divide by 2.
Parameter 1-40 Back EMF at 1000 RPM RMS (line to line value).	This parameter gives back EMF across stator terminal of PM motor at 1000 RPM mechanical speed specifically. It is defined between line-to-line and expressed in RMS value.

N O T I C E

Motor manufacturers provide values for stator resistance (*parameter 1-30 Stator Resistance (Rs)*) and d-axis inductance (*parameter 1-37 d-axis Inductance (Ld)*) in technical specifications as between line and common (starpoint) or line between line. There is no general standard. The different setups of stator winding resistance and induction are shown in Illustration 31. Danfoss AC drives always require the line-to-common value. The back EMF of a PM motor is defined as induced EMF developed across any of 2 phases of stator winding of a free-running motor. Danfoss AC drives always require the line-to-line RMS value measured at 1000 RPM, mechanical speed of rotation, see Illustration 32.

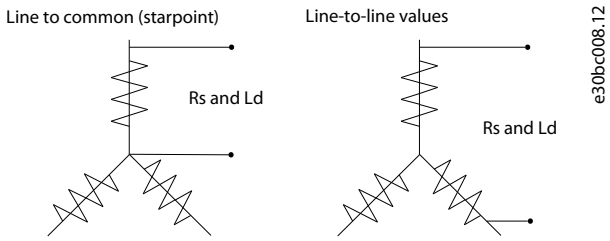


Illustration 31: Stator Winding Setups

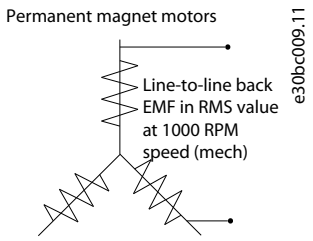


Illustration 32: Machine Parameter Definitions of Back EMF of PM Motors

Parameter 1-38 q-axis Inductance (Lq)

Table 91: Parameter 1-38 q-axis Inductance (Lq)

1-38 q-axis Inductance (Lq)		
Default value: Size related	Parameter type: Range, 0.001 - 1000 mH	Setup: All setups
Conversion index: -6	Data type: Int32	Change during operation: False

Set the value of the q-axis inductance. See the motor datasheet.

Parameter 1-39 Motor Poles

Table 92: Parameter 1-39 Motor Poles

1-39 Motor Poles		
Default value: Size related	Parameter type: Range, 2 - 255	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

Enter the number of motor poles. The number of motor poles is always an even number as it refers to the total number of poles, not pairs of poles.

Table 93: Pole Number for Normal Speed Ranges

Poles	**~n_n@ 50 Hz**	**~n_n@ 60 Hz**
2	2700–2880	3520–3460
4	1350–1450	1625–1730
6	700–960	840–1153

The table shows the pole number for normal speed ranges of various motor types. Define motors designed for other frequencies separately. The motor pole value is always an even number because it refers to the total pole number, not pairs of poles. The drive creates the initial setting of *parameter 1-39 Motor Poles* based on *parameter 1-23 Motor Frequency* and *parameter 1-25 Motor Nominal Speed*.

Parameter 1-40 Back EMF at 1000 RPM

Table 94: Parameter 1-40 Back EMF at 1000 RPM

1-40 Back EMF at 1000 RPM		
Default value: Size related	Parameter type: Range, 1 - 9000 V	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

NOTICE

This parameter is only active when *parameter 1-10 Motor Construction* is set to options that enable PM (permanent magnet) motors.

Set the nominal back EMF for the motor when running at 1000 RPM. Back EMF is the voltage generated by a PM motor when no drive is connected and the shaft is turned externally. Back EMF is normally specified for nominal motor speed or for 1000 RPM measured between 2 lines. If the value is not available for a motor speed of 1000 RPM, calculate the correct value as follows:

Back EMF = (Voltage ÷ RPM) × 1000

In an example where the voltage is 320 V and RPM is 1800, the back EMF at 1000 RPM is:

(320 ÷ 1800) × 1000 = 178

NOTICE

When using PM motors, it is recommended to use brake resistors.

Parameter 1-44 d-axis Inductance Sat. (LdSat)

Table 95: Parameter 1-44 d-axis Inductance Sat. (LdSat)

1-44 d-axis Inductance Sat. (LdSat)		
Default value: Size related	Parameter type: Range, 0.001 - 1000 mH	Setup: All setups
Conversion index: -6	Data type: Int32	Change during operation: False

This parameter corresponds to the inductance saturation of Ld. Ideally, this parameter has the same value as *parameter 1-37 d-axis Inductance (Ld)*. If the motor supplier provides an induction curve, enter the induction value at 200% of the nominal value.

Parameter 1-45 q-axis Inductance Sat. (LqSat)

Table 96: Parameter 1-45 q-axis Inductance Sat. (LqSat)

1-45 q-axis Inductance Sat. (LqSat)		
Default value: Size related	Parameter type: Range, 0 - 1000 mH	Setup: All setups
Conversion index: -6	Data type: Int32	Change during operation: False

This parameter corresponds to the inductance saturation of Lq. Ideally, this parameter has the same value as *parameter 1-38 q-axis Inductance (Lq)*. If the motor supplier provides an induction curve, enter the induction value at 200% of the nominal value.

Parameter 1-46 Position Detection Gain

Table 97: Parameter 1-46 Position Detection Gain

1-46 Position Detection Gain		
Default value: 120%	Parameter type: Range, 20 - 200%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Adjusts the amplitude of the test pulse during position detection at start. Adjust this parameter to improve the position measurement.

Parameter 1-47 Torque Calibration

Table 98: Parameter 1-47 Torque Calibration

1-47 Torque Calibration		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Use this parameter to optimize the torque estimate in the full speed range. The estimated torque is based on the shaft power, $P_{shaft} = P_m - R_s \times I^2$. Make sure that the R_s value is correct. The R_s value in this formula is equal to the power loss in the motor, the cable, and the drive. When this parameter is active, the drive calculates the R_s value during power-up, ensuring the optimal torque estimate and optimal performance. Use this feature in cases when it is not possible to adjust *parameter 1-30 Stator Resistance (Rs)* on each drive to compensate for the cable length, drive losses, and the temperature deviation on the motor.

Option	Name	Description
[0]*	Off	
[1]	1st start after pwr-up	Calibrates at the 1st start-up after power-up and keeps this value until reset by a power cycle.
[2]	Every start	Calibrates at every start-up, compensating for a possible change in motor temperature since last start-up. The value is reset after a power cycle.
[3]	1st start with store	The drive calibrates the torque at the 1st start-up after power-up. This option is used to update motor parameters: • *Parameter 1-30 Stator Resistance (Rs).* • *Parameter 1-33 Stator Leakage Reactance (X1).* • *Parameter 1-34 Rotor Leakage Reactance (X2).* • *Parameter 1-37 d-axis Inductance (Ld).*
[4]	Every start with store	The drive calibrates the torque at every start-up, compensating for a possible change in motor temperature since last start-up. This option is used to update motor parameters: • *Parameter 1-30 Stator Resistance (Rs).* • *Parameter 1-33 Stator Leakage Reactance (X1).* • *Parameter 1-34 Rotor Leakage Reactance (X2).* • *Parameter 1-37 d-axis Inductance (Ld).*

Parameter 1-48 d-axis Inductance Sat. Point

Table 99: Parameter 1-48 d-axis Inductance Sat. Point

1-48 d-axis Inductance Sat. Point		
Default value: Size related	Parameter type: Range, 1 - 500%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

N O T I C E

Run an AMA to set the value of this parameter. Edit the value manually only when the application requires a value other than determined by AMA.

Select the d-axis inductance saturation point. The drive uses this value to optimize the performance of SynRM motors. Select the value that matches the point where the inductance equals the mean value of *parameter 1-37 d-axis Inductance (Ld)* and *parameter 1-44 d-axis Inductance Sat. (LdSat)*, as percentage of nominal current.

Parameter 1-49 q-axis Inductance Sat. Point

Table 100: Parameter 1-49 q-axis Inductance Sat. Point

1-49 q-axis Inductance Sat. Point		
Default value: Size related	Parameter type: Range, 1 - 200%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

N O T I C E

Run an AMA to set the value of this parameter. Edit the value manually only when the application requires a value other than determined by AMA.

Enter the q-axis inductance saturation point. The drive uses this value to optimize the performance of IPM motors. Select the value that matches the point where the inductance equals the average value of *parameter 1-38 q-axis Inductance (Lq)* and *parameter 1-45 q-axis Inductance Sat. (LqSat)*, as a percentage of nominal current.

5.2.6 1-5* Load Indep. Setting

N O T I C E

The following parameter is only available in FC 302:

– *Parameter 1-53 Model Shift Frequency*

This parameter group contains parameters related to:

- Motor nameplate load compensations.
- Application load type.
- Electronic brake function for quick stop/hold of the motor.

Parameter 1-50 Motor Magnetization at Zero Speed

Table 101: Parameter 1-50 Motor Magnetization at Zero Speed

1-50 Motor Magnetization at Zero Speed		
Default value: 100%	Parameter type: Range, 0 - 300%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

N O T I C E

Parameter 1-50 Motor Magnetisation at Zero Speed has no effect when *parameter 1-10 Motor Construction = [1] PM, nonsalient SPM*.

Use this parameter along with *parameter 1-51 Min Speed Normal Magnetising [RPM]* to obtain a different thermal load on the motor when running at low speed. Enter a value which is a percentage of the rated magnetizing current. If the setting is too low, the torque on the motor shaft may be reduced.

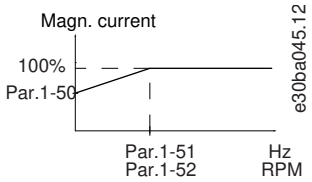


Illustration 33: Motor Magnetization

Parameter 1-51 Min Speed Normal Magnetising [RPM]

Table 102: Parameter 1-51 Min Speed Normal Magnetising [RPM]

1-51 Min Speed Normal Magnetising [RPM]		
Default value: Size related	Parameter type: Range, 10 - 600 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

N O T I C E

Parameter 1-51 Min Speed Normal Magnetising [RPM] has no effect when *parameter 1-10 Motor Construction = [1] PM, nonsalient SPM*.

Set the required speed for normal magnetizing current. If the speed is set lower than the motor slip speed, *parameter 1-50 Motor Magnetisation at Zero Speed* and *parameter 1-51 Min Speed Normal Magnetising [RPM]* are of no significance. Use this parameter along with *parameter 1-50 Motor Magnetisation at Zero Speed*.

Parameter 1-52 Min Speed Normal Magnetising [Hz]

Table 103: Parameter 1-52 Min Speed Normal Magnetising [Hz]

1-52 Min Speed Normal Magnetising [Hz]		
Default value: Size related	Parameter type: Range, 0 - 250.0 Hz	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

N O T I C E

Parameter 1-52 Min Speed Normal Magnetising [Hz] has no effect when *parameter 1-10 Motor Construction = [1] PM, non-salient SPM*.

Set the required frequency for normal magnetizing current. If the frequency is set lower than the motor slip frequency, *parameter 1-50 Motor Magnetisation at Zero Speed* is inactive. Use this parameter along with *parameter 1-50 Motor Magnetisation at Zero Speed*.

Parameter 1-53 Model Shift Frequency

Table 104: Parameter 1-53 Model Shift Frequency

1-53 Model Shift Frequency		
Default value: Size related	Parameter type: Range, 4 - 18.0 Hz	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

Flux model shift: Enter the frequency value for shifting between 2 models for determining motor speed. Select the value based on settings in *parameter 1-00 Configuration Mode* and *parameter 1-01 Motor Control Principle*. There are the following options:

- Shift between flux model 1 and flux model 2.
- Shift between variable current mode and flux model 2.
- No shift between models at low speed if *parameter 40-50 Flux Sensorless Model Shift* is set to option *[0] Off*.

Flux model 1 - flux model 2: This model is used when *parameter 1-00 Configuration Mode* is set to *[1] Speed closed loop* or *[2] Torque*, and *parameter 1-01 Motor Control Principle* is set to *[3] Flux w/motor feedback*. With this parameter, it is possible to make an adjustment of the shifting point where the drive changes between flux model 1 and flux model 2, which is useful in some sensitive speed and torque control applications.

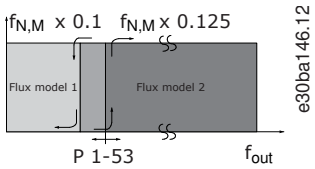


Illustration 34: Example of Parameter 1-00 Configuration Mode = [1] Speed closed loop or [2] Torque and parameter 1-01 Motor Control Principle = [3] Flux w/motor feedback

Variable current - flux model - sensorless: This model is used when *parameter 1-00 Configuration Mode* is set to *[0] Speed open loop* and *parameter 1-01 Motor Control Principle* is set to *[2] Flux sensorless*. In speed open loop in flux mode, the speed is determined from

the current measurement. Below f_{norm} x 0.1, the drive runs on a variable current model. Above f_{norm} x 0.125 the drive runs on a flux model.

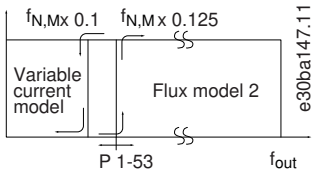


Illustration 35: Parameter 1-00 Configuration Mode = [0] Speed open loop, parameter 1-01 Motor Control Principle = [2] Flux sensorless

Parameter 1-54 Voltage Reduction in Fieldweakening

Table 105: Parameter 1-54 Voltage reduction in fieldweakening

1-54 Voltage reduction in fieldweakening		
Default value: 0 V	Parameter type: Range, -50 - 100 V	Setup: All setups
Conversion index: 0	Data type: Int8	Change during operation: True

The value of this parameter reduces the maximum voltage available for the flux of the motor in field weakening, providing more voltage for torque. Increasing the value increases the risk of stalling at high speed. When reducing the voltage below 0, the output voltage is increased and at some point the current controller is forced into "Voltage Limit".

Parameter 1-55 U/f Characteristic - U

Table 106: Parameter 1-55 U/f Characteristic - U

1-55 U/f Characteristic - U		
Default value: Size related	Parameter type: Range, 0 - 1000 V, Array [6]	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Enter the voltage at each frequency point to manually form a U/f characteristic matching the motor. The frequency points are defined in *parameter 1-56 U/f Characteristic - F*. This parameter is an array parameter [0-5] and is only accessible when *parameter 1-01 Motor Control Principle* is set to *[0] U/f*.

Parameter 1-56 U/f Characteristic - F

Table 107: Parameter 1-56 U/f Characteristic - F

1-56 U/f Characteristic - F		
Default value: Size related	Parameter type: Range, 0 - 1000.0 V, Array [6]	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Enter the frequency points to form a U/f characteristic manually matching the motor. The voltage at each point is defined in *parameter 1-55 U/f Characteristic - U*. This parameter is an array parameter [0–5] and is only accessible when *parameter 1-01 Motor Control Principle* is set to *[0] U/f*.

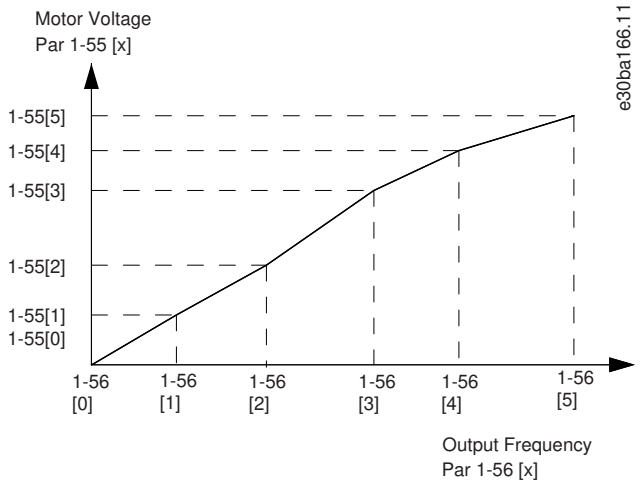


Illustration 36: U/f Characteristic

Parameter 1-57 Torque Estimation Time Constant

Table 108: Parameter 1-57 Torque Estimation Time Constant

1-57 Torque Estimation Time Constant		
Default value: 150 ms	Parameter type: Range, 50 - 1000 ms	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

N O T I C E

This parameter is only valid with software version 48.XX.

Enter the time constant for the torque estimation below model change point in flux sensorless control principle.

Parameter 1-58 Flying Start Test Pulses Current

Table 109: Parameter 1-58 Flying Start Test Pulses Current

1-58 Flying Start Test Pulses Current		
Default value: Size related	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

N O T I C E

This parameter is only available in VVC+.

N O T I C E

This parameter has effect on PM motors only.

Sets the current level for the flying start test pulses that are used to detect the motor direction. 100% means $I_{m,n}$. Adjust the value to be high enough to avoid noise influence, but low enough to avoid affecting the accuracy (current must be able to drop to 0 before the next pulse). Reduce the value to reduce the generated torque. Default is 30% for asynchronous motors, but may vary for PM motors. For adjusting PM motors, the value tunes for back EMF and d-axis inductance of the motor.

Parameter 1-59 Flying Start Test Pulses Frequency

Table 110: Parameter 1-59 Flying Start Test Pulses Frequency

1-59 Flying Start Test Pulses Frequency		
Default value: Size related	Parameter type: Range, 0 - 500%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Asynchronous motor: Set the frequency of the flying start test pulses that are used to detect the motor direction. For asynchronous motors, the value 100% means that the slip is doubled. Increase this value to reduce the generated torque. For synchronous motors, this value is the percentage $n_{m,n}$ of the free-running motor. Above this value, flying start is always performed. Below this value, the start mode is selected in *parameter 1-70 Start Mode*.

5.2.7 1-6* Load Depend. Setting

N O T I C E

The following parameters are only available in FC 302:

- *Parameter 1-66 Min. Current at Low Speed*
- *Parameter 1-67 Load Type*
- *Parameter 1-68 Motor Inertia*
- *Parameter 1-69 System Inertia*

Parameter 1-60 Low Speed Load Compensation

Table 111: Parameter 1-60 Low Speed Load Compensation

1-60 Low Speed Load Compensation		
Default value: 100%	Parameter type: Range, 0 - 300%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Enter the % value to compensate voltage in relation to load when the motor is running at low speed and obtain the optimum U/f characteristic. The motor size determines the frequency range within which this parameter is active.

Motor size	Changeover
0.25–7.5 kW	<10 Hz
11–45 kW	<5 Hz
55–maximum power size kW	<3–4 Hz

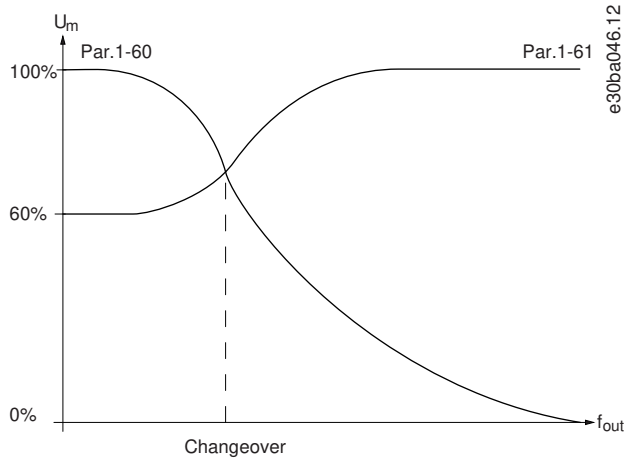


Illustration 37: Changeover

Parameter 1-61 High Speed Load Compensation

Table 112: Parameter 1-61 High Speed Load Compensation

1-61 High Speed Load Compensation		
Default value: 100%	Parameter type: Range, 0 - 300%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Enter the % value to compensate voltage in relation to load when the motor is running at high speed and obtain the optimum U/f characteristic. The motor size determines the frequency range within which this parameter is active.

Motor size	**Changeover**
0.25–7.5 kW	>10 Hz
11–45 kW	>5 Hz
55–maximum power size kW	>3–4

Parameter 1-62 Slip Compensation

Table 113: Parameter 1-62 Slip Compensation

1-62 Slip Compensation		
Default value: Size related	Parameter type: Range, -500 - 500%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Enter the % value for slip compensation to compensate for tolerances in the value of $n_{M,N}$. Slip compensation is calculated automatically, that is on the basis of the nominal motor speed $n_{M,N}$. This function is not active when *parameter 1-00 Configuration Mode* is set to *[1] Speed closed loop* or *[2] Torque* torque control with speed feedback or when *parameter 1-01 Motor Control Principle* is set to *[0] U/f*.

Parameter 1-63 Slip Compensation Time Constant

Table 114: Parameter 1-63 Slip Compensation Time Constant

1-63 Slip Compensation Time Constant		
Default value: Size related	Parameter type: Range, 0.05 - 5 s	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

N O T I C E

Parameter 1-63 Slip Compensation Time Constant has no effect when *parameter 1-10 Motor Construction = [1] PM, nonsalient SPM*.

Enter the slip compensation reaction speed. A high value results in slow reaction, and a low value results in quick reaction. If low-frequency resonance problems arise, use a longer time setting.

Parameter 1-64 Resonance Damping

Table 115: Parameter 1-64 Resonance Damping

1-64 Resonance Damping		
Default value: Size related	Parameter type: Range, 0 - 1000%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

N O T I C E

Parameter 1-64 Resonance Damping has no effect when *parameter 1-10 Motor Construction = [1] PM, nonsalient SPM*.

Enter the resonance damping value. Set *parameter 1-64 Resonance Damping* and *parameter 1-65 Resonance Damping Time Constant* to help eliminate high-frequency resonance problems. To reduce resonance oscillation, increase the value of *parameter 1-64 Resonance Damping*.

Parameter 1-65 Resonance Damping Time

Table 116: Parameter 1-65 Resonance Damping Time Constant

1-65 Resonance Damping Time Constant		
Default value: 5 ms	Parameter type: Range, 1 - 50 ms	Setup: All setups
Conversion index: -3	Data type: Uint8	Change during operation: True

N O T I C E

Parameter 1-65 Resonance Damping Time Constant has no effect when *parameter 1-10 Motor Construction = [1] PM, non-salient SPM*.

Set *parameter 1-64 Resonance Damping* and *parameter 1-65 Resonance Damping Time Constant* to help eliminate high-frequency resonance problems. Enter the time constant that provides the best dampening.

Parameter 1-66 Min. Current at Low Speed

Table 117: Parameter 1-66 Min. Current at Low Speed

1-66 Min. Current at Low Speed		
Default value: Size related	Parameter type: Range, 1 - 200%	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

N O T I C E

If *parameter 40-50 Flux Sensorless Model Shift* is set to *[0] Off*, this parameter is ignored.

Enter the minimum motor current at low speed, see *parameter 1-53 Model Shift Frequency*. Increasing this current improves motor torque at low speed. *Parameter 1-66 Min. Current at Low Speed* is enabled when *parameter 1-00 Configuration Mode* is set to *[0] Speed open loop* only. The drive runs with constant current through motor for speeds below 10 Hz. For speeds above 10 Hz, the motor flux model in the drive controls the motor. *Parameter 4-16 Torque Limit Motor Mode* and/or *parameter 4-17 Torque Limit Generator Mode* automatically adjust *parameter 1-66 Min. Current at Low Speed*. The parameter with the highest value adjusts *parameter 1-66 Min. Current at Low Speed*. The current setting in *parameter 1-66 Min. Current at Low Speed* is composed of the torque generating current and the magnetizing current. **Example:** Set *parameter 4-16 Torque Limit Motor Mode* to 100% and set *parameter 4-17 Torque Limit Generator Mode* to 60%. *Parameter 1-66 Min. Current at Low Speed* automatically adjusts to about 127%, depending on the motor size.

Parameter 1-67 Load Type

Table 118: Parameter 1-67 Load Type

1-67 Load Type		
Default value: [0] Passive load	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Passive load	For conveyors, fans, and pump applications.
[1]	Active load	For hoisting applications. This option allows the drive to ramp up at 0 RPM. When *[1] Active Load* is selected, set *parameter 1-66 Min. Current at Low Speed* to a level which corresponds to maximum torque.

Parameter 1-68 Motor Inertia

Table 119: Parameter 1-68 Motor Inertia

1-68 Motor Inertia		
Default value: 0 kgm²	Parameter type: Range, 0.0000 - 10000.0000 kgm^2	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: False

Enter the motor inertia to obtain an improved torque readout and therefore a better estimate of the mechanical torque on the shaft. Available in flux control principle only.

Parameter 1-69 System Inertia

Table 120: Parameter 1-69 System Inertia

1-69 System Inertia		
Default value: Size related	Parameter type: Range, 0000 - 10000.0000 kgm^2	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

The system inertia and *parameter 7-08 Speed PID Feed Forward Factor* are used to calculate acceleration feed forward for the speed PID controller. Automatic measurement of system inertia and setting of this parameter are activated by setting the parameter to 0. System inertia is calculated after the 1st running cycle with sufficient data and the parameter is automatically set after stop. The function is only active when *parameter 1-01 Motor Control Principle* is set to *[2] Flux Sensorless* or *[3] Flux w/motor feedb*. Accelerate to at least model shift frequency (*parameter 1-53 Model Shift Frequency*) + 10 Hz and decelerate to produce a result. Measurement is possible in both speed, position, or synchronization mode.

5.2.8 1-7* Start Adjustments

Parameter 1-70 Start Mode

Table 121: Parameter 1-70 Start Mode

1-70 Start Mode		
Default value: [0] Rotor detection	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the start-up mode. This is done to initialize the VVC+ control core for previously free-running motor. Both selections estimate the speed and angle. Active for PM and SynRM motors in VVC+ only.

Option	Name	Description
[0]*	Rotor detection	Estimates the electrical angle of the rotor and uses this as a starting point. Standard selection for automation applications.
[1]	Parking	The parking function applies DC current across the stator winding and rotates the rotor to electrical 0 position (typically selected for HVAC applications). Parking current and time are configured in *parameter 2-06 Parking Current* and *parameter 2-07 Parking Time*.
[2]	Rotor det. w/ parking	Combining rotor detection with the parking function.

Parameter 1-71 Start Delay

Table 122: Parameter 1-71 Start Delay

1-71 Start Delay		
Default value: 0 s	Parameter type: Range, 0 - 25.5 s	Setup: All setups
Conversion index: -1	Data type: Uint8	Change during operation: True

This parameter refers to the start function selected in *parameter 1-72 Start Function*. Enter the time delay required before commencing acceleration.

Parameter 1-72 Start Function

Table 123: Parameter 1-72 Start Function

1-72 Start Function		
Default value: [2] Coast/delay time	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the start function during start delay. This parameter is linked to *parameter 1-71 Start Delay*.

Option	Name	Description
[0]	DC hold/ delay time	Energize the motor with a DC hold current (*parameter 2-00 DC Hold Current*) during the start delay time.
[1]	DC brake/ delay time	Energize the motor with a DC brake current (*parameter 2-01 DC Brake Current*) during the start delay time.
[2]*	Coast/delay time	Motor coasted during the start delay time (inverter off).
[3]	Start speed cw	Only possible with VVC+. Connect the function described in *parameter 1-74 Start Speed [RPM]* and *parameter 1-76 Start Current* in the start delay time. Regardless of the value applied by the reference signal, the output speed applies the setting of the start speed in *parameter 1-74 Start Speed [RPM]* or *parameter 1-75 Start Speed [Hz]*, and the output current corresponds to the setting of the start current in *parameter 1-76 Start Current*. This function is typically used in hoisting applications without counterweight and especially in applications with a cone-motor where the start is clockwise, followed by rotation in the reference direction.
[4]	Horizontal operation	Only possible with VVC+. For obtaining the function described in *parameter 1-74 Start Speed [RPM]* and *parameter 1-76 Start Current during the start delay time*. The motor rotates in the reference direction. If the reference signal equals 0, *parameter 1-74 Start Speed [RPM]* is ignored and the output speed equals 0. The output current corresponds to the setting of the start current in *parameter 1-76 Start Current*.
[5]	VVC$^+$/flux clockwise	For the function described in *parameter 1-74 Start Speed [RPM]* only. The start current is calculated automatically. This function uses the start speed in the start delay time only. Regardless of the value set by the reference signal, the output speed equals the setting of the start speed in *parameter 1-74 Start Speed [RPM]*. *[3] Start speed/current clockwise* and *[5] VVC+/Flux clockwise* are typically used in hoisting applica-

Option	Name	Description
		tions. *[4] Start speed/current* in reference direction is particularly used in applications with counterweight and horizontal movement.
[6]	Hoist mech. brake rel	For utilizing mechanical brake control functions (*parameter 2-24 Stop Delay* to *parameter 2-28 Gain Boost Factor*). This parameter is only active in flux control principle, in a mode with motor feedback or sensorless mode.
[7]	VVC$^+$/flux counter-cw	Same function as in *[5] VVC+/flux clockwise* but running in the opposite direction.

Flying start function

When flying start is enabled, *parameter 1-71 Start Delay* and *parameter 1-72 Start Function* have no function. When options *[1] Enable* and *[2] Enabled always* are enabled, *parameter 1-58 Flying Start Test Pulses Current* and *parameter 1-59 Flying Start Test Pulses Frequency* are used to specify conditions for flying start. For flying start version 1, options *[3] Enabled ref. dir.* and *[4] Enab. always ref. dir.* are set to search for the motor in the reference direction only, which allows a faster execution of the motor catch. For flying start version 2, options *[11]* to *[14]* are specific to asynchronous motor (induction motor) in VVC+ up to 132 Hz output frequency. These options provide a faster, more reliable, and robust flying start. When *parameter 1-73 Flying Start* is enabled, *parameter 1-71 Start Delay* has no function.

Parameter 1-73 Flying Start

Table 124: Parameter 1-73 Flying Start

1-73 Flying Start		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

NOTICE

This function is not recommended for hoisting applications. For power levels above 55 kW, flux mode must be used to achieve the best performance.

NOTICE

To obtain the best flying start performance, the advanced motor data, *parameter 1-30 Stator Resistance (Rs)* to *parameter 1-35 Main Reactance (Xh)*, must be correct.

This function makes it possible to catch a freely spinning motor, for example coasted because of mains dropout. When *parameter 1-73 Flying Start* is enabled, *parameter 1-71 Start Delay* has no function. Search direction for flying start is linked to the setting in *parameter 4-10 Motor Speed Direction*. *[0] Clockwise*: Flying start searches in clockwise direction. If not successful, a DC brake is carried out. *[2] Both Directions*: The flying start first searches in the direction determined by the last reference (direction). If the speed is not found, flying start searches in the other direction. If not successful, a DC brake activates in the time set in *parameter 2-02 DC Braking Time*. Start then takes place from 0 Hz.

Option	Name	Description
[0]*	Disabled	No function.
[1]	Enabled	Enable after coast.
[2]	Enabled always	Enable at every start.
[3]	Enabled ref. dir.	Enable after coast, search in reference direction only.
[4]	Enab. always ref. dir.	Enable at every start, search in reference direction only.
[11]	v2 Enabled	Enable flying start version 2, after coast.

Option	Name	Description
[12]	v2 Enabled Always	Enable flying start version 2, at every start.
[13]	v2 Enabled Ref. Dir.	Enable flying start version 2, after coast, search in reference direction only.
[14]	v2 Enab. Alw. Ref. Dir.	Enable flying start version 2, ok at every start, search in reference direction only.

Parameter 1-74 Start Speed [RPM]

Table 125: Parameter 1-74 Start Speed [RPM]

1-74 Start Speed [RPM]		
Default value: Size related	Parameter type: Range, 0 - 600 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Set a motor start speed. After the start signal, the output speed leaps to set value. Set the start function in *parameter 1-72 Start Function* to *[3] Start speed cw*, *[4] Horizontal operation*, or *[5] VVC+ /Flux clockwise*, and set a start delay time in *parameter 1-71 Start Delay*.

Parameter 1-75 Start Speed [Hz]

Table 126: Parameter 1-75 Start Speed [HZ]

1-75 Start Speed [HZ]		
Default value: Size related	Parameter type: Range, 0 - 500.0 Hz	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

This parameter can be used for hoist applications (cone rotor). Set a motor start speed. After the start signal, the output speed leaps to the set value. Set the start function in *parameter 1-72 Start Function* to *[3] Start speed cw*, *[4] Horizontal operation*, or *[5] VVC+/Flux clockwise*, and set a start delay time in *parameter 1-71 Start Delay*.

Parameter 1-76 Start Current

Table 127: Parameter 1-76 Start Current

1-76 Start Current		
Default value: 0 A	Parameter type: Range, 0 - par. 1-24 A	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Some motors, for example cone rotor motors, need extra current/starting speed to disengage the rotor. To obtain this boost, set the required current in *parameter 1-76 Start Current*. Set *parameter 1-74 Start Speed [RPM]*. Set *parameter 1-72 Start Function* to *[3] Start speed cw* or *[4] Horizontal operation*, and set a start delay time in *parameter 1-71 Start Delay*. This parameter can be used for hoist applications (cone rotor).

5.2.9 1-8* Stop Adjustments

Parameter 1-80 Function at Stop

Table 128: Parameter 1-80 Function at Stop

1-80 Function at Stop		
Default value: [0] Coast	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the drive function after a stop command or after the speed is ramped down to the settings in *parameter 1-81 Min Speed for Function at Stop [RPM]*.

Table 129: Choices Depending on Control

		ASM	SPM	IPM	SynRM
VVC+	Speed OL	All choices	[0],[1],[5]	[0],[1],[5]	[0],[1],[5]
Flux OL	Speed OL	[0],[1],[2],[3],[5],[6]	[0],[1],[5]	[0],[1],[5]	–
Flux CL	Speed CL	All choices	[0],[1],[5],[8]	[0],[1],[5],[8]	–

Option	Name	Description
[0]*	Coast	Leaves motor in free mode. The motor is disconnected from the drive.
[1]	DC hold	Energizes the motor with a DC hold current (see *parameter 2-00 DC Hold Current*).
[2]	Motor check	Checks if a motor has been connected. The interval for checking the motor can be defined in *parameter 4-49 Motor Check Time Interval*.
[3]	Premagnetizing	Builds up a magnetic field while the motor is stopped. This allows the motor to produce torque quickly at subsequent start commands (asynchronous motors only). This premagnetizing function does not help the 1st start command. Two different solutions are available to premagnetize the machine for the 1st start command: • Start the drive with a 0 RPM reference and wait 2–4 rotor time constants before increasing the speed reference. • Use the start delay with DC hold: Set *parameter 1-71 Start Delay* to the required premagnetizing time (2–4 rotor time constants). See the time constants description further in this section. Set *parameter 1-72 Start Function* to either *[0] DC hold* or *[1] DC Brake*. Set the DC hold or DC brake current magnitude (*parameter 2-00 DC Hold Current* or *parameter 2-01 DC Brake Current*) to be equal to I_pre-mag = Unom/(1.73 x Xh). Sample rotor time constants = (Xh+X2)/(6.3*Freq_nom*Rr) • 1 kW = 0.2 s • 10 kW = 0.5 s • 100 kW = 1.7 s • 1000 kW = 2.5 s
[4]	DC voltage U0	When the motor is stopped, *parameter 1-55 U/f Characteristic - U [0]* defines the voltage at 0 Hz.
[5]	Coast at low reference	When the reference is below *parameter 1-81 Min Speed for Function at Stop [RPM]*, the drive coasts the motor.
[6]	Motor check, alarm	The drive issues an alarm if 1 or more motor phases are missing.
[8]	Torque ramp to zero	**NOTICE** This option is only available in FC 302. When the motor reaches the speed defined in *parameter 1-81 Min Speed for Function at Stop [RPM]*, the drive ramps the torque down to 0 torque (for example, for extruder applications where a high torque is present at low speed). The torque ramp time can be set in *parameter 1-89 Stop Func Torque Ramp Time*.

Parameter 1-81 Min Speed for Function at Stop [RPM]

Table 130: Parameter 1-81 Min Speed for Function at Stop [RPM]

1-81 Min Speed for Function at Stop [RPM]		
Default value: Size related	Parameter type: Range, 0 - 600 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Set the speed at which to activate *parameter 1-80 Function at Stop*.

Parameter 1-82 Min Speed for Function at Stop [Hz]

Table 131: Parameter 1-82 Min Speed for Function at Stop [Hz]

1-82 Min Speed for Function at Stop [Hz]		
Default value: Size related	Parameter type: Range, 0 - 500.0 Hz	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Set the output frequency at which to activate *parameter 1-80 Function at Stop*.

Parameter 1-83 Precise Stop Function

Table 132: Parameter 1-83 Precise Stop Function

1-83 Precise Stop Function		
Default value: [0] Precise ramp stop	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

NOTICE

This is valid for FC 302 only.

NOTICE

This parameter cannot be adjusted while the motor is running.

Option	Name	Description
[0]*	Precise ramp stop	Only optimal when the operational speed, for example, the operational speed of a conveyor belt, is constant. This is an open-loop control. Achieves high repetitive precision at the stop point.
[1]	Cnt stop with reset	Counts the number of pulses, typically from an encoder, and generates a stop signal after a preprogrammed number of pulses, defined in *parameter 1-84 Precise Stop Counter Value*, has been received at terminal 29 or terminal 33. This is direct feedback with one-way closed-loop control. The counter function is activated (starts timing) at the edge of the start signal (when it changes from stop to start). After each precise stop, the number of pulses counted during ramp-down to 0 RPM are reset.
[2]	Cnt stop w/o reset	Same as *[2] Cnt stop with reset* but the number of pulses counted during ramp down to 0 RPM are deducted from the counter value entered in *parameter 1-84 Precise Stop Counter Value*. This reset function can be used to compensate for the extra distance done during ramping down and to reduce the impacts of gradual wear of mechanical parts.
[3]	Speed comp stop	Stops at precisely the same point, regardless of the present speed. The stop signal is delayed internally when the present speed is lower than the maximum speed (set in *parameter 4-19 Max Output Frequency*).

Op-tion	Name	Description
		The delay is calculated on the basis of the reference speed of the drive and not on the basis of the actual speed. Make sure that the drive has ramped up before activating the speed–compensated stop.
[4]	Com cnt stop w/rst	Same as *[3] Speed comp stop* but after each precise stop, the number of pulses counted during ramp down to 0 RPM is reset.
[5]	Comp cnt stop w/o r	Same as *[3] Speed comp stop* but the number of pulses counted during ramp down to 0 RPM is deducted from the counter value entered in *parameter 1-84 Precise Stop Counter Value*. This reset function can be used to compensate for the extra distance done during ramping down and to reduce the impacts of gradual wear of mechanical parts.

The precise stop functions are advantageous in applications where high precision is required. If using a standard stop command, the accuracy is determined by the internal task time. That is not the case when using the precise stop function. It eliminates the task time dependence and increases the accuracy substantially. The drive tolerance is normally given by its task time. However, by using its special precise stop function, the tolerance is independent of the task time because the stop signal immediately interrupts the execution of the drive program. The precise stop function gives a highly reproducible delay from the stop signal is given until the ramping down starts. Run a test to find this delay as it is a sum of sensor, PLC, drive, and mechanical parts.

To ensure optimum accuracy, there should be at least 10 cycles during ramping down, see:

- *Parameter 3-42 Ramp 1 Ramp Down Time*
- *Parameter 3-52 Ramp 2 Ramp Down Time*
- *Parameter 3-62 Ramp 3 Ramp Down Time*
- *Parameter 3-72 Ramp 4 Ramp Down Time*

The precise stop function is set up here and enabled from DI at terminal 29 or terminal 33.

Parameter 1-84 Precise Stop Counter Value

Table 133: Parameter 1-84 Precise Stop Counter Value

1-84 Precise Stop Counter Value		
Default value: 100000	Parameter type: Range, 0 - 999999999	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Enter the counter value to be used in the integrated precise stop function, *parameter 1-83 Precise Stop Function*. The maximum permissible frequency at terminal 29 or 33 is 110 kHz.

N O T I C E

Not used for selections *[0] Precise ramp stop* and *[3] Speed comp stop* in *parameter 1-83 Precise Stop Function*.

Parameter 1-85 Precise Stop Speed Compensation Delay

Table 134: Parameter 1-85 Precise Stop Speed Compensation Delay

1-85 Precise Stop Speed Compensation Delay		
Default value: 10 ms	Parameter type: Range, 0 - 100 ms	Setup: All setups
Conversion index: -3	Data type: Uint8	Change during operation: True

Enter the delay time for sensors, PLCs, and so on for use in *parameter 1-83 Precise Stop Function*. In speed–compensated stop mode, the delay time at different frequencies has a major influence on the stop function.

N O T I C E

Not used for selections *[0] Precise ramp stop*, *[1] Cnt stop with reset*, and *[2] Cnt stop w/o reset* in *parameter 1-83 Precise Stop Function*.

Parameter 1-89 Stop Func Torque Ramp Time

Table 135: Parameter 1-89 Stop Func Torque Ramp Time

1-89 Stop Func Torque Ramp Time		
Default value: 0.01 s	Parameter type: Range, 0.01 - 3600.00 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Configure the time in seconds during which the torque is ramped to 0, after the motor speed is ramped down to the minimum speed as specified in *parameter 1-81 Min Speed for Function at Stop [RPM]*.

5.2.10 1-9* Motor Temperature

N O T I C E

The following parameters are only available in FC 302:

- *Parameter 1-94 ATEX ETR Cur.Lim. Speed Reduction*
- *Parameter 1-95 Thermistor Sensor Type*
- *Parameter 1-96 Thermistor Sensor Resource*
- *Parameter 1-98 ATEX ETR Interpol. Points Freq.*
- *Parameter 1-99 ATEX ETR Interpol. Points Current*

Parameter 1-90 Motor Thermal Protection

Table 136: Parameter 1-90 Motor Thermal Protection

1-90 Motor Thermal Protection		
Default value: [0] No protection	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Motor thermal protection can be implemented using a range of techniques:

- Via a PTC sensor in the motor windings connected to 1 of the analog or digital inputs (*parameter 1-93 Thermistor Resource*). See the *chapter PTC Thermistor Connection*.
- Via a KTY sensor in the motor winding connected to an analog input (*parameter 1-96 Thermistor Sensor Resource*). See the *chapter KTY Sensor Connection*.
- Via calculation (ETR = Electronic Thermal Relay) of the thermal load, based on the actual load and time. The calculated thermal load is compared with the rated motor current $I_{M,N}$ and the rated motor frequency $f_{M,N}$. See the *chapter ETR*.
- Via a mechanical thermal switch (Klixon type). See the *chapter Klixon*.

For the North American market: The ETR functions provide class 20 motor overload protection in accordance with NEC.

Option	Name	Description
[0]*	No protection	Continuously overloaded motor when no warning or trip of the drive is required.
[1]	Thermistor warning	Activates a warning when the connected thermistor or KTY sensor in the motor reacts in the event of motor overtemperature.
[2]	Thermistor trip	Stops (trips) the drive when connected thermistor or KTY sensor in the motor reacts in the event of motor overtemperature. The thermistor cutout value must be more than 3 kΩ. Integrate a thermistor (PTC sensor) in the motor for winding protection.
[3]	ETR warning 1	Calculates the load when setup 1 is active and activates a warning on the display when the motor is overloaded. Program a warning signal via 1 of the digital outputs.

Option	Name	Description
[4]	ETR trip 1	Calculates the load when set-up 1 is active and stops (trips) the drive when the motor is overloaded. Program a warning signal via 1 of the digital outputs. The signal appears in the event of a warning and if the drive trips (thermal warning).
[5]	ETR warning 2	
[6]	ETR trip 2	
[7]	ETR warning 3	
[8]	ETR trip 3	
[9]	ETR warning 4	
[10]	ETR trip 4	
[20]	ATEX ETR	Activates the thermal monitoring function for Ex-e motors for ATEX. Enables *parameter 1-94 ATEX ETR cur.lim. speed reduction*, *parameter 1-98 ATEX ETR interpol. points freq.*, and *parameter 1-99 ATEX ETR interpol points current*.
[21]	Advanced ETR	

NOTICE

If *[20] ATEX ETR* is selected, follow the instructions in the dedicated chapter of the design guide and the instructions provided by the motor manufacturer.

NOTICE

If *[20] ATEX ETR* is selected, set *parameter 4-18 Current Limit* to 150%.

Parameter 1-91 Motor External Fan

Table 137: Parameter 1-91 Motor External Fan

1-91 Motor External Fan		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	No	No external fan is required, that is the motor is derated at low speed.
[1]	Yes	Applies an external motor fan (external ventilation), so no derating of the motor is required at low speed. The upper curve in Illustration 43 ($f_{out} = 1 \times f_{M,N}$) is followed if the motor current is lower than nominal motor current (see *parameter 1-24 Motor Current*). If the motor current exceeds nominal current, the operation time still decreases as if no fan was installed.

Parameter 1-93 Thermistor Resource

Table 138: Parameter 1-93 Thermistor Resource

1-93 Thermistor Resource		
Default value: [0] None	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

NOTICE

This parameter cannot be adjusted while the motor is running.

NOTICE

Set digital input to *[0] PNP - Active at 24 V* in *parameter 5-00 Digital I/O Mode*.

NOTICE

When using VLT® PTC Thermistor Card MCB 112 always always select *[0] None*.

Select the input to which the thermistor (PTC sensor) should be connected. An analog input option *[1] Analog Input 53* or *[2] Analog Input 54* cannot be selected if the analog input is already in use as a reference source (selected in *parameter 3-15 Reference Resource 1*, *parameter 3-16 Reference Resource 2*, or *parameter 3-17 Reference Resource 3*).

Option	Name	Description
[0]*	None	
[1]	Analog input 53	
[2]	Analog input 54	
[3]	Digital input 18	
[4]	Digital input 19	
[5]	Digital input 32	
[6]	Digital input 33	

Parameter 1-94 ATEX ETR Cur. Lim. Speed Reduction

Table 139: Parameter 1-94 ATEX ETR Cur. Lim. Speed Reduction

1-94 ATEX ETR Cur. Lim. Speed Reduction		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 2 setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Only visible if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR*.

Configure the reaction for operating in Ex-e current limit. 0%: The drive does not change anything besides issuing *warning 163, ATEX ETR cur.lim.warning*. >0%: The drive issues *warning 163, ATEX ETR cur.lim.warning* and reduces motor speed following ramp 2 (*parameter group 3-5* Ramp 2*).

Example:

Actual reference = 50 RPM

Parameter 1-94 ATEX ETR cur.lim. speed reduction = 20%

Resulting reference = 40 RPM

Parameter 1-95 Thermistor Sensor Type

Table 140: Parameter 1-95 Thermistor Sensor Type

1-95 Thermistor Sensor Type		
Default value: [0] KTY Sensor 1	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the used type of thermistor sensor.

Option	Name	Description
[0]*	KTY sensor 1	1 kΩ at 100 °C (212 °F).
[1]	KTY sensor 2	1 kΩ at 25 °C (77 °F).
[2]	KTY sensor 3	2 kΩ at 25 °C (77 °F).
[3]	Pt1000	1 kΩ at 0 °C (32 °F).
[4]	Ni1000 (6178 ppm/K)	1 kΩ at 0 °C (32 °F).
[5]	Ni1000-LG (TC5)	Examples: • Siemens LG-Ni1000 • Tasseron RTD Ni1000-TC5 1000 Ohm

Parameter 1-96 Thermistor Sensor Resource

Table 141: Parameter 1-96 Thermistor Sensor Resource

1-96 Thermistor Sensor Resource		
Default value: [0] None	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select analog input terminal 54 to be used for connection of KTY/Pt1000/Ni1000 thermistor sensor. Terminal 54 cannot be selected as thermistor source if otherwise used as reference (see *parameter 3-15 Reference Resource 1* to *parameter 3-17 Reference Resource 3*).

N O T I C E

Connection of thermistor sensor between terminals 54 and 55 (GND).

Option	Name	Description
[0]*	None	
[2]	Analog input 54	

Parameter 1-97 Thermistor Threshold Level

Table 142: Parameter 1-97 Thermistor Threshold Level

1-97 Thermistor Threshold Level		
Default value: 80 °C	Parameter type: Range, -40 - 220 °C	Setup: 1 setup
Conversion index: 100	Data type: Int16	Change during operation: True

Select the thermistor sensor threshold level for motor thermal protection.

Parameter 1-98 ATEX ETR Interpol. Points Freq.

Table 143: Parameter 1-98 ATEX ETR Interpol. Points Freq.

1-98 ATEX ETR Interpol. Points Freq.		
Default value: Size related	Parameter type: Range, 0 - 1000.0 Hz, Array [4]	Setup: 1 setup
Conversion index: -1	Data type: Uint16	Change during operation: True

Only visible if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR*.

Enter the 4 frequency points [Hz] from the motor nameplate into this array.

N O T I C E

- All frequency/current limit points from the motor nameplate or motor datasheet must be programmed.

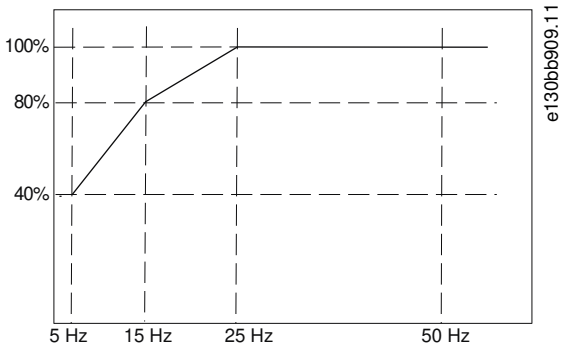


Illustration 38: Example of ATEX ETR Thermal Limitation Curve

x-axis: f_m [Hz]

y-axis: $I_m/I_{m,n}$ x 100 [%]

Table 144: Interpolation Points

Parameter 1-98 ATEX ETR interpol. points freq.	Parameter 1-99 ATEX ETR interpol. points current
[0]=5 Hz	[0]=40%
[1]=15 Hz	[1]=80%
[2]=25 Hz	[2]=100%
[3]=50 Hz	[3]=100%

All operating points underneath the curve are allowed continuously. Above the line, however, these are only allowed for a limited time calculated as a function of the overload. When machine current is greater than 1.5 times the rated current, shutdown is immediate.

Parameter 1-99 ATEX ETR Interpol. Points Current

Table 145: Parameter 1-99 ATEX ETR Interpol. Points Current

1-99 ATEX ETR Interpol. Points Current		
Default value: Size related	Parameter type: Range, 0 - 100%, Array [4]	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Definition of the thermal limitation curve. For example, see *parameter 1-98 ATEX ETR Interpol. Points Freq*.

Use the 4 current points [A] from the motor nameplate. Calcualte the values as percentage of nominal motor current, $I_m/I_{m,n}$ x 100 [%], and enter the values into this array.

Together with *parameter 1-98 ATEX ETR Interpol. Points Freq.*, these constitute a table (f [Hz], I [%]).

N O T I C E

All frequency/current limit points from the motor nameplate or motor datasheet must be programmed.

5.2.10.1 PTC Thermistor Connection

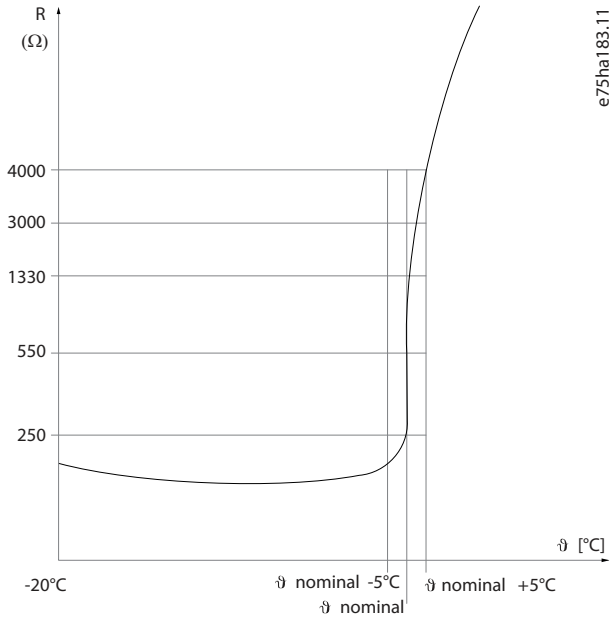


Illustration 39: PTC Profile

Using a digital input and 10 V as supply: Example: The drive trips when the motor temperature is too high.
Parameter setup:

- Set *parameter 1-90 Motor Thermal Protection* to *[2] Thermistor Trip*.
- Set *parameter 1-93 Thermistor Source* to *[6] Digital Input*.

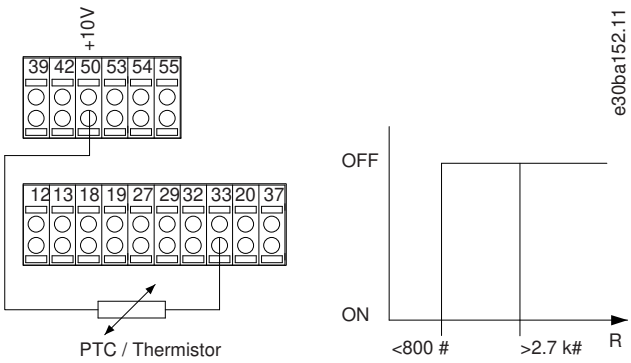


Illustration 40: PTC Thermistor Connection - Digital Input

Using an analog input and 10 V as supply: Example: The drive trips when the motor temperature is too high.
Parameter setup:

- Set *parameter 1-90 Motor Thermal Protection* to *[2] Thermistor Trip*.
- Set *parameter 1-93 Thermistor Source* to *[2] Analog Input 54*.

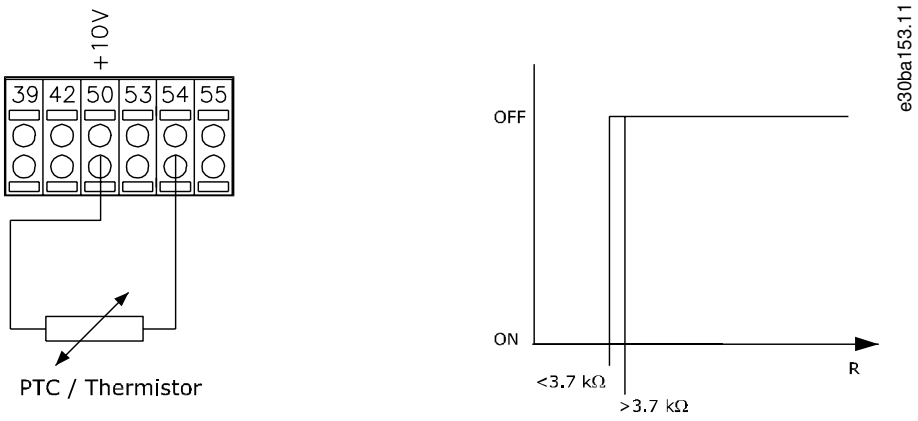


Illustration 41: PTC Thermistor Connection - Analog Input

Table 146: Threshold Cutout Values

Input digital/analog	Supply voltage	Threshold cutout values
Digital	10 V	<800 Ω⇒2.7 kΩ
Analog	10 V	<3.0 kΩ⇒3.0 kΩ

N O T I C E

Check that the selected supply voltage follows the specification of the used thermistor element.

5.2.10.2 KTY Sensor Connection

N O T I C E

KTY sensor connection is only available in FC 302.

KTY sensors are used especially in permanent magnet servo motors (PM motors) for dynamic adjusting of motor parameters as stator resistance (*parameter 1-30 Stator Resistance (Rs)*) for PM motors and also rotor resistance (*parameter 1-31 Rotor Resistance (Rr)*) for asynchronous motors, depending on winding temperature. The calculation is:

$Rs = Rs_{20°C} \times (1 + \alpha_{cu} \times \Delta T)\ \Omega$ where $\alpha_{cu} = 0.00393$

KTY sensors can be used for motor protection (*parameter 1-97 KTY Threshold level*). FC 301 can handle 3 types of KTY sensors, defined in *parameter 1-95 KTY Sensor Type*. The actual sensor temperature can be read out from *parameter 16-19 KTY sensor temperature*.

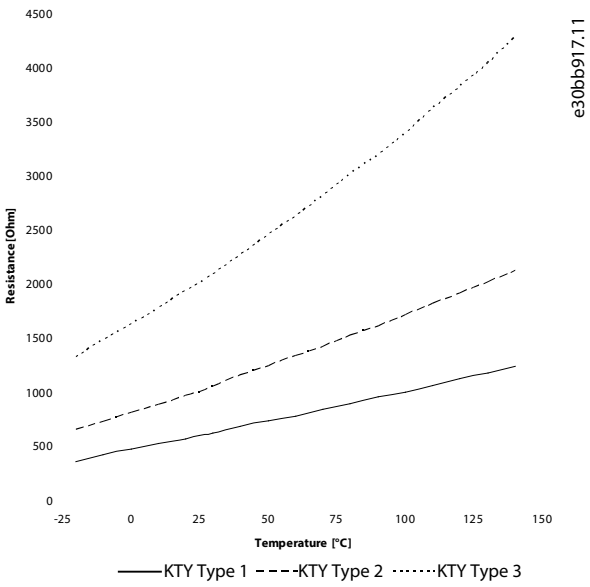


Illustration 42: KTY Type Selection

KTY Sensor 1: 1 kΩ at 100 °C (212 °F) (for example Philips KTY 84-1)
KTY Sensor 2: 1 kΩ at 25 °C (77 °F) (for example Philips KTY 83-1)
KTY Sensor 3: 2 kΩ at 25 °C (77 °F) (for example Infineon KTY-10)

N O T I C E

If the temperature of the motor is utilized through a thermistor or KTY sensor, the PELV is not complied with if there are short circuits between motor windings and the sensor. Put extra isolation on the sensor to comply with PELV.

5.2.10.3 ETR

The calculations estimate the need for a lower load at lower speed due to less cooling from the fan incorporated in the motor.

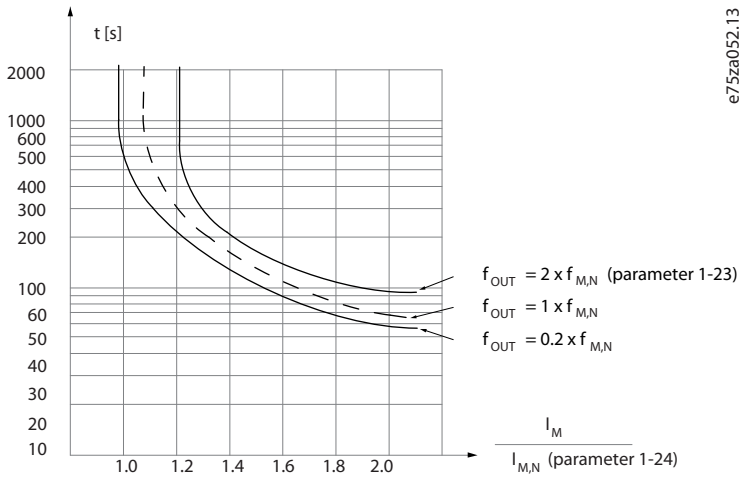


Illustration 43: ETR Profile

5.2.10.4 ATEX ETR

The VLT® PTC Thermistor Card MCB 112 offers ATEX-approved monitoring of motor temperature. Alternatively, an external ATEX-approved PTC protection device can be used.

N O T I C E

Only use ATEX Ex-e-approved motors for this function. See motor nameplate, approval certificate, datasheet, or contact motor supplier.

When controlling an Ex-e motor with increased safety, it is important to ensure certain limitations. The parameters that must be programmed are presented in the following table.

Table 147: Parameters

Function	Setting
Parameter 1-90 Motor Thermal Protection	[20] ATEX ETR
Parameter 1-94 ATEX ETR cur.lim. speed reduction	20%
Parameter 1-98 ATEX ETR interpol. points freq.	Motor nameplate.
Parameter 1-99 ATEX ETR interpol points current	
Parameter 1-23 Motor Frequency	Enter the same value as for *parameter 4-19 Max Output Frequency*.
Parameter 4-19 Max Output Frequency	Motor nameplate, possibly reduced for long motor cables, sine-wave filter, or reduced supply voltage.
Parameter 4-18 Current Limit	Forced to 150% by 1-90 [20]
Parameter 5-15 Terminal 33 Digital Input	[80] PTC Card 1
Parameter 5-19 Terminal 37 Safe Stop	[4] PTC 1 Alarm
Parameter 14-01 Switching Frequency	Check that the default value fulfills the requirement from the motor nameplate. If not, use a sine-wave filter.
Parameter 14-26 Trip Delay at Inverter Fault	0

N O T I C E

Compare the minimum switching frequency requirement stated by the motor manufacturer to the minimum switching frequency of the drive, the default value in *parameter 14-01 Switching Frequency*. If the drive does not meet this requirement, use a sine-wave filter.

More information about ATEX ETR thermal monitoring can be found in Application Note for FC 300 ATEX ETR Thermal Monitoring Function.

5.2.10.5 Klixon

The Klixon type thermal circuit breaker uses a KLIXON® metal dish. At a predetermined overload, the heat caused by the current through the disc causes a trip.

Using a digital input and 24 V as supply:

Example: The drive trips when the motor temperature is too high.

Parameter setup:

- Set *parameter 1-90 Motor Thermal Protection* to *[2] Thermistor Trip*.
- Set *parameter 1-93 Thermistor Source* to *[6] Digital Input*.

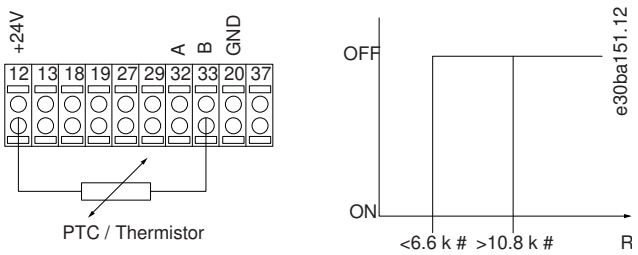


Illustration 44: Thermistor Connection

5.2.10.6 PM Settings

If *[2] Std. PM, non-salient* is selected in *parameter 1-10 Motor Construction*, enter the motor parameters manually in the following order:

- *Parameter 1-24 Motor Current*.
- *Parameter 1-26 Motor Cont. Rated Torque*.
- *Parameter 1-25 Motor Nominal Speed*.
- *Parameter 1-39 Motor Poles*.
- *Parameter 1-30 Stator Resistance (Rs)*.
- *Parameter 1-37 d-axis Inductance (Ld)*.
- *Parameter 1-40 Back EMF at 1000 RPM*.

The following parameters have been added for PM motors.

- *Parameter 1-41 Motor Angle Offset*.
- *Parameter 1-07 Motor Angle Offset Adjust*.
- *Parameter 1-14 Damping Gain*.
- *Parameter 1-47 Torque Calibration*.
- *Parameter 1-58 Flying Start Test Pulses Current*.
- *Parameter 1-59 Flying Start Test Pulses Frequency*.
- *Parameter 1-70 Start Mode*.
- *Parameter 30-20 High Starting Torque Time [s]*.
- *Parameter 30-21 High Starting Torque Current [%]*.

N O T I C E

Standard parameters still need configuration (for example *parameter 4-19 Max Output Frequency*).

Table 148: Recommendations for VVC$^+$ Applications

Application	Settings
Low inertia applications I_{Load}/I_{Motor} <5	Increase *parameter 1-17 Voltage Filter Time Const.* by factor 5–10. Reduce *parameter 1-14 Damping Gain*. Reduce *parameter 1-66 Min. Current at Low Speed* (<100%).
Low inertia applications 50>I_{Load}/I_{Motor} >5	Keep calculated values.
High inertia applications	Increase *parameter 1-14 Damping Gain*, *parameter 1-15 Low Speed Filter Time Const.*, and *parameter 1-16 High Speed Filter Time Const.*

Application	Settings
I_{Load}/I_{Motor} > 50	
High load at low speed <30% (rated speed)	Increase *parameter 1-17 Voltage filter time const*. Increase *parameter 1-66 Min. Current at Low Speed* (>100% for longer time can overheat the motor).

If the motor starts oscillating at a certain speed, increase *parameter 1-14 Damping Gain*. Increase the value in small steps. Depending on the motor, a good value for this parameter can be 10% or 100% higher than the default value.

Adjust starting torque in *parameter 1-66 Min. Current at Low Speed*. 100% provides nominal torque as starting torque.

Table 149: Recommendations for Flux Applications

Application	Settings
Low inertia applications	Keep calculated values.
High inertia applications	*Parameter 1-66 Min. Current at Low Speed*. Increase speed to a value between default and maximum depending on application. Set ramp times matching the application. Too fast ramp-up causes an overcurrent/overtorque. Too fast ramp-down causes an overvoltage trip.
High load at low speed	*Parameter 1-66 Min. Current at Low Speed*. Increase speed to a value between default and maximum depending on application.

Adjust starting torque in *parameter 1-66 Min. Current at Low Speed*. 100% provides nominal torque as starting torque.

5.3 Parameter Group 2-** Brakes

5.3.1 2-0* DC Brakes

Parameter group for configuring the DC brake and DC hold functions.

Parameter 2-00 DC Hold Current

Table 150: Parameter 2-00 DC Hold Current

2-00 DC Hold Current		
Default value: 50%	Parameter type: Range, 0 - 160%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

NOTICE

The maximum value depends on the rated motor current. Avoid 100% current for too long. It may damage the motor. In VVC+ control core, low values (<20%) of DC hold may result in wrong currents with larger motor sizes (>90 kW) and should be avoided. In cases when low DC hold currents with larger motors are required, select Flux control core to ensure the right currents.

Enter a value for holding current as a percentage of the rated motor current $I_{M,N}$ set in *parameter 1-24 Motor Current*. 100% DC hold current corresponds to $I_{M,N}$. This parameter holds the motor function (holding torque) or preheats the motor. This parameter is active if DC hold is selected in *parameter 1-72 Start Function [0]* or *parameter 1-80 Function at Stop [1]*.

Parameter 2-01 DC Brake Current

Table 151: Parameter 2-01 DC Brake Current

2-01 DC Brake Current		
Default value: 50%	Parameter type: Range, 0 - 1000%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

NOTICE

The maximum value depends on the rated motor current. Avoid 100% current for too long. It may damage the motor.

Enter a value for current as a percentage of the rated motor current $I_{M,N}$, see *parameter 1-24 Motor Current*. 100% DC brake current corresponds to $I_{M,N}$. DC brake current is applied on a stop command, when the speed is lower than the limit set in *parameter 2-03 DC Brake Cut In Speed [RPM]*; when the DC brake inverse function is active, or via the serial communication port. The braking current is active during the time period set in *parameter 2-02 DC Braking Time*.

Parameter 2-02 DC Braking Time

Table 152: Parameter 2-02 DC Braking Time

2-02 DC Braking Time		
Default value: 10 s	Parameter type: Range, 0 - 60 s	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Set the duration of the DC brake current set in *parameter 2-01 DC Brake Current*, once activated.

Parameter 2-03 DC Brake Cut In Speed [RPM]

Table 153: Parameter 2-03 DC Brake Cut In Speed [RPM]

2-03 DC Brake Cut In Speed [RPM]		
Default value: Size related	Parameter type: Range, 0 - par. 4-13 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Set the DC brake cut-in speed for activation of the DC brake current set in *parameter 2-01 DC Brake Current*, upon a stop command.

Parameter 2-04 DC Brake Cut In Speed [Hz]

Table 154: Parameter 2-04 DC Brake Cut In Speed [Hz]

2-04 DC Brake Cut In Speed [Hz]		
Default value: Size related	Parameter type: Range, 0 - par. 4-14 RPM	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

N O T I C E

Parameter 2-04 DC Brake Cut In Speed [Hz] is not effective when *parameter 1-10 Motor Construction = [1] PM, nonsalient SPM*.

Set the DC brake cut-in speed for activation of the DC brake current set in *parameter 2-01 DC Brake Current*, upon a stop command.

Parameter 2-05 Maximum Reference

Table 155: Parameter 2-05 Maximum Reference

2-05 Maximum Reference		
Default value: Size related	Parameter type: Range, par. 3-02 - 999999.999 Reference- FeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

This is an access parameter to *parameter 3-03 Maximum Reference* for legacy products. The maximum reference is the highest value obtainable by summing all references. The maximum reference unit matches the option selected in *parameter 1-00 Configuration Mode* and the unit in *parameter 3-01 Reference/Feedback Unit*.

Parameter 2-06 Parking Current

Table 156: Parameter 2-06 Parking Current

2-06 Parking Current		
Default value: 50%	Parameter type: Range, 0 - 1000%	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Set current as percentage of rated motor current, *parameter 1-24 Motor Current*. Is used when enabled in *parameter 1-70 Start Mode*.

Parameter 2-07 Parking Time

Table 157: Parameter 2-07 Parking Time

2-07 Parking Time		
Default value: 3 s	Parameter type: Range, 0.1 - 60 s	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Set the duration of the parking current set in *parameter 2-06 Parking Current*, once activated.

5.3.2 2-1* Brake Energy Funct.

Parameter group for selecting dynamic brake parameters. Only valid for drives with brake chopper.

Parameter 2-10 Brake Function

Table 158: Parameter 2-10 Brake Function

2-10 Brake Function		
Default value: [1] Resistor brake	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	Off	No brake resistor installed.
[1]*	Resistor brake	A brake resistor is incorporated in the system for dissipation of surplus brake energy as heat. Connecting a brake resistor allows a higher DC-link voltage during braking (generating operation). The resistor brake function is only active in drives with an integral dynamic brake.
[2]	AC brake	Improves braking without using a brake resistor. This parameter controls an overmagnetization of the motor when running with a generatoric load. This function can improve the OVC function. Increasing the electrical losses in the motor allows the OVC function to increase the braking torque without exceeding the overvoltage limit. **NOTICE** The AC brake is not as efficient as dynamic braking with resistor. AC brake is for VVC+ mode in both open and closed loop.

Parameter 2-11 Brake Resistor (ohm)

Table 159: Parameter 2-11 Brake Resistor (ohm)

2-11 Brake Resistor (ohm)		
Default value: Size related	Parameter type: Range, 0 - 65535 Ohm	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Set the brake resistor value in Ω. This value is used for monitoring the power to the brake resistor in *parameter 2-13 Brake Power Monitoring*. This parameter is only active in drives with an integral dynamic brake. Use this parameter for values without decimals. For a selection with 2 decimals, use *parameter 30-81 Brake Resistor (ohm)*.

Parameter 2-12 Brake Power Limit (kW)

Table 160: Parameter 2-12 Brake Power Limit (kW)

2-12 Brake Power Limit (kW)		
Default value: Size related	Parameter type: Range, 0.001 - 2000.000 kW	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Parameter 2-12 Brake Power Limit (kW) is the expected average power dissipated in the brake resistor over a period of 120 s. It is used as the monitoring limit for *parameter 16-33 Brake Energy Average* and thereby specifies when a warning/alarm is to be given. To calculate *parameter 2-12 Brake Power Limit (kW)*, the following formula can be used.

$$P_{br,avg}[W] = \frac{U^2_{br}[V] \times t_{br}[s]}{R_{br}[\Omega] \times T_{br}[s]}$$

$P_{br,avg}$ is the average power dissipated in the brake resistor. R_{br} is the resistance of the brake resistor. t_{br} is the active braking time within the 120 s period, T_{br}. U_{br} is the DC voltage where the brake resistor is active. This depends on the unit as follows:

- T2 units: 390 V
- T4 units: 810 V
- T5 units: 810 V
- T6 units: 943 V/1099 V for D–F enclosures
- T7 units: 1099 V

N O T I C E

If R_{br} is not known, or if T_{br} is different from 120 s, the practical approach is to run the brake application, read *parameter 16-33 Brake Energy Average* and then enter this + 20% in *parameter 2-12 Brake Power Limit (kW)*.

Parameter 2-13 Brake Power Monitoring

Table 161: Parameter 2-13 Brake Power Monitoring

2-13 Brake Power Monitoring		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter is only active in drives with a brake. This parameter enables monitoring of the power to the brake resistor. The power is calculated based on the resistance (*parameter 2-11 Brake Resistor (ohm)*), the DC-link voltage, and the resistor duty time. If power monitoring is set to *[0] Off* or *[1] Warning*, the brake function remains active, even if the monitoring limit is exceeded. This may lead to thermal overload of the resistor. It is also possible to generate a warning via a relay/digital output. The measuring accuracy of the power monitoring depends on the accuracy of the resistance of the resistor (better than ±20%).

Option	Name	Description
[0]*	Off	No brake power monitoring required.
[1]	Warning 120s	Activates a warning on the display when the power transmitted during the duty time exceeds 100% of the monitoring limit (*parameter 2-12 Brake Power Limit (kW)*). The warning disappears when the transmitted power drops below 80% of the monitoring limit.
[2]	Trip 120s	Trips the drive and shows an alarm when the calculated power exceeds 100% of the monitoring limit.
[3]	Warning & Trip 120s	Activates both of the above, including warning, trip, and alarm.
[4]	Warning 30s	
[5]	Trip 30s	

Option	Name	Description
[6]	Warning & trip 30s	
[7]	Warning 60s	
[8]	Trip 60s	
[9]	Warning & trip 60s	
[10]	Warning 300s	
[11]	Trip 300s	
[12]	Warning & trip 300s	
[13]	Warning 600s	
[14]	Trip 600s	
[15]	Warning & trip 600s	

Parameter 2-14 Brake Voltage Reduce

Table 162: Parameter 2-14 Brake Voltage Reduce

2-14 Brake Voltage Reduce		
Default value: 0	Parameter type: Range, 0 - 200 V	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter can reduce the DC voltage where the brake resistor is active. It is only valid for T4 units. Setting this parameter may change the brake resistor (*parameter 2-11 Brake Resistor (ohm)*).

Parameter 2-15 Brake Check

Table 163: Parameter 2-15 Brake Check

2-15 Brake Check		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Parameter 2-15 Brake Check is only active in drives with an integral dynamic brake. Select type of test and monitoring function to check the connection to the brake resistor, or whether a brake resistor is present, and then show a warning or an alarm in the event of a fault.

N O T I C E

The brake resistor disconnection function is tested during power-up. However, the brake IGBT test is performed when there is no braking. A warning or trip disconnects the brake function.

The testing sequence is as follows:

- 1: The DC-link ripple amplitude is measured for 300 ms without braking.
- 2: The DC-link ripple amplitude is measured for 300 ms with the brake turned on.
  - If the DC-link ripple amplitude while braking is lower than the DC-link ripple amplitude before braking +1%: *Brake check has failed by returning a warning or alarm*.
  - If the DC-link ripple amplitude while braking is higher than the DC-link ripple amplitude before braking +1%: *Brake check is OK*.

N O T I C E

Remove a warning arising with *[0] Off* or *[1] Warning* by cycling the mains supply. The fault must be corrected first. For *[0] Off* or *[1] Warning*, the drive keeps running even if a fault is located.

Option	Name	Description
[0]*	Off	Monitors brake resistor and brake IGBT for a short circuit during operation. If a short circuit occurs, *Warning 25 Brake resistor shortcircuited* appears.
[1]	Warning	Monitors brake resistor and brake IGBT for a short circuit and runs a test for brake resistor disconnection during power-up.
[2]	Trip	Monitors for a short circuit or disconnection of the brake resistor, or a short circuit of the brake IGBT. If a fault occurs, the drive cuts out while showing an alarm (trip lock).
[3]	Stop and trip	Monitors for a short circuit or disconnection of the brake resistor, or a short circuit of the brake IGBT. If a fault occurs, the drive ramps down to coast and then trips. A trip lock alarm is shown (for example, warnings 25, 27, or 28).
[4]	AC brake	**N O T I C E** This option is only available with FC 302. Monitors for a short circuit or disconnection of the brake resistor, or a short circuit of the brake IGBT. If a fault occurs, the drive performs a controlled ramp-down.
[5]	Trip lock	

Parameter 2-16 AC Brake Max. Current

Table 164: Parameter 2-16 AC Brake Max. Current

2-16 AC Brake Max. Current		
Default value: 100%	Parameter type: Range, 0 - 1000.0%	Setup: All setups
Conversion index: -1	Data type: Uint32	Change during operation: True

Enter the maximum allowed current when using AC braking to avoid overheating of motor windings.

N O T I C E

Parameter 2-16 AC brake Max. Current has no effect when *parameter 1-10 Motor Construction=[1] PM, non salient SPM*.

Parameter 2-17 Over-voltage Control

Table 165: Parameter 2-17 Over-voltage Control

2-17 Over-voltage Control		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Overvoltage control (OVC) reduces the risk of the drive tripping due to an overvoltage on the DC-link caused by generative power from the load.

N O T I C E

Do not enable OVC in hoisting applications.

Option	Name	Description
[0]*	Disabled	No OVC required.
[1]	Enabled (not at stop)	Activates OVC except when using a stop signal to stop the drive.
[2]	Enabled	Activates OVC.

Parameter 2-18 Brake Check Condition

Table 166: Parameter 2-18 Brake Check Condition

2-18 Brake Check Condition		
Default value: [0] At power up	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	At power up	Brake check at power-up.
[1]	After coast situations	Brake check is performed after coast situations.

Parameter 2-19 Over-voltage Gain

Table 167: Parameter 2-19 Over-voltage Gain

2-19 Over-voltage Gain		
Default value: 100%	Parameter type: Range, 10 - 200%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Select overvoltage gain.

5.3.3 2-2* Mechanical Brake

Parameters for controlling operation of an electro-magnetic (mechanical) brake, typically required in hoisting applications.

To control a mechanical braking, a relay output (relay 01 or relay 02) or a programmed digital output (terminal 27 or 29) is required. Normally, this output must be closed during periods when the drive is unable to hold the motor, for example due to an excessive load.

Select *[32] Mechanical Brake Control* for applications with an electro-magnetic brake in *parameter 5-40 Function Relay*, *parameter 5-30 Terminal 27 Digital Output*, or *parameter 5-31 Terminal 29 Digital Output*. When selecting *[32] Mechanical brake control*, the mechanical braking is closed from start-up until the output current is above the level selected in *parameter 2-20 Release Brake Current*. During stop, the mechanical braking activates when the speed drops below the level specified in *parameter 2-21 Activate Brake Speed [RPM]*. If the drive enters an alarm condition, an overcurrent, or overvoltage situation, the mechanical braking immediately cuts in. This is also the case during Safe Torque Off.

N O T I C E

Protection mode and trip delay features (*parameter 14-25 Trip Delay at Torque Limit* and *parameter 14-26 Trip Delay at Inverter Fault*) may delay the activation of the mechanical braking in an alarm condition. These features must be disabled in hoisting applications.

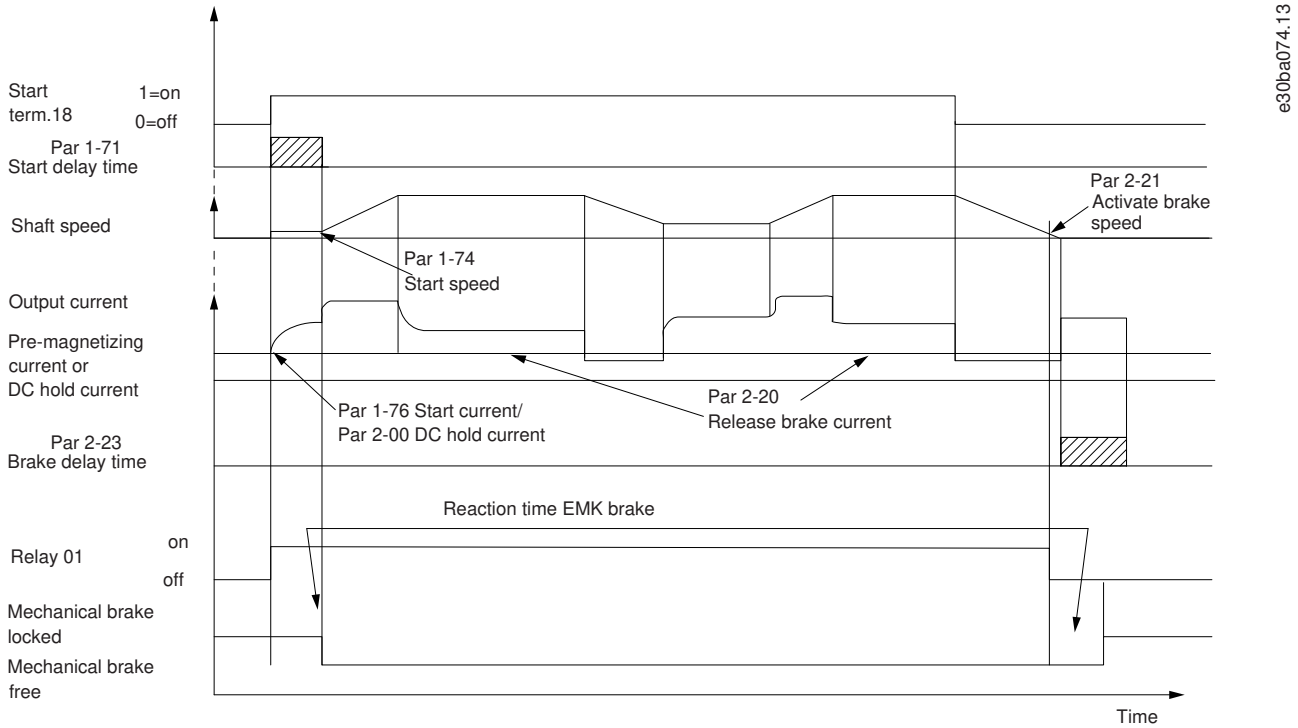


Illustration 45: Mechanical Braking

Parameter 2-20 Release Brake Current

Table 168: Parameter 2-20 Release Brake Current

2-20 Release Brake Current		
Default value: Size related	Parameter type: Range, 10 - par. 16-37 A	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Set the motor current for release of the mechanical braking when a start condition is present. The default value is the maximum current the inverter can provide for the particular power size. The upper limit is specified in *parameter 16-37 Inv. Max. Current*.

N O T I C E

When mechanical brake control output is selected, but no mechanical braking is connected, the function does not work by default setting due to too low motor current.

Parameter 2-21 Activate Brake Speed [RPM]

Table 169: Parameter 2-21 Activate Brake Speed [RPM]

2-21 Activate Brake Speed [RPM]		
Default value: Size related	Parameter type: Range, 0 - par. 4-53 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Set the motor speed for activation of the mechanical braking when a stop condition is present.

Parameter 2-22 Activate Brake Speed [Hz]

Table 170: Parameter 2-22 Activate Brake Speed [Hz]

2-22 Activate Brake Speed [Hz]		
Default value: Size related	Parameter type: Range, 0 - 5000.0 Hz	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Set the motor frequency for activation of the mechanical braking when a stop condition is present.

Parameter 2-23 Activate Brake Delay

Table 171: Parameter 2-23 Activate Brake Delay

2-23 Activate Brake Delay		
Default value: 0 s	Parameter type: Range, 0 - 5 s	Setup: All setups
Conversion index: -1	Data type: Uint8	Change during operation: True

Enter the brake delay time of the coast after ramp-down time. The shaft is held at 0 speed with full holding torque. Ensure that the mechanical braking has locked the load before the motor enters coast mode. To adjust transition of the load to the mechanical braking, set *parameter 2-23 Activate Brake Delay* and *parameter 2-24 Stop Delay*. Setting of brake delay parameters does not affect the torque. The drive does not register that mechanical braking is holding the load. After setting *parameter 2-23 Activate Brake Delay*, the torque drops to 0 after a few minutes. The sudden torque change leads to movement and noise.

Parameter 2-24 Stop Delay

Table 172: Parameter 2-24 Stop Delay

2-24 Stop Delay		
Default value: 0 s	Parameter type: Range, 0 - 5 s	Setup: All setups
Conversion index: -1	Data type: Uint8	Change during operation: True

Set the time interval from the moment when the motor is stopped until the brake closes. To adjust transition of the load to the mechanical braking, set *parameter 2-23 Activate Brake Delay* and *parameter 2-24 Stop Delay*. This parameter is a part of the stop function.

Parameter 2-25 Brake Release Time

Table 173: Parameter 2-25 Brake Release Time

2-25 Brake Release Time		
Default value: 0.20 s	Parameter type: Range, 0 - 5 s	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

This value defines the time it takes for the mechanical brake to open. This parameter must act as a timeout when brake feedback is activated.

Parameter 2-26 Torque Ref

Table 174: Parameter 2-26 Torque Ref

2-26 Torque Ref		
Default value: 0%	Parameter type: Range, -300 - 300%	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

The value defines the torque applied against the closed mechanical brake before release. The torque/load on a crane is positive and is 10–160%. To obtain the best starting point, set *parameter 2-26 Torque Ref* to approximately 70%. The torque/load on a lift can be both positive and negative and between -160% and +160%. To obtain the best starting point, set *parameter 2-26 Torque Ref* to 0%. The higher the torque error is (*parameter 2-26 Torque Ref* vs. actual torque), the more movement during load takeover.

Parameter 2-27 Torque Ramp Up Time

Table 175: Parameter 2-27 Torque Ramp Up Time

2-27 Torque Ramp Up Time		
Default value: 0.2 s	Parameter type: Range, 0 - 5 s	Setup: All setups
Conversion index: -1	Data type: Uint8	Change during operation: True

The value defines the duration of the torque ramp in clockwise direction. Value 0 enables very fast magnetization in flux control principle.

Parameter 2-28 Gain Boost Factor

Table 176: Parameter 2-28 Gain Boost Factor

2-28 Gain Boost Factor		
Default value: 1	Parameter type: Range, 0 - 4	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

Only active in flux closed loop. The function ensures a smooth transition from torque control mode to speed control mode when the motor takes over the load from the brake. Increase to minimize the movement. Activate the advanced mechanical braking (*parameter group 2-3* Adv. Mech Brake*) by setting *parameter 2-28 Gain Boost Factor* to 0.

Parameter 2-29 Torque Ramp Down Time

Table 177: Parameter 2-29 Torque Ramp Down Time

2-29 Torque Ramp Down Time		
Default value: 0 s	Parameter type: Range, 0 - 5 s	Setup: All setups
Conversion index: -1	Data type: Uint8	Change during operation: True

Torque ramp-down time.

5.3.3.1 Hoist Mechanical Brake

The hoist mechanical brake control supports the following functions:

- 2 channels for mechanical braking feedback to offer further protection against unintended behavior resulting from broken cable.
- Monitoring of mechanical braking feedback throughout the complete cycle. This helps protect the mechanical brake, especially if more drives are connected to the same shaft.
- No ramp-up until feedback confirms that mechanical brake is open.
- Improved load control at stop. If the value of *parameter 2-23 Activate Brake Delay* is too low, *Warning 22, Hoist mech. brake* is activated and the torque is not allowed to ramp down.
- The transition when motor takes over the load from the brake can be configured. *Parameter 2-28 Gain Boost Factor* can be increased to minimize the movement. To achieve smooth transition, change the setting from the speed control to the position control during the changeover.
- Set *parameter 2-28 Gain Boost Factor* to 0 to enable position control during *parameter 2-02 DC Braking Time*. This enables *parameter 2-30 Position P Start Proportional Gain* to *parameter 2-33 Speed PID Start Lowpass Filter Time*, which are PID parameters for the position control.

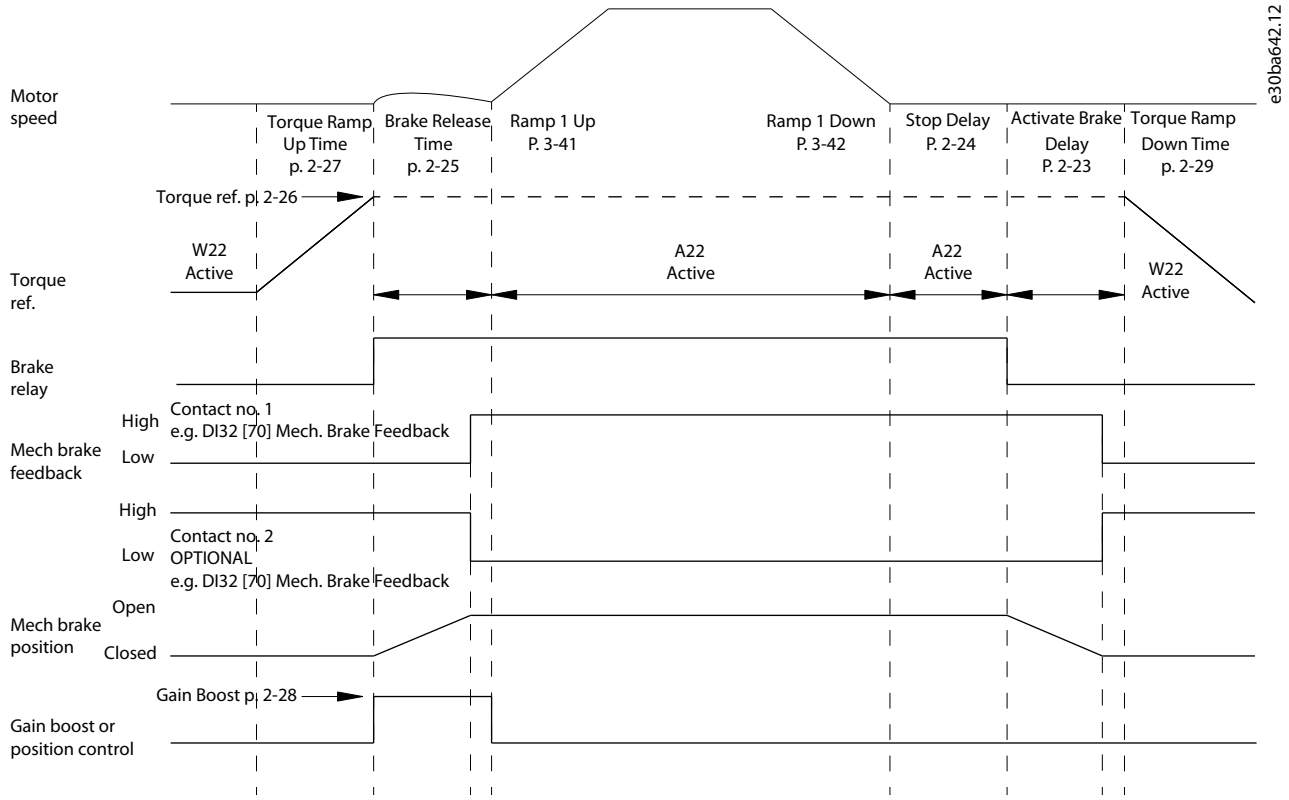


Illustration 46: Brake Release Sequence for Hoist Mechanical Brake Control

Parameter 2-26 Torque Ref to *parameter 2-33 Speed PID Start Lowpass Filter Time* are only available for the hoist mechanical brake control (flux with motor feedback).

5.3.4 2-3* Adv. Mech Brake

Parameter 2-30 Position P Start Proportional Gain to *parameter 2-33 Speed PID Start Lowpass Filter Time* can be set up for very smooth transition change from speed control to position control during *parameter 2-25 Brake Release Time* - the time when the load is transferred from the mechanical brake to the drive. *Parameter 2-30 Position P Start Proportional Gain* to *parameter 2-33 Speed PID Start Lowpass Filter Time* are activated when *parameter 2-28 Gain Boost Factor* is set to 0. See Illustration 46 for more information.

Parameter 2-30 Position P Start Proportional Gain

Table 178: Parameter 2-30 Position P Start Proportional Gain

2-30 Position P Start Proportional Gain		
Default value: X0.0500	Parameter type: Range, 0.0000 - 1.0000	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: True

Enter the position controller during start proportional gain. Quick control is obtained at high amplification. However, if the amplification is too high, the process may become unstable.

Parameter 2-31 Speed PID Start Proportional Gain

Table 179: Parameter 2-31 Speed PID Start Proportional Gain

2-31 Speed PID Start Proportional Gain		
Default value: 0.0500	Parameter type: Range, 0.0000 - 1.0000	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: True

Enter the speed controller proportional gain during start. Quick control is obtained at high amplification. However, if amplification is too high, the process may become unstable.

Parameter 2-32 Speed PID Start Integral Time

Table 180: Parameter 2-32 Speed PID Start Integral Time

2-32 Speed PID Start Integral Time		
Default value: 20.0 ms	Parameter type: Range, 1.0 - 20000.0 ms	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: True

Enter the speed controller integral time. Obtain quick control through a short integral time, though if the integral time is too short, the process becomes unstable. An excessively long integral time disables the integral action.

Parameter 2-33 Speed PID Start Lowpass Filter Time

Table 181: Parameter 2-33 Speed PID Start Lowpass Filter Time

2-33 Speed PID Start Lowpass Filter Time		
Default value: 2.0 ms	Parameter type: Range, 0.1 - 100.0 ms	Setup: All setups
Conversion index: -4	Data type: Uint16	Change during operation: True

Set a time constant for the speed control low-pass filter. The low-pass filter improves steady-state performance and dampens oscillations on the feedback signal. However, severe filtering can be detrimental to dynamic performance.

Parameter 2-34 Zero Speed Position P Proportional Gain

Table 182: Parameter 2-34 Zero Speed Position P Proportional Gain

2-34 Zero Speed Position P Proportional Gain		
Default value: 0.0000	Parameter type: Range, 0.0000 - 1.0000	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX.

Enter the proportional gain for position control at standstill in speed mode.

5.4 Parameter Group 3-** Reference/Ramps

Parameters for handling of reference, definition of limitations, and configuration of the reaction of the drive to changes.

5.4.1 3-0* Reference Limits

Parameter 3-00 Reference Range

Table 183: Parameter 3-00 Reference Range

3-00 Reference Range		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the range of the reference signal and the feedback signal. Signal values can be positive only, or positive and negative. The minimum limit may have a negative value, unless *[1] Speed closed loop control* or *[3] Process* is selected in *parameter 1-00 Configuration Mode*.

Option	Name	Description
[0]	Min - Max	Select the range of the reference signal and the feedback signal. Signal values can be positive only, or positive and negative. The minimum limit may have a negative value, unless *[1] Speed closed loop control* or *[3] Process* is selected in *parameter 1-00 Configuration Mode*.
[1]	-Max - +Max	For both positive and negative values (both directions, relative to *parameter 4-10 Motor Speed Direction*).

Parameter 3-01 Reference/Feedback Unit

Table 184: Parameter 3-01 Reference/Feedback Unit

3-01 Reference/Feedback Unit		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the unit to be used in process PID control references and feedbacks. *Parameter 1-00 Configuration Mode* must be either *[3] Process* or *[8] Extended PID Control*.

Option	Name	Description
[0]	None	
[1]	%	
[2]	RPM	
[3]	Hz	
[4]	Nm	
[5]	PPM	
[10]	l/min	
[12]	Pulse/s	
[20]	l/s	
[21]	l/min	
[22]	l/h	
[23]	m^3/s	
[24]	m^3/min	
[25]	m^3/h	
[30]	kg/s	
[31]	kg/min	
[32]	kg/h	
[33]	t/min	
[34]	t/h	
[40]	m/s	
[41]	m/min	
[45]	m	

Option	Name	Description
[60]	°C	
[70]	mbar	
[71]	bar	
[72]	Pa	
[73]	kPa	
[74]	m WG	
[80]	kW	
[120]	GPM	
[121]	gal/s	
[122]	gal/min	
[123]	gal/h	
[124]	CFM	
[125]	ft^3/s	
[126]	ft^3/min	
[127]	ft^3/h	
[130]	lb/s	
[131]	lb/min	
[132]	lb/h	
[140]	ft/s	
[141]	ft/min	
[145]	ft	
[150]	lb ft	
[160]	°F	
[170]	psi	
[171]	lb/in^3	
[172]	in WG	
[173]	ft WG	
[180]	HP	

Parameter 3-02 Minimum Reference

Table 185: Parameter 3-02 Minimum Reference

3-02 Minimum Reference		
Default value: Size related	Parameter type: Range, -999999.999 - 999999.999 Reference- FeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the minimum reference. The minimum reference is the lowest value obtainable by summing all references. Minimum reference is active only when *parameter 3-00 Reference Range* is set to *[0] Min.- Max*. The minimum reference unit matches:

- The configuration of *parameter 1-00 Configuration Mode*: For *[1] Speed closed loop, RPM*; for *[2] Torque, Nm*.
- The unit selected in *parameter 3-01 Reference/ Feedback Unit*.

If option *[10] Synchronization* is selected in *parameter 1-00 Configuration Mode*, this parameter defines the maximum speed deviation when performing the position offset defined in *parameter 3-26 Master Offset*. Also see *parameter 3-28 Master Offset Speed Ref*.

Parameter 3-03 Maximum Reference

Table 186: Parameter 3-03 Maximum Reference

3-03 Maximum Reference		
Default value: Size related	Parameter type: 0.000 - 999999.999 Reference- FeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the maximum reference. The maximum reference is the highest value obtainable by summing all references. The maximum reference unit matches:

- The configuration selected in *parameter 1-00 Configuration Mode*: For *[1] Speed closed loop, RPM*; for *[2] Torque, Nm*.
- The unit selected in *parameter 3-00 Reference Range*.

If *[9] Positioning* is selected in *parameter 1-00 Configuration Mode*, this parameter defines the default speed for positioning.

Parameter 3-04 Reference Function

Table 187: Parameter 3-04 Reference Function

3-04 Reference Function		
Default value: [0] Sum	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Sum	Sums both external and preset reference sources.
[1]	External/Preset	Use either the preset or the external reference source. Shift between external and preset via a command or a digital input.

Parameter 3-05 On Reference Window

Table 188: Parameter 3-05 On Reference Window

3-05 On Reference Window		
Default value: Size related	Parameter type: Range, 0 - 999999.999 Reference- FeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX

Enter the tolerance window for on-reference or on-target status. Depending on the option selected in *parameter 1-00 Configuration Mode*, this parameter defines the following:

- Speed mode: Speed window for on-reference status.
- Torque mode: Torque window for on-reference status.
- Position mode: Speed window for on-target status. See also *parameter 3-08 On Target Window*.

Parameter 3-06 Minimum Position

Table 189: Parameter 3-06 Minimum Position

3-06 Minimum Position		
Default value: -100000 Custom- Readout-Unit2	Parameter type: Range, -2147483648 - 2147483647 CustomReadoutUnit2	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX

Enter the minimum position. This parameter defines the position range in linear axis mode (*parameter 17-76 Position Axis Mode*) and in the position limit function (*parameter 4-73 Position Limit Function*).

Parameter 3-07 Maximum Position

Table 190: Parameter 3-07 Maximum Position

3-07 Maximum Position		
Default value: 100000 Custom- ReadoutU-nit2	Parameter type: Range, -2147483648 - 2147483647 CustomReadoutUnit2	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX

Enter the maximum position. This parameter defines the position range in linear axis mode (*parameter 17-76 Position Axis Mode*). Position range limits:

- Linear: *Parameter 3-06 Minimum Position* to *parameter 3-07 Maximum Position*.
- Rotary: 0– *parameter 3-07 Maximum Position*.

The position limit function uses this parameter (*parameter 4-73 Position Limit Function*).

Parameter 3-08 On Target Window

Table 191: Parameter 3-08 On Target Window

3-08 On Target Window		
Default value: 5 Custom- ReadoutUni t2	Parameter type: Range, 0 - 2147483647 CustomRea-doutUnit2	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX

The drive considers the positioning completed and sends the on target signal when the actual position is within *parameter 3-08 On Target Window* for the duration of *parameter 3-09 On Target Time* and the actual speed is less than *parameter 3-05 On Reference Window*.

Parameter 3-09 On Target Time

Table 192: Parameter 3-09 On Target Time

3-09 On Target Time		
Default value: 1 ms	Parameter type: Range, 0 - 60000 ms	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX

Enter the time for evaluating the on-target window, see also *parameter 3-08 On Target Window*.

5.4.2 3-1* References

Select the preset reference(s). Select Preset ref. bit 0/1/2 [16], [17], or [18] for the corresponding digital inputs in *parameter group 5-1* Digital Inputs*.

Parameter 3-10 Preset Reference

Table 193: Parameter 3-10 Preset Reference

3-10 Preset Reference		
Default value: 0%	Parameter type: Range, -100 - 100%, Array [8]	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Enter up to 8 different preset references (0–7) in this parameter, using array programming. The preset reference is stated as a percentage of the value Ref_{MAX} (*parameter 3-03 Maximum Reference*). If a Ref_{MIN} different from 0 (*parameter 3-02 Minimum Reference*) is programmed, the preset reference is calculated as a percentage of the full reference range, that is on the basis of the difference between Ref_{MAX} and Ref_{MIN}. Afterwards, the value is added to Ref_{MIN}. When using preset references, select preset reference bit 0/1/2 [16], [17] or [18] for the corresponding digital inputs in *parameter group 5-1* Digital Inputs*.

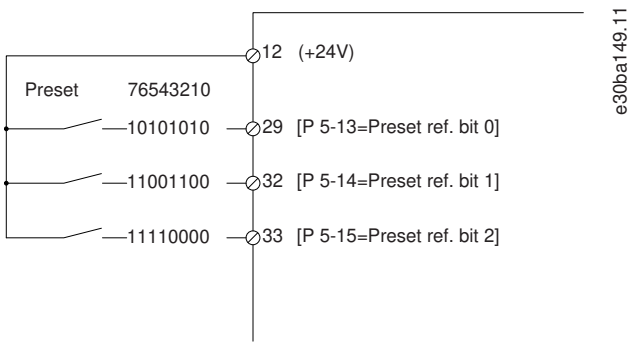


Illustration 47: Preset Reference

Table 194: Preset Referenece Bits

Preset ref. bit	2	1	0
Preset ref. 0	0	0	0
Preset ref. 1	0	0	1
Preset ref. 2	0	1	0
Preset ref. 3	0	1	1
Preset ref. 4	1	0	0
Preset ref. 5	1	0	1
Preset ref. 6	1	1	0
Preset ref. 7	1	1	1

Parameter 3-11 Jog Speed [Hz]

Table 195: Parameter 3-11 Jog Speed [Hz]

3-11 Jog Speed [Hz]		
Default value: Size related	Parameter type: Range, 0 - par. 4-14 Hz	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

The jog speed is a fixed output speed at which the drive is running when the jog function is activated. See also *parameter 3-80 Jog/Homing Ramp Time*.

Parameter 3-12 Catch Up/Slow Down Value

Table 196: Parameter 3-12 Catch Up/Slow Down Value

3-12 Catch Up/Slow Down Value		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Enter a percentage (relative) value to be either added to or deducted from the actual reference for catch up or slow down. If catch up is selected via 1 of the digital inputs (*parameter 5-10 Terminal 18 Digital Input* to *parameter 5-15 Terminal 33 Digital Input*), the percentage (relative) value is added to the total reference. If slow down is selected via 1 of the digital inputs (*parameter 5-10 Terminal 18 Digital Input* to *parameter 5-15 Terminal 33 Digital Input*), the percentage (relative) value is deducted from the total reference. Obtain extended functionality with the DigiPot function. See *parameter group 3-9* Digital Potentiometer*.

Parameter 3-13 Reference Site

Table 197: Parameter 3-13 Reference Site

3-13 Reference Site		
Default value: [0] Linked to hand/auto	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select which reference site to activate.

Option	Name	Description
[0]*	Linked to hand/auto	Use local reference when in hand-on mode, or remote reference when in auto-on mode.
[1]	Remote	Use remote reference in both hand-on mode and auto-on mode.
[2]	Local	Use local reference in both hand-on and auto-on mode. **NOTICE** When set to *[2] Local*, the drive starts with this setting again after a power-down.
[3]	Linked to H/A MCO	Select this option to enable the FFACC factor in *parameter 32-66 Acceleration Feed-Forward*. Enabling FFACC reduces jitter and makes the transmission from the motion controller to the control card of the drive faster. This leads to faster response times for dynamic applications and position control. For more information about FFACC, see VLT® Motion Control MCO 305 Operating Instructions.

Parameter 3-14 Preset Relative Reference

Table 198: Parameter 3-14 Preset Relative Reference

3-14 Preset Relative Reference		
Default value: 0%	Parameter type: Range, -200 - 200%	Setup: All setups
Conversion index: -2	Data type: Int32	Change during operation: True

The actual reference, X, is increased or decreased with percentage Y, which gives the resulting actual reference, Z. The actual reference (X) is the sum of the inputs selected in:

- *Parameter 3-15 Reference Resource 1*.
- *Parameter 3-16 Reference Resource 2*.
- *Parameter 3-17 Reference Resource 3*.
- *Parameter 8-02 Control Word Source*.

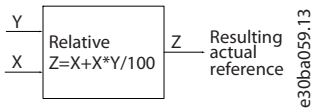


Illustration 48: Preset Relative Reference

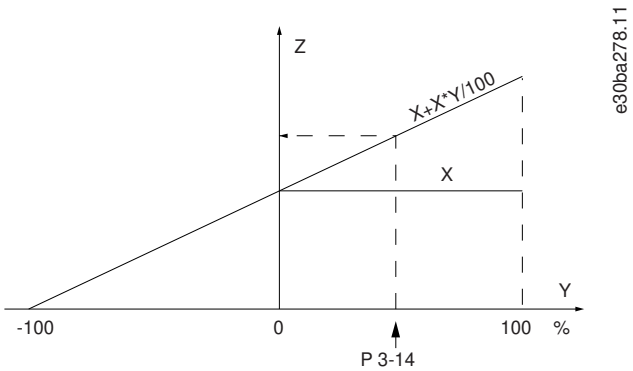


Illustration 49: Actual Reference

Parameter 3-15 Reference Resource 1

Table 199: Parameter 3-15 Reference Resource 1

3-15 Reference Resource 1		
Default value: [1] Analog input 53	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the reference input to be used for the 1st reference signal. *Parameter 3-15 Resource Reference 1*, *parameter 3-16 Resource Reference 2*, and *parameter 3-17 Resource Reference 3* define up to 3 different reference signals. The sum of these reference signals defines the actual reference. Select the speed reference source in *parameter 3-15 Reference Resource 1* when *parameter 1-00 Configuration Mode* is set to *[9] Positioning* in positioning mode.

N O T I C E

The options [3],[4],[5], [6], [12], [13], and [14] are only available with software version 48.XX.

Option	Name	Description
[0]	No function	
[1]*	Analog Input 53	
[2]	Analog Input 54	
[3]	24V Encoder 32/33	
[4]	MCB 102	
[5]	MCB 103	
[6]	Virtual Master	
[7]	Frequency Input 29	**N O T I C E** This option is only available in FC 302.
[8]	Frequency Input 33	
[11]	Local Bus Reference	Reference from terminals 68 and 69.
[12]	Preset Reference	Select this option to set the speed reference in *parameter 3-10 Preset Reference* together with the preset target in *parameter 3-20 Preset Target* to calculate speed profile for positioning.
[13]	24V Encoder 27/29	
[14]	MCB 102 Absolute	
[15]	MCO Encoder 1 X56	
[16]	MCO Encoder 2 X55	
[20]	Digital Potmeter	
[21]	Analog Input X30/11	VLT® General Purpose I/O MCB 101
[22]	Analog Input X30/12	VLT® General Purpose I/O MCB 101
[29]	Analog Input X48/2	

Option	Name	Description
[37]	Analog Input X49/1	
[38]	Analog Input X49/3	
[39]	Analog Input X49/5	

Parameter 3-16 Reference Resource 2

Table 200: Parameter 3-16 Reference Resource 2

3-16 Reference Resource 2		
Default value: [20] Digital pot.meter	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the reference input to be used for the 2nd reference signal. *Parameter 3-15 Resource Reference 1*, *parameter 3-16 Resource Reference 2*, and *parameter 3-17 Resource Reference 3* define up to 3 different reference signals. The sum of these reference signals defines the actual reference. When *parameter 1-00 Configuration Mode* is set to *[9] Positioning*. Configure *parameter 3-16 Reference Resource 2* to select the source for target position.

N O T I C E

The options [3],[4],[5], [6], [12], [13], and [14] are only available with software version 48.XX.

Option	Name	Description
[0]	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[3]	24V Encoder 32/33	Single signal generated from 24 V High Threshold Logic (HTL) encoder connected to terminals 32 and 33. Configure the 24 V encoder interface in *parameter group 5–7* 24 V Encoder Option*. Program terminals 32/33 to *[0] No operation*.
[4]	MCB 102	This is only available for VLT® Encoder Option MCB 102. Configure the encoder interface in *parameter groups 17-0*, 17-1*, and 17-2**.
[5]	MCB 103	This is only available for VLT® Resolver Option MCB 103. Configure the resolver interface in *parameter group 17-5* Resolver Interface*.
[6]	Virtual Master	Master signal for the drive which hosts the virtual master without an external connection. This option is only active when option *[10] Synchronization* is selected in *parameter 1-00 Configuration Mode*.
[7]	Frequency Input 29	**N O T I C E** This option is only available in FC 302.
[8]	Frequency Input 33	
[11]	Local Bus Reference	Reference from terminals 68 and 69.
[12]	Preset Reference	

Option	Name	Description
[13]	24V Encoder 27/29	Single signal generated from 24 V High Threshold Logic (HTL) encoder connected to terminals 27 and 29. Configure the 24 V encoder interface in *parameter group 5.7* 24 V Encoder Input*. Program terminals 27/29 to *[0] No operation*.
[14]	MCB 102 Absolute	The option is only available for VLT® Encoder Option MCB 102 with version 4.00 and newer and when *parameter 17-00 Encoders Connected* is set to option *[1] Two Encoders*.
[15]	MCO Encoder 1 X56	
[16]	MCO Encoder 2 X55	
[20]*	Digital Potmeter	
[21]	Analog Input X30/11	VLT® General Purpose I/O MCB 101
[22]	Analog Input X30/12	VLT® General Purpose I/O MCB 101
[29]	Analog Input X48/2	
[37]	Analog Input X49/1	
[38]	Analog Input X49/3	
[39]	Analog Input X49/5	

Parameter 3-17 Reference Resource 3

Table 201: Parameter 3-17 Reference Resource 3

3-17 Reference Resource 3		
Default value: [11] Local bus reference	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the reference input to be used for the 3rd reference signal. *Parameter 3-15 Resource Reference 1*, *parameter 3-16 Resource Reference 2*, and *parameter 3-17 Resource Reference 3* define up to 3 different reference signals. The sum of these reference signals defines the actual reference.

Option	Name	Description
[0]	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[3]	24V Encoder 32/33	
[4]	MCB 102	
[5]	MCB 103	
[6]	Virtual Master	
[7]	Frequency Input 29	**NOTICE** This option is only available in FC 302.
[8]	Frequency Input 33	

Option	Name	Description
[11]*	Local Bus Reference	Reference from terminals 68 and 69.
[12]	Preset Reference	
[13]	24V Encoder 27/29	
[14]	MCB 102 Absolute	
[15]	MCO Encoder 1 X56	
[16]	MCO Encoder 2 X55	
[20]	Digital Potmeter	
[21]	Analog Input X30/11	
[22]	Analog Input X30/12	
[29]	Analog Input X48/2	
[37]	Analog Input X49/1	
[38]	Analog Input X49/3	
[39]	Analog Input X49/5	

Parameter 3-18 Relative Scaling Reference Resource

Table 202: Parameter 3-18 Relative Scaling Reference Resource

3-18 Relative Scaling Reference Resource		
Default value: [0] No Function	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

N O T I C E

This parameter cannot be adjusted while the motor is running.

N O T I C E

The options [3],[4],[5], [6], [12], [13], and [14] are only available with software version 48.XX.

Select a variable value to be added to the fixed value (defined in *parameter 3-14 Preset Relative Reference*). The sum of the fixed and variable values (labeled Y in Illustration 50) is multiplied by the actual reference (labeled X in Illustration 50). This product is then added to the actual reference (X+X*Y/100) to give the resulting actual reference.

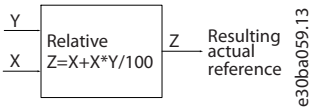


Illustration 50: Resulting Actual Reference

Option	Name	Description
[0]*	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	

Option	Name	Description
[3]	24V Encoder 32/33	
[4]	MCB 102	
[5]	MCB 103	
[6]	Virtual Master	
[7]	Frequency Input 29	**NOTICE** This option is only available in FC 302.
[8]	Frequency Input 33	
[11]	Local Bus Reference	Reference from terminals 68 and 69.
[12]	Preset Reference	
[13]	24V Encoder 27/29	
[14]	MCB 102 Absolute	
[15]	MCO Encoder 1 X56	
[16]	MCO Encoder 2 X55	
[20]	Digital Potmeter	
[21]	Analog Input X30/11	
[22]	Analog Input X30/12	
[29]	Analog Input X48/2	
[37]	Analog Input X49/1	
[38]	Analog Input X49/3	
[39]	Analog Input X49/5	

Parameter 3-19 Jog Speed [RPM]

Table 203: Parameter 3-19 Jog Speed [RPM]

3-19 Jog Speed [RPM]		
Default value: Size related	Parameter type: Range, 0 - par. 4-13 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Enter a value for the jog speed n_{JOG}, which is a fixed output speed. The drive runs at this speed when the jog function is activated. The maximum limit is defined in *parameter 4-13 Motor Speed High Limit [RPM]*. See also *parameter 3-80 Jog/Homing Ramp Time*.

5.4.3 3-2* References II

Parameter 3-20 Preset Target

Table 204: Parameter 3-20 Preset Target

3-20 Preset Target		
Default value: 0 Custom- ReadoutUnit2	Parameter type: Range, -2147483648 - 2147483647 CustomReadoutUnit2, Array [8]	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX.

Set up to 8 target positions. Select from the 8 preset positions using digital inputs or the fieldbus control word.

Parameter 3-21 Touch Target

Table 205: Parameter 3-21 Touch Target

3-21 Touch Target		
Default value: 0 Custom- ReadoutUnit2	Parameter type: Range, -2147483648 - 2147483647 CustomReadoutUnit2, Array [8]	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX.

2147483647 = Latch Only. With Latch Only actual position of touch sensor is latched and updated in *parameter 18-25 Latched Actual Pos* but no positioning is executed. Enter the target position in touch probe positioning mode. This parameter defines the distance from the detection event of the touch probe sensor to the final target position in position units.

Parameter 3-22 Master Scale Numerator

Table 206: Parameter 3-22 Master Scale Numerator

3-22 Master Scale Numerator		
Default value: 1	Parameter type: Range, -2147483648 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX.

Parameter 3-22 Master Scale Numerator and *parameter 3-23 Master Scale Denominator* define the gear ratio between the master and the follower in synchronization mode.

$$\text{Master revolutions} = \frac{\text{Par. } 3-22}{\text{Par. } 3-23} \times \text{Follower revolutions}$$

Parameter 3-23 Master Scale Denominator

Table 207: Parameter 3-23 Master Scale Denominator

3-23 Master Scale Denominator		
Default value: 1	Parameter type: Range, -2147483648 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Refer to *Parameter 3-22 Master Scale Numerator*.

Parameter 3-24 Master Lowpass Filter Time

Table 208: Parameter 3-24 Master Lowpass Filter Time

3-24 Master Lowpass Filter Time		
Default value: 20 ms	Parameter type: Range, 1.0 - 2000.0 ms	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Enter the time constant for master speed calculation in synchronizing mode.

Parameter 3-25 Fieldbus Sync. Resolution

Table 209: Parameter 3-25 Fieldbus Sync. Resolution

3-25 Fieldbus Sync. Resolution		
Default value: 1048576	Parameter type: Range, 0 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Set the resolution of the fieldbus reference in synchronization mode. 0 sets the full unsigned 32-bit value, 2^{32} = 429496729.

Parameter 3-26 Master Offset

Table 210: Parameter 3-26 Master Offset

3-26 Master Offset		
Default value: 0 CustomReadoutUnit2	Parameter type: Range, -2147483648 - 2147483647 CustomReadoutUnit2	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Enter the position offset between the master and the follower in synchronization mode. This value is added to the follower position at each activation of a digital input with option *[113] Enable Reference* or bit 5 of the fieldbus control word. *Parameter 3-02 Minimum Reference* defines the maximum deviation from the actual master speed during the execution of the offset.

Parameter 3-27 Virtual Master Max Ref

Table 211: Parameter 3-27 Virtual Master Max Ref

3-27 Virtual Master Max Ref		
Default value: 50 Hz	Parameter type: Range, 0.0 - 590.0 Hz	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX.

Enter the maximum reference for the virtual master. The actual reference is set relative to this value using the source selected in *parameter 3-15 Reference Resource 1* or fieldbus reference 1. The rotation direction is controlled by the forward/reverse signal on a digital input or fieldbus. Use *parameter group 3-6* Ramp 3* to configure acceleration and deceleration.

Parameter 3-28 Master Offset Speed Ref

Table 212: Parameter 3-28 Master Offset Speed Ref

3-28 Master Offset Speed Ref		
Default value: 1500 RPM	Parameter type: Range, 0 - 65000 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX.

Enter the speed reference for changing the master offset in synchronization mode. To ensure compatibility with software versions 48.01 and 48.10, this parameter is only active when *parameter 3-02 Minimum Reference* is set to 0.

Parameter 3-29 Interpolation Time Period

Table 213: Parameter 3-29 Interpolation Time Period

3-29 Interpolation Time Period		
Default value: Size related	Parameter type: Range, Size related, Array [2]	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Set the time interval of the cyclic reference for CSV, CSP, or synchronizing. **CSV:** When providing only speed reference. Acceleration/deceleration is interpolated based on this time interval. **CSP/Synchronizing:** When only providing position reference speed and acceleration/deceleration is interpolated based on this time interval.

Index	Range	Description
[0], default 1	1–1000	The time period in seconds but actual time is scaled by index 1.
[1], default -3	-3–0	The exponent for the time period in index 0. Actual time = index 0 to the power of index 1. Example: Index 0 = 1 and index 1 = -3 ⇒ time set in ms.

5.4.4 3-3* Gen Ramp & Sync

Parameter 3-32 Ramp Speed Ref

Table 214: Parameter 3-32 Ramp Speed Ref

3-32 Ramp Speed Ref		
Default value: 0 RPM	Parameter type: Range, 0 - 1000000 RPM	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX.

Enter a value to specify the ramp speed reference. When 0 is specified, the ramp speed is selected based on the settings in *parameter 1-23 Motor Frequency* for induction motors and *parameter 1-25 Motor Nominal Speed* for synchronous motors. When a value greater than 0 is specified, the ramp speed reference is used to accelerate or decelerate irrespectively of motor type or data.

Parameter 3-33 Sync Mode & Start Behavior

Table 215: Parameter 3-33 Sync Mode & Start Behavior

3-33 Sync Mode & Start Behavior		
Default value: [0] Relative Sync	Parameter type: Option	Setup:
Conversion index: -	Data type: Uint8	Change during operation:

N O T I C E

This parameter is only available with software version 48.XX.

Select the type of synchronization and start mechanism for synchronization mode. Marker synchronization is enabled when options *[10] Marker Shortest*, *[11] Marker Catch Up*, or *[12] Marker Slow Down* is selected.

Option	Name	Description
[0]*	Relative Sync.	The follower position is locked to the master position at start, then Enable Reference is active.
[1]	Relative Re-Sync.	The position of the follower drive stays locked to the master drive's position when Enable Reference is active, though the drive is stopped or coasted. For example, when the drive is restarted after an alarm, the follower drive realigns with the master drive.
[2]	Absolute Sync.	The position of the follower drive is always locked to the position of the master drive.
[10]	Marker Shortest	Controls the behavior of the 1st marker synchronization. Marker synchronization start-up behavior depends on *parameter 3-34 Marker Distance*: • When *parameter 3-34 Marker Distance* = 0 (OFF), the 1st follower marker is aligned with the 1st master marker. • When *parameter 3-34 Marker Distance* > 0, the 1st follower marker is aligned with the closest master marker to accelerate or decelerate to the correct position by a maximum of half the marker distance.
[11]	Marker Catch Up	Select this option to accelerate the follower to reach the position of the previous master marker during marker synchronization.
[12]	Marker Slow Down	Select this option to decelerate the follower to align with the subsequent master marker during marker synchronization.
[13]	Mar. Dis. Meas. Fo.	Select this option to measure the follower marker distance while synchronizing without marker correction, when the master is running. The measured follower marker distance is set in *parameter 3-34 Marker Distance*.
[14]	Mar. Dis. Meas. Ma.	Select this option to measure master marker distance while synchronizing without marker correction, when the master is running. The measured master marker distance is set in *parameter 3-34 Marker Distance*.
[15]	Mar. meas. shortest	Continuous measurement of distance between master and follower marker where the behavior depends on *parameter 3-34 Marker Distance*. • *Parameter 3-34 Marker Distance* = 0 (OFF): Distance is measure between the 1st follower marker and the 1st master marker no matter which one comes first, this is considered as the 1st pair of markers. Distance will then be measured between every following pairs of master and follower markers. • *Parameter 3-34 Marker Distance* > 0: At every follower marker distance is measured to the closest master marker. The result of the measurement is updated in *parameter 18-24 Marker Pos. Offset* in position units as defined in *parameter group 17-0* Position Scaling*.

Option	Name	Description
[16]	Mar. meas. catch up	Continuous measurement of distance between master and follower marker. At every follower marker the distance is measured to the latest master marker. The result of the measurement is updated in *parameter 18-24 Marker Pos. Offset* in position units as defined in *parameter group 17-0* Position Scaling*.
[17]	Mar. meas. slow down	Continuous mesaurement of distance between master and follower marker. At every master marker the distance is measured to the latest follower maker. The result of the measurement is updated in *parameter 18-24 Marker Po. Offset* in position units as defined in *parameter group 17-0* Position Scaling*.
[20]	CAM	Synchronizing according to the profile defined by *parameter 3-36 CAM Master Table* and *parameter 3-37 CAM Follower Table*.
[21]	CAM offset	Synchronizing according to the profile defined by *parameter 3-36 CAM Master Table* and *parameter 3-37 CAM Follower Table* with master offset defined in *parameter 3-26 Master Offset*.

Parameter 3-34 Marker Distance

Table 216: Parameter 3-34 Marker Distance

3-34 Marker Distance		
Default value: 0 CustomReadoutUnit2	Parameter type: Range, 0 - 2147483647 CustomReadoutUnit2	Setup:
Conversion index: 0	Data type: Int32	Change during operation:

NOTICE

This parameter is only available with software version 48.XX.

Enter the approximate distance between 2 markers. To measure the marker distance for follower or master marker, select the corresponding marker measuring function in *parameter 3-33 Sync. Mode & Start Behavior*. Marker distance is in position units as defined in *parameter group 17-1* Position Scaling*. The value is converted to the position units of the follower using the master scale set in *parameter 3-22 Master Scale Numerator* and *parameter 3-23 Master Scale Denominator*. Configure the marker distance to utilize the marker window function.

Parameter 3-35 Marker Window

Table 217: Parameter 3-35 Marker Window

3-35 Marker Window		
Default value: 0 CustomReadoutUnit2	Parameter type: Range, 0 - par. 3-34 CustomReadoutUnit2	Setup:
Conversion index: 0	Data type: Int32	Change during operation:

NOTICE

This parameter is only available with software version 48.XX.

Make sure to configure *parameter 3-34 Marker Distance*. The marker window function is only active when the marker distance is set. Enter the window size around the expected marker position where the marker is accepted. The marker window is used for both master and follower marker and the position units are as defined in *parameter group 17-7* Position Scaling*. Master position value is converted to follower position units using the master scale set in *parameter 3-22 Master Scale Numerator* and *parameter 3-23 Master Scale Denominator*.

Parameter 3-36 CAM Master Table

Table 218: Parameter 3-36 CAM Master Table

3-36 CAM Master Table		
Default value: 0	Parameter type: Range, -2147483648 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Int32, Array [20]	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Master position which together with the corresponding element of *parameter 3-37 CAM Follower Table* forms a CAM position point.

Parameter 3-37 CAM Follower Table

Table 219: Parameter 3-37 CAM Follower Table

3-37 CAM Follower Table		
Default value: 0	Parameter type: Range, -2147483648 - 2147483647 [AbsolutePositionUnit]	Setup: All setups
Conversion index: 0	Data type: Int32, Array [20]	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Follower position which together with the corresponding element of *parameter 3-36 CAM Master Table* forms a CAM position point.

Parameter 3-38 CAM Curve Table

Table 220: Parameter 3-38 CAM Curve Table

3-38 CAM Curve Table		
Default value: [0] None	Parameter type: Option	Setup: All setups
Conversion index: 0	Data type: Uint8, Array [20]	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Option	Name	Description
[0]*	None	
[1]	Linear	Connects the CAM table point with a straight line, corresponds to a fixed gear ratio between master and follower.
[2]	Poly x'order	Connects the CAM table points with an x-order polynomial where x is determined by the number of consecutive points of this type.
[3]	Poly 2'order	Connects the CAM table points with a 2nd order polynomial.
[4]	Poly 3'order	Connects the CAM table points with a 3rd order polynomial.
[5]	Poly 4'order	Connects the CAM table points with a 4th order polynomial. At least 2 consecutive CAM table points of this type are required to use this selection.

Option	Name	Description
[6]	Poly 5'order	Connects the CAM table points with a 5th order polynomial. At least 3 consecutive CAM table points of this type are required to use this selection.
[8]	Sine	Connects the CAM table points with a full sine wave.
[9]	Cosine	Connects the CAM table points with a full cosine wave.
[10]	End	Always select this option for the last point of the curve.

Parameter 3-39 CAM Follower Gain

Table 221: Parameter 3-39 CAM Follower Gain

3-39 CAM Follower Gain		
Default value: 100.0	Parameter type: Range, 0.0 - 500.0%	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX.

The follower table is multiplied by this gain which can be adjusted while running.

5.4.5 3-4* Ramp 1

For each of the 4 ramps (*parameter groups 3-4* Ramp 1*, *3-5* Ramp 2*, *3-6* Ramp 3*, and *3-7* Ramp 4*) configure the ramp parameters:

- Ramp type
- Ramping times (duration of acceleration and deceleration)
- Level of jerk compensation for S-ramps

Start by setting the linear ramping times corresponding to Illustration 51 and Illustration 52.

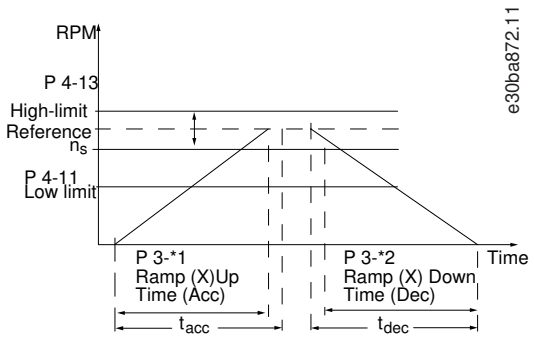


Illustration 51: Linear Ramping Times

If S-ramps are selected, set the level of non-linear jerk compensation required. Set jerk compensation by defining the proportion of ramp-up and ramp-down times where acceleration and deceleration are variable (that is, increasing or decreasing). The S-ramp acceleration and deceleration settings are defined as a percentage of the actual ramp time.

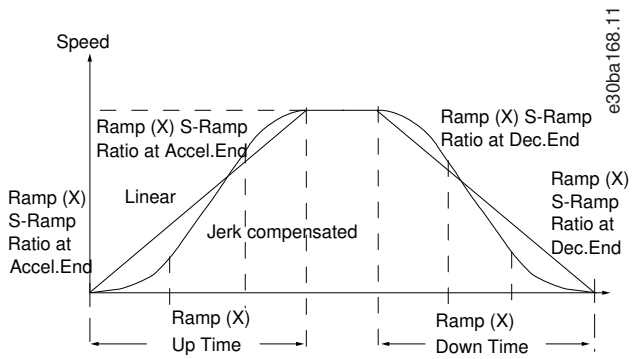


Illustration 52: Non-linear Ramping Times

Parameter 3-40 Ramp 1 Type

Table 222: Parameter 3-40 Ramp 1 Type

3-40 Ramp 1 Type		
Default value: [1] Linear	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

N O T I C E

If *[1] S-ramp Const Jerk* is selected and the reference during ramping is changed, the ramp time may be prolonged to realize a jerk-free movement, which may result in a longer start or stop time. Extra adjustment of the S-ramp ratios or switching initiators may be necessary.

Select the ramp type, depending on requirements for acceleration/deceleration. A linear ramp gives constant acceleration during ramping. An S-ramp gives non-linear acceleration, compensating for jerk in the application.

Option	Name	Description
[0]*	Linear	
[1]	S-ramp Const Jerk	Acceleration with lowest possible jerk.
[2]	S-ramp Const Time	S-ramp based on the values set in *parameter 3-41 Ramp 1 Ramp Up Time* and *parameter 3-42 Ramp 1 Ramp Down Time*.

Parameter 3-41 Ramp 1 Ramp Up Time

Table 223: Parameter 3-41 Ramp 1 Ramp Up Time

3-41 Ramp 1 Ramp Up Time		
Default value: Size related	Parameter type: Range, 0.01 - 3600 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the ramp-up time, that is the acceleration time from 0 RPM to the synchronous motor speed n_S. Select a ramp-up time which prevents the output current from exceeding the current limit in *parameter 4-18 Current Limit during ramping*. The value 0.00 corresponds to 0.01 s in speed mode. See ramp-down time in *parameter 3-42 Ramp 1 Ramp Down Time*.

$$\text{Par. } 3-41 = \frac{t_{acc}\,[s] \times n_s\,[\text{RPM}]}{\text{ref}\,[\text{RPM}]}$$

Parameter 3-42 Ramp 1 Ramp Down Time

Table 224: Parameter 3-42 Ramp 1 Ramp Down Time

3-42 Ramp 1 Ramp Down Time		
Default value: Size related	Parameter type: Range, 0.01 - 3600 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the ramp-down time, that is the deceleration time from the synchronous motor speed n_s to 0 RPM. Select a ramp-down time such that no overvoltage occurs in the inverter due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in *parameter 4-18 Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See ramp-up time in *parameter 3-41 Ramp 1 Ramp Up Time*.

$$\text{Par. } 3-42 = \frac{t_{dec}\,[s] \times n_s\,[\text{RPM}]}{\text{ref}\,[\text{RPM}]}$$

Parameter 3-45 Ramp 1 S-ramp Ratio at Accel. Start

Table 225: Parameter 3-45 Ramp 1 S-ramp Ratio at Accel. Start

3-45 Ramp 1 S-ramp Ratio at Accel. Start		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the proportion of the total ramp-up time (*parameter 3-41 Ramp 1 Ramp Up Time*) in which the acceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks occurring in the application.

Parameter 3-46 Ramp 1 S-ramp Ratio Accel. End

Table 226: Parameter 3-46 Ramp 1 S-ramp Ratio at Accel. End

3-46 Ramp 1 S-ramp Ratio at Accel. End		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the proportion of the total ramp-up time (*parameter 3-41 Ramp 1 Ramp Up Time*) in which the acceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

Parameter 3-47 Ramp 1 S-ramp Ratio at Decel. Start

Table 227: Parameter 3-47 Ramp 1 S-ramp Ratio at Decel. Start

3-47 Ramp 1 S-ramp Ratio at Decel. Start		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the proportion of the total ramp-down time (*parameter 3-42 Ramp 1 Ramp Down Time*) where the deceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

Parameter 3-48 Ramp 1 S-ramp Ratio at Decel. End

Table 228: Parameter 3-48 Ramp 1 S-ramp Ratio at Decel. End

3-48 Ramp 1 S-ramp Ratio at Decel. End		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the proportion of the total ramp-down time (*parameter 3-42 Ramp 1 Ramp Down Time*) where the deceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

5.4.6 3-5* Ramp 2

Parameter 3-50 Ramp 2 Type

Table 229: Parameter 3-50 Ramp 2 Type

3-50 Ramp 2 Type		
Default value: [1] Linear	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

N O T I C E

If *[1] S-ramp Const Jerk* is selected and the reference during ramping is changed, the ramp time may be prolonged to realize a jerk-free movement, which may result in a longer start or stop time. Additional adjustment of the S-ramp ratios or switching initiators may be necessary.

Select the ramp type, depending on requirements for acceleration/deceleration. A linear ramp gives constant acceleration during ramping. An S-ramp gives non-linear acceleration, compensating for jerk in the application.

Option	Name	Description
[0]*	Linear	
[1]	S-ramp Const Jerk	Acceleration with lowest possible jerk.
[2]	S-ramp Const Time	S-ramp based on the values set in *parameter 3-51 Ramp 2 Ramp Up Time* and *parameter 3-52 Ramp 2 Ramp Down Time*.

Parameter 3-51 Ramp 2 Ramp Up Time

Table 230: Parameter 3-51 Ramp 2 Ramp Up Time

3-51 Ramp 2 Ramp Up Time		
Default value: Size related	Parameter type: Range, 0.01 - 3600 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the ramp-up time, that is the acceleration time from 0 RPM to the nominal motor speed ns. Select a ramp-up time such that the output current does not exceed the current limit in *parameter 4-18 Current Limit* during ramping. The value 0.00 corresponds to 0.01 s in speed mode. See ramp-down time in *parameter 3-52 Ramp 2 Ramp Down Time*.

$$\text{Par. } 3-51 = \frac{t_{acc}\,[s] \times n_s\,[\text{RPM}]}{\text{ref [RPM]}}$$

Parameter 3-52 Ramp 2 Ramp Down Time

Table 231: Parameter 3-52 Ramp 2 Ramp Down Time

3-52 Ramp 2 Ramp Down Time		
Default value: Size related	Parameter type: Range, 0.01 - 3600 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the ramp-down time, that is the deceleration time from the nominal motor speed n_s to 0 RPM. Select a ramp-down time such that no overvoltage occurs in the drive due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in *parameter 4-18 Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See ramp-up time in *parameter 3-51 Ramp 2 Ramp Up Time*.

$$\text{Par. } 3-52 = \frac{t_{dec}[s] \times n_s[\text{RPM}]}{\text{ref}[\text{RPM}]}$$

Parameter 3-55 Ramp 2 S-ramp Ratio at Accel. Start

Table 232: Parameter 3-55 Ramp 2 S-ramp Ratio at Accel. Start

3-55 Ramp 2 S-ramp Ratio at Accel. Start		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the proportion of the total ramp-up time (*parameter 3-51 Ramp 2 Ramp Up Time*) in which the acceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks occurring in the application.

Parameter 3-56 Ramp 2 S-ramp Ratio at Accel. End

Table 233: Parameter 3-56 Ramp 2 S-ramp Ratio at Accel. End

3-56 Ramp 2 S-ramp Ratio at Accel. End		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the proportion of the total ramp-up time (*parameter 3-51 Ramp 2 Ramp Up Time*) in which the acceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

Parameter 3-57 Ramp 2 S-ramp Ratio Decel. Start

Table 234: Parameter 3-57 Ramp 2 S-ramp Ratio at Decel. Start

3-57 Ramp 2 S-ramp Ratio at Decel. Start		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the proportion of the total ramp-down time (*parameter 3-52 Ramp 1 Ramp Down Time*) where the deceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

Parameter 3-58 Ramp 2 S-ramp Ratio at Decel. End

Table 235: Parameter 3-58 Ramp 2 S-ramp Ratio at Decel. End

3-58 Ramp 2 S-ramp Ratio at Decel. End		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the proportion of the total ramp-down time (*parameter 3-52 Ramp 2 Ramp Down Time*) where the deceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

5.4.7 3-6* Ramp 3

Parameter 3-60 Ramp 3 Type

Table 236: Parameter 3-60 Ramp 3 Type

3-60 Ramp 3 Type		
Default value: [1] Linear	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

N O T I C E

If *[1] S-ramp Const Jerk* is selected and the reference during ramping is changed, the ramp time may be prolonged to realize a jerk-free movement, which may result in a longer start or stop time. Additional adjustment of the S-ramp ratios or switching initiators may be necessary.

Select the ramp type, depending on requirements for acceleration/deceleration. A linear ramp gives constant acceleration during ramping. An S-ramp gives non-linear acceleration, compensating for jerk in the application.

Option	Name	Description
[0]*	Linear	
[1]	S-ramp Const Jerk	Acceleration with lowest possible jerk.
[2]	S-ramp Const Time	S-ramp based on the values set in *parameter 3-61 Ramp 3 Ramp Up Time* and *parameter 3-62 Ramp 3 Ramp Down Time*.

Parameter 3-61 Ramp 3 Ramp Up Time

Table 237: Parameter 3-61 Ramp 3 Ramp Up Time

3-61 Ramp 3 Ramp Up Time		
Default value: Size related	Parameter type: Range, 0.01 - 3600 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the ramp-up time, that is the acceleration time from 0 RPM to the nominal motor speed ns. Select a ramp-up time such that the output current does not exceed the current limit in *parameter 4-18 Current Limit* during ramping. The value 0.00 corresponds to 0.01 s in speed mode. See ramp-down time in *parameter 3-62 Ramp 3 Ramp Down Time*.

$$\text{Par. } 3-61 = \frac{t_{acc}\,[s] \times n_s\,[\text{RPM}]}{\text{ref}\,[\text{RPM}]}$$

Parameter 3-62 Ramp 3 Ramp Down Time

Table 238: Parameter 3-62 Ramp 3 Ramp Down Time

3-62 Ramp 3 Ramp Down Time		
Default value: Size related	Parameter type: Range, 0.01 - 3600 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the ramp-down time, that is the deceleration time from the nominal motor speed n_s to 0 RPM. Select a ramp-down time such that no overvoltage occurs in the drive due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in *parameter 4-18 Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See ramp-up time in *parameter 3-61 Ramp 3 Ramp Up Time*.

$$\text{Par. } 3-62 = \frac{t_{dec}\,[s] \times n_s\,[\text{RPM}]}{\text{ref}\,[\text{RPM}]}$$

Parameter 3-65 Ramp 3 S-ramp Ratio at Accel. Start

Table 239: Parameter 3-65 Ramp 3 S-ramp Ratio at Accel. Start

3-65 Ramp 3 S-ramp Ratio at Accel. Start		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the proportion of the total ramp-up time (*parameter 3-61 Ramp 3 Ramp Up Time*) in which the acceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks occurring in the application.

Parameter 3-66 Ramp 3 S-ramp Ratio at Accel. End

Table 240: Parameter 3-66 Ramp 3 S-ramp Ratio at Accel. End

3-66 Ramp 3 S-ramp Ratio at Accel. End		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the proportion of the total ramp-up time (*parameter 3-61 Ramp 3 Ramp Up Time*) in which the acceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

Parameter 3-67 Ramp 3 S-ramp Ratio at Decel. Start

Table 241: Parameter 3-67 Ramp 3 S-ramp Ratio at Decel. Start

3-67 Ramp 3 S-ramp Ratio at Decel. Start		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the proportion of the total ramp-down time (*parameter 3-52 Ramp 1 Ramp Down Time*) where the deceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

Parameter 3-68 Ramp 3 S-ramp Ratio at Decel. End

Table 242: Parameter 3-68 Ramp 3 S-ramp Ratio at Decel. End

3-68 Ramp 3 S-ramp Ratio at Decel. End		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the proportion of the total ramp-down time (*parameter 3-62 Ramp 3 Ramp Down Time*) where the deceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

5.4.8 3-7* Ramp 4

Parameter 3-70 Ramp 4 Type

Table 243: Parameter 3-70 Ramp 4 Type

3-70 Ramp 4 Type		
Default value: [1] Linear	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

N O T I C E

If *[1] S-ramp Const Jerk* is selected and the reference during ramping is changed, the ramp time may be prolonged to realize a jerk-free movement, which may result in a longer start or stop time. Additional adjustment of the S-ramp ratios or switching initiators may be necessary.

Select the ramp type, depending on requirements for acceleration/deceleration. A linear ramp gives constant acceleration during ramping. An S-ramp gives non-linear acceleration, compensating for jerk in the application.

Option	Name	Description
[0]*	Linear	
[1]	S-ramp Const Jerk	Acceleration with lowest possible jerk.
[2]	S-ramp Const Time	S-ramp based on the values set in *parameter 3-71 Ramp 3 Ramp Up Time* and *parameter 3-72 Ramp 3 Ramp Down Time*.

Parameter 3-71 Ramp 4 Ramp Up Time

Table 244: Parameter 3-71 Ramp 4 Ramp Up Time

3-71 Ramp 4 Ramp Up Time		
Default value: Size related	Parameter type: Range, 0.01 - 3600 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the ramp-up time, that is the acceleration time from 0 RPM to the nominal motor speed ns. Select a ramp-up time such that the output current does not exceed the current limit in *parameter 4-18 Current Limit* during ramping. The value 0.00 corresponds to 0.01 s in speed mode. See ramp-down time in *parameter 3-72 Ramp 4 Ramp Down Time*.

$$\text{Par. } 3-71 = \frac{t_{acc}\,[s] \times n_s\,[\text{RPM}]}{\text{ref [RPM]}}$$

Parameter 3-72 Ramp 4 Ramp Down Time

Table 245: Parameter 3-72 Ramp 4 Ramp Down Time

3-72 Ramp 4 Ramp Down Time		
Default value: Size related	Parameter type: Range, 0.01 - 3600 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the ramp-down time, that is the deceleration time from the nominal motor speed n_s to 0 RPM. Select a ramp-down time such that no overvoltage occurs in the drive due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in *parameter 4-18 Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See ramp-up time in *parameter 3-71 Ramp 4 Ramp Up Time*.

$$\text{Par. } 3-72 = \frac{t_{dec}\,[s] \times n_s\,[\text{RPM}]}{\text{ref [RPM]}}$$

Parameter 3-75 Ramp 4 S-ramp Ratio Accel. Start

Table 246: Parameter 3-75 Ramp 4 S-ramp Ratio at Accel. Start

3-75 Ramp 4 S-ramp Ratio at Accel. Start		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the proportion of the total ramp-up time (*parameter 3-71 Ramp 4 Ramp Up Time*) in which the acceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks occurring in the application.

Parameter 3-76 Ramp 4 S-ramp Ratio at Accel. End

Table 247: Parameter 3-76 Ramp 4 S-ramp Ratio at Accel. End

3-76 Ramp 4 S-ramp Ratio at Accel. End		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the proportion of the total ramp-up time (*parameter 3-71 Ramp 4 Ramp Up Time*) in which the acceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

Parameter 3-77 Ramp 4 S-ramp Ratio at Decel. Start

Table 248: Parameter 3-77 Ramp 4 S-ramp Ratio at Decel. Start

3-77 Ramp 4 S-ramp Ratio at Decel. Start		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the proportion of the total ramp-down time (*parameter 3-72 Ramp 4 Ramp Down Time*) where the deceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

Parameter 3-78 Ramp 4 S-ramp Ratio at Decel. End

Table 249: Parameter 3-78 Ramp 4 S-ramp Ratio at Decel. End

3-78 Ramp 4 S-ramp Ratio at Decel. End		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the proportion of the total ramp-down time (*parameter 3-72 Ramp 4 Ramp Down Time*) where the deceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

5.4.9 3-8* Other Ramps

Parameter 3-80 Jog/Homing Ramp Time

Table 250: Parameter 3-80 Jog/Homing Ramp Time

3-80 Jog/Homing Ramp Time		
Default value: Size related	Parameter type: Range, 0.01 - 3600 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the jog ramp time, that is the acceleration/deceleration time between 0 RPM and the rated motor frequency n_s. Ensure that the resulting output current required for the given jog ramp time does not exceed the current limit in *parameter 4-18 Current Limit*. The jog ramp time starts after activation of a jog signal via the LCP, a selected digital input, or the serial communication port. When jog state is disabled, then the normal ramping times are valid.

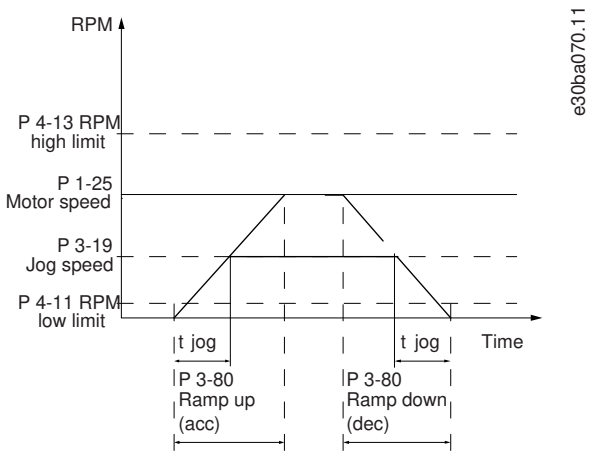


Illustration 53: Jog Ramp Time

$$\text{Par. } 3-80 = \frac{t_{jog}\,[s] \times n_s\,[\text{RPM}]}{\Delta \text{ jog speed (par. } 3-19)\,[\text{RPM}]}$$

Parameter 3-81 Quick Stop Ramp Time

Table 251: Parameter 3-81 Quick Stop Ramp Time

3-81 Quick Stop Ramp Time		
Default value: Size related	Parameter type: Range, 0.01 - 3600 s	Setup: 2 setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the quick–stop ramp-down time, that is the deceleration time from the synchronous motor speed to 0 RPM. Ensure that no resulting overvoltage occurs in the inverter due to regenerative operation of the motor required to achieve the given ramp-down time. Ensure also that the generated current required to achieve the given ramp-down time does not exceed the current limit (set in *parameter 4-18 Current Limit*). Quick stop is activated with a signal on a selected digital input, or via the serial communication port.

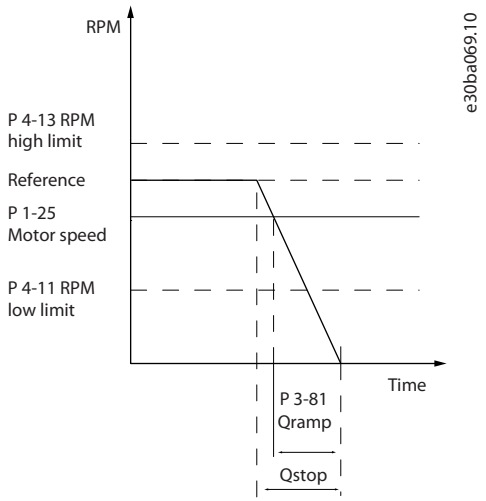


Illustration 54: Quick Stop Ramp Time

Parameter 3-82 Quick Stop Ramp Type

Table 252: Parameter 3-82 Quick Stop Ramp Type

3-82 Quick Stop Ramp Type		
Default value: [1] Linear	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the ramp type, depending on requirements for acceleration/deceleration. A linear ramp gives constant acceleration during ramping. An S-ramp gives non-linear acceleration, compensating for jerk in the application.

Option	Name	Description
[0]*	Linear	
[1]	S-ramp Const Jerk	
[2]	S-ramp Const Time	

Parameter 3-83 Quick Stop S-ramp Ratio at Decel. Start

Table 253: Parameter 3-83 Quick Stop S-ramp Ratio at Decel. Start

3-83 Quick Stop S-ramp Ratio at Decel. Start		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the proportion of the total ramp-up time (*parameter 3-41 Ramp 1 Ramp Up Time*) where the deceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

Parameter 3-84 Quick Stop S-ramp at Decel. End

Table 254: Parameter 3-84 Quick Stop S-ramp at Decel. End

3-84 Quick Stop S-ramp at Decel. End		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the proportion of the total ramp-down time (*parameter 3-42 Ramp 1 Ramp Down Time*) where the deceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

Parameter 3-89 Ramp Lowpass Filter Time

Table 255: Parameter 3-89 Ramp Lowpass Filter Time

3-89 Ramp Lowpass Filter Time		
Default value: 1 ms	Parameter type: Range, 1 - 2000 ms	Setup: All setups
Conversion index: -4	Data type: Uint16	Change during operation: True

Use this parameter to set how smoothly the speed changes.

5.4.10 3-9* Digital Pot.Meter

The digital potentiometer enables increase or decrease of the actual reference by adjusting the setup of the digital inputs using the functions increase, decrease, or clear. To activate the function, set at least 1 digital input to increase or decrease.

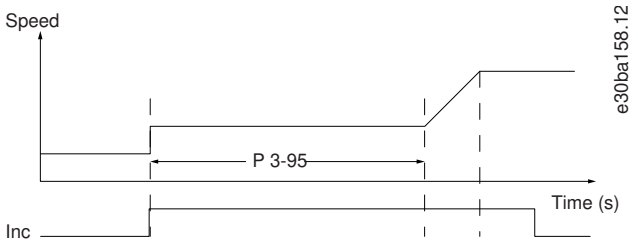


Illustration 55: Increase Actual Reference

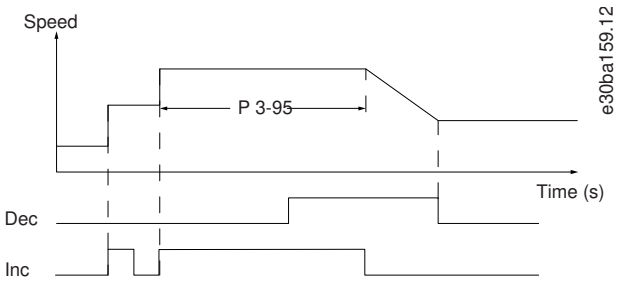


Illustration 56: Increase/Decrease Actual Reference

Parameter 3-90 Step Size

Table 256: Parameter 3-90 Step Size

3-90 Step Size		
Default value: 0.1%	Parameter type: Range, 0.01 - 200%	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

Enter the increment size required for increase/decrease as a percentage of the synchronous motor speed, n_s. If increase/decrease is activated, the resulting reference is increased or decreased by the value set in this parameter.

Parameter 3-91 Ramp Time

Table 257: Parameter 3-91 Ramp Time

3-91 Ramp Time		
Default value: 0 s	Parameter type: Range, 0 - 3600 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the ramp time, that is the time for adjustment of the reference 0–100% of the specified digital potentiometer function (increase, decrease, or clear). If increase/decrease is activated for longer than the ramp delay period specified in *parameter 3-95 Ramp Delay*, the actual reference is ramped up/down according to this ramp time. The ramp time is defined as the time used to adjust the reference by the step size specified in *parameter 3-90 Step Size*.

Parameter 3-92 Power Restore

Table 258: Parameter 3-92 Power Restore

3-92 Power Restore		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Off	Resets the digital potentiometer reference to 0% after power-up.
[1]	On	Restores the most recent digital potentiometer reference at power-up.

Parameter 3-93 Maximum Limit

Table 259: Parameter 3-93 Maximum Limit

3-93 Maximum Limit		
Default value: 100%	Parameter type: Range, -200 - 200%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Set the maximum allowed value for the resulting reference. This is recommended if the digital potentiometer is used for fine-tuning of the resulting reference.

Parameter 3-94 Minimum Limit

Table 260: Parameter 3-94 Minimum Limit

3-94 Minimum Limit		
Default value: 100%	Parameter type: Range, -200 - 200%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Set the minimum allowed value for the resulting reference. This is recommended if the digital potentiometer is used for fine-tuning of the resulting reference.

Parameter 3-95 Ramp Delay

Table 261: Parameter 3-95 Ramp Delay

3-95 Ramp Delay		
Default value: Size related	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: -3	Data type: TimeDiff w/o DateIdent.	Change during operation: True

Enter the delay required from activation of the digital potentiometer function until the drive starts to ramp the reference. With a delay of 0 ms, the reference starts to ramp when increase/decrease is activated. See also *parameter 3-91 Ramp Time*.

5.5 Parameter Group 4-** Limits/Warnings

5.5.1 4-1* Motor Limits

Define torque, current, and speed limits for the motor, and the reaction of the drive when the limits are exceeded. A limit may generate a message in the display. A warning always generates a message in the display or on the fieldbus. A monitoring function may initiate a warning or a trip, after which the drive stops and generates an alarm message.

Parameter 4-10 Motor Speed Direction

Table 262: Parameter 4-10 Motor Speed Direction

4-10 Motor Speed Direction		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

Select the motor speed directions required. Use this parameter to prevent unwanted reversing. When *parameter 1-00 Configuration Mode* is set to *[3] Process*, *parameter 4-10 Motor Speed Direction* is set to *[0] Clockwise* as default. The setting in *parameter 4-10 Motor Speed Direction* does not limit options for setting *parameter 4-13 Motor Speed High Limit [RPM]*.

Option	Name	Description
[0]	Clockwise	The reference is set to CW rotation. Reversing input (default terminal 19) must be open.
[1]	Counterclockwise	The reference is set to CCW rotation. Reversing input (default terminal 19) must be closed. If reversing is required with reverse input open, the motor direction can be changed by *parameter 1-06 Clockwise Direction*.
[2]	Both directions	Allows the motor to rotate in both directions.

Parameter 4-11 Motor Speed Low Limit [RPM]

Table 263: Parameter 4-11 Motor Speed Low Limit [RPM]

4-11 Motor Speed Low Limit [RPM]		
Default value: Size related	Parameter type: Range, 0 - setting in par. 4-13 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Enter the minimum limit for motor speed. The motor speed low limit can be set to correspond to the manufacturer's recommended minimum motor speed. The motor speed low limit must not exceed the setting in *parameter 4-13 Motor Speed High Limit [RPM]*.

Parameter 4-12 Motor Speed Low Limit [Hz]

Table 264: Parameter 4-12 Motor Speed Low Limit [Hz]

4-12 Motor Speed Low Limit [Hz]		
Default value: Size related	Parameter type: Range, 0 - setting in par. 4-14 Hz	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Enter the minimum limit for motor speed. The motor speed low limit can be set to correspond to the minimum output frequency of the motor shaft. The motor speed low limit must not exceed the setting in *parameter 4-14 Motor Speed High Limit [Hz]*.

Parameter 4-13 Motor Speed High Limit [RPM]

Table 265: Parameter 4-13 Motor Speed High Limit [RPM]

4-13 Motor Speed High Limit [RPM]		
Default value: Size related	Parameter type: Range, Setting in par. 4-11 - 60000 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Enter the maximum limit for motor speed. The motor speed high limit can be set to correspond to the manufacturer's maximum nominal motor speed. The motor speed high limit must exceed the setting in *parameter 4-11 Motor Speed Low Limit [RPM]*.

Parameter 4-14 Motor Speed High Limit [Hz]

Table 266: Parameter 4-14 Motor Speed High Limit [Hz]

4-14 Motor Speed High Limit [Hz]		
Default value: Size related	Parameter type: Range, Setting in par. 4-12 - setting in par. 4-19	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Enter the maximum limit for motor speed in Hz. *Parameter 4-14 Motor Speed High Limit [Hz]* can be set to correspond to the manufacturer's recommended maximum motor speed. The motor speed high limit must exceed the value in *parameter 4-12 Motor Speed Low Limit [Hz]*. The output frequency must not exceed 10% of the switching frequency (*parameter 14-01 Switching Frequency*).

Parameter 4-16 Torque Limit Motor Mode

Table 267: Parameter 4-16 Torque Limit Motor Mode

4-16 Torque Limit Motor Mode		
Default value: Size related	Parameter type: Range, 0 - 1000.0%	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

N O T I C E

If changing *parameter 4-16 Torque Limit Motor Mode* when *parameter 1-00 Configuration Mode* is set to *[0] Speed open loop*, *parameter 1-66 Min. Current at Low Speed* is automatically readjusted.

N O T I C E

The torque limit reacts to the actual, non-filtered torque, including torque spikes. This is not the torque that is seen from the LCP or the fieldbus as the torque is filtered.

This function limits the torque on the shaft to protect the mechanical installation.

Parameter 4-17 Torque Limit Generator Mode

Table 268: Parameter 4-17 Torque Limit Generator Mode

4-17 Torque Limit Generator Mode		
Default value: 100%	Parameter type: Range, 0 - 1000.0%	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

This function limits the torque on the shaft to protect the mechanical installation.

Parameter 4-18 Current Limit

Table 269: Parameter 4-18 Current Limit

4-18 Current Limit		
Default value: Size related	Parameter type: Range, 1.0 - 1000.0%	Setup: All setups
Conversion index: -1	Data type: Uint32	Change during operation: True

N O T I C E

If *[20] ATEX ETR* is selected in *parameter 1-90 Motor Thermal Protection*, set *parameter 4-18 Current Limit* current limit to 150%.

This is a true current limit function that continues in the oversynchronous range. However, due to field weakening the motor torque at current limit will drop accordingly when the voltage increase stops above the synchronized speed of the motor.

Parameter 4-19 Max Output Frequency

Table 270: Parameter 4-19 Max Output Frequency

4-19 Max Output Frequency		
Default value: Size related	Parameter type: Range, 1 - 590 Hz	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

N O T I C E

Maximum output frequency cannot exceed 10% of the inverter switching frequency (*parameter 14-01 Switching Frequency*).

Provides a final limit on the output frequency for improved safety in applications where overspeeding is to be avoided. This limit is final in all configurations (independent of the setting in *parameter 1-00 Configuration Mode*).

5.5.2 4-2* Limit Factors

N O T I C E

The following parameters are only available in FC 302.

- *Parameter 4-25 Power Limit Motor Factor Source*
- *Parameter 4-26 Power Limit Gener. Factor Source*

Parameter 4-20 Torque Limit Factor Source

Table 271: Parameter 4-20 Torque Limit Factor Source

4-20 Torque Limit Factor Source		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select an analog input for scaling the settings in *parameter 4-16 Torque Limit Motor Mode* and *parameter 4-17 Torque Limit Generator Mode* 0–100% (or inverse). The signal levels corresponding to 0% and 100% are defined in the analog input scaling, for example *parameter group 6-1* Analog Input 1*. This parameter is only active when *parameter 1-00 Configuration Mode* is in *[0] Speed Open Loop* or *[1] Speed Closed Loop*.

Option	Name	Description
[0]*	No function	
[2]	Analog in 53	
[4]	Analog in 53 inv	
[6]	Analog in 54	
[8]	Analog in 54 inv	
[10]	Analog in X30-11	
[12]	Analog in X30-11 inv	
[14]	Analog in X30-12	
[16]	Analog in X30-12 inv	

Parameter 4-21 Speed Limit Factor Source

Table 272: Parameter 4-21 Speed Limit Factor Source

4-21 Speed Limit Factor Source		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select an analog input for scaling the settings in *parameter 4-19 Max Output Frequency* 0–100% (or the other way around). The signal levels corresponding to 0% and 100% are defined in the analog input scaling, for example *parameter group 6-1* Analog Input 1*. This parameter is only active when *parameter 1-00 Configuration Mode* is in *[4] Torque Open Loop*.

Option	Name	Description
[0]*	No function	
[2]	Analog in 53	
[4]	Analog in 53 inv	
[6]	Analog in 54	
[8]	Analog in 54 inv	
[10]	Analog in X30-11	
[12]	Analog in X30-11 inv	
[14]	Analog in X30-12	
[16]	Analog in X30-12 inv	

Parameter 4-23 Brake Check Limit Factor Source

Table 273: Parameter 4-23 Brake Check Limit Factor Source

4-23 Brake Check Limit Factor Source		
Default value: [0] DC-link Voltage	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the input source for the function in *parameter 2-15 Brake Check*. If several drives are carrying out a brake check simultaneously, the resistance in the grid leads to a voltage drop on the mains or DC-link and a false brake check can occur. Use an external current sensor on every brake resistor. If an application requires a 100% valid brake check, connect the sensor to an analog input.

Option	Name	Description
[0]*	DC-link voltage	The drive performs the brake check by monitoring the DC-link voltage. The drive injects current in the brake resistor, which lowers the DC-link voltage.
[1]	Analog input 53	Select to use an external current sensor for brake monitoring.
[2]	Analog input 54	Select to use an external current sensor for brake monitoring

Parameter 4-24 Brake Check Limit Factor

Table 274: Parameter 4-24 Brake Check Limit Factor

4-24 Brake Check Limit Factor		
Default value: 98%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -1	Data type: Uint8	Change during operation: True

Enter the limit factor that *parameter 2-15 Brake Check* uses when performing the brake check. The drive uses the limit factor depending on the selection in *parameter 4-23 Brake Check Limit Factor Source*: *[0] DC-link voltage* - the drive applies the factor to the EEPROM data in the DC-link. *[1] Analog Input 53* or *[2] Analog Input 54* - the brake check fails if the input current on the analog input is lower than the maximum input current multiplied by the limit factor. For example, in the following configuration the brake check fails if the input current is lower than 16 mA:

- A current transducer with a range of 4-20 mA is connected to analog input 53.
- *Parameter 4-24 Brake Check Limit Factor* is set to 80%.

Parameter 4-25 Power Limit Motor Factor Source

Table 275: Parameter 4-25 Power Limit Motor Factor Source

4-25 Power Limit Motor Factor Source		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the input that scales the value in *parameter 4-82 Power Limit Motor Mode* from 0% to 100%.

Option	Name	Description
[0]*	No function	
[2]	Analog in 53	
[4]	Analog in 53 inv	
[6]	Analog in 54	
[8]	Analog in 54 inv	
[10]	Analog in X30-11	
[12]	Analog in X30-11 inv	
[14]	Analog in X30-12	
[16]	Analog in X30-12 inv	

Parameter 4-26 Power Limit Gener. Factor Source

Table 276: Parameter 4-26 Power Limit Gener. Factor Source

4-26 Power Limit Gener. Factor Source		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the input that scales the value in *parameter 4-83 Power Limit Generator Mode* from 0% to 100%.

Option	Name	Description
[0]*	No function	
[2]	Analog in 53	
[4]	Analog in 53 inv	
[6]	Analog in 54	
[8]	Analog in 54 inv	
[10]	Analog in X30-11	
[12]	Analog in X30-11 inv	
[14]	Analog in X30-12	
[16]	Analog in X30-12 inv	

5.5.3 4-3* Motor Feedback Monitoring

This parameter group includes monitoring and handling of motor feedback devices, such as encoders and resolvers.

Parameter 4-30 Motor Feedback Monitoring Loss Function

Table 277: Parameter 4-30 Motor Feedback Loss Function

4-30 Motor Feedback Loss Function		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This function is used to monitor consistency in the feedback signal, that is if the feedback signal is available. Select which action the drive should take if a feedback fault is detected. The selected action is to take place when the feedback signal differs from the output speed by the value set in *parameter 4-31 Motor Feedback Speed Error* for longer than the value set in *parameter 4-32 Motor Feedback Loss Timeout*.

Option	Name	Description
[0]	Disabled	
[1]	Warning	
[2]	Trip	
[3]	Jog	
[4]	Freeze output	
[5]	Max speed	
[6]	Switch to open loop	
[7]	Select setup 1	

Option	Name	Description
[8]	Select setup 2	
[9]	Select setup 3	
[10]	Select setup 4	
[11]	Stop & trip	

Warning 90, Feedback monitor is active as soon as the value in *parameter 4-31 Motor Feedback Speed Error* is exceeded, regardless of the setting in *parameter 4-32 Motor Feedback Loss Timeout*. *Warning/Alarm 61, Feedback Error* is related to the motor feedback loss function.

Parameter 4-31 Motor Feedback Speed Error

Table 278: Parameter 4-31 Motor Feedback Speed Error

4-31 Motor Feedback Speed Error		
Default value: 300 RPM	Parameter type: Range, 1 - 600 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Select the minimum allowed error in speed (output speed vs. feedback).

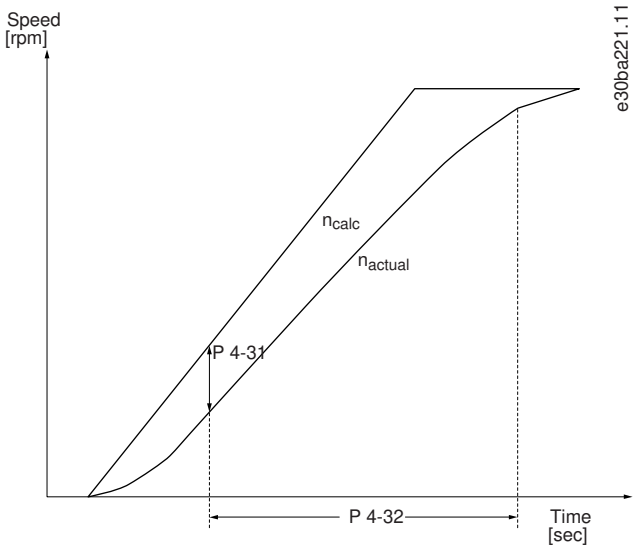


Illustration 57: Motor Feedback Speed Error

Parameter 4-32 Motor Feedback Loss Timeout

Table 279: Parameter 4-32 Motor Feedback Loss Timeout

4-32 Motor Feedback Loss Timeout		
Default value: Size related	Parameter type: Range, 0 - 60 RPM	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

Set the timeout value allowing the speed error set in *parameter 4-31 Motor Feedback Speed Error* to be exceeded before enabling the function selected in *parameter 4-30 Motor Feedback Loss Function*.

Parameter 4-34 Tracking Error Function

Table 280: Parameter 4-34 Tracking Error Function

4-34 Tracking Error Function		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This function is used to monitor that the application follows the expected speed profile. In closed loop, the speed reference to the PID is compared to the encoder feedback (filtered). In open loop, the speed reference to the PID is compensated for slip and compared to the frequency that is sent to the motor (*parameter 16-13 Frequency*). The reaction is activated if the measured difference is more than the value specified in *parameter 4-35 Tracking Error* for the time specified in *parameter 4-36 Tracking Error Timeout*. A tracking error in closed loop does not imply that there is a problem with the feedback signal. A tracking error can be the result of torque limit at too heavy loads.

Option	Name	Description
[0]	Disable	
[1]	Warning	
[2]	Trip	
[3]	Trip after stop	

Warning/Alarm 78, Tracking Error is related to the tracking error function.

Parameter 4-35 Tracking Error

Table 281: Parameter 4-35 Tracking Error

4-35 Tracking Error		
Default value: 10 RPM	Parameter type: Range, 1 - 600 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Enter the maximum allowed speed error between the motor speed and the output of the ramp when not ramping. In open loop, the motor speed is estimated and in closed loop, it is the feedback from encoder/resolver.

Parameter 4-36 Tracking Error Timeout

Table 282: Parameter 4-36 Tracking Error Timeout

4-36 Tracking Error Timeout		
Default value: 1 s	Parameter type: Range, 0 - 60 s	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

Enter the timeout period during which an error greater than the value set in *parameter 4-35 Tracking Error* is allowed.

Parameter 4-37 Tracking Error Ramping

Table 283: Parameter 4-37 Tracking Error Ramping

4-37 Tracking Error Ramping		
Default value: 100 RPM	Parameter type: Range, 1 - 600 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Enter the maximum allowed speed error between the motor speed and the output of the ramp when ramping. In open loop, the motor speed is estimated and in closed loop, the encoder measures the speed.

Parameter 4-38 Tracking Error Ramping Timeout

Table 284: Parameter 4-38 Tracking Error Ramping Timeout

4-38 Tracking Error Ramping Timeout		
Default value: 1 s	Parameter type: Range, 0 - 60 s	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

Enter the timeout period during which an error greater than the value set in *parameter 4-37 Tracking Error Ramping* while ramping is allowed.

Parameter 4-39 Tracking Error After Ramping Timeout

Table 285: Parameter 4-39 Tracking Error After Ramping Timeout

4-39 Tracking Error After Ramping Timeout		
Default value: 5 s	Parameter type: Range, 0 - 60 s	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

Enter the timeout period after ramping where *parameter 4-37 Tracking Error Ramping* and *parameter 4-38 Tracking Error Ramping Timeout* are still active.

5.5.4 4-4* Speed Monitor

Parameter 4-43 Motor Speed Monitor Function

Table 286: Parameter 4-43 Motor Speed Monitor Function

4-43 Motor Speed Monitor Function		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

N O T I C E

This parameter is only available in the flux control principle.

Select how the drive reacts when the motor speed monitor-function detects overspeed or wrong rotation direction. When the motor speed monitor is active, the drive detects an error if the following conditions are true for a time period specified in *parameter 4-45 Motor Speed Monitor Timeout*:

- The actual speed differs from the reference speed in *parameter 16-48 Speed Ref. After Ramp [RPM]*.
- The difference between the speeds exceeds the value in *parameter 4-44 Motor Speed Monitor Max*.

In speed closed loop, the actual speed is the feedback from the encoder measured during the time defined in *parameter 7-06 Speed PID Lowpass Filter Time*. In open loop, the actual speed is the estimated motor speed.

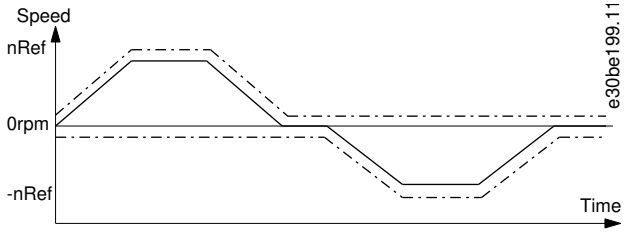


Illustration 58: Speed Reference and Maximum Allowed Speed Difference

Solid line	*Parameter 16-48 Speed Ref. After Ramp [RPM]*

Dotted line	*Parameter 4-44 Motor Speed Monitor Max*

Option	Name	Description
[0]	Disabled	
[1]	Warning	The drive reports *warning 101, Speed monitor* when the speed is outside the limit.
[2]	Trip	The drive trips and reports *alarm 101, Speed monitor*.
[3]	Jog	
[4]	Freeze output	
[5]	Max speed	
[6]	Switch to open loop	
[7]	Select setup 1	
[8]	Select setup 2	
[9]	Select setup 3	
[10]	Select setup 4	
[11]	Stop & trip	
[12]	Trip/warning	The drive reports *alarm 101, Speed monitor* in running mode and *warning 101, Speed monitor* in stop or coast mode. This option is only available in closed-loop operation.
[13]	Trip/catch	Select when there is a need to catch a load, for example when mechanical braking fails. This option is available in closed loop only. The drive trips and reports *alarm 101, Speed monitor* in running mode. In stop mode, the drive catches the flying load and reports *warning 101, Speed monitor*. In catch mode, the drive applies holding torque to control the 0 speed on a potentially malfunctioning brake (closed loop). To exit this mode, send a new start signal to the drive. A coast or Safe Torque Off also terminates the function.

Parameter 4-44 Motor Speed Monitor Max

Table 287: Parameter 4-44 Motor Speed Monitor Max

4-44 Motor Speed Monitor Max		
Default value: 300 RPM	Parameter type: Range, 10 - 500 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

N O T I C E

Only available in flux control principle.

Enter the maximum allowable speed deviation between the actual mechanical shaft speed and the value in *parameter 16-48 Speed Ref. After Ramp [RPM]*.

Parameter 4-45 Motor Speed Monitor Timeout

Table 288: Parameter 4-45 Motor Speed Monitor Timeout

4-45 Motor Speed Monitor Timeout		
Default value: 0.1 s	Parameter type: Range, 0 - 60 s	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

N O T I C E

Only available in flux control principle.

Enter the timeout period during which a deviation defined in *parameter 4-44 Motor Speed Monitor Max* is allowable. The timer for this parameter is reset if the deviation stops exceeding the value in *parameter 4-44 Motor Speed Monitor Max*.

Parameter 4-49 Motor Check Time Interval

Table 289: Parameter 4-49 Motor Check Time Interval

4-49 Motor Check Time Interval		
Default value: [0] As fast as possible	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the time interval at which the connections between the motor and the drive are checked, when the motor is stopped. The motor check is performed at a specified interval, unless the motor is started in between.

Option	Name	Description
[0]*	As fast as possible	The motor time constant (x10) is used as the time interval to check the motor.
[5]	Every 1 hour	
[10]	Every 2 hours	
[15]	Every 12 hours	
[20]	Every 24 hours	

5.5.5 4-5* Adjustable Warnings

Use these parameters for adjusting warning limits for current, speed, reference, and feedback.

Warnings are shown on the LCP and can be programmed to be outputs or to be read out via fieldbus in the extended status word.

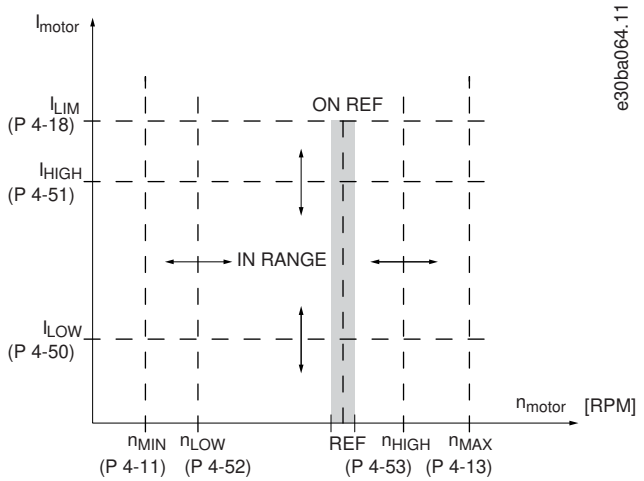


Illustration 59: Adjustable Warnings

Parameter 4-50 Warning Current Low

Table 290: Parameter 4-50 Warning Current Low

4-50 Warning Current Low		
Default value: 0 A	Parameter type: Range, 0 - setting in par. 4-51	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the I_{LOW} value. When the motor current drops below this limit, the display reads *Current Low*. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 (FC 302 only) and on relay output 01 or 02 (FC 302 only). Refer to Illustration 59.

Parameter 4-51 Warning Current High

Table 291: Parameter 4-51 Warning Current High

4-51 Warning Current High		
Default value: Size related	Parameter type: Range, setting in par. 4-50 - setting in par. 16-37	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the I_{HIGH} value. When the motor current exceeds this limit, the display reads *Current High*. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 (FC 302 only) and on relay output 01 or 02 (FC 302 only). Refer to Illustration 59.

Parameter 4-52 Warning Speed Low

Table 292: Parameter 4-52 Warning Speed Low

4-52 Warning Speed Low		
Default value: 0 RPM	Parameter type: Range, 0 - setting in par. 4-53 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Enter the n_{LOW} value. When the motor speed exceeds this limit, the display reads *Speed low*. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 (FC 302 only) and on relay output 01 or 02 (FC 302 only).

Parameter 4-53 Warning Speed High

Table 293: Parameter 4-53 Warning Speed High

4-53 Warning Speed High		
Default value: Size related	Parameter type: Range, setting in par. 4-52 - 60000 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Enter the n_{HIGH} value. When the motor speed exceeds this value, the display reads *Speed high*. The signal outputs can be programmed to produce a status signal on terminals 27 or 29 (FC 302 only) and on relay outputs 01 or 02 (FC 302 only). Refer to Illustration 59.

Parameter 4-54 Warning Reference Low

Table 294: Parameter 4-54 Warning Reference Low

4-54 Warning Reference Low		
Default value: -999999.999	Parameter type: Range, -999999.999 - setting in par. 4-55	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the lower reference limit. When the actual reference drops below this limit, the display indicates Ref_{LOW}. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 (FC 302 only) and on relay output 01 or 02 (FC 302 only).

Parameter 4-55 Warning Reference High

Table 295: Parameter 4-55 Warning Reference High

4-55 Warning Reference High		
Default value: 999999.999	Parameter type: Range, setting in par. 4-55 - 999999.999	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the upper reference limit. When the actual reference exceeds this limit, the display reads Ref_{high}. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 (FC 302 only) and on relay output 01 or 02 (FC 302 only).

Parameter 4-56 Warning Feedback Low

Table 296: Parameter 4-56 Warning Feedback Low

4-56 Warning Feedback Low		
Default value: Size related	Parameter type: Range, setting in par. 4-57 - -999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the lower feedback limit. When the feedback drops below this limit, the display reads $Feedb_{Low}$. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 (FC 302 only) and on relay output 01 or 02 (FC 302 only).

Parameter 4-57 Warning Feedback High

Table 297: Parameter 4-57 Warning Feedback High

4-57 Warning Feedback High		
Default value: Size related	Parameter type: Range, par 4-56 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the upper feedback limit. When the feedback exceeds this limit, the display reads $Feedb_{High}$. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 (FC 302 only) and on relay output 01 or 02 (FC 302 only).

Parameter 4-58 Missing Motor Phase Function

Table 298: Parameter 4-58 Missing Motor Phase Function

4-58 Missing Motor Phase Function		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The function detects missing motor phase while the motor is running. Shows alarms 30, 31, 32 if a motor phase is missing. Enable this function to protect the application and motor from malfunctioning if a motor phase is missing.

Option	Name	Description
[0]	Disabled	The drive does not issue a missing motor phase alarm.
[1]	Trip 100 ms	The drive performs a scan for 100 ms to detect missing motor phase. When a missing motor phase is detected, the drive trips. This selection is recommended when the motor is running at a speed of 10 Hz and above.
[2]	Trip 1000 ms	The drive performs a scan for 1000 ms to detect missing motor phase. When a missing motor phase is detected, the drive trips. This selection is recommended when the motor is running at a low speed of 1 Hz and above.
[3]	Trip 100 ms 3ph detec.	**NOTICE** Only available in FC 302 in flux closed loop. To activate for U/f and VVC+. set *parameter 4-59 Motor Check at Start* to *[0] On*.

Option	Name	Description
		This option is relevant for applications where the motor load and motor currents are very low, such as lowering a lift. Selecting this option allows to prevent false motor phase detection due to low currents. The drive performs a scan for 100 ms to detect missing motor phases.
[5]	Motor check	**NOTICE** This option is only available in FC 302. **NOTICE** The motor automatically resumes operation when the motor is reconnected. This option allows disconnection of the motor with a service switch without issuing an alarm. The drive coasts and automatically resumes operation when the motor is reconnected.

The following table details the detection of missing motor phase function for different motor control principles:

Table 299: Missing Motor Phase for Different Motor Control Principles

Option	Missing motor phase function	U/f	VVC+	Flux open loop	Flux closed loop
[0]	Disabled	No function			
[1]	Trip 100 ms	Detects missing 1 phase	Detects missing 1 phase	Detects 1–3 phase	Detects 1–3 phase
[2]	Trip 1000 ms	Detects missing 1 phase	Detects missing 1 phase	Detects missing 1 phase	N/A
[3]	Trip 100 ms 3 phase limit	N/A[1]			Detects 1–3 phase
[5]	Motor check (service switch)	Coasts if motor is disconnected or auto started when the motor is reconnected.			

[1] When *parameter 4-59 Motor Check at Start* is set to *[1] On*, then 3-phase detection is enabled for U/f and VVC+ motor control.

Parameter 4-59 Motor Check at Start

Table 300: Parameter 4-59 Motor Check at Start

4-59 Motor Check at Start		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

NOTICE

Adjusting this parameter while the motor is running will not have effect until the next motor start.

This function detects missing motor phase before each start. Shows *alarm 30*, *alarm 31*, *alarm 32* if motor phases are missing. In these cases, the drive trips and an alarm is issued. The function has been developed to avoid disengaging a mechanical brake if motor phases are missing, for example, in lift applications.

Option	Name	Description
[0]*	Off	⚠ CAUTION ⚠ **RISK OF MOTOR DAMAGE** Using this option may lead to motor damage. The drive does not issue a missing motor phase alarm.
[1]	On	Before each start, the drive checks if all 3 motor phases are present. The check is performed without any shaft movement. The function also enables 3-phase detection in U/f and VVC+ mode. See description in *parameter 4-58 Missing Motor Phase Function*.

The table details the motor check at start for different motor control principles.

Table 301: Motor Check at Start for Different Motor Control Principles

Option	Motor Check at Start	U/f	VVC+	Flux open loop	Flux closed loop
[0]	*Off*	No function.			
[1]	*On*	Check for missing motor phase before start is executed and enables 3-phase detection for U/f and VVC+ in *parameter 4-58 Missing Motor Phase Function*.			

5.5.6 4-6* Speed Bypass

Some systems require that certain output frequencies or speeds are avoided due to resonance problems in the system. A maximum of 4 frequency or speed ranges can be avoided.

Parameter 4-60 Bypass Speed From [RPM]

Table 302: Parameter 4-60 Bypass Speed From [RPM]

4-60 Bypass Speed From [RPM]		
Default value: Size related	Parameter type: Range, 0 - setting in par. 4-13 RPM, Array [4]	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Some systems call for avoiding certain output speeds due to resonance problems in the system. Enter the lower limits of the speeds to be avoided.

Parameter 4-61 Bypass Speed From [Hz]

Table 303: Parameter 4-61 Bypass Speed From [Hz]

4-61 Bypass Speed From [Hz]		
Default value: Size related	Parameter type: Range, 0 - setting in par. 4-14 Hz, Array [4]	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Some systems require that certain output frequencies or speeds are avoided due to resonance problems in the system. Enter the lower limits of the speeds to be avoided.

Parameter 4-62 Bypass Speed To [RPM]

Table 304: Parameter 4-62 Bypass Speed To [RPM]

4-62 Bypass Speed To [RPM]		
Default value: Size related	Parameter type: Range, 0 - setting in par. 4-13 RPM, Array [4]	Setup: All setups
Conversion index: 67	Data type: Uint16]	Change during operation: True

Some systems call for avoiding certain output speeds due to resonance problems in the system. Enter the upper limits of the speeds to be avoided.

Parameter 4-63 Speed Bypass To [Hz]

Table 305: Parameter 4-63 Bypass Speed To [Hz]

4-63 Bypass Speed To [Hz]		
Default value: Size related	Parameter type: Range, 0 - setting in par. 4-14 Hz, Array [4]	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Some systems require that certain output frequencies or speeds are avoided due to resonance problems in the system. Enter the upper limits of the speeds to be avoided.

5.5.7 4-7* Position Monitor

Parameter 4-70 Position Error Function

Table 306: Parameter 4-70 Position Error Function

4-70 Position Error Function		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX.

Select the function which is activated when the position error exceeds the maximum allowed value. Position error is the difference between the actual position and the commanded position. The position error is the input for the position PI controller.

Option	Name	Description
[0]*	Disabled	The drive does not monitor the position error.
[1]	Warning	The drive issues a warning when the maximum allowed position error is exceeded. The drive continues operation.
[2]	Trip	The drive trips when the maximum allowed position error is exceeded.
[3]	Jog	
[4]	Freeze Output	
[5]	Max Speed	
[6]	Switch to Open Loop	
[7]	Select setup 1	
[8]	Select setup 2	
[9]	Select setup 3	
[10]	Select setup 4	
[11]	Stop & Trip	
[12]	Trip/Warning	
[13]	Trip/Catch	

Parameter 4-71 Maximum Position Error

Table 307: Parameter 4-71 Maximum Position Error

4-71 Maximum Position Error		
Default value: 1000 CustomReadoutUnit2	Parameter type: Range, 0 - 2147483647 Custom-ReadoutUnit2	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Enter the maximum allowed position tracking error in position units defined in *parameter group 17-7* Position Scaling*. If this value is exceeded during the time set in *parameter 4-72 Position Error Timeout*, the position error function in *parameter 4-70 Position Error Function* is activated.

Parameter 4-72 Position Error Timeout

Table 308: Parameter 4-72 Position Error Timeout

4-72 Position Error Timeout		
Default value: 0.100 s	Parameter type: Range, 0.000 - 60.000 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

If the error defined in *parameter 4-71 Maximum Position Error* is present longer than the time in this parameter, the drive activates the function selected in *parameter 4-70 Position Error Function*.

Parameter 4-73 Position Limit Function

Table 309: Parameter 4-73 Position Limit Function

4-73 Position Limit Function		
Default value: [3] Abs. Pos. Mode Stop	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Select the function which is activated when the position is outside the limits defined in *parameter 3-06 Minimum Position* and *parameter 3-07 Maximum Position*.

Option	Name	Description
[0]	Disabled	The drive does not monitor the position limits.
[1]	Warning	The drive issues a warning when the position is outside the limits.
[2]	Warning & Trip	The drive issues a warning when the set target is outside the position limits. The drive starts the positioning and then trips when the position limit is reached.
[3]*	Abs. Pos. Mode Stop	The drive monitors position limits only in absolute positioning mode. The drive issues a warning and stops at the position limit when the target position is outside the position limits.

Op-tion	Name	Description
[4]	Abs. Pos. Md. Stop & Trip	The drive monitors position limits only in absolute positioning mode. The drive stops at the position limit and trips when the target position is outside the position limits.
[5]	Position Stop	When the set target is outside the position limits, the drive uses the position limit as target. This option works in all modes of operation including speed and torque control. The drive issues a warning when at limit position.
[6]	Position Stop & Trip	When the set target is outside the position limits, the drive uses the position limit as target. This option works in all modes of operation including speed and torque control. The drive trips when at limit position.
[7]	Speed Stop	When the set target is outside the position limits, the drive performs a ramp down and stops at the limit position. This option works in all modes of operation. The drive issues a warning stop.
[8]	Speed Stop & Trip	When the set target is outside the position limits, the drive performs a ramp down and stops at the limit position. This option works in all modes of operation. The drive trips at stop.

Parameter 4-74 Start Fwd/Rev Function

Table 310: Parameter 4-74 Start Fwd/Rev Function

4-74 Start Fwd/Rev Function		
Default value: [0] Stop	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX.

Select the action that the drive executes when there is an active signal on a digital input with options *[12] Enable Start Forward* or *[13] Enable Start Reverse* selected. The drive executes the function selected in this parameter when running into an end limit switch and then the motion is only allowed in the opposite direction. When an option with trip is selected, the drive can resume motion only after reset.

Option	Name	Description
[0]*	Stop	The drive stops the motor.
[1]	Stop & Warning	The drive stops the motor and shows *warning 215, Start Fwd/Rev*.
[2]	Stop & Trip	The drive stops the motor and trips with *alarm 215, Start Fwd/Rev*.
[3]	Qstop	The drive performs the quick stop.
[4]	Qstop & Warning	The drive performs the quick stop and shows *warning 215, Start Fwd/Rev*.
[5]	Qstop & Trip	The drive performs the quick stop and trips with *alarm 215, Start Fwd/Rev*.
[6]	Coast	The drive coasts the motor.
[7]	Coast & Warning	The drive coasts the motor and trips with *warning 215, Start Fwd/Rev*.
[8]	Coast & Trip	The drive coasts the motor and trips with *alarm 215, Start Fwd/Rev*.
[9]	Zero Speed Ref	The drive ramps down and keeps the motor magnetized at 0 speed. In the positioning and the synchronization modes, the position controller stays active and retains the actual position.
[10]	Zero Sp. Ref. & War.	Same as option *[9] Zero Speed Ref* and shows *warning 215, Start Fwd/Rev*.

Parameter 4-75 Touch Timeout

Table 311: Parameter 4-75 Touch Timeout

4-75 Touch Timeout		
Default value: 6000.0 s	Parameter type: Range, 0.1 - 6000.0 s	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Enter the timeout for the touch probe positioning. If the drive does not detect the touch probe sensor before the timeout when the touch probe positioning is active, the drive trips with *alarm 216, Touch Timeout*. The value 6000 equals Off.

5.5.8 4-8* Power Limit

NOTICE

This parameter group is only available in FC 302.

Parameter 4-80 Power Limit Func. Motor Mode

Table 312: Parameter 4-80 Power Limit Func. Motor Mode

4-80 Power Limit Func. Motor Mode		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select whether the power limit function is enabled. Define the power limit motor mode in *parameter 4-82 Power Limit Motor Mode*.

Option	Name	Description
[0]*	Disabled	
[1]	Enabled	
[2]	When activated	Activation via a digital input or a fieldbus.

Parameter 4-81 Power Limit Func. Generator Mode

Table 313: Parameter 4-81 Power Limit Func. Generator Mode

4-81 Power Limit Func. Generator Mode		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select whether the power limit function is enabled in generating mode. Define the power limit motor mode in *parameter 4-83 Power Limit Generator Mode*.

Option	Name	Description
[0]*	Disabled	
[1]	Enabled	
[2]	When activated	Activation via a digital input or a fieldbus.

Parameter 4-82 Power Limit Motor Mode

Table 314: Parameter 4-82 Power Limit Motor Mode

4-82 Power Limit Motor Mode		
Default value: 100.0%	Parameter type: Range, 0.0 - 200.0%	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Enter the maximum output power when the power limit function is active. Related parameters: *parameter 1-20 Motor Power [kW]*, *parameter 1-21 Motor Power [HP]*.

Parameter 4-83 Power Limit Generator Mode

Table 315: Parameter 4-83 Power Limit Generator Mode

4-83 Power Limit Generator Mode		
Default value: 100.0%	Parameter type: Range, 0.0 - 200.0%	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Enter the maximum generating power when the power limit function is active. Related parameters: *parameter 1-20 Motor Power [kW]*, *parameter 1-21 Motor Power [HP]*.

5.5.9 4-9* Directional Limits

The directional limits functionality allows to specify different torque and speed limits for different combinations of torque application direction and rotation direction. In Illustration 60, quadrants 1–4 show different combinations of rotation direction and torque application direction, and the parameters that act in different quadrants.

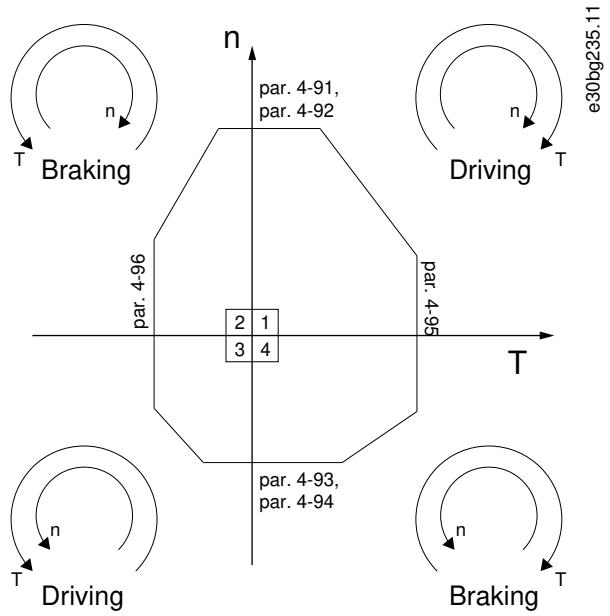


Illustration 60: Example of Directional Limits

A speed limit value cannot exceed the value of *parameter 4-13 Motor Speed High Limit [RPM]* or *parameter 4-14 Motor Speed High Limit [Hz]*. A torque limit value cannot exceed the value of *parameter 4-16 Torque Limit Motor Mode* or *parameter 4-17 Torque Limit Generator Mode*.

Parameter 4-90 Directional Limit Mode

Table 316: Parameter 4-90 Directional Limit Mode

4-90 Directional Limit Mode		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select whether the directional limits are enabled. With directional limits enabled, it is possible to specify different speed and torque limits for clockwise and counterclockwise rotation directions.

Option	Name	Description
[0]*	Disabled	Directional limits are disabled.
[1]	Enabled	Directional limits are active for the speed values.
[2]	Torque	Directional limits are active for the torque values.
[3]	Speed and torque	Directional limits are active for both torque and speed values.

Parameter 4-91 Positive Speed Limit [RPM]

Table 317: Parameter 4-91 Positive Speed Limit [RPM]

4-91 Positive Speed Limit [RPM]		
Default value: Size related	Parameter type: Range, 0.0 - par. 4-13 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Enter the limit for the motor speed when the rotation direction is clockwise.

Parameter 4-92 Positive Speed Limit [Hz]

Table 318: Parameter 4-92 Positive Speed Limit [Hz]

4-92 Positive Speed Limit [Hz]		
Default value: Size related	Parameter type: Range, 0.0 - par. 4-14 RPM	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Enter the limit for the motor speed when the rotation direction is clockwise.

Parameter 4-93 Negative Speed Limit [RPM]

Table 319: Parameter 4-93 Negative Speed Limit [RPM]

4-93 Negative Speed Limit [RPM]		
Default value: Size related	Parameter type: Range, 0.0 - par. 4-13 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Enter the limit for the motor speed when the rotation direction is counterclockwise.

Parameter 4-94 Negative Speed Limit [Hz]

Table 320: Parameter 4-94 Negative Speed Limit [Hz]

4-94 Negative Speed Limit [Hz]		
Default value: Size related	Parameter type: Range, 0.0 - par. 4-14 RPM	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Enter the limit for the motor speed when the rotation direction is counterclockwise.

Parameter 4-95 Positive Torque Limit

Table 321: Parameter 4-95 Positive Torque Limit

4-95 Positive Torque Limit		
Default value: Size related	Parameter type: Range, 1 - 160.0%	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Enter the limit for the motor torque when the rotation direction is clockwise.

Parameter 4-96 Negative Torque Limit

Table 322: Parameter 4-96 Negative Torque Limit

4-96 Negative Torque Limit		
Default value: Size related	Parameter type: Range, 1 - 160.0%	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Enter the limit for the motor torque when the rotation direction is counterclockwise.

5.6 Parameter Group 5-** Digital In/Out

5.6.1 5-0* Digital I/O Mode

N O T I C E

The following parameter is only available in FC 302:

- *Parameter 5-02 Terminal 29 Mode*

Parameters for configuring the input and output using NPN and PNP.

Parameter 5-00 Digital I/O Mode

Table 323: Parameter 5-00 Digital I/O Mode

5-00 Digital I/O Mode		
Default value: [0] PNP	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

N O T I C E

Perform a power cycle to activate the parameter once it has been changed.

Digital inputs and programmed digital outputs are preprogrammable for operation either in PNP or NPN systems.

Option	Name	Description
[0]*	PNP	Action on positive directional pulses (↕). PNP systems are pulled down to GND.
[1]	NPN	Action on negative directional pulses (↕). NPN systems are pulled up to +24 V, internally in the drive.

Parameter 5-01 Terminal 27 Mode

Table 324: Parameter 5-01 Terminal 27 Mode

5-01 Terminal 27 Mode		
Default value: [0] Input	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

NOTICE

This parameter cannot be adjusted while the motor is running.

Option	Name	Description
[0]*	Input	Defines terminal 27 as a digital input.
[1]	Output	Defines terminal 27 as a digital output.

Parameter 5-02 Terminal 29 Mode

Table 325: Parameter 5-02 Terminal 29 Mode

5-02 Terminal 29 Mode		
Default value: [0] Input	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Input	Defines terminal 29 as a digital input.
[1]	Output	Defines terminal 29 as a digital output.

5.6.2 5-1* Digital Inputs

NOTICE

The following parameter is only available in FC 302:

- *Parameter 5-13 Terminal 29 Digital Input*

The digital inputs are used for selecting various functions in the drive. Refer to Table 327 for functions which can be assigned to digital inputs.

Functions in function group 1 have higher priority than functions in function group 2.

Table 326: Function Groups

Group	Functions
1	Reset, coast stop, reset, and coast stop, quick stop, DC brake, stop, and the [Off] key.
2	Start, latched start, reversing, start reversing, jog, and freeze output.

Table 327: Digital Input Functions and Terminals

Digital input function	Select	Terminal
No operation	[0]	All, terminal 32, 33
Reset	[1]	All
Coast inverse	[2]	All, terminal 27
Coast and reset inverse	[3]	All
Quick stop inverse	[4]	All
DC brake inverse	[5]	All
Stop inverse	[6]	All

Digital input function	Select	Terminal
Start	[8]	All, terminal 18
Latched start	[9]	All
Reversing	[10]	All, terminal 19
Start reversing	[11]	All
Enable start forward	[12]	All
Enable start reverse	[13]	All
Jog	[14]	All, terminal 29
Preset reference on	[15]	All
Preset ref bit 0	[16]	All
Preset ref bit 1	[17]	All
Preset ref bit 2	[18]	All
Freeze reference	[19]	All
Freeze output	[20]	All
Speed up	[21]	All
Speed down	[22]	All
Set-up select bit 0	[23]	All
Set-up select bit 1	[24]	All
Precise stop inverse	[26]	Terminal 18, 19
Precise start, stop	[27]	Terminal 18, 19
Catch up	[28]	All
Slow down	[29]	All
Counter input	[30]	Terminal 29, 33
Pulse input edge triggered	[31]	Terminal 29, 33
Pulse input time based	[32]	Terminal 29, 33
Ramp bit 0	[34]	All
Ramp bit 1	[35]	All
Emergency mode	[37]	All
Latched precise start	[40]	Terminal 18, 19
Latched precise stop inverse	[41]	Terminal 18, 19
Restart drive	[44]	
External interlock	[51]	–
DigiPot increase	[55]	All

Digital input function	Select	Terminal
DigiPot decrease	[56]	All
DigiPot clear	[57]	All
DigiPot hoist	[58]	All
Counter A (up)	[60]	Terminal 29, 33
Counter A (down)	[61]	Terminal 29, 33
Reset Counter A	[62]	All
Counter B (up)	[63]	Terminal 29, 33
Counter B (down)	[64]	Terminal 29, 33
Reset Counter B	[65]	All
Mech. brake feedb.	[70]	All
Mech. brake feedb. inv.	[71]	All
PID error inv.	[72]	All
PID reset I-part	[73]	All
PID enable	[74]	All
MCO specific	[75]	All
Reset maint. word	[78]	
PTC card 1	[80]	All
PROFIdrive OFF2	[91]	All
PROFIdrive OFF3	[92]	All
Light-load detection	[94]	All
Evacuation	[95]	All
Mains loss	[96]	Terminal 32, 33
Mains loss inverse	[97]	Terminal 32, 33
Start edge triggered	[98]	All
Safety option reset	[100]	–
Active CAM table	[104]	
Set vir. mas. pos. to actual	[105]	
Enable master offset	[108]	All
Start virtual master	[109]	All
Start homing	[110]	All
Activate touch	[111]	All
Relative position	[112]	All

Digital input function	Select	Terminal
Enable reference	[113]	All
Sync. to pos. mode	[114]	All
Home sensor	[115]	All
Home sensor inverse	[116]	All
Touch sensor	[117]	All
Touch sensor inverse	[118]	All
Speed mode	[119]	All
Dir. home sensor	[127]	All
Dir. home sen. inv.	[128]	All
Emcy mode ref bit 0	[190]	All
Emcy mod ref bit 1	[191]	All
Emcy mode ref bit 2	[192]	All
Emcy mode setup bit 0	[193]	All
Emcy mode setup bit 1	[194]	All
Test emcy mode	[195]	All
Reset emcy mode	[196]	All
Power limit mot.	[231]	All
Power limit gen.	[232]	All
Power limit both	[233]	All
Light load + evacuation	[234]	All

VLT® AutomationDrive FC 301/FC 302 standard terminals are 18, 19, 27, 29, 32, and 33. VLT® General Purpose I/O MCB 101 terminals are X30/2, X30/3, and X30/4. In FC 302, terminal 29 also functions as an output.
Functions dedicated to only 1 digital input are stated in the associated parameter.
All digital inputs can be programmed to these functions:

Table 328: Digital Inputs, Function Descriptions - 1

Option		Function
[0]	No operation	No reaction to signals transmitted to the terminal.
[1]	Reset	Resets the drive after a trip/alarm. Not all alarms can be reset.
[2]	Coast inverse	(Default digital input 27): Coast stop, inverted input (NC). The drive leaves the motor in free mode. Logic 0⇒coast stop.
[3]	Coast and reset inverse	Reset and coast stop inverted input (NC). Leaves the motor in free mode and resets the drive. Logic 0⇒coast stop and reset.
[4]	Quick stop inverse	Inverted input (NC). Generates a stop in accordance with quick stop ramp time set in *parameter 3-81 Quick Stop Ramp Time*. When the motor stops, the shaft is in free mode. Logic 0⇒quick stop.

Option		Function
[5]	DC brake inverse	Inverted input for DC brake (NC). Stops motor by energizing it with a DC current for a certain time period. See *parameter 2-01 DC Brake Current* to *parameter 2-03 DC Brake Cut In Speed [RPM]*. The function is only active when the value in *parameter 2-02 DC Braking Time* is different from 0. Logic 0⇒DC brake.
[6]	Stop inverse	Stop inverted function. Generates a stop function when the selected terminal goes from logical level 1 to logical level 0. The stop is performed according to the selected ramp time: • *Parameter 3-42 Ramp 1 Ramp Down Time*, • *Parameter 3-52 Ramp 2 Ramp Down Time*, • *Parameter 3-62 Ramp 3 Ramp down Time*, and • *Parameter 3-72 Ramp 4 Ramp Down Time*. **NOTICE** When the drive is at the torque limit and has received a stop command, it may not stop by itself. To ensure that the drive stops, configure a digital output to *[27] Torque limit and stop*. Connect this digital output to a digital input that is configured as coast.
[8]	Start	(Default digital input 18): Select start for a start/stop command. Logic 1 = start, logic 0 = stop.
[9]	Latched start	If a pulse is applied for minimum 2 ms, the motor starts. The motor stops when stop inverse is activated, or a reset command (via DI, bus, or LCP) is given.
[10]	Reversing	(Default digital input 19): Change the direction of motor shaft rotation. Select logic 1 to reverse. The reversing signal only changes the direction of rotation. It does not activate the start function. Select both directions in *parameter 4-10 Motor Speed Direction*. The function is not active in process closed loop.
[11]	Start reversing	Used for start/stop and for reversing on the same wire. Signals on start are not allowed at the same time.
[12]	Enable start forward	Disengages the counterclockwise movement and allows clockwise direction.
[13]	Enable start reverse	Disengages the clockwise movement and allows counterclockwise direction.
[14]	Jog	(Default digital input 29): Activate jog speed. See *parameter 3-11 Jog Speed [Hz]*.
[15]	Preset reference on	Shifts between external reference and preset reference. It is assumed that *[1] External/preset* has been selected in *parameter 3-04 Reference Function*. Logic 0 = external reference active; logic 1 = 1 of the 8 preset references is active.
[16]	Preset ref bit 0	Preset reference bit 0, 1, and 2 enable a choice between 1 of the 8 preset references according to Table 329.
[17]	Preset ref bit 1	Same as *[16] Preset ref bit 0*.
[18]	Preset ref bit 2	Same as *[16] Preset ref bit 0*.

Table 329: Preset Reference Bit

Preset ref. bit	2	1	0
Preset ref. 0	0	0	0
Preset ref. 1	0	0	1
Preset ref. 2	0	1	0

Preset ref. bit	2	1	0
Preset ref. 3	0	1	1
Preset ref. 4	1	0	0
Preset ref. 5	1	0	1
Preset ref. 6	1	1	0
Preset ref. 7	1	1	1

Table 330: Digital Inputs, Function Descriptions - 2

Option		Function
[19]	Freeze ref	Freezes the actual reference, which is now the point of enable/condition to be used for *[21] Speed up* and *[22] Speed down*. If speed up/speed down is used, the speed change always follows ramp 2 (*parameter 3-51 Ramp 2 Ramp Up Time* and *parameter 3-52 Ramp 2 Ramp Down Time*) in the range 0–*parameter 3-03 Maximum Reference*.
[20]	Freeze output	Freezes the actual motor frequency (Hz), which is now the point of enable/condition to be used for *[21] Speed up* and *[22] Speed down*. If speed up/speed down is used, the speed change always follows ramp 2 (*parameter 3-51 Ramp 2 Ramp Up Time* and *parameter 3-52 Ramp 2 Ramp Down Time*) in the range 0–*parameter 1-23 Motor Frequency*. **NOTICE** When freeze output is active, the drive cannot be stopped via a low *[8] Start signal*. Stop the drive via a terminal programmed for *[2] Coasting inverse* or *[3] Coast and reset inverse*.
[21]	Speed up	Select *[21] Speed* up and *[22] Speed down* for digital control of the up/down speed (motor potentiometer). Activate this function by selecting either *[19] Freeze ref* or *[20] Freeze output*. When speed up/speed down is activated for less than 400 ms, the resulting reference is increased/decreased by 0.1%. If speed up/speed down is activated for more than 400 ms, the resulting reference follows the setting in ramping up/down parameters 3-x1/3-x2.

Table 331: Shut Down/Catch Up

	Shut down	Catch up
Unchanged speed	0	0
Reduced by %-value	1	0
Increased by %-value	0	1
Reduced by %-value	1	1

Table 332: Digital Inputs, Function Descriptions - 3

Option		Function
[22]	Speed down	Same as *[21] Speed up*.
[23]	Set-up select bit 0	Select *[23] Set-up select bit 0* or select *[24] Set-up select bit 1* to select 1 of the 4 set-ups. Set *parameter 0-10 Active Set-up* to *[9] Multi Set-up*.
[24]	Set-up select bit 1	(Default digital input 32): Same as *[23] Set-up select bit 0*.

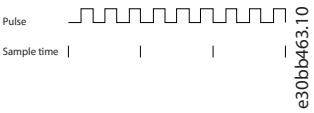
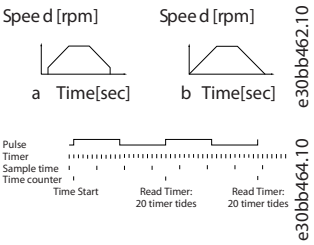
Option		Function
[26]	Precise stop inv.	Sends an inverted stop signal when the precise stop function is activated in *parameter 1-83 Precise Stop Function*. Precise stop inverse function is available for terminals 18 or 19.
[27]	Precise start, stop	Use when *[0] Precise ramp stop* is selected in *parameter 1-83 Precise Stop Function*. Precise start, stop is available for terminals 18 and 19. Precise start ensures that the rotor turning angle from standing still to reference is the same for each start (for same ramp time, same setpoint). This function is the equivalent to the precise stop where the rotor turning angle from reference to standstill is the same for each stop. When using *parameter 1-83 Precise Stop Function* option *[1] Cnt stop with reset* or *[2] Cnt stop w/o reset*: The drive needs a precise stop signal before reaching the value of *parameter 1-84 Precise Stop Counter Value*. If this signal is not supplied, the drive does not stop when the value in *parameter 1-84 Precise Stop Counter Value* is reached. Trigger precise start, stop by a digital input. The function is available for terminals 18 and 19.
[28]	Catch up	Increases reference value by percentage (relative) set in *parameter 3-12 Catch up/slow Down Value*.
[29]	Slow down	Reduces reference value by percentage (relative) set in *parameter 3-12 Catch up/slow Down Value*.
[30]	Counter input	Precise stop function in *parameter 1-83 Precise Stop Function* acts as counter stop or speed-compensated counter stop with or without reset. Set the counter value in *parameter 1-84 Precise Stop Counter Value*.
[31]	Pulse edge triggered	Counts the number of pulse flanks per sample time. This gives a higher resolution at high frequencies, but is not as precise at lower frequencies. Use this pulse principle for encoders with low resolution (for example 30 PPR).  **Illustration 61: Pulse Flanks per Sample Time**
[32]	Pulse time-based	Measures the duration between pulse flanks. This gives a higher resolution at lower frequencies, but is not as precise at higher frequencies. This principle has a cutoff frequency, which makes it unsuited for encoders with low resolutions (for example 30 PPR) at low speeds.  **Illustration 62: Duration Between Pulse Flanks**
[34]	Ramp bit 0	Enables a selection between 1 of the 4 ramps available, according to Table 333.
[35]	Ramp bit 1	Same as *[34] Ramp bit 0*.

Table 333: Preset Ramp Bit

Preset ramp bit	1	0
Ramp 1	0	0
Ramp 2	0	1
Ramp 3	1	0
Ramp 4	1	1

Table 334: Digital Inputs, Function Descriptions - 4

Option		Function
[37]	Emergency mode	A signal applied puts the drive into emergency mode and the preset ref bits 0–2 define the operation mode of emergency mode where all other commands are disregarded. See *parameter group 24-0* Emergency Mode* and *parameter group 24-2* Emergency Mode 2*.
[40]	Latched precise start	A latched precise start only requires a pulse of 3 ms on terminals 18 or 19. When using for *parameter 1-83 Precise Stop Function[1] Cnt stop with reset* or *[2] Cnt stop w/o reset*: When the reference is reached, the drive internally enables the precise stop signal. This means that the drive does the precise stop when the counter value of *parameter 1-84 Precise Stop Counter Value* is reached.
[41]	Latched precise stop inverse	Sends a latched stop signal when the precise stop function is activated in *parameter 1-83 Precise Stop Function*. The latched precise stop inverse function is available for terminals 18 or 19.
[44]	Restart drive	
[51]	External interlock	This function makes it possible to give an external fault to the drive. This fault is treated in the same way as an internally generated alarm.
[55]	DigiPot increase	Increase signal to the digital potentiometer function described in *parameter group 3-9* Digital Pot. Meter*.
[56]	DigiPot Decrease	Decrease signal to the digital potentiometer function described in *parameter group 3-9* Digital Pot. Meter*.
[57]	DigiPot Clear	Clears the digital potentiometer reference described in *parameter group 3-9* Digital Pot. Meter*.
[58]	DigiPot hoist	
[60]	Counter A (up)	(Terminal 29 or 33 only). Input for increment counting in the SLC counter.
[61]	Counter A (down)	(Terminal 29 or 33 only). Input for decrement counting in the SLC counter.
[62]	Reset Counter A	Input for reset of counter A.
[63]	Counter B (up)	(Terminal 29 or 33 only). Input for increment counting in the SLC counter.
[64]	Counter B (down)	(Terminal 29 or 33 only). Input for decrement counting in the SLC counter.
[65]	Reset Counter B	Input for reset of counter B.
[70]	Mech. Brake Feedback	Brake feedback for hoisting applications: Set *parameter 1-01 Motor Control Principle* to *[3] Flux w/ motor feedback*; set *parameter 1-72 Start Function* to *[6] Hoist mech brake Ref*.
[71]	Mech. Brake Feedback inv.	Inverted brake feedback for hoisting applications.
[72]	PID error inverse	When enabled, this option inverts the resulting error from the process PID controller. Available only if *parameter 1-00 Configuration Mode* is set to *[6] Surface Winder*, *[7] Extended PID Speed OL*, or *[8] Extended PID Speed CL*.
[73]	PID reset I-part	When enabled, this option resets the I-part of the process PID controller. Equivalent to *parameter 7-40 Process PID I-part Reset*. Available only if *parameter 1-00 Configuration Mode* is set to *[6] Surface Winder*, *[7] Extended PID Speed OL*, or *[8] Extended PID Speed CL*.
[74]	PID enable	Enables the extended process PID controller. Equivalent to *parameter 7-50 Process PID Extended PID*. Available only if *parameter 1-00 Configuration Mode* is set to *[7] Extended PID Speed OL* or *[8] Extended PID Speed CL*.

Option		Function
[75]	MCO specific	
[78]	Preset main. word	
[80]	PTC Card 1	All digital inputs can be set to *[80] PTC Card 1*. However, only 1 digital input must be set to this option.
[91]	PROFIdrive OFF2	The functionality is the same as the corresponding control word bit of the PROFIBUS/PROFINET option.
[92]	PROFIdrive OFF3	The functionality is the same as the corresponding control word bit of the PROFIBUS/PROFINET option.
[94]	Light Load Detection	Light-load detection is a feature for lift application to ensure that the lift runs in the evacuation direction which requires the least energy (UPS capacity), during an emergency. See *parameter 30-25 Light Load Delay [s]*, *parameter 30-26 Delay Before Measurements*, *parameter 30-27 Light Load Speed [%]*, *parameter 30-28 Evacuation Speed [%]*, and *parameter 30-29 Ramp Time* for light-load detection configurations. **NOTICE** Flying start overrules light load detection.
[95]	Evacuation	Evacuation Mode is a feature for lift application to enable drives to operate at reduced DC voltage for evacuation of people if there is power failure. When the feature is activated, undervoltage limits and enable voltage limits are reduced so that the drive can be operated with 230 V single-phase UPS-supply.
[96]	Mains loss	Select to improve kinetic back-up. When the mains voltage goes back to a level that is close to (but still lower than) the detection level, the output speed increases and kinetic back-up remains active. To avoid this situation, send a status signal to the drive. When the signal on the digital input is low (0), the drive forcibly turns off the kinetic back-up. **NOTICE** Only available for pulse inputs at terminals 32/33.
[97]	Mains loss inverse	When the signal on the digital input is high (1), the drive forcibly turns off the kinetic back-up. For more details, see the description of *[96] Mains loss*. **NOTICE** Only available for pulse inputs at terminals 32/33.
[98]	Start edge triggered	Edge-triggered start command. Keeps the start command alive. It can be used for a start push key.
[100]	Safety option reset	Resets the safety option. Available only when the safety option is mounted.
[104]	Activate CAM table	**NOTICE** This option is only available with software version 48.XX. Signal for activation of new CAM table while running with bumpless transfer.

Option		Function
[105]	Set vir. mas. pos. to actual	**NOTICE** This option is only available with software version 48.XX. Signal for setting virtual master position = actual follower position. This is needed for setting the correct starting position for position-controlled virtual master ensuring that the virtual master position is aligned with the physical position of the follower.
[106]	Set master home	**NOTICE** This option is only available with software version 48.XX. Sets the actual master position to the value of *parameter 17-88 Master Home Position*.
[107]	Target inverse	**NOTICE** This option is only available with software version 48.XX. Changes the sign of the set target position. For example, if the set target is 1000, the activation of this option changes the value to -1000.
[108]	Enable master offset	**NOTICE** This option is only available with software version 48.XX. Activates the master offset selected in *parameter 3-26 Master Offset* when *parameter 17-93 Master Offset Selection* has a selection from *[1] Absolute* to *[5] Relative Touch Sensor*.
[109]	Enable. vir.master	**NOTICE** This option is only available with software version 48.XX. Enable signal for the virual master function. Only applicable when option *[10] Synchronization* is selected in *parameter 1-00 Configuration Mode*.
[110]	Start homing	**NOTICE** This option is only available with software version 48.XX. Starts the homing function selected in *parameter 17-80 Homing Function*. Must remain high until homing is done, otherwise homing is aborted.
[111]	Activate touch	**NOTICE** This option is only available with software version 48.XX. Activates monitoring of the touch sensor input.
[112]	Relative position	**NOTICE** This option is only available with software version 48.XX.

Option		Function
		This option selects between absolute and relative positioning. The option is valid for the next positioning command.
[113]	Enable reference	**NOTICE** This option is only available with software version 48.XX. Positioning mode: The drive activates the selected positioning type and target, and starts the motion towards the new target. The motion starts either immediately or when active positioning is completed, depending on the settings of *parameter 17-90 Absolute Position Mode* and *parameter 17-91 Relative Position Mode*. Synchronization mode: High signal locks the actual follower position to the actual master position. The follower starts and catches up with the master. Low signal stops the synchronization and the follower makes a controlled stop.
[114]	Sync. to pos. mode	**NOTICE** This option is only available with software version 48.XX. Select positioning in synchronization mode.
[115]	Home sensor	**NOTICE** This option is only available with software version 48.XX. Normally-open contact for defining the home position. The function is defined in *parameter 17-80 Homing Function*.
[116]	Home sensor inv.	**NOTICE** This option is only available with software version 48.XX. Normally-closed contact for defining the home position. The function is defined in *parameter 17-80 Homing Function*.
[117]	Touch sensor	**NOTICE** This option is only available with software version 48.XX. Normally-open contact. Serves as a reference for touch probe positioning.
[118]	Touch sensor inv	**NOTICE** This option is only available with software version 48.XX. Normally-closed contact. Serves as a reference for touch probe positioning.
[119]	Speed mode	**NOTICE** This option is only available with software version 48.XX.

Option		Function
		Select the speed mode when *[9] Positioning* or *[10] Synchronization* is selected in *parameter 1-00 Configuration Mode*. Speed reference is set by reference resource 1 or fieldbus REF1 relative to *parameter 3-03 Maximum Reference*.
[122]	Position vir. master	**NOTICE** This option is only available with software version 48.XX. Activates position-controlled virutal master when *[10] Synchronization* is selected in *parameter 1-00 Configuration Mode*. When the option is selected, the following occurs: • Target position is set by Fieldbus Pos. Ref. or preset target is as defined in *parameter 3-20 Preset Target*. • Speed is set relative to *parameter 3-27 Virtual Master Max Ref* by the source selected in *parameter 3-15 Reference Resource 1* or fieldbus REF1. • Acceleration and deceleration are set as defined in *parameter group 3-6* Ramp 3*.
[123]	Master marker	**NOTICE** This option is only available with software version 48.XX. Normally-open contact. Serves as input for master marker signal during marker synchronization based on the option selected in *parameter 3-33 Sync. Mode & Start behavior*.
[124]	Master marker inv.	**NOTICE** This option is only available with software version 48.XX. Normally-closed contact. Activates master marker signal for marker synchronization based on the option selected in *parameter 3-33 Sync. Mode & Start Behavior*.
[125]	Follower marker	**NOTICE** This option is only available with software version 48.XX. Normally-open contact. Serves as input for follower marker signal during marker synchronization based on the option selected in *parameter 3-33 Sync. Mode & Start Behavior*.
[126]	Follow marker inv	**NOTICE** This option is only available with software version 48.XX. Normally-closed contact. Serves as input for follower marker signal during marker synchronization based on the option selected in *parameter 3-33 Sync. Mode & Start Behavior*.
[127]	Dir. home sensor	**NOTICE** This option is only available with software version 48.XX. Normally open contact for defining the home position at the same edge of the sensor signal independent of running direction. Only for the 2 homing types *[2] Home Sync* and *[9] Direction with Sensor*.

Option		Function
[128]	Dir. home sen. inv.	**NOTICE** This option is only available with software version 48.XX. Normally closed contact for defining the home position at the same edge of the sensor signal independent of running direction. Only for the 2 homing types *[2] Home Sync* and *[9] Direction with Sensor*.
[190]	Emcy mode ref bit 0	Enables a choice between 1 of the 8 preset reference according to Table 329.
[191]	Emcy mode ref bit 1	Enables a choice between 1 of the 8 preset reference according to Table 329.
[192]	Emcy mode ref bit 2	Enables a choice between 1 of the 8 preset reference according to Table 329.
[193]	Emcy mode setup bit 0	Switch between emergency mode setup 1 to 4 in *parameter group 24-0* Emergency Mode* and *parameter group 24-4* Emergency Mode 2* without changing starting setup mode for the rest of the parameters.
[194]	Emcy mode setup bit 1	Switch between emergency mode setup 1 to 4 in *parameter group 24-0* Emergency Mode* and *parameter group 24-4* Emergency Mode 2* without changing starting setup mode for the rest of the parameters.
[195]	Test emcy mode	Activation of emergency mode via *parameter 24-09 Emergency Mode Alarm Handling*, option *[2] Trip all alarms/test* with stop on all alarms and in normal operation mode. The test timer is set in *parameter 24-42 Timeout for Emergency Mode Test*, and countdown starts when the test signal is active.
[196]	Reset emcy mode	When operating in emergency mode with impulse signals (*parameter 24-43 Emergency Mode Signal Operation*, option *[2] Impulse, set-reset*) the reset signal stops the emergency mode operation.
[231]	Power limit mot.	**NOTICE** This option is only available in FC 302. Serves as input to activate the power limit function in the motor mode. See *parameter group 4-8* Power Limit*.
[232]	Power limit gen.	**NOTICE** This option is only available in FC 302. Serves as input to activate the power limit function in the generating mode. See *parameter group 4-8* Power Limit*.
[233]	Power limit both	**NOTICE** This option is only available in FC 302. Serves as input to activate the power limit function in both the motor and the generating mode. See *parameter group 4-8* Power Limit*.
[234]	Light load + evacuation	**NOTICE** This option is only available in FC 302. Use this option to activate both light-load detection and evacuation.

Parameter 5-10 Terminal 18 Digital Input

Table 335: Parameter 5-10 Terminal 18 Digital Input

5-10 Terminal 18 Digital Input		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the function from the available digital input range and the additional options *[60] Counter A (up)*, *[61] Counter A (down)*, *[63] Counter B (up)*, and *[64] Counter B (down)*. Counters are used in smart logic control functions. All functions are described in Table 328, Table 330, Table 332, and Table 334.

Option	Name	Description
[0]	No operation	
[1]	Reset	
[2]	Coast inverse	
[3]	Coast and reset inv	
[4]	Quick stop inverse	
[5]	DC-brake inverse	
[6]	Stop inverse	
[8]	Start	
[9]	Latched	
[10]	Reversing	
[11]	Start reversing	
[12]	Enable start forward	
[13]	Enable start reverse	
[14]	Jog	
[15]	Preset reference on	
[16]	Preset ref bit 0	
[17]	Preset ref bit 1	
[18]	Preset ref bit 2	
[19]	Freeze reference	
[20]	Freeze output	
[21]	Speed up	
[22]	Speed down	
[23]	Set-up select bit 0	
[24]	Set-up select bit 1	
[26]	Precise stop inverse	
[27]	Precise start, stop	

Option	Name	Description
[28]	Catch up	
[29]	Slow down	
[34]	Ramp bit 0	
[35]	Ramp bit 1	
[37]	Emergency mode	
[40]	Latched precise start	
[41]	Latch prec stop inv	
[44]	Restart drive	
[51]	External interlock	
[55]	DigiPot increase	
[56]	DigiPot decrease	
[57]	DigiPot clear	
[58]	DigiPot hoist	
[62]	Reset counter A	
[65]	Reset counter B	
[70]	Mech. brake feedb.	
[71]	Mech. brake feedb. inv.	
[72]	PID error inverse	
[73]	PID reset 1 part	
[74]	PID enable	
[75]	MCO specific	
[78]	Reset maint. word	
[80]	PTC card 1	
[91]	PROFIdrive OFF2	
[92]	PROFIdrive OFF3	
[94]	Light load detection	
[95]	Evacuation mode	
[96]	Mains loss	
[97]	Mains loss inverse	
[98]	Start edge triggered	
[100]	Safe option reset	
[104]	Active CAM table	

Option	Name	Description
[105]	Set vir. mas. pos. to actual	
[106]	Set master home	
[107]	Target inverse	
[108]	Enable mast. offset	
[109]	Enable vir. master	
[110]	Start homing	
[111]	Activate touch	
[112]	Relative position	
[113]	Enable reference	
[114]	Sync. to pos. mode	
[115]	Home sensor	
[116]	Home sensor inv.	
[117]	Touch sensor	
[118]	Touch sensor inv.	
[119]	Speed mode	
[122]	Position vir. master	
[123]	Master marker	
[124]	Master marker inv.	
[125]	Follower marker	
[126]	Follow. marker inv.	
[127]	Dir. home sensor	
[128]	Dir. home sen. inv.	
[190]	Emcy mode ref bit 0	
[191]	Emcy mode ref bit 1	
[192]	Emcy mode ref bit 2	
[193]	Emcy mode setup bit 0	
[194]	Emcy mode setup bit 1	
[195]	Test emcy mode	
[196]	Reset emcy mode	
[231]	Power limit mot.	

Option	Name	Description
[232]	Power limit gen.	
[233]	Power limit both	
[234]	Light load + evacuation	

Parameter 5-11 Terminal 19 Digital Input

Table 336: Parameter 5-11 Terminal 19 Digital Input

5-11 Terminal 19 Digital Input		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-10 Terminal 18 Digital Input*.

Parameter 5-12 Terminal 27 Digital Input

Table 337: Parameter 5-12 Terminal 27 Digital Input

5-12 Terminal 27 Digital Input		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-10 Terminal 18 Digital Input*.

Parameter 5-13 Terminal 29 Digital Input

Table 338: Parameter 5-13 Terminal 29 Digital Input

5-13 Terminal 29 Digital Input		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-10 Terminal 18 Digital Input*.

Parameter 5-14 Terminal 32 Digital Input

Table 339: Parameter 5-14 Terminal 32 Digital Input

5-14 Terminal 32 Digital Input		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-10 Terminal 18 Digital Input*.

Parameter 5-15 Terminal 33 Digital Inputs

Table 340: Parameter 5-15 Terminal 33 Digital Input

5-15 Terminal 33 Digital Input		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-10 Terminal 18 Digital Input*.

Parameter 5-16 Terminal X30/2 Digital Input

Table 341: Parameter 5-16 Terminal X30/2 Digital Input

5-16 Terminal X30/2 Digital Input		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-10 Terminal 18 Digital Input*.

Parameter 5-17 Terminal X30/3 Digital Input

Table 342: Parameter 5-17 Terminal X30/3 Digital Input

5-17 Terminal X30/3 Digital Input		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-10 Terminal 18 Digital Input*.

Parameter 5-18 Terminal X30/4 Digital Input

Table 343: Parameter 5-18 Terminal X30/4 Digital Input

5-18 Terminal X30/4 Digital Input		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-10 Terminal 18 Digital Input*.

Parameter 5-19 Terminal 37 Safe Stop

Table 344: Parameter 5-19 Terminal 37 Safe Stop

5-19 Terminal 37 Safe Stop		
Default value: Size related	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

NOTICE

Options *[4] PTC 1 Alarm* to *[9] PTC 1 & Relay W/A* are only available when the VLT® PTC Thermistor Card MCB 112 is connected.

NOTICE

Selecting Auto Reset/Warning enables automatic restart of the drive.

Use this parameter to configure the Safe Torque Off functionality. A warning message makes the drive coast the motor and enables the automatic restart. An alarm message makes the drive coast the motor and requires a manual restart (via a fieldbus, Digital I/O, or by pressing [RESET] on the LCP). When the VLT® PTC Thermistor Card MCB 112 is mounted, configure the PTC options to get the full benefit from the alarm handling.

Option	Name	Description
[1]	Safe stop alarm	Coasts the drive when Safe Torque Off is activated. Manual reset from LCP, digital input, or fieldbus.
[3]	Safe stop warning	Coasts the drive when Safe Torque Off is activated (terminal 37 off). When the Safe Torque Off circuit is re-established, the drive continues without manual reset.
[4]	PTC 1 alarm	Coasts the drive when Safe Torque Off is activated. Manual reset from LCP, digital input, or fieldbus.

Option	Name	Description
[5]	PTC 2 warning	Coasts the drive when Safe Torque Off is activated (terminal 37 off). When the Safe Torque Off circuit is re-established, the drive continues without manual reset, unless a digital input set to *[80] PTC Card 1* is still enabled.
[6]	PTC 1 & Relay A	This option is used when the VLT® PTC Thermistor Card MCB 112 gates with a stop key through a safety relay to terminal 37. Coasts the drive when Safe Torque Off is activated. Manual reset from LCP, digital input, or fieldbus.
[7]	PTC 1 & Relay W	This option is used when the VLT® PTC Thermistor Card MCB 112 gates with a stop key through a safety relay to terminal 37. Coasts the drive when Safe Torque Off is activated (terminal 37 off). When the Safe Torque Off circuit is re-established, the drive continues without manual reset, unless a digital input set to *[80] PTC Card 1* is still enabled.
[8]	PTC 1 & Relay A/W	This option enables using a combination of alarm and warning.
[9]	PTC 1 & Relay W/A	This option enables using a combination of warning and alarm.

Table 345: Overview of Functions, Alarms, and Warnings

Function	Number	PTC	Relay
No function	[0]	–	–
Safe Torque Off alarm	[1]*	–	Safe Torque Off [A68[1]]
Safe Torque Off warning	[3]	–	Safe Torque Off [W68[1]]

[1] W means warning and A means alarm.

A dangerous failure related to STO issues *alarm 72, Dangerous Failure*.

Parameter 5-20 Terminal X46/1 Digital Input

Table 346: Parameter 5-20 Terminal X46/1 Digital Input

5-20 Terminal X46/1 Digital Input		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

All functions are described in Table 328, Table 330, Table 332, and Table 334.

Option	Name	Description
[0]*	No operation	
[1]	Reset	
[2]	Coast inverse	
[3]	Coast and reset inv	
[4]	Quick stop inverse	
[5]	DC-brake inverse	
[6]	Stop inverse	
[8]	Start	

Option	Name	Description
[9]	Latched	
[10]	Reversing	
[11]	Start reversing	
[12]	Enable start forward	
[13]	Enable start reverse	
[14]	Jog	
[15]	Preset reference on	
[16]	Preset ref bit 0	
[17]	Preset ref bit 1	
[18]	Preset ref bit 2	
[19]	Freeze reference	
[20]	Freeze output	
[21]	Speed up	
[22]	Speed down	
[23]	Set-up select bit 0	
[24]	Set-up select bit 1	
[26]	Precise stop inverse	
[27]	Precise start, stop	
[28]	Catch up	
[29]	Slow down	
[34]	Ramp bit 0	
[35]	Ramp bit 1	
[37]	Emergency mode	
[40]	Latched precise start	
[41]	Latch prec stop inv	
[44]	Restart drive	
[51]	External interlock	
[55]	DigiPot increase	
[56]	DigiPot decrease	
[57]	DigiPot clear	
[58]	DigiPot hoist	
[62]	Reset counter A	

Option	Name	Description
[65]	Reset counter B	
[70]	Mech. brake feedb.	
[71]	Mech. brake feedb. inv.	
[72]	PID error inverse	
[73]	PID reset 1 part	
[74]	PID enable	
[75]	MCO specific	
[78]	Reset maint. word	
[80]	PTC card 1	
[91]	PROFIdrive OFF2	
[92]	PROFIdrive OFF3	
[94]	Light load detection	**NOTICE** This option is only available in FC 302.
[95]	Evacuation mode	**NOTICE** This option is only available in FC 302.
[96]	Mains loss	
[97]	Mains loss inverse	
[98]	Start edge triggered	
[100]	Safe option reset	
[106]	Set master home	
[107]	Target inverse	
[122]	Position vir. master	
[123]	Master marker	
[124]	Master marker inv	
[125]	Follower marker	
[126]	Follow. marker inv.	
[190]	Emcy mode ref bit 0	
[191]	Emcy mode ref bit 1	
[192]	Emcy mode ref bit 2	
[195]	Test emcy mode	

Option	Name	Description
[196]	Reset emcy mode	
[231]	Power limit mot.	**NOTICE** This option is only available in FC 302.
[232]	Power limit gen.	**NOTICE** This option is only available in FC 302.
[233]	Power limit both	**NOTICE** This option is only available in FC 302.
[234]	Light load + evacuation	**NOTICE** This option is only available in FC 302.

Parameter 5-21 Terminal X46/3 Digital Input

Table 347: Parameter 5-21 Terminal X46/3 Digital Input

5-21 Terminal X46/3 Digital Input		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-20 Terminal X46/1 Digital Input*.

Parameter 5-22 Terminal X46/5 Digital Input

Table 348: Parameter 5-22 Terminal X46/5 Digital Input

5-22 Terminal X46/5 Digital Input		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-20 Terminal X46/1 Digital Input*.

Parameter 5-23 Terminal X46/7 Digital Input

Table 349: Parameter 5-23 Terminal X46/7 Digital Input

5-23 Terminal X46/7 Digital Input		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as for those lited for *parameter 5-20 Terminal X46/1 Digital Input*.

Parameter 5-24 Terminal X46/9 Digital Input

Table 350: Parameter 5-24 Terminal X46/9 Digital Input

5-24 Terminal X46/9 Digital Input		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-20 Terminal X46/1 Digital Input*.

Parameter 5-25 Terminal X46/11 Digital Input

Table 351: Parameter 5-25 Terminal X46/11 Digital Input

5-25 Terminal X46/11 Digital Input		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-20 Terminal X46/1 Digital Input*.

Parameter 5-26 Terminal X46/13 Digital Input

Table 352: Parameter 5-26 Terminal X46/13 Digital Input

5-26 Terminal X46/13 Digital Input		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-20 Terminal X46/1 Digital Input*.

5.6.3 5-3* Digital Outputs

N O T I C E

The following parameter is only available in FC 302:

- *Parameter 5-31 Terminal 29 Digital Output*

The 2 solid-state digital outputs are common for terminals 27 and 29. Set the I/O function for terminal 27 in *parameter 5-01 Terminal 27 Mode*, and set the I/O function for terminal 29 in *parameter 5-02 Terminal 29 Mode*.

N O T I C E

These parameters cannot be adjusted while the motor is running.

Table 353: Digital Outputs, Function Descriptions - 1

Option		Function
[0]	No operation	Default for all digital outputs and relay outputs.
[1]	Control ready	The control card is ready.
[2]	Drive ready	The drive is ready for operation and applies a supply signal on the control card.
[3]	Drive rdy/rem ctrl	The drive is ready for operation and is in auto-on mode.
[4]	Enable/no warning	Ready for operation. No start or stop command has been given (start/disable). No warnings are active.
[5]	Running	The motor runs, and shaft torque is present.

Option		Function
[6]	Running/no warning	The output speed is higher than the speed set in *parameter 1-81 Min Speed for Function at Stop [RPM]*. The motor runs and there are no warnings.
[7]	Run inrange/no warn	The motor runs within the programmed current and speed ranges set in *parameter 4-50 Warning Current Low* to *parameter 4-53 Warning Speed High*. There are no warnings.
[8]	Run on ref/no warn	The motor runs at reference speed. There are no warnings.
[9]	Alarm	An alarm activates the output. There are no warnings.
[10]	Alarm or warning	An alarm or warning activates the output.
[11]	At torque limit	The torque limit set in *parameter 4-16 Torque Limit Motor Mode* or *parameter 4-17 Torque Limit Generator Mode* has been exceeded.
[12]	Out of current range	The motor current is outside the range set in *parameter 4-18 Current Limit*.
[13]	Below current, low	The motor current is lower than set in *parameter 4-50 Warning Curent Low*.
[14]	Above current, high	The motor current is higher than set in *parameter 4-51 Warning Current High*.
[15]	Out of speed range	The output frequency is outside the frequency range set in *parameter 4-52 Warning Speed Low* and *parameter 4-53 Warning Speed High*.
[16]	Below speed, low	Output speed is lower than the setting in *parameter 4-52 Warning Speed Low*.
[17]	Above speed, high	The output speed is higher than the setting in *parameter 4-53 Warning Speed High*.
[18]	Out of feedb. range	Feedback is below the limit set in *parameter 4-56 Warning Feedback Low* and *parameter 4-57 Warning Feedback High*.
[19]	Below feedback, low	Feedback is below the limit set in *parameter 4-56 Warning Feedback Low*.
[20]	Above feedback, high	Feedback is above the limit set in *parameter 4-57 Warning Feedback High*.
[21]	Thermal warning	The thermal warning turns on when the temperature exceeds the limit in the motor, the drive, the brake resistor, or the thermistor.
[22]	Ready, no thermal W	The drive is ready for operation, and there is no overtemperature warning.
[23]	Remote, ready, no TW	The drive is ready for operation and is in auto-on mode. There is no overtemperature warning.
[24]	Ready, voltage OK	The drive is ready for operation and the mains voltage is within the specified voltage range.
[25]	Reverse	The motor runs (or is ready to run) clockwise when logic = 0 and runs counterclockwise when logic = 1. The output changes when the reversing signal is applied.
[26]	Bus OK	Active communication (no timeout) via the serial communication port.
[27]	Torque limit & stop	Used for coast stop and in torque limit conditions. If the drive has received a stop signal and is at the torque limit, the signal is logic 0.
[28]	Brake, no brake war	Brake is active, and there are no warnings.
[29]	Brake ready, no fault	Brake is ready for operation and there are no faults.

Option		Function
[30]	Brake fault (IGBT)	Output is logic 1 when the brake IGBT is short-circuited. Use this function to protect the drive if there is a fault on the brake modules. To cut out the main voltage from the drive, use the output/relay.
[31]	Relay 123	Relay is activated when *[0] Control Word* is selected in *parameter group 8-** Communications and Options*.
[32]	Mech brake ctrl	Enables control of an external mechanical brake. For more information on mechanical brake control, refer to the drive-specific design guide.
[33]	Safe stop active	Indicates that the Safe Torque Off on terminal 37 is activated.
[35]	External interlock	
[38]	Motor feedback error	
[39]	Tracking Error	
[40]	Out of ref range	Active when the actual speed is outside settings in *parameter 4-52 Warning Speed Low* in *parameter 4-55 Warning Reference High*.
[41]	Below reference, low	Active when the actual speed is below speed reference setting.
[42]	Above ref, high	Active when the actual speed is above speed reference setting.
[43]	Extended PID limit	
[45]	Bus ctrl.	Controls output via bus. The state of the output is set in *parameter 5-90 Digital & Relay Bus Control*. If a bus timeout occurs, the output state is retained.
[46]	Bus ctrl, 1 if timeout	Controls output via bus. The state of the output is set in *parameter 5-90 Digital & Relay Bus Control*. If a bus timeout occurs, the output state is set high (on).
[47]	Bus ctrl, 0 if timeout	Controls output via bus. The state of the output is set in *parameter 5-90 Digital & Relay Bus Control*. If a bus timeout occurs, the output state is set low (off).
[50]	On reference	Active when a VLT® Advanced Cascade Controller MCO 102 or VLT® Motion Control MCO 305 is connected. The output is controlled from the option.
[51]	MCO controlled	Active when a VLT® Advanced Cascade Controller MCO 102 or VLT® Motion Control MCO 305 is connected. The output is controlled from the option.
[54]	24V encoder sim	Digital outputs 27 and 29 simulate a single-signal HTL encoder. Select source for the signal generation in *parameter 5-78 Term 27/29 Encoder Sim*.
[55]	Pulse output	
[58]	Actual position	
[59]	Actual position 4–20 mA	
[60]	Comparator 0	See *parameter group 13-1* Comparators*. If comparator 0 is evaluated as true, the output goes high. Otherwise, it is low.
[61]	Comparator 1	See *parameter group 13-1* Comparators*. If comparator 1 is evaluated as true, the output goes high. Otherwise, it is low.
[62]	Comparator 2	See *parameter group 13-1* Comparators*. If comparator 2 is evaluated as true, the output goes high. Otherwise, it is low.

Option		Function
[63]	Comparator 3	See *parameter group 13-1* Comparators*. If comparator 3 is evaluated as true, the output goes high. Otherwise, it is low.
[64]	Comparator 4	See *parameter group 13-1* Comparators*. If comparator 4 is evaluated as true, the output goes high. Otherwise, it is low.
[65]	Comparator 5	See *parameter group 13-1* Comparators*. If comparator 5 is evaluated as true, the output goes high. Otherwise, it is low.
[66]	Comparator 6	See *parameter group 13-1* Comparators*. If comparator 6 is evaluated as true, the output goes high. Otherwise, it is low.
[67]	Comparator 7	See *parameter group 13-1* Comparators*. If comparator 7 is evaluated as true, the output goes high. Otherwise, it is low.
[68]	Comparator 8	See *parameter group 13-1* Comparators*. If comparator 8 is evaluated as true, the output goes high. Otherwise, it is low.
[69]	Comparator 9	See *parameter group 13-1* Comparators*. If comparator 9 is evaluated as true, the output goes high. Otherwise, it is low.
[70]	Logic rule 0	See *parameter group 13-4* Logic Rules*. If logic rule 0 is evaluated as true, the output goes high. Otherwise, it is low.
[71]	Logic rule 1	See *parameter group 13-4* Logic Rules*. If logic rule 1 is evaluated as true, the output goes high. Otherwise, it is low.
[72]	Logic rule 2	See *parameter group 13-4* Logic Rules*. If logic rule 2 is evaluated as true, the output goes high. Otherwise, it is low.
[73]	Logic rule 3	See *parameter group 13-4* Logic Rules*. If logic rule 3 is evaluated as true, the output goes high. Otherwise, it is low.
[74]	Logic rule 4	See *parameter group 13-4* Logic Rules*. If logic rule 4 is evaluated as true, the output goes high. Otherwise, it is low.
[75]	Logic rule 5	See *parameter group 13-4* Logic Rules*. If logic rule 5 is evaluated as true, the output goes high. Otherwise, it is low.
[80]	SL digital output A	See *parameter 13-52 SL Controller Action*. The output goes high whenever the smart logic action *[38] Set dig. out. A high* is executed. The output goes low whenever the smart logic action *[32] Set dig. out. A low* is executed.
[81]	SL digital output B	See *parameter 13-52 SL Controller Action*. The output goes high whenever the smart logic action *[39] Set dig. out. B high* is executed. The output goes low whenever the smart logic action *[33] Set dig. out. B low* is executed.
[82]	SL digital output C	See *parameter 13-52 SL Controller Action*. The output goes high whenever the smart logic action *[40] Set dig. out. C high* is executed. The output goes low whenever the smart logic action *[34] Set dig. out. C low* is executed.
[83]	SL digital output D	See *parameter 13-52 SL Controller Action*. The output goes high whenever the smart logic action *[41] Set dig. out. D high* is executed. The output goes low whenever the smart logic action *[35] Set dig. out. D low* is executed.
[84]	SL digital output E	See *parameter 13-52 SL Controller Action*. The output goes high whenever the smart logic action *[42] Set dig. out. E high* is executed. The output goes low whenever the smart logic action *[36] Set dig. out. E low* is executed.
[85]	SL digital output F	See *parameter 13-52 SL Controller Action*. The output goes high whenever the smart logic action *[43] Set dig. out. F high* is executed. The output goes low whenever the smart logic action *[37] Set dig. out. F low* is executed.

Option		Function
[90]	kWh counter pulse	Sends a pulse (200 ms pulse width) to output terminal whenever kWh counter changes (*parameter 15-02 kWh Counter*).
[90]	kWh counter pulse	**NOTICE** This option is only available with software version 48.XX. Sends a pulse (200 ms pulse width) to the output terminal whenever kWh counter changes (*parameter 15-02 kWh Counter*).
[98]	Virtual master dir.	**NOTICE** This option is only available with software version 48.XX. A virtual master signal that controls the rotation direction of followers.
[120]	Local ref active	Output is high when *parameter 313 Reference Site = [2] Local*.

Table 354: Local Reference Active

Reference site set in *parameter 3-13 Reference Site*	**Local reference active [120]**	**Remote reference active [121]**
Reference site: Local *parameter 3-13 Reference Site [2] Local*	1	0
Reference site: Remote *parameter 3-13 Reference Site [1] Remote*	0	1
Reference site: Linked to Hand/ Auto	–	–
Hand	1	0
Hand⇒off	1	0
Auto⇒off	0	0
Auto	0	1

Table 355: 5-30 Digital Outputs - 2

Option		Function
[121]	Remote ref active	Output is high when *parameter 3-13 Reference Site = [1] Remote* or *[0] Linked to hand/auto* while the LCP is in auto-on mode. See Table 354.
[122]	No alarm	Output is high when no alarm is present.
[123]	Start command active	Output is high when there is an active start command (that is via digital input bus connection, hand-on, or auto-on), and no stop or start command is active.
[124]	Running reverse	Output is high when the drive runs counterclockwise (the logical product of the status bits running AND reverse).
[125]	Drive in hand mode	Output is high when the drive is in hand-on mode (as indicated by the LED light above [Hand On]).
[126]	Drive in auto mode	Output is high when the drive is in auto-on mode (as indicated by the LED light above [Auto On]).
[151]	ATEX ETR cur. alarm	Selectable if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *Alarm 164 ATEX ETR cur.lim.alarm* is active, the output is 1.

Option		Function
[152]	ATEX ETR freq. alarm	Selectable if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *Alarm 166, ATEX ETR freq.lim.alarm* is active, the output is 1.
[153]	ATEX ETR cur. warning	
[154]	ATEX ETR freq. warning	Selectable if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *Warning 165, ATEX ETR freq.lim.warning* is active, the output is 1.
[173]	10Wh counter pulse	
[178]	RS Flipflop 8	
[179]	RS Flipflop 9	
[180]	Clock fault	
[181]	Prev. maintenance	
[188]	AHF capacitor connect	The capacitors are turned on at 20% (hysteresis of 50% gives an interval of 10– 30%). The capacitors are disconnected below 10%. The off delay is 10 s and restarts if the nominal power goes above 10% during the delay. *Parameter 5-80 AHF Cap Reconnect Delay* is used to guarantee a minimum off time for the capacitors.
[189]	External fan control	The internal logics for the internal fan control is transferred to this output to make it possible to control an external fan (relevant for hp duct cooling).
[190]	Safe function active	
[191]	Safe opt. reset req.	
[192]	RS Flipflop 0	See *parameter group 13-1* Comparators*.
[193]	RS Flipflop 1	See *parameter group 13-1* Comparators*.
[194]	RS Flipflop 2	See *parameter group 13-1* Comparators*.
[195]	RS Flipflop 3	See *parameter group 13-1* Comparators*.
[196]	RS Flipflop 4	See *parameter group 13-1* Comparators*.
[197]	RS Flipflop 5	See *parameter group 13-1* Comparators*.
[198]	RS Flipflop 6	See *parameter group 13-1* Comparators*.
[199]	RS Flipflop 7	See *parameter group 13-1* Comparators*.
[221]	IGBT cooling	Use this option for handling the overcurrent trips. When the drive detects an overcurrent condition, it shows *alarm 13, Overcurrent* and triggers a reset. If the overcurrent condition occurs for the 3rd time in a row, the drive shows *alarm 13, Overcurrent* and initiates a 3-minute delay before the next reset.
[222]	Homing OK	**NOTICE** This option is only available with software version 48.XX. Homing is completed with the selected homing function in *parameter 17-80 Homing Function*.

Option		Function
[223]	On target	**NOTICE** This option is only available with software version 48.XX. Positioning is completed and the on-target signal is sent when the actual position is within *parameter 3-05 On Reference Window* for the duration of *parameter 3-09 On Target Time* and the actual speed does not exceed *parameter 3-05 On Reference Window*.
[224]	Position limit	**NOTICE** This option is only available with software version 48.XX. The position error exceeds the value in *parameter 4-71 Maximum Position Error* for the time set in *parameter 4-72 Position Error Timeout*.
[225]	Position error	**NOTICE** This option is only available with software version 48.XX. The position is outside the limits set in *parameter 3-06 Minimum Position* and *parameter 3-07 Maximum Position*.
[226]	Touch on target	**NOTICE** This option is only available with software version 48.XX. The target position is reached in touch probe position mode.
[227]	Touch activated	**NOTICE** This option is only available with software version 48.XX. Touch probe positioning is active. The drive monitors the touch probe sensor input.
[228]	Touch sensor found	**NOTICE** This option is only available with software version 48.XX. The touch sensor has been detected.
[229]	Vir. master on ref.	**NOTICE** This option is only available with software version 48.XX. The virtual master is running on the set reference.
[231]	In power lim. mot.	
[232]	In power lim. gen.	
[233]	In power limit	
[234]	PE power off	

Option		Function
[246]	Emcy mode was act.	The drive has been operating in emergency mode.
[247]	Emergency mode	The drive is operating in emergency mode. See *parameter group 24-0* Emergency Mode*.
[249]	Emcy m. OPR unexpected	Emergency mode input or safe stop is not operating as expected, for example, live zero monitoring on an analog input is activated.
[250]	Emcy mode limits	During emergency mode operation, 1 of the critical alarms has been activated and suppressed by emergency mode. This may lead to reduced drive performance and expected operation lifetime before service is required.
[254]	Testing emcy mode	Emergency mode is activated in a special test mode where the drive stops on all alarms.

Parameter 5-30 Terminal 27 Digital Output

Table 356: Parameter 5-30 Terminal 27 Digital Output

5-30 Terminal 27 Digital Output		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the function from the available digital output range and the additional options *[60] Counter A (up)*, *[61] Counter A (down)*, *[63] Counter B (up)*, and *[64] Counter B (down)*. Counters are used in smart logic control functions. All functions are described in Table 353 and Table 355.

Option	Name	Description
[0]	No operation	
[1]	Control ready	
[2]	Drive ready	
[3]	Coast and reset inv	
[4]	Enable/no warning	
[5]	Running	
[6]	Running/no warning	
[7]	Run in range/no warn	
[8]	Run on ref/no warn	
[9]	Alarm	
[10]	Alarm or warning	
[11]	At torque limit	
[12]	Out of current range	
[13]	Below current, low	
[14]	Above current, high	
[15]	Out of speed range	
[16]	Below speed, low	
[17]	Above speed, high	

Option	Name	Description
[18]	Out of feedb. range	
[19]	Below feedback, low	
[20]	Above feedback, high	
[21]	Thermal warning	
[22]	Ready,no thermal W	
[23]	Remote,ready, no TW	
[24]	Ready, Voltage OK	
[25]	Reverse	
[26]	Bus OK	
[27]	Torque limit & stop	
[28]	Brake, no brake war	
[29]	Brake ready, no fault	
[30]	Brake fault (IGBT)	
[31]	Relay 123	
[32]	Mech brake ctrl	
[33]	Safe stop active	
[35]	External interlock	
[38]	Motor feedback error	
[39]	Tracking error	
[40]	Out of ref range	
[41]	Below reference, low	
[42]	Above ref, high	
[43]	Extended PID Limit	
[45]	Bus ctrl.	
[46]	Bus ctrl, 1 if timeout	
[47]	Bus ctrl, 0 if timeout	
[50]	On reference	
[54]	24V Encoder Sim	
[55]	Pulse output	
[58]	Actual position	
[59]	Actual position 4–20mA	
[60]	Comparator 0	

Option	Name	Description
[61]	Comparator 1	
[62]	Comparator 2	
[63]	Comparator 3	
[64]	Comparator 4	
[65]	Comparator 5	
[66]	Comparator 6	
[67]	Comparator 7	
[68]	Comparator 8	
[69]	Comparator 9	
[70]	Logic rule 0	
[71]	Logic rule 1	
[72]	Logic rule 2	
[73]	Logic rule 3	
[74]	Logic rule 4	
[75]	Logic rule 5	
[79]	PE power off	
[80]	SL digital output A	
[81]	SL digital output B	
[82]	SL digital output C	
[83]	SL digital output D	
[84]	SL digital output E	
[85]	SL digital output F	
[90]	kWh counter pulse	
[96]	Reverse after ramp	
[98]	Virtual master dir	
[120]	Local ref active	
[121]	Remote ref active	
[122]	No alarm	
[123]	Start command activ	
[124]	Running reverse	
[125]	Drive in hand mode	
[126]	Drive in auto mode	

Option	Name	Description
[151]	ATEX ETR cur. alarm	
[152]	ATEX ETR freq. alarm	
[153]	ATEX ETR cur. warning	
[154]	ATEX ETR freq. warning	
[173]	10Wh counter pulse	
[178]	RS Flipflops 8	
[179]	RS flipflops 9	
[180]	Clock fault	
[181]	Prev. Maintenance	
[188]	AHF Capacitor Connect	
[189]	External Fan Control	
[190]	Safe Function active	
[191]	Safe Opt. Reset req.	
[192]	RS Flipflop 0	
[193]	RS Flipflop 1	
[194]	RS Flipflop 2	
[195]	RS Flipflop 3	
[196]	RS Flipflop 4	
[197]	RS Flipflop 5	
[198]	RS Flipflop 6	
[199]	RS Flipflop 7	
[221]	IGBT-cooling	
[222]	Homing OK	
[223]	On target	
[224]	Position limit	
[225]	Position error	
[226]	Touch on target	
[227]	Touch activated	
[228]	Touch sensor found	
[229]	Vir. master on ref.	
[231]	In Power Lim. Mot.	
[232]	In Power Lim. Gen.	

Option	Name	Description
[233]	In Power Limit	
[234]	PE power off	
[246]	Emcy mode was act.	
[247]	Emergency mode	
[249]	Emcy m. OPR unexpected	
[250]	Emcy mode limits	
[254]	Testing emcy mode	

Parameter 5-31 Terminal 29 Digital Output

Table 357: Parameter 5-31 Terminal 29 Digital Output

5-31 Terminal 29 Digital Output		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-30 Terminal 27 Digital Output*.

Parameter 5-32 Term X30/6 Digi Out (MCB 101)

Table 358: Parameter 5-32 Term X30/6 Digi Out (MCB 101)

5-32 Term X30/6 Digi Out (MCB 101)		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter is active when option module VLT® General Purpose I/O MCB 101 is mounted in the drive. The options for this parameter are the same as those listed for *parameter 5-30 Terminal 27 Digital Output*.

Table 359: Parameter 5-33 Term X30/7 Digi Out (MCB 101)

5-33 Term X30/7 Digi Out (MCB 101)		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter is active when option module VLT® General Purpose I/O MCB 101 is mounted in the drive. The options for this parameter are the same as those listed for *parameter 5-30 Terminal 27 Digital Output*.

5.6.4 5-4* Relays

Parameters for configuring the timing and the output functions for the relays.

Parameter 5-40 Function Relay

Table 360: Parameter 5-40 Function Relay

5-40 Function Relay		
Default value: Size related	Parameter type: Option, Array [9]	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select options to define the function of the relays. Relay 1 [0], relay 2 [1]. With VLT® Extended Relay Card MCB 113 installed: Relay 3 [2], Relay 4 [3], Relay 5 [4], Relay 6 [5]. With VLT® Relay Card MCB 105 installed: Relay 7 [6], relay 8 [7], Relay 9 [8].

Option	Name	Description
[0]	No operation	All digital and relay outputs are by default set to No Operation.
[1]	Control ready	The control card is ready.
[2]	Drive ready	The drive is ready to operate. Mains and control supplies are OK.
[3]	Drive rdy/rem ctrl	The drive is ready for operation and is in auto-on mode.
[4]	Enable/no warning	Ready for operation. No start or stop commands have been applied (start/disable). No warnings are active.
[5]	Running	The motor is running, and shaft torque is present.
[6]	Running/no warning	Output speed is higher than the speed set in *parameter 1-81 Min Speed for Function at Stop [RPM]*. The motor runs and there are no warnings.
[7]	Run in range/no warn	The motor runs within the programmed current and the speed ranges set in *parameter 4-50 Warning Current Low* and *parameter 4-53 Warning Speed High*. No warnings.
[8]	Run on ref/no warn	The motor runs at reference speed. No warnings.
[9]	Alarm	An alarm activates the output. No warnings.
[10]	Alarm or warning	An alarm or a warning activates the output.
[11]	At torque limit	The torque limit set in *parameter 4-16 Torque Limit Motor Mode* or *parameter 4-17 Torque Limit Generator Mode* has been exceeded.
[12]	Out of current range	The motor current is outside the range set in *parameter 4-18 Current Limit*.
[13]	Below current, low	The motor current is lower than set in *parameter 4-50 Warning Current Low*.
[14]	Above current, high	The motor current is higher than set in *parameter 4-51 Warning Current High*.
[15]	Out of speed range	Output speed/frequency is outside the frequency range set in *parameter 4-52 Warning Speed Low* and *parameter 4-53 Warning Speed High*.
[16]	Below speed, low	Output speed is lower than the setting in *parameter 4-52 Warning Speed Low*.
[17]	Above speed, high	Output speed is higher than the setting in *parameter 4-53 Warning Speed High*.
[18]	Out of feedb. range	Feedback is outside the range set in *parameter 4-56 Warning Feedback Low* and *parameter 4-57 Warning Feedback High*.
[19]	Below feedback, low	Feedback is below the limit set in *parameter 4-56 Warning Feedback Low*.
[20]	Above feedback, high	Feedback is above the limit set in *parameter 4-57 Warning Feedback High*.
[21]	Thermal warning	Thermal warning turns on when the temperature exceeds the limit either in motor, drive, brake resistor, or connected thermistor.
[22]	Ready,no thermal W	The drive is ready for operation and there is no overtemperature warning.
[23]	Remote,ready, no TW	The drive is ready for operation and is in auto-on mode. There is no overtemperature warning.
[24]	Ready, Voltage OK	The drive is ready for operation and the mains voltage is within the specified voltage range.
[25]	Reverse	The motor runs (or is ready to run) clockwise when logic = 0 and counterclockwise when logic = 1. The output changes as soon as the reversing signal is applied.
[26]	Bus OK	Active communication (no timeout) via the serial communication port.

Option	Name	Description
[27]	Torque limit & stop	Use for performing a coasted stop in a torque limit condition. If the drive has received a stop signal and is in torque limit, the signal is logic 0.
[28]	Brake, no brake war	Brake is active and there are no warnings.
[29]	Brake ready, no fault	Brake is ready for operation and there are no faults.
[30]	Brake fault (IGBT)	Output is logic 1 when the brake IGBT is short-circuited. Use this function to protect the drive if there is a fault on the brake module. Use the digital output/relay to cut out the main voltage from the drive.
[31]	Relay 123	Digital output/relay is activated when *[0] Control Word* is selected in *parameter group 8-** Comm. and Options*.
[32]	Mech brake ctrl	Selection of mechanical brake control. When selected parameters in *parameter group 2-2* Mechanical Brake* are active. The output must be reinforced to carry the current for the coil in the brake. Usually solved by connecting an external relay to the selected digital output.
[33]	Safe stop active	**NOTICE** This option is only available in FC 302. Indicates that the Safe Torque Off on terminal 37 has been activated.
[35]	External interlock	
[36]	Control word bit 11	Activate relay 1 by control word from fieldbus. No other functional impact in the drive. Typical application: Controlling auxiliary device from fieldbus. The function is valid when *[0] FC profile* in *parameter 8-10 Control Word Profile* is selected.
[37]	Control word bit 12	**NOTICE** This option is only available in FC 302. Activate relay 2 by control word from fieldbus. No other functional impact in the drive. Typical application: Controlling auxiliary device from fieldbus. The function is valid when *[0] FC profile* in *parameter 8-10 Control Word Profile* is selected.
[38]	Motor feedback error	Failure in the speed feedback loop from motor running in closed loop. The output can eventually be used to prepare switching the drive in open loop in an emergency case.
[39]	Tracking error	When the difference between calculated speed and actual speed in *parameter 4-35 Tracking Error* is larger than selected, the digital output/relay is active.
[40]	Out of ref range	Active when the actual speed is outside the settings in *parameter 4-52 Warning Speed Low* to *parameter 4-55 Warning Reference High*.
[41]	Below reference, low	Active when the actual speed is below speed reference setting.
[42]	Above ref, high	Active when actual speed is above speed reference setting.
[43]	Extended PID Limit	
[45]	Bus ctrl.	Controls digital output/relay via bus. The state of the output is set in *parameter 5-90 Digital & Relay Bus Control*. The output state is retained in the event of bus timeout.
[46]	Bus ctrl, 1 if timeout	Controls output via bus. The state of the output is set in *parameter 5-90 Digital & Relay Bus Control*. If a bus timeout occurs, the output state is set high (on).

Option	Name	Description
[47]	Bus ctrl, 0 if timeout	Controls output via bus. The state of the output is set in parameter *5-90 Digital & Relay Bus Control*. If a bus timeout occurs, the output state is set low (off).
[50]	On reference	
[51]	MCO controlled	
[59]	Remote, enable, no TW	
[60]	Comparator 0	See *parameter group 13-1* Comparators*. If comparator 0 in SLC is true, the output goes high. Otherwise, it is low.
[61]	Comparator 1	See *parameter group 13-1* Comparators*. If comparator 1 in SLC is true, the output goes high. Otherwise, it is low.
[62]	Comparator 2	See *parameter group 13-1* Comparators*. If comparator 2 in SLC is true, the output goes high. Otherwise, it is low.
[63]	Comparator 3	See *parameter group 13-1* Comparators*. If comparator 3 in SLC is true, the output goes high. Otherwise, it is low.
[64]	Comparator 4	See *parameter group 13-1* Comparators*. If comparator 4 in SLC is true, the output goes high. Otherwise, it is low.
[65]	Comparator 5	See *parameter group 13-1* Comparators*. If comparator 5 in SLC is true, the output goes high. Otherwise, it is low.
[66]	Comparator 6	See *parameter group 13-1* Comparators*. If comparator 6 in SLC is true, the output goes high. Otherwise, it is low.
[67]	Comparator 7	See *parameter group 13-1* Comparators*. If comparator 7 in SLC is true, the output goes high. Otherwise, it is low.
[68]	Comparator 8	See *parameter group 13-1* Comparators*. If comparator 8 in SLC is true, the output goes high. Otherwise, it is low.
[69]	Comparator 9	See *parameter group 13-1* Comparators*. If comparator 9 in SLC is true, the output goes high. Otherwise, it is low.
[70]	Logic rule 0	See *parameter group 13-4* Logic Rules*. If logic rule 0 in SLC is true, the output goes high. Otherwise, it is low.
[71]	Logic rule 1	See *parameter group 13-4* Logic Rules*. If logic rule 1 in SLC is true, the output goes high. Otherwise, it is low.
[72]	Logic rule 2	See *parameter group 13-4* Logic Rules*. If logic rule 2 in SLC is true, the output goes high. Otherwise, it is low.
[73]	Logic rule 3	See *parameter group 13-4* Logic Rules*. If logic rule 3 in SLC is true, the output goes high. Otherwise, it is low.
[74]	Logic rule 4	See *parameter group 13-4* Logic Rules*. If logic rule 4 in SLC is true, the output goes high. Otherwise, it is low.
[75]	Logic rule 5	See *parameter group 13-4* Logic Rules*. If logic rule 5 in SLC is true, the output goes high. Otherwise, it is low.
[76]	Logic rule 6	See *parameter group 13-4* Logic Rules*. If logic rule 6 in SLC is true, the output goes high. Otherwise, it is low.
[77]	Logic rule 7	See *parameter group 13-4* Logic Rules*. If logic rule 7 in SLC is true, the output goes high. Otherwise, it is low.

Option	Name	Description
[78]	Logic rule 8	See *parameter group 13-4* Logic Rules*. If logic rule 8 in SLC is true, the output goes high. Otherwise, it is low.
[79]	Logic rule 9	See *parameter group 13-4* Logic Rules*. If logic rule 9 in SLC is true, the output goes high. Otherwise, it is low.
[80]	SL digital output A	See *parameter 13-52 SL Controller Action*. Output A is low on smart logic action *[32] Set digital out A low*. Output A is high on smart logic action *[38]*.
[81]	SL digital output B	See *parameter 13-52 SL Controller Action*. Output B is low on smart logic action *[33] Set digital out B low*. Output B is high on smart logic action *[39]*.
[82]	SL digital output C	See *parameter 13-52 SL Controller Action*. Output C is low on smart logic action *[34] Set digital out C low*. Output C is high on smart logic action *[40]*.
[83]	SL digital output D	See *parameter 13-52 SL Controller 1 Action*. Output D is low on smart logic action *[35] Set digital out D low*. Output D is high on smart logic action *[41]*.
[84]	SL digital output E	See *parameter 13-52 SL Controller Action*. Output E is low on smart logic action *[36] Set digital out E low*. Output E is high on smart logic action *[42]*.
[85]	SL digital output F	See *parameter 13-52 SL Controller Action*. Output F is low on smart logic action *[37] Set digital out F low*. Output F is high on smart logic action *[43]*.
[90]	kWh counter pulse	
[96]	Reverse after ramp	**NOTICE** This option is only available with software version 48.XX. See the description in *parameter group 5-3* Digital Outputs*.
[98]	Virtual master dir.	**NOTICE** This option is only available with software version 48.XX. See the description in *parameter group 5-3* Digital Outputs*.
[120]	Local ref active	Output is high when *parameter 3-13 Reference Site = [2] Local* or when *parameter 3-13 Reference Site = [0] Linked* to hand auto at the same time as the LCP is in hand-on mode.

Table 361: Local Reference Active

Reference site set in *parameter 3-1 3 Reference Site*	**Local reference active [120]**	**Remote reference active [121]**
Reference site: Local *parameter 3-13 Reference Site [2] Local*	1	0
Reference site: Remote *parameter 3-13 Reference Site [1] Remote*	0	1
Reference site: Linked to Hand/ Auto		
Hand	1	0
Hand⇒off	1	0
Auto⇒off	0	0
Auto	0	1

Option	Name	Description
[121]	Remote ref active	Output is high when *parameter 3-13 Reference Site = [1] Remote* or *[0] Linked to hand/auto while the LCP*.
[122]	No alarm	Output is high when no alarm is present.
[123]	Start command active	Output is high when the start command is high (that is via digital input, bus connection, [Hand On], or [Auto On]), and a stop has been the last command.
[124]	Running reverse	Output is high when the drive is running counterclockwise (the logical product of the status bits running AND reverse).
[125]	Drive in hand mode	Output is high when the drive is in hand-on mode (as indicated by the LED light above [Hand On]).
[126]	Drive in auto mode	Output is high when the drive is in auto-on mode (as indicated by LED light on above [Auto On]).
[151]	ATEX ETR cur. alarm	Selectable if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 164, ATEX ETR cur.lim.alarm* is active, the output is 1.
[152]	ATEX ETR freq. alarm	Selectable if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 166, ATEX ETR freq.lim.alarm* is active, the output is 1.
[153]	ATEX ETR cur. warning	Selectable if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 163, ATEX ETR cur.lim.warning* is active, the output is 1.
[154]	ATEX ETR freq. warning	Selectable if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *warning 165, ATEX ETR freq.lim.warning* is active, the output is 1.
[173]	10Wh counter pulse	
[178]	RS Flipflop 8	See *parameter group 13-1* Comparators*.
[179]	RS Flipflop 9	See *parameter group 13-1* Comparators*.
[180]	Clock fault	
[181]	Prev. Maintenance	
[188]	AHF Capacitor Connect	
[189]	External Fan Control	The internal logics for the internal fan control is transferred to this output to make it possible to control an external fan (relevant for hp duct cooling).
[190]	Safe Function active	
[191]	Safe Opt. Reset req.	
[192]	RS Flipflop 0	See *parameter group 13-1* Comparators*.
[193]	RS Flipflop 1	See *parameter group 13-1* Comparators*.
[194]	RS Flipflop 2	See *parameter group 13-1* Comparators*.
[195]	RS Flipflop 3	See *parameter group 13-1* Comparators*.
[196]	RS Flipflop 4	See *parameter group 13-1* Comparators*.
[197]	RS Flipflop 5	See *parameter group 13-1* Comparators*.
[198]	RS Flipflop 6	See *parameter group 13-1* Comparators*.

Option	Name	Description
[199]	RS Flipflop 7	See *parameter group 13-1* Comparators*.
[221]	IGBT-cooling	Use this option for handling the overcurrent trips. When the drive detects an overcurrent condition, it shows *alarm 13, Overcurrent* and triggers a reset. If the overcurrent condition occurs 3 times in a row, the drive shows *alarm 13, Overcurrent* and initiates a 3 minute delay before the next reset.
[222]	Homing OK	**NOTICE** This option is available only with software version 48.XX. Homing is completed with the selected homing function (*parameter 17-80 Homing Function*).
[223]	On target	**NOTICE** This option is available only with software version 48.XX. Positioning is completed and the on target signal is sent when the actual position is within *parameter 3-05 On Reference Window* for the duration of *parameter 3-09 On Target Time* and the actual speed does not exceed *parameter 3-05 On Reference Window*.
[224]	Position limit	**NOTICE** This option is available only with software version 48.XX. The position error exceeds the value in *parameter 4-71 Maximum Position Error* for the time set in *parameter 4-72 Position Error Timeout*.
[225]	Position error	**NOTICE** This option is available only with software version 48.XX. The position is outside the limits set in *parameter 3-06 Minimum Position* and *parameter 3-07 Maximum Position*.
[226]	Touch on target	**NOTICE** This option is available only with software version 48.XX. Target position is reached in touch probe position mode.
[227]	Touch activated	**NOTICE** This option is available only with software version 48.XX. Touch probe positioning active. The drive monitors the touch probe sensor input.
[228]	Touch sensor found	**NOTICE** This option is available only with software version 48.XX. The touch sensor has been detected.

Option	Name	Description
[229]	Vir. master on ref.	**NOTICE** This option is available only with software version 48.XX. The virtual master is running on the set reference.
[231]	In power lim. mot.	**NOTICE** This option is only available in FC 302.
[232]	In power lim. gen.	**NOTICE** This option is only available in FC 302.
[233]	In power limit	**NOTICE** This option is only available in FC 302.
[234]	PE power off	
[246]	Emcy mode was act.	The drive has been operating in emergency mode.
[247]	Emergency mode	The drive is operating in emergency mode. See *parameter group 24-0* Emergency Mode*.
[249]	Emcy m. OPR un-exptected	Emergency mode is not operating as expected, for example, live zero monitoring on an analog input is activated.
[250]	Emcy mode limits	During emergency mode operation, 1 of the critical alarms has been activated and suppressed by emergency mode. This may lead to reduced drive performance and expected lifetime before service is required.
[254]	Testing emcy mode	Emergency mode was activated in a special test mode where the drive stops on all alarms.

Parameter 5-41 On Delay, Relay

Table 362: Parameter 5-41 On Delay, Relay

5-41 On Delay, Relay		
Default value: 0.01 s	Parameter type: Range, 0.01 – 600 s, Array [9]	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

Enter the delay of the relay cut in time. Select 1 of 2 internal mechanical relays in an array function. See *parameter 5-40 Function Relay* for details.

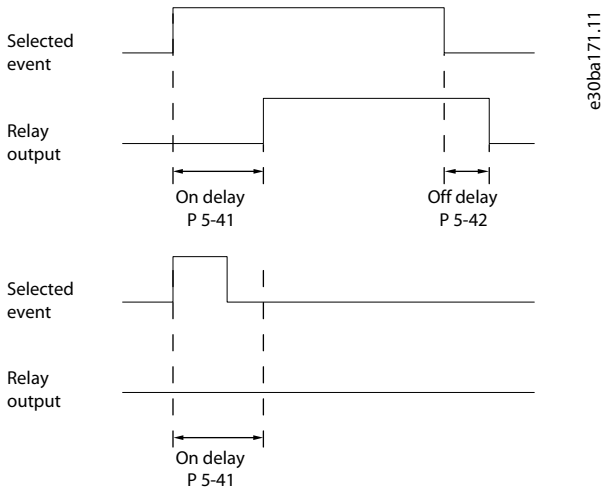


Illustration 63: On Delay, Relay

Parameter 5-42 Off Delay, Relay

Table 363: Parameter 5-42 Off Delay, Relay

5-42 Off Delay, Relay		
Default value: 0.01 s	Parameter type: Range, 0.01 – 600 s, Array [9]	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

Enter the delay of the relay cutout time. Select 1 of 2 internal mechanical relays in an array function. See *parameter 5-40 Function Relay* for details. If the selected event condition changes before a delay timer expires, the relay output is unaffected.

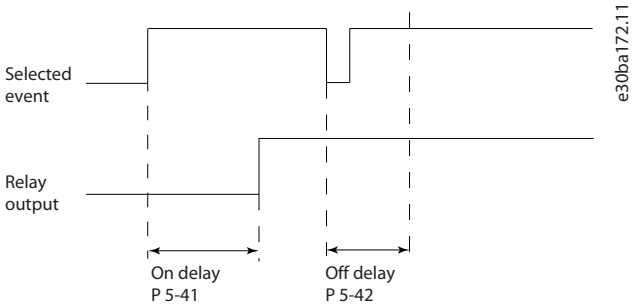


Illustration 64: Off Delay, Relay

5.6.5 5-5* Pulse Input

N O T I C E

The following parameters are only available in FC 302:

- *Parameter 5-50 Term. 29 Low Frequency*
- *Parameter 5-51 Term. 29 High Frequency*
- *Parameter 5-52 Term. 29 Low Ref./Feedb. Value*
- *Parameter 5-53 Term. 29 High Ref./Feedb. Value*
- *Parameter 5-54 Pulse Filter Time Constant #29*

The pulse input parameters are used to define an appropriate window for the impulse reference area by configuring the scaling and filter settings for the pulse inputs. Input terminals 29 or 33 act as frequency reference inputs. Set terminal 29 (*parameter 5-13 Terminal 29 Digital Input*) or terminal 33 (*parameter 5-15 Terminal 33 Digital Input*) to *[32] Pulse input*. If terminal 29 is used as an input, set *parameter 5-01 Terminal 27 Mode* to *[0] Input*.

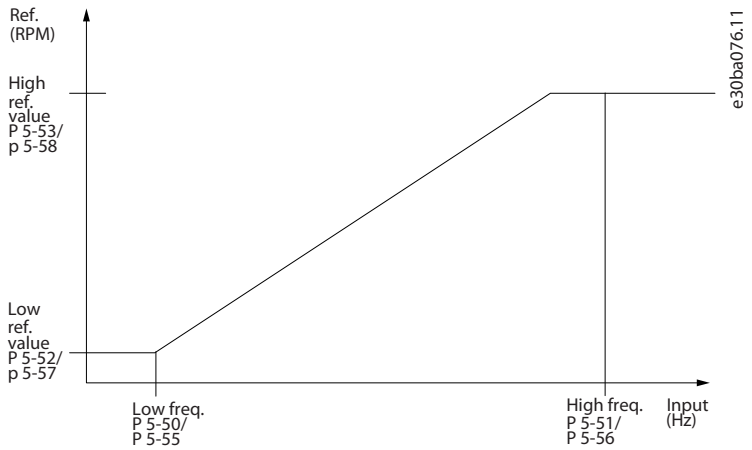


Illustration 65: Pulse Input

Parameter 5-50 Term. 29 Low Frequency

Table 364: Parameter 5-50 Term. 29 Low Frequency

5-50 Term. 29 Low Frequency		
Default value: 100 Hz	Parameter type: Range, 0 – 110000 Hz	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Enter the low frequency limit corresponding to the low motor shaft speed (that is low reference value) in *parameter 5-52 Term. 29 Low Ref./Feedb. Value*. Refer to Illustration 65.

Parameter 5-51 Term. 29 High Frequency

Table 365: Parameter 5-51 Term. 29 High Frequency

5-51 Term. 29 High Frequency		
Default value: Size related	Parameter type: Range, 0 – 110000 Hz	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Enter the high frequency limit corresponding to the high motor shaft speed (that is high reference value) in *parameter 5-53 Term. 29 High Ref./Feedb. Value*.

Parameter 5-52 Term. 29 Low Ref./Feedb. Value

Table 366: Parameter 5-52 Term. 29 Low Ref./Feedb. Value

5-52 Term. 29 Low Ref./Feedb. Value		
Default value: Size related	Parameter type: Range, -999999.999 - 999999.999 Reference- FeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the low reference value limit for the motor shaft speed [RPM]. This is also the lowest feedback value, see also *parameter 5-57 Term. 33 Low Ref./Feedb. Value*. Set terminal 29 to digital input (*parameter 5-02 Terminal 29 Mode = [0] Input* (default) and *parameter 5-13 Terminal 29 Digital Input* = applicable value).

Parameter 5-53 Term. 29 High Ref./Feedb. Value

Table 367: Parameter 5-53 Term. 29 High Ref./Feedb. Value

5-53 Term. 29 High Ref./Feedb. Value		
Default value: Size related	Parameter type: Range, -999999.999 - 999999.999 Reference- FeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the high reference value [RPM] for the motor shaft speed and the high feedback value, see also *parameter 5-58 Term. 33 High Ref./Feedb. Value*. Select terminal 29 as a digital input (*parameter 5-02 Terminal 29 Mode = [0] Input* (default) and *parameter 5-13 Terminal 29 Digital Input* = applicable value).

Parameter 5-54 Pulse Filter Time Constant #29

Table 368: Parameter 5-54 Pulse Filter Time Constant #29

5-54 Pulse Filter Time Constant #29		
Default value: 100 ms	Parameter type: Range, 1 - 1000 ms	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: False

Enter the pulse filter time constant. The pulse filter dampens oscillations of the feedback signal. If there is much noise in the system this is an advantage. A high time constant value results in better dampening but also increases the time delay through the filter.

Parameter 5-55 Term. 33 Low Frequency

Table 369: Parameter 5-55 Term. 33 Low Frequency

5-55 Term. 33 Low Frequency		
Default value: 100 Hz	Parameter type: Range, 0 - 110000 Hz	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Enter the low frequency corresponding to the low motor shaft speed (that is low reference value) in *parameter 5-57 Term. 33 Low Ref./Feedb. Value*.

Parameter 5-56 Term. 33 High Frequency

Table 370: Parameter 5-56 Term. 33 High Frequency

5-56 Term. 33 High Frequency		
Default value: Size related	Parameter type: Range, 0 - 110000 Hz	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Enter the high frequency corresponding to the high motor shaft speed (that is high reference value) in *parameter 5-58 Term. 33 High Ref./Feedb. Value*.

Parameter 5-57 Term. 33 Low Ref./Feedb. Value

Table 371: Parameter 5-57 Term. 33 Low Ref./Feedb. Value

5-57 Term. 33 Low Ref./Feedb. Value		
Default value: Size related	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the low reference value [RPM] for the motor shaft speed. This is also the low feedback value, see also *parameter 5-52 Term. 29 Low Ref./Feedb. Value*.

Parameter 5-58 Term. 33 High Ref./Feedb. Value

Table 372: Parameter 5-58 Term. 33 High Ref./Feedb. Value

5-58 Term. 33 High Ref./Feedb. Value		
Default value: Size related	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the high reference value [RPM] for the motor shaft speed. See also *parameter 5-53 Term. 29 High Ref./Feedb. Value*.

Parameter 5-59 Pulse Filter Time Constant #33

Table 373: Parameter 5-59 Pulse Filter Time Constant #33

5-59 Pulse Filter Time Constant #33		
Default value: 100 ms	Parameter type: Range, 1 - 1000 ms	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

Enter the pulse filter time constant. The low-pass filter reduces the influence and dampens oscillations on the feedback signal from the control. This is an advantage if there is a lot of noise in the system.

5.6.6 5-6* Pulse Outputs

N O T I C E

These parameters cannot be adjusted while the motor is running.

N O T I C E

The following parameters are only available in FC 302:

- *Parameter 5-63 Terminal 29 Pulse Output Variable*
- *Parameter 5-65 Pulse Output Max Freq #29*

These parameters configure pulse outputs with their functions and scaling. Terminals 27 and 29 are allocated to pulse output via *parameter 5-01 Terminal 27 Mode* and *parameter 5-02 Terminal 29 Mode*, respectively.

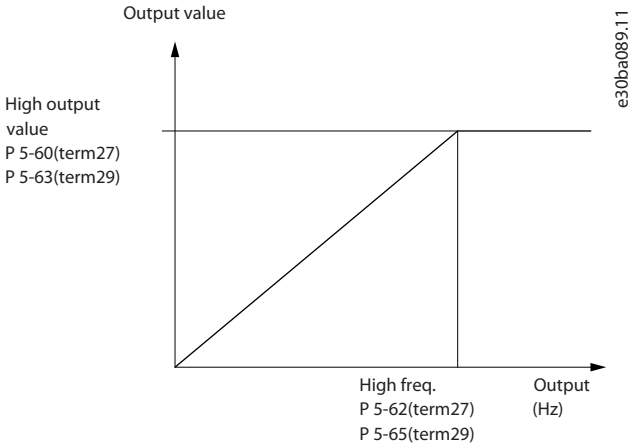


Illustration 66: Configuration of Pulse Outputs

Table 374: Options for Readout Output Variables

Option	Name	Description
		Parameters for configuring the scaling and output functions of pulse outputs. The pulse outputs are designated to terminals 27 or 29. Select terminal 27 output in *parameter 5-01 Terminal 27 Mode* and terminal 29 output in *parameter 5-02 Terminal 29 Mode*.
[0]	No operation	
[45]	Bus control	
[48]	Bus control timeout	
[51]	MCO-controlled	
[97]	Reference after ramp	**NOTICE** This option is available only with software version 48.XX. Actual speed reference after the ramp. Use this output as master signal for speed synchronization of follower drives. The reference is set in *parameter 16-48 Speed Ref. After Ramp [RPM]*.
[99]	Virtual master speed	**NOTICE** This option is only available with software version 48.XX. Virtual master signal for controlling the speed or position the followers.
[100]	Output frequency	
[101]	Reference	
[102]	Feedback	
[103]	Motor current	
[104]	Torque relative to limit	
[105]	Torque relative to rated	
[106]	Power	
[107]	Speed	
[108]	Torque	
[109]	Max. out freq	

Parameter 5-60 Terminal 27 Pulse Output Variable

Table 375: Parameter 5-60 Terminal 27 Pulse Output Variable

5-60 Terminal 27 Pulse Output Variable		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	No operation	Select the display output for terminal 27.
[45]	Bus ctrl.	
[48]	Bus ctrl., timeout	
[51]	MCO controlled	
[97]	Reference after ramp	**NOTICE** This option is only available with software version 48.XX. Actual speed reference after the ramp. Use this output as master signal for speed synchronization of follower drives. The reference is set in *parameter 16-48 Speed Ref. After Ramp [RPM]*.
[99]	Virtual master speed	**NOTICE** This option is only available with software version 48.XX. Virtual master signal for controlling the speed or position of the followers.
[100]	Output frequency	
[101]	Reference	
[102]	Feedback	
[103]	Motor current	
[104]	Torque rel to limit	
[105]	Torque related to rated	
[106]	Power	
[107]	Speed	
[108]	Torque	
[109]	Max out freq	
[119]	Torque % lim	

Parameter 5-62 Pulse Output Max Freq #27

Table 376: Parameter 5-62 Pulse Output Max Freq #27

5-62 Pulse Output Max Freq #27		
Default value: Size related	Parameter type: Range, 0 - 110000 Hz	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Set the maximum frequency for terminal 27 corresponding to the output variable selected in *parameter 5-60 Terminal 27 Pulse Output Variable*.

Parameter 5-63 Terminal 29 Pulse Output Variable

Table 377: Parameter 5-63 Terminal 29 Pulse Output Variable

5-63 Terminal 29 Pulse Output Variable		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	No operation	Select the display output for terminal 27.
[45]	Bus ctrl.	
[48]	Bus ctrl., timeout	
[51]	MCO controlled	
[97]	Reference after ramp	**NOTICE** This option is only available with software version 48.XX. Actual speed reference after the ramp. Use this output as master signal for speed synchronization of follower drives. The reference is set in *parameter 16-48 Speed Ref. After Ramp [RPM]*.
[99]	Virtual master speed	**NOTICE** This option is only available with software version 48.XX. Virtual master signal for controlling the speed or position of the followers.
[100]	Output frequency	
[101]	Reference	
[102]	Feedback	
[103]	Motor current	
[104]	Torque rel to limit	
[105]	Torque related to rated	
[106]	Power	
[107]	Speed	
[108]	Torque	
[109]	Max out freq	
[119]	Torque % lim	

Parameter 5-65 Pulse Output Max Freq #29

Table 378: Parameter 5-65 Pulse Output Max Freq #29

5-65 Pulse Output Max Freq #29		
Default value: Size related	Parameter type: Range, 0 - 110000 Hz	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Set the maximum frequency for terminal 29 corresponding to the output variable selected in *parameter 5-63 Terminal 29 Pulse Output Variable*.

Parameter 5-66 Terminal X30/6 Pulse Output Variable

Table 379: Parameter 5-66 Terminal X30/6 Pulse Output Variable

5-66 Terminal X30/6 Pulse Output Variable		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the variable for readout on terminal X30/6. This parameter is active when VLT® General Purpose I/O MCB 101 is installed in the drive. The options and functions are the same as in *parameter group 5-6* Pulse Outputs*.

Option	Name	Description
[0]	No operation	Select the display output for terminal 27.
[45]	Bus ctrl.	
[48]	Bus ctrl., timeout	
[51]	MCO controlled	
[97]	Reference after ramp	**NOTICE** This option is only available with software version 48.XX. Actual speed reference after the ramp. Use this output as master signal for speed synchronization of follower drives. The reference is set in *parameter 16-48 Speed Ref. After Ramp [RPM]*.
[99]	Virtual master speed	**NOTICE** This option is only available with software version 48.XX. Virtual master signal for controlling the speed or position of the followers.
[100]	Output frequency	
[101]	Reference	
[102]	Feedback	
[103]	Motor current	
[104]	Torque rel to limit	
[105]	Torque related to rated	
[106]	Power	
[107]	Speed	
[108]	Torque	
[109]	Max out freq	
[119]	Torque % lim	

Parameter 5-68 Pulse Output Max Freq #30/6

Table 380: Parameter 5-68 Pulse Output Max Freq #30/6

5-68 Pulse Output Max Freq #30/6		
Default value: Size related	Parameter type: Range, 0 - 110000 Hz	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

N O T I C E

This parameter cannot be changed while the motor is running.

Set the maximum frequency on terminal X30/6 referring to the output variable selected in *parameter 5-66 Terminal X30/6 Pulse Output Variable*. This parameter is active when VLT® General Purpose I/O MCB 101 is installed in the drive.

5.6.7 5-7* 24 V Encoder Input

Connect the 24 V encoder to terminal 12 (24 V DC supply), terminal 32 (channel A), terminal 33 (channel B), and terminal 20 (GND). The digital inputs 32/33 are active for encoder inputs when *[1] 24 V encoder* is selected in *parameter 1-02 Flux Motor Feedback Source* and *parameter 7-00 Speed PID Feedback Source*. The encoder used is a dual-channel (A and B) 24 V type. Maximum input frequency: 110 kHz.

Encoder connection to the drive

24 V incremental encoder. Maximum cable length is 5 m (16.4 ft).

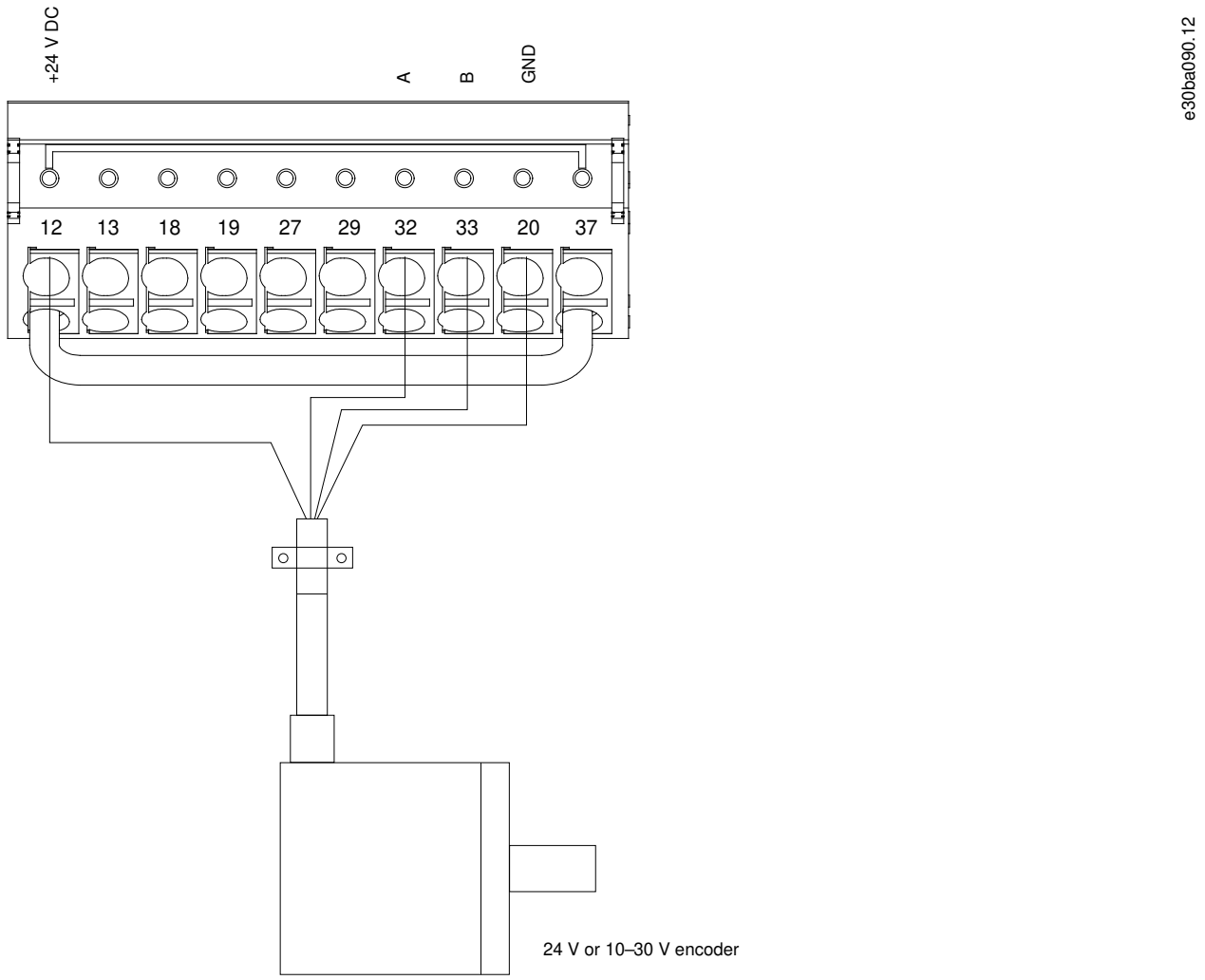


Illustration 67: Encoder Connection

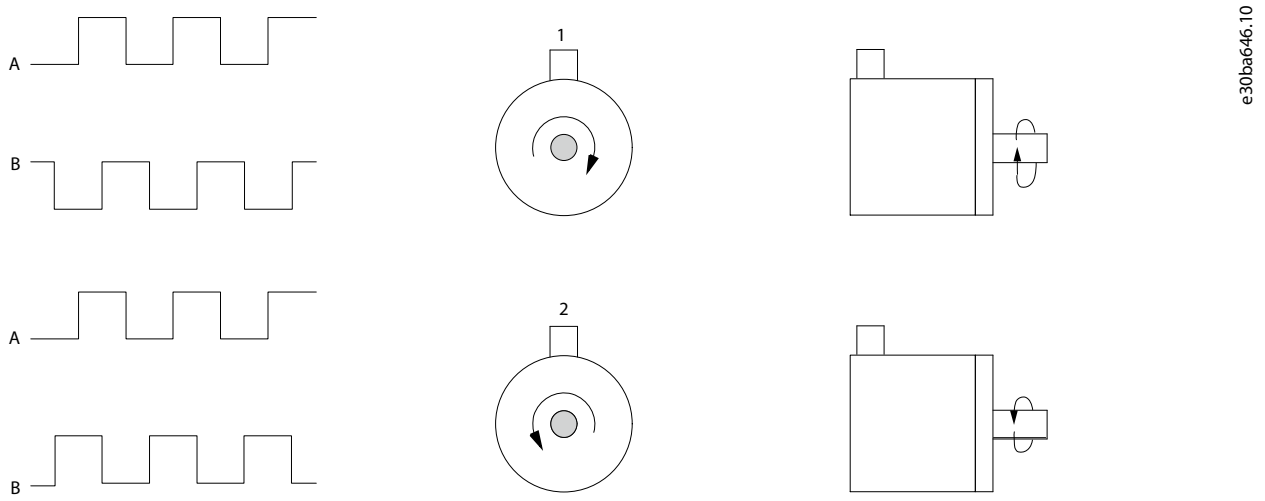


Illustration 68: Encoder Rotation Direction

Parameter 5-70 Term 32/33 Pulses Per Revolution

Table 381: Parameter 5-70 Term 32/33 Pulses Per Revolution

5-70 Term 32/33 Pulses Per Revolution		
Default value: 1024	Parameter type: Range, 1 - 4096	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Set the resolution of the encoder connected to terminal 32/33 in pulses per revolution.

Parameter 5-71 Term 32/33 Encoder Direction

Table 382: Parameter 5-71 Term 32/33 Encoder Direction

5-71 Term 32/33 Encoder Direction		
Default value: [0] Clockwise	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

Change the detected encoder rotation direction without changing the wiring to the encoder.

Option	Name	Description
[0]*	Clockwise	Sets channel A 90° (electrical degrees) behind channel B upon clockwise rotation of the encoder shaft.
[1]	Counter clockwise	Sets channel A 90° (electrical degrees) ahead of channel B upon clockwise rotation of the encoder shaft.

Parameter 5-72 Term 32/33 Encoder Type

Table 383: Parameter 5-72 Term 32/33 Encoder Type

5-72 Term 32/33 Encoder Type		
Default value: [0] Quadrature A/B format	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

NOTICE
This parameter is only available with software version 48.XX.

Select the signal type of the encoder connected to terminals 32, 33.

Option	Name	Description
[0]*	Quadrature A/B format	Encoder with 2 tracks: A and B, displaced 90° for detecting the rotational direction.
[1]	Single channel 33	Encoder with 1 track connected to terminal 33.
[2]	Single channel w/dir.	Encoder with 1 track connected to terminal 33. The direction is set with a signal on terminal 32: 0 V = forward/clockwise, 24 V = reverse/counterclockwise.

Parameter 5-75 Term 27/29 Pulses Per Revolution

Table 384: Parameter 5-75 Term 27/29 Pulses Per Revolution

5-75 Term 27/29 Pulses Per Revolution		
Default value: 1024	Parameter type: Range, 1 - 4096	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Set the resolution of the encoder connected to terminal 27/29 in pulses per revolution.

Parameter 5-76 Term 27/29 Encoder Direction

Table 385: Parameter 5-76 Term 27/29 Encoder Direction

5-76 Term 27/29 Encoder Direction		
Default value: [0] Clockwise	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

NOTICE
This parameter cannot be adjusted while the motor is running.

Change the detected encoder rotation direction without changing the wiring to the encoder.

Option	Name	Description
[0]*	Clockwise	Sets channel A 90° (electrical degrees) behind channel B upon clockwise rotation of the encoder shaft.
[1]	Counter clock-wise	Sets channel A 90° (electrical degrees) ahead of channel B upon clockwise rotation of the encoder shaft.

Parameter 5-77 Term 27/29 Encoder Type

Table 386: Parameter 5-77 Term 27/29 Encoder Type

5-77 Term 27/29 Encoder Type		
Default value: [0] Quadrature A/B format	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

NOTICE
This parameter is only available with software version 48.XX.

Select the signal type of the encoder connected to terminals 27, 29.

Option	Name	Description
[0]*	Quadrature A/B format	Encoder with 2 tracks: A and B, displaced 90° for detecting the rotational direction.
[1]	Single channel 33	Encoder with 1 track connected to terminal 29.
[2]	Single channel w/dir.	Encoder with 1 track connected to terminal 29. The direction is set with a signal on terminal 32: 0 V = forward/clockwise, 24 V = reverse/counterclockwise.

Parameter 5-78 Term 27/29 Encoder Sim

Table 387: Parameter 5-78 Term 27/29 Encoder Sim

5-78 Term 27/29 Encoder Sim		
Default value: [1] Actual position	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

Select the source for generation of the encoder simulation output. To enable 24 V encoder simulation on terminal 27/29, set *parameter 5-30 Terminal 27 Digital Output* and *parameter 5-31 Terminal 29 Digital Output* to *[54] 24V Encoder Sim*.

Option	Name	Description
[1]*	Actual position	The encoder simulation is a mirror of the actual position. The output is scaled by *parameter 5-75 Term 27/29 Pulses Per Revolution* related to 1 motor revolution. One motor revolution is represented by the number of pulses set in *parameter 5-75 Term 27/29 Pulses Per Revolution*. This means that 1 motor revolution is represented by the number of pulses set in *parameter 5-75 Term 27/29 Pulses Per Revolution*.
[2]	Commanded position	The encoder simulation is a mirror of the commanded position (position setpoint for the position PI controller). The output is scaled by *parameter 5-75 Term 27/29 Pulses Per Revolution* related to 1 motor revolution. This means that 1 motor revolution is represented by the number of pulses set in *parameter 5-75 Term 27/29 Pulses Per Revolution*.
[3]	Vir. master position	The encoder simulation is generated by the virtual master function. The output is scaled by *parameter 5-75 Term 27/29 Pulses Per Revolution*. Virtual master speed reference can be set by fieldbus REF 1 or the source selected in *parameter 3-16 Reference Resource 2* relative to *parameter 3-27 Virtual Master Max Ref*. Example: With *parameter 3-27 Virtual Master Max Ref* = 50 Hz and a reference of 50% the output corresponds to a master speed of 50 Hz * 60/min * 50% =1500 RPM. The pulse frequency will be *parameter 5-75 Term 27/29 Pulses Per Revolution*, for example, 1024 * 1500 RPM / 60 = 25.6 kHz. Speed of the individual followers is determined by their scaling in *parameter 3-22 Master Scale Numerator*, *parameter 3-23 Master Scale Denominator*, *parameter 17-72 Position Unit Numerator*, and *parameter 17-73 Position Unit Denominator*.
[4]	24V encoder 32/33	The encoder simulation is a mirror of the encoder signal on terminal 32/33. The drive can be used as repeater.

5.6.8 5-8* I/O Options

N O T I C E

This parameter group is only available in FC 302.

Parameter 5-80 AHF Cap Reconnect Delay

Table 388: Parameter 5-80 AHF Cap Reconnect Delay

5-80 AHF Cap Reconnect Delay		
Default value: 25 s	Parameter type: Range, 1 - 120 s	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Guarantees a minimum off-time for the capacitors. The timer starts once the AHF capacitor disconnects and has to expire before the output is allowed to be on again. It only turns on again if the drive power is 20–30%.

5.6.9 5-9* Bus-controlled

N O T I C E

The following parameters are only available in FC 302:

- *Parameter 5-95 Pulse Out #29 Bus Control*
- *Parameter 5-96 Pulse Out #29 Timeout Preset*

This parameter group selects digital and relay outputs via a fieldbus setting.

Parameter 5-90 Digital & Relay Bus Control

Table 389: Parameter 5-90 Digital & Relay Bus Control

5-90 Digital & Relay Bus Control		
Default value: 0	Parameter type: Range, 0 - 0xFFFFFFFF	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter holds the state of the digital outputs and relays that is controlled by bus. A logical 1 indicates that the output is high or active. A logical 0 indicates that the output is low or inactive.

Table 390: Bus-controlled Digital Outputs and Relays

Bit	Output/Relay
0	Digital output terminal 27
1	Digital output terminal 29
2	Digital output terminal X30/6
3	Digital output terminal X30/7
4	Relay 1 output terminal
5	Relay 2 output terminal
6	Option B relay 1 output terminal
7	Option B relay 2 output terminal
8	Option B relay 3 output terminal
9-15	Reserved for future terminals
16	Option C relay 1 output terminal
17	Option C relay 2 output terminal
18	Option C relay 3 output terminal
19	Option C relay 4 output terminal
20	Option C realy 5 output terminal
21	Option C relay 6 output terminal

Bit	Output/Relay
22	Option C relay 7 output terminal
23	Option C relay 8 output terminal
21–31	Reserved for future terminals

Parameter 5-93 Pulse Out #27 Bus Control

Table 391: Parameter 5-93 Pulse Out #27 Bus Control

5-93 Pulse Out #27 Bus Control		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -2	Data type: N2	Change during operation: True

Set the output frequency transferred to output terminal 27 when the terminal is configured as *[45] Bus Controlled* in *parameter 5-60 Terminal 27 Pulse Output Variable*.

Parameter 5-94 Pulse Out #27 Timeout Preset

Table 392: Parameter 5-94 Pulse Out #27 Timeout Preset

5-94 Pulse Out #27 Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: -2	Data type: Uint16	Change during operation: True

Set the output frequency transferred to output terminal 27 when the terminal is configured as *[48] Bus Ctrl Timeout* in *parameter 5-60 Terminal 27 Pulse Output Variable* and a timeout is detected.

Parameter 5-95 Pulse Out #29 Bus Control

Table 393: Parameter 5-95 Pulse Out #29 Bus Control

5-95 Pulse Out #29 Bus Control		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -2	Data type: N2	Change during operation: True

Set the output frequency transferred to output terminal 29 when the terminal is configured as *[45] Bus Controlled* in *parameter 5-63 Terminal 29 Pulse Output Variable*.

Parameter 5-96 Pulse Out #29 Timeout Preset

Table 394: Parameter 5-96 Pulse Out #29 Timeout Preset

5-96 Pulse Out #29 Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: -2	Data type: Uint16	Change during operation: True

Set the output frequency transferred to output terminal 29 when the terminal is configured as *[48] Bus Ctrl Timeout* in *parameter 5-63 Terminal 29 Pulse Output Variable* and a timeout is detected.

Parameter 5-97 Pulse Out #X30/6 Bus Control

Table 395: Parameter 5-97 Pulse Out #30/6 Bus Control

5-97 Pulse Out #30/6 Bus Control		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -2	Data type: N2	Change during operation: True

Set the output frequency transferred to output terminal X30/6 when the terminal is configured as *[45] Bus ctrl.* in *parameter 5-66 Terminal X30/6 Pulse Output Variable*.

Parameter 5-98 Pulse Out #X30/6 Timeout Preset

Table 396: Parameter 5-98 Pulse Out #30/6 Timeout Preset

5-98 Pulse Out #30/6 Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: -2	Data type: Uint16	Change during operation: True

Set the output frequency transferred to output terminal X30/6 when the terminal is configured as *[48] Bus Ctrl Timeout* in *parameter 5-66 Terminal X30/6 Pulse Output Variable* and a timeout is detected.

5.7 Parameter Group 6-** Analog In/Out

5.7.1 6-0* Analog I/O Mode

The analog inputs can be allocated to be either voltage (FC 301: 0–10 V, FC 302: 0 to ±10 V) or current input (0/4–20 mA).

N O T I C E

Thermistors may be connected to either an analog or a digital input.

Parameter 6-00 Live Zero Timeout Time

Table 397: Parameter 6-00 Live Zero Timeout Time

6-00 Live Zero Timeout Time		
Default value: 10 s	Parameter type: Range, 0 - 99 s	Setup: All setup
Conversion index: 0	Data type: Int16	Change during operation: True

Enter the live zero timeout in s. Live zero timeout time is active for analog inputs, that is terminal 53 or terminal 54, used as reference or feedback sources. If the reference signal value associated with the selected current input drops below 50% of the value set in:

- *Parameter 6-10 Terminal 53 Low Voltage*
- *Parameter 6-12 Terminal 53 Low Current*
- *Parameter 6-20 Terminal 54 Low Voltage*
- *Parameter 6-22 Terminal 54 Low Current*

for a time period longer than the time set in *parameter 6-00 Live Zero Timeout Time*, the function selected in *parameter 6-01 Live Zero Timeout Function* is activated.

Parameter 6-01 Live Zero Timeout Function

Table 398: Parameter 6-01 Live Zero Timeout Function

6-01 Live Zero Timeout Function		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the timeout function. If the input signal on terminal 53 or 54 is below 50% of the value in

- *Parameter 6-10 Terminal 53 Low Voltage*
- *Parameter 6-12 Terminal 53 Low Current*
- *Parameter 6-20 Terminal 54 Low Voltage*
- *Parameter 6-22 Terminal 54 Low Current*

for a time period defined in *parameter 6-00 Live Zero Timeout Time*, then the function set in *parameter 6-01 Live Zero Timeout Function* is activated. If several timeouts occur simultaneously, the drive prioritizes the timeout functions as follows:

- *Parameter 6-01 Live Zero Timeout Function*
- *Parameter 8-04 Control Word Timeout Function*

Option	Name	Description
[0]*	Off	
[1]	Freeze output	Frozen at the present value.
[2]	Stop	Overruled to stop.
[3]	Jogging	Overruled to jog speed.
[4]	Max. speed	Overruled to maximum speed.
[5]	Stop and trip	Overruled to stop with subsequent trip.
[20]	Coast	
[21]	Coast and trip	

Parameter 6-02 Emergency Mode Live Zero Timeout Function

Table 399: Parameter 6-02 Emergency Mode Live Zero Timeout Function

6-02 Emergency Mode Live Zero Timeout Function		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the timeout function when emergency mode is active. The function set in this parameter is activated if the input signal on analog inputs is below 50% of the low value for a period defined in *parameter 6-00 Live Zero Timeout Time*.

Option	Name	Description
[0]*	Off	
[1]	Freeze output	Frozen at the present value.
[2]	Stop	Overruled to stop.
[3]	Jogging	Overruled to jog speed.
[4]	Max. speed	Overruled to maximum speed.

5.7.2 6-1* Analog Input 1

Parameters for configuring the scaling and limits for analog input 1 (terminal 53).

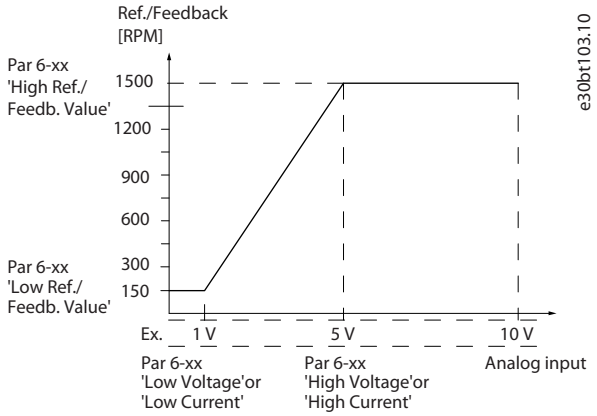


Illustration 69: Analog Input 1

Parameter 6-10 Terminal 53 Low Voltage

Table 400: Parameter 6-10 Terminal 53 Low Voltage

6-10 Terminal 53 Low Voltage		
Default value: Size related	Parameter type: Range, -10.00 - par. 6-11 V	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Enter the low voltage value. This analog input scaling value should correspond to the minimum reference value set in *parameter 6-14 Terminal 53 Low Ref./Feedb. Value*.

Parameter 6-11 Terminal 53 High Voltage

Table 401: Parameter 6-11 Terminal 53 High Voltage

6-11 Terminal 53 High Voltage		
Default value: 10 V	Parameter type: Range, par. 6-10 V - 10 V	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Enter the high voltage value. This analog input scaling value should correspond to the high reference feedback value set in *parameter 6-15 Terminal 53 High Ref./Feedb. Value*.

Parameter 6-12 Terminal 53 Low Current

Table 402: Parameter 6-12 Terminal 53 Low Current

6-12 Terminal 53 Low Current		
Default value: 0.14 mA	Parameter type: Range, par. 0 - par. 6-13 mA	Setup: All setups
Conversion index: -5	Data type: Int16	Change during operation: True

Enter the low current value. This reference signal should correspond to the minimum reference value, set in *parameter 3-02 Minimum Reference*. Set the value to exceed 2 mA to activate the live zero timeout function in *parameter 6-01 Live Zero Timeout Function*.

Parameter 6-13 Terminal 53 High Current

Table 403: Parameter 6-13 Terminal 53 High Current

6-13 Terminal 53 High Current		
Default value: 20 mA	Parameter type: Range, par. par. 6-12 mA - 20 mA	Setup: All setups
Conversion index: -5	Data type: Int16	Change during operation: True

Enter the high current value corresponding to the high reference/feedback set in *parameter 6-15 Terminal 53 High Ref./Feedb. Value*.

Parameter 6-14 Terminal 53 Low Ref./Feedb. Value

Table 404: Parameter 6-14 Terminal 53 Low Ref./Feedb. Value

6-14 Terminal 53 Low Ref./Feedb. Value		
Default value: Size related	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the analog input scaling value that corresponds to the low voltage/low current set in *parameter 6-10 Terminal 53 Low Voltage* and *parameter 6-12 Terminal 53 Low Current*.

Parameter 6-15 Terminal 53 High Ref./Feedb. Value

Table 405: Parameter 6-15 Terminal 53 High Ref./Feedb. Value

6-15 Terminal 53 High Ref./Feedb. Value		
Default value: Size related	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the analog input scaling value that corresponds to the maximum reference feedback value set in *parameter 6-11 Terminal 53 High Voltage* and *parameter 6-13 Terminal 53 High Current*.

Parameter 6-16 Terminal 53 Filter Time Constant

Table 406: Parameter 6-16 Terminal 53 Filter Time Constant

6-16 Terminal 53 Filter Time Constant		
Default value: 0.001 s	Parameter type: Range, 0.001 - 10 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

N O T I C E

This parameter cannot be adjusted while the motor is running.

Enter the filter time constant. This constant is a first-order digital low-pass filter time for suppressing electrical noise in terminal 53. A high value improves dampening but also increases the delay through the filter.

5.7.3 6-2* Analog Input 2

Parameters for configuring the scaling and limits for analog input 2 (terminal 54).

Parameter 6-20 Terminal 54 Low Voltage

Table 407: Parameter 6-20 Terminal 54 Low Voltage

6-20 Terminal 54 Low Voltage		
Default value: Size related	Parameter type: Range, -10.00 - par. 6-21 V	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Enter the low voltage value. This analog input scaling value should correspond to the minimum reference value set in *parameter 3-02 Minimum Reference*.

Parameter 6-21 Terminal 54 High Voltage

Table 408: Parameter 6-21 Terminal 54 High Voltage

6-21 Terminal 54 High Voltage		
Default value: 10 V	Parameter type: Range, par. 6-20 V - 10 V	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Enter the high voltage value. This analog input scaling value should correspond to the high reference feedback value set in *parameter 6-25 Terminal 54 High Ref./Feedb. Value*.

Parameter 6-22 Terminal 54 Low Current

Table 409: Parameter 6-22 Terminal 54 Low Current

6-22 Terminal 54 Low Current		
Default value: Size related	Parameter type: Range, par. 0 - par. 6-23 mA	Setup: All setups
Conversion index: -5	Data type: Int16	Change during operation: True

Enter the low current value. This reference signal should correspond to the minimum reference value, set in *parameter 3-02 Minimum Reference*. Enter the value that exceeds 2 mA to activate the live zero timeout function in *parameter 6-01 Live Zero Timeout Function*.

Parameter 6-23 Terminal 54 High Current

Table 410: Parameter 6-23 Terminal 54 High Current

6-23 Terminal 54 High Current		
Default value: 20 mA	Parameter type: Range, par. par. 6-22 mA - 20 mA	Setup: All setups
Conversion index: -5	Data type: Int16	Change during operation: True

Enter the high current value corresponding to the high reference feedback value set in *parameter 6-25 Terminal 54 High Ref./Feedb. Value*.

Parameter 6-24 Terminal 54 Low Ref./Feedb. Value

Table 411: Parameter 6-24 Terminal 54 Low Ref./Feedb. Value

6-24 Terminal 54 Low Ref./Feedb. Value		
Default value: Size related	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setup
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the analog input scaling value that corresponds to the minimum reference feedback value set in *parameter 3-02 Minimum Reference*.

Parameter 6-25 Terminal 54 High Ref./Feedb. Value

Table 412: Parameter 6-25 Terminal 54 High Ref./Feedb. Value

6-25 Terminal 54 High Ref./Feedb. Value		
Default value: Size related	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the analog input scaling value that corresponds to the maximum reference feedback value set in *parameter 3-03 Maximum Reference*.

Parameter 6-26 Terminal 54 Filter Time Constant

Table 413: Parameter 6-26 Terminal 54 Filter Time Constant

6-26 Terminal 54 Filter Time Constant		
Default value: 0.001 s	Parameter type: Range, 0.001 - 10 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

N O T I C E

This parameter cannot be adjusted while the motor is running.

Enter the filter time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal 54. Increasing the value improves dampening but also increases the time delay through the filter.

5.7.4 6-3* Analog Input 3 General Purpose I/O MCB 101

Parameter group for configuring the scale and limits for analog input 3 (X30/11) in VLT® General Purpose I/O MCB 101.

Parameter 6-30 Terminal X30/11 Low Voltage

Table 414: Parameter 6-30 Terminal X30/11 Low Voltage

6-30 Terminal X30/11 Low Voltage		
Default value: Size related	Parameter type: Range, -10.00 - par. 6-31 V	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Sets the analog input scaling value to correspond to the low reference feedback value (set in *parameter 6-34 Term. X30/11 Low Ref./Feedb. Value*).

Parameter 6-31 Terminal X30/11 High Voltage

Table 415: Parameter 6-31 Terminal X30/11 High Voltage

6-31 Terminal X30/11 High Voltage		
Default value: 10 V	Parameter type: Range, par. 6-30 V - 10 V	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Sets the analog input scaling value to correspond to the high reference feedback value (set in *parameter 6-35 Term. X30/11 High Ref./Feedb. Value*).

Parameter 6-34 Term. X30/11 Low Ref./Feedb. Value

Table 416: Parameter 6-34 Term. X30/11 Low Ref./Feedb. Value

6-34 Term. X30/11 Low Ref./Feedb. Value		
Default value: Size related	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setup
Conversion index: -3	Data type: Int32	Change during operation: True

Sets the analog input scaling value to correspond to the low voltage value (set in *parameter 6-30 Terminal X30/11 Low Voltage*).

Parameter 6-35 Term. X30/11 High Ref./Feedb. Value

Table 417: Parameter 6-35 Term. X30/11 High Ref./Feedb. Value

6-35 Term. X30/11 High Ref./Feedb. Value		
Default value: Size related	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Sets the analog input scaling value to correspond to the high-voltage value (set in *parameter 6-31 Terminal X30/11 High Voltage*).

Parameter 6-36 Term. X30/11 Filter Time Constant

Table 418: Parameter 6-36 Term. X30/11 Filter Time Constant

6-36 Term. X30/11 Filter Time Constant		
Default value: 0.001 s	Parameter type: Range, 0.001 - 10 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

N O T I C E

This parameter cannot be adjusted while the motor is running.

Enter the filter time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal X30/11. Increasing the value improves dampening but also increases the time delay through the filter.

5.7.5 6-4* Analog Input X30/12

Parameter group for configuring the scale and limits for analog input 4 (X30/12) in VLT® General Purpose I/O MCB 101.

Parameter 6-40 Terminal X30/12 Low Voltage

Table 419: Parameter 6-40 Terminal X30/12 Low Voltage

6-40 Terminal X30/12 Low Voltage		
Default value: Size related	Parameter type: Range, -10.00 - par. 6-41 V	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Sets the analog input scaling value to correspond to the low reference feedback value set in *parameter 6-44 Term. X30/12 Low Ref./Feedb. Value*.

Parameter 6-41 Terminal X30/12 High Voltage

Table 420: Parameter 6-41 Terminal X30/12 High Voltage

6-41 Terminal X30/12 High Voltage		
Default value: 10 V	Parameter type: Range, par. 6-40 V - 10 V	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Sets the analog input scaling value to correspond to the high reference feedback value set in *parameter 6-45 Term. X30/12 High Ref./Feedb. Value*.

Parameter 6-44 Term. X30/12 Low Ref./Feedb. Value

Table 421: Parameter 6-44 Term. X30/12 Low Ref./Feedb. Value

6-44 Term. X30/12 Low Ref./Feedb. Value		
Default value: Size related	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setup
Conversion index: -3	Data type: Int32	Change during operation: True

Sets the analog output scaling value to correspond to the low voltage value set in *parameter 6-40 Terminal X30/12 Low Voltage*.

Parameter 6-45 Term. X30/12 High Ref./Feedb. Value

Table 422: Parameter 6-45 Term. X30/12 High Ref./Feedb. Value

6-45 Term. X30/12 High Ref./Feedb. Value		
Default value: Size related	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Sets the analog input scaling value to correspond to the high voltage value set in *parameter 6-41 Terminal X30/12 High Voltage*.

Parameter 6-46 Term. X30/12 Filter Time Constant

Table 423: Parameter 6-46 Term. X30/12 Filter Time Constant

6-46 Term. X30/12 Filter Time Constant		
Default value: 0.001 s	Parameter type: Range, 0.001 - 10 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

N O T I C E

This parameter cannot be adjusted while the motor is running.

Enter the filter time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal X30/12. Increasing the value improves dampening but also increases the time delay through the filter.

5.7.6 6-5* Analog Output 1

Parameters for configuring the scaling and limits for analog output 1, that is terminal 42. Analog outputs are current outputs of 0/4–20 mA. Common terminal (terminal 39) is the same terminal and has the same electrical potential for analog common and digital common connection. The resolution on analog output is 12 bit.

Parameter 6-50 Terminal 42 Output

Table 424: Parameter 6-50 Terminal 42 Output

6-50 Terminal 42 Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the function of terminal 42 as an analog current output. Depending on the selection, the output is either a 0–20 mA or 4–20 mA output. The current value can be read out in the LCP in *parameter 16-65 Analog Output 42 [mA]*.

Option	Name	Description
[0]*	No operation	Indicates no signal on the analog output.
[52]	MCO	
[53]	MCO 4–20mA	

Option	Name	Description
[58]	Actual position	**NOTICE** This option is available only with software version 48.XX. The actual position. 0–20 mA corresponds to *parameter 3-06 Minimum Position* to *parameter 3-07 Maximum Position*.
[59]	Actual position 4–20 mA	**NOTICE** This option is available only with software version 48.XX. The actual position. 4–20 mA corresponds to *parameter 3-06 Minimum Position* to *parameter 3-07 Maximum Position*.
[100]	Output frequency	0 Hz = 0 mA; 100 Hz = 20 mA.
[101]	Reference	*Parameter 3-00 Reference Range [Min - Max]* 0% = 0 mA; 100% = 20 mA *Parameter 3-00 Reference Range [-Max - Max]* -100% = 0 mA; 0% = 10 mA; +100% = 20 mA.
[102]	Feedback	
[103]	Motor current	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. **Example:** Inverter normal current (11 kW) is 24 A. 160 %=38.4 A. Motor normal current is 22 A, the readout is 11.46 mA. $\frac{20\text{ mA} \times 22\text{ A}}{38.4\text{ A}} = 11.46\text{ mA}$ When the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{VLT,MAX} \times 100}{I_{Motor,Nom}} = \frac{38.4 \times 100}{22} = 175\,\%$
[104]	Torque rel to limit	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[105]	Torque relate to rated	The torque is related to the motor torque setting.
[106]	Power	Taken from *parameter 1-20 Motor Power [kW]*.
[107]	Speed	Taken from *parameter 3-03 Maximum Reference*. 20 mA equals the value in *parameter 3-03 Maximum Reference*.
[108]	Torque	Torque reference related to 160% torque.
[109]	Max out freq	0 Hz = 0 mA, *parameter 4-19 Max Output Frequency* = 20 mA.
[113]	PID clamped output	
[119]	Torque % lim	
[123]	Speed both dir	

Option	Name	Description
[124]	Speed both dir 4–20 mA	
[130]	Output freq. 4–20mA	0 Hz = 4 mA, 100 Hz = 20 mA.
[131]	Reference 4–20mA	*Parameter 3-00 Reference Range [Min-Max]* 0% = 4 mA; 100% = 20 mA *Parameter 3-00 Reference Range [-Max-Max]* -100% = 4 mA; 0% = 12 mA; +100% = 20 mA.
[132]	Feedback 4–20mA	
[133]	Motor cur. 4–20mA	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 16 mA. Example: Inverter normal current (11 kW) is 24 A. 160% = 38.4 A. Motor normal current is 22 A, the readout is 13.17 mA. $\frac{16\text{ mA} \times 22\text{ A}}{38.4\text{ A}} = 13.17\text{ mA}$ If the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{VLT,MAX} \times 100}{I_{Motor,Nom}} = \frac{38.4 \times 100}{22} = 175\,\%$
[134]	Torq.% lim 4–20mA	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[135]	Torq.% nom 4–20mA	The torque setting is related to the motor torque setting.
[136]	Power 4–20mA	Taken from *parameter 1-20 Motor Power [kW]*.
[137]	Speed 4–20mA	Taken from *parameter 3-03 Maximum Reference*. 20 mA = value in *parameter 3-03 Maximum Reference*.
[138]	Torque 4–20mA	Torque reference related to 160% torque.
[139]	Bus ctrl.	An output value set from fieldbus process data. The output works independently of internal functions in the drive.
[140]	Bus ctrl. 4-20mA	An output value set from fieldbus process data. The output works independently of internal functions in the drive.
[141]	Bus ctrl t.o.	*Parameter 4-54 Warning Reference Low* defines the behavior of the analog output in case of fieldbus timeout.
[142]	Bus ctrl 4-20mA t.o.	*Parameter 4-54 Warning Reference Low* defines the behavior of the analog output in case of fieldbus timeout.
[147]	Main act val	
[148]	Main act val 4-20mA	
[149]	Torque % lim 4-20mA	Analog output at 0 torque is 12 mA. Motoring torque increases the output current to maximum torque limit 20 mA (set in *parameter 4-16 Torque Limit Motor Mode*). Generating torque decreases the output to torque limit in generator mode (set in *parameter 4-17 Torque Limit Generator Mode*) Example: *Parameter 4-16 Torque Limit Motor Mode* = 200% and *parameter 4-17 Torque Limit Generator Mode* = 200%. 20 mA = 200% motoring and 4 mA = 200% generating.

Option	Name	Description
[150]	Max Out Fr 4-20mA	0 Hz = 0 mA, *parameter 4-19 Max Output Frequency* = 20 mA.
[158]	Motor Volt.	
[159]	Motor Volt. 4-20mA	

Parameter 6-51 Terminal 42 Output Min Scale

Table 425: Parameter 6-51 Terminal 42 Output Min Scale

6-51 Terminal 42 Output Min Scale		
Default value: 0%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Scale for the minimum output (0 mA or 4 mA) of the analog signal at terminal 42. Set the value to be the percentage of the full range of the variable selected in *parameter 6-50 Terminal 42 Output*.

Parameter 6-52 Terminal 42 Output Max Scale

Table 426: Parameter 6-52 Terminal 42 Output Max Scale

6-52 Terminal 42 Output Max Scale		
Default value: 100%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Scale the maximum output of the selected analog signal at terminal 42. Set the value to the maximum value of the current signal output. Scale the output to give a current lower than 20 mA at full scale; or 20 mA at an output below 100% of the maximum signal value. If 20 mA is the required output current at a value 0–100% of the full-scale output, program the percentage value in the parameter, that is 50% = 20 mA. If a current 4–20 mA is required at maximum output (100%), calculate the percentage value as follows: 20 mA/desired maximum current x 100%

$$10\ \text{mA}: \frac{20}{10} \times 100 = 200\%$$

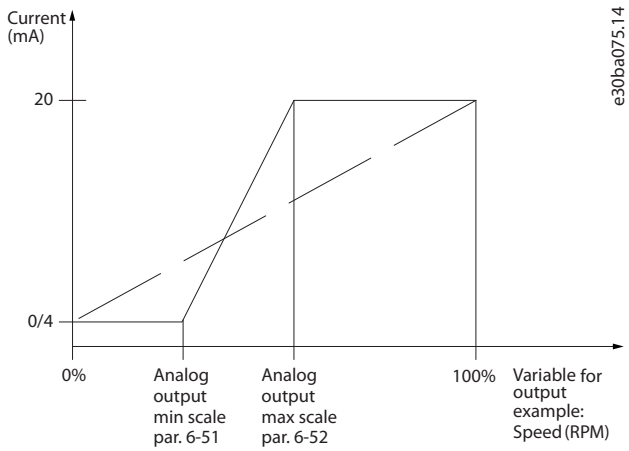


Illustration 70: Output Maximum Scale

Parameter 6-53 Term 42 Output Bus Ctrl

Table 427: Parameter 6-53 Term 42 Output Bus Ctrl

6-53 Term 42 Output Bus Ctrl		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -2	Data type: N2	Change during operation: True

Holds the level of output 42 if controlled by bus.

Parameter 6-54 Term 42 Output Timeout Preset

Table 428: Parameter 6-54 Term 42 Output Timeout Preset

6-54 Term 42 Output Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: -2	Data type: Uint16	Change during operation: True

Holds the preset level of output 42. If a timeout function is selected in *parameter 6-50 Terminal 42 Output*, the output is preset to this level if a fieldbus timeout occurs.

Parameter 6-55 Analog Output Filter

Table 429: Parameter 6-55 Analog Output Filter

6-55 Analog Output Filter		
Default value: [0] Off	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

The following readout parameters from selection in *parameter 6-50 Terminal 42 Output* have a filter selected when *parameter 6-55 Analog Output Filter* is on.

Table 430: Readout Parameters

Selection	0–20 mA	4–20 mA
Motor current (I_{max})	[103]	[133]
Torque limit (0–T_{lim})	[104]	[134]
Rated torque (0–T_{nom})	[105]	[135]
Power (0–P_{nom})	[106]	[136]
Speed (0–$Speed_{max}$)	[107]	[137]

Option	Name	Description
[0]*	Off	Filter off.
[1]	On	Filter on.

5.7.7 6-6* Analog Output 2 MCB 101

Analog outputs are current outputs: 0/4–20 mA. Common terminal (terminal X30/8) is the same terminal and electrical potential for analog common communication. Resolution on analog output is 12 bit.

Parameter 6-60 Terminal X30/8 Output

Table 431: Parameter 6-60 Terminal X30/8 Output

6-60 Terminal X30/8 Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the function of terminal X30/8 as an analog current output. Depending on the selection, the output is either a 0–20 mA or 4–20 mA output. The current value can be read out in the LCP in *parameter 16-65 Analog Output 42 [mA]*.

Option	Name	Description
[0]*	No operation	Indicates no signal on the analog output.
[52]	MCO	
[53]	MCO 4–20mA	
[58]	Actual position	**NOTICE** This option is available only with software version 48.XX. The actual position. 0–20 mA corresponds to *parameter 3-06 Minimum Position* to *parameter 3-07 Maximum Position*.
[59]	Actual position 4–20 mA	**NOTICE** This option is available only with software version 48.XX. The actual position. 4–20 mA corresponds to *parameter 3-06 Minimum Position* to *parameter 3-07 Maximum Position*.
[100]	Output frequency	0 Hz = 0 mA; 100 Hz = 20 mA.
[101]	Reference	*Parameter 3-00 Reference Range [Min - Max]* 0% = 0 mA; 100% = 20 mA *Parameter 3-00 Reference Range [-Max - Max]* -100% = 0 mA; 0% = 10 mA; +100% = 20 mA.
[102]	Feedback	
[103]	Motor current	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. **Example:** Inverter normal current (11 kW) is 24 A. 160 %=38.4 A. Motor normal current is 22 A, the readout is 11.46 mA. $\frac{20\text{ mA} \times 22\ A}{38.4\ A} = 11.46\text{ mA}$ When the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{VLT,MAX} \times 100}{I_{Motor,Nom}} = \frac{38.4 \times 100}{22} = 175\,\%$
[104]	Torque rel to limit	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[105]	Torque relate to rated	The torque is related to the motor torque setting.
[106]	Power	Taken from *parameter 1-20 Motor Power [kW]*.

Option	Name	Description
[107]	Speed	Taken from *parameter 3-03 Maximum Reference*. 20 mA equals the value in *parameter 3-03 Maximum Reference*.
[108]	Torque	Torque reference related to 160% torque.
[109]	Max out freq	0 Hz = 0 mA, *parameter 4-19 Max Output Frequency* = 20 mA.
[113]	PID clamped output	
[117]	Shaft power	
[118]	Shaft power 4–20mA	
[119]	Torque % lim	
[123]	Speed both dir	
[124]	Speed both dir 4–20 mA	
[130]	Output freq. 4–20mA	0 Hz = 4 mA, 100 Hz = 20 mA.
[131]	Reference 4–20mA	*Parameter 3-00 Reference Range [Min-Max]* 0% = 4 mA; 100% = 20 mA *Parameter 3-00 Reference Range [-Max-Max]* -100% = 4 mA; 0% = 12 mA; +100% = 20 mA.
[132]	Feedback 4–20mA	
[133]	Motor cur. 4–20mA	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. Example: Inverter normal current (11 kW) is 24 A. 160% = 38.4 A. Motor normal current is 22 A, the readout is 11.46 mA. $\frac{16\ \text{mA} \times 22\ A}{38.4\ A} = 13.17\ \text{mA}$ If the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{VLT,MAX} \times 100}{I_{Motor,Nom}} = \frac{38.4 \times 100}{22} = 175\ \%$
[134]	Torq.% lim 4–20mA	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[135]	Torq.% nom 4–20mA	The torque setting is related to the motor torque setting.
[136]	Power 4–20mA	Taken from *parameter 1-20 Motor Power [kW]*.
[137]	Speed 4–20mA	Taken from *parameter 3-03 Maximum Reference*. 20 mA = value in *parameter 3-03 Maximum Reference*.
[138]	Torque 4–20mA	Torque reference related to 160% torque.
[139]	Bus ctrl.	An output value set from fieldbus process data. The output works independently of internal functions in the drive.
[140]	Bus ctrl. 4–20mA	An output value set from fieldbus process data. The output works independently of internal functions in the drive.

Option	Name	Description
[141]	Bus ctrl t.o.	*Parameter 4-54 Warning Reference Low* defines the behavior of the analog output in case of field-bus timeout.
[142]	Bus ctrl 4-20mA t.o.	*Parameter 4-54 Warning Reference Low* defines the behavior of the analog output in case of field-bus timeout.
[147]	Main act val	
[148]	Main act val 4-20mA	
[149]	Torque % lim 4-20mA	Analog output at 0 torque is 12 mA. Motoring torque increases the output current to maximum torque limit 20 mA (set in *parameter 4-16 Torque Limit Motor Mode*). Generating torque decreases the output to torque limit in generator mode (set in *parameter 4-17 Torque Limit Generator Mode*) Example: *Parameter 4-16 Torque Limit Motor Mode* = 200% and *parameter 4-17 Torque Limit Generator Mode* = 200%. 20 mA = 200% motoring and 4 mA = 200% generating.
[150]	Max Out Fr 4-20mA	0 Hz = 0 mA, *parameter 4-19 Max Output Frequency* = 20 mA.
[158]	Motor Volt.	
[159]	Motor Volt. 4-20mA	

Parameter 6-61 Terminal X30/8 Min. Scale

Table 432: Parameter 6-61 Terminal X30/8 Min. Scale

6-61 Terminal X30/8 Min. Scale		
Default value: 0%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Scales the minimum output of the selected analog signal on terminal X30/8. Scale the minimum value as a percentage of the maximum signal value. For example, enter the value 25% if the output should be 0 mA at 25% of the maximum output value. The value can never exceed the corresponding setting in *parameter 6-62 Terminal X30/8 Max. Scale* if the value is below 100%. This parameter is active when VLT® General Purpose I/O MCB 101 is mounted in the drive.

Parameter 6-62 Terminal X30/8 Max. Scale

Table 433: Parameter 6-62 Terminal X30/8 Max. Scale

6-62 Terminal X30/8 Max. Scale		
Default value: 100%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Scales the maximum output of the selected analog signal on terminal X30/8. Scale the value to the required maximum value of the current signal output. Scale the output to give a lower current than 20 mA at full scale or 20 mA at an output below 100% of the maximum signal value. If 20 mA is the required output current at a value between 0–100% of the fullscale output, program the percentage value in the parameter, that is 50%=20 mA. If a current 4–20 mA is required at maximum output (100%), calculate the percentage value as follows: 20 mA/desired maximum current x 100%

$$10\ \text{mA}: \frac{20-4}{10} \times 100 = 160\%$$

Parameter 6-63 Terminal X30/8 Bus Control

Table 434: Parameter 6-63 Terminal X30/8 Bus Control

6-63 Terminal X30/8 Bus Control		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -2	Data type: N2	Change during operation: True

Holds the level of output X30/8 if controlled by bus.

Parameter 6-64 Terminal X30/8 Output Timeout Preset

Table 435: Parameter 6-64 Terminal X30/8 Output Timeout Preset

6-64 Terminal X30/8 Output Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: -2	Data type: Uint16	Change during operation: True

Holds the preset level of output X30/8. If a timeout function is selected in *parameter 6-60 Terminal X30/8 Output*, the output is preset to this level if a fieldbus timeout occurs.

5.7.8 6-7* Analog Output 3 MCB 113

Parameters for configuring the scaling and limits for analog output 3, terminals X45/1, and X45/2. Analog outputs are current outputs: 0/4–20 mA. Resolution on analog output is 11 bit.

Parameter 6-70 Terminal X45/1 Output

Table 436: Parameter 6-70 Terminal X45/1 Output

6-70 Terminal X45/1 Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the function of terminal X45/1 as an analog current output.

Option	Name	Description
[0]*	No operation	Indicates no signal on the analog output.
[52]	MCO	
[100]	Output frequency	0 Hz = 0 mA; 100 Hz = 20 mA.
[101]	Reference	*Parameter 3-00 Reference Range [Min - Max]* 0% = 0 mA; 100% = 20 mA *Parameter 3-00 Reference Range [-Max - Max]* -100% = 0 mA; 0% = 10 mA; +100% = 20 mA.
[102]	Feedback	
[103]	Motor current	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. **Example:** Inverter normal current (11 kW) is 24 A. 160 %=38.4 A. Motor normal current is 22 A, the readout is 11.46 mA. $\frac{20\text{ mA} \times 22\ A}{38.4\ A} = 11.46\text{ mA}$ When the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is:

Option	Name	Description
		$\frac{I_{VLT,MAX} \times 100}{I_{Motor,Nom}} = \frac{38.4 \times 100}{22} = 175\,\%$
[104]	Torque rel to limit	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[105]	Torque relate to rated	The torque is related to the motor torque setting.
[106]	Power	Taken from *parameter 1-20 Motor Power [kW]*.
[107]	Speed	Taken from *parameter 3-03 Maximum Reference*. 20 mA equals the value in *parameter 3-03 Maximum Reference*.
[108]	Torque	Torque reference related to 160% torque.
[109]	Max out freq	0 Hz = 0 mA, *parameter 4-19 Max Output Frequency* = 20 mA.
[113]	PID clamped output	
[117]	Shaft power	
[118]	Shaft power 4–20mA	
[119]	Torque % lim	
[123]	Speed both dir	
[124]	Speed both dir 4–20mA	
[130]	Output freq. 4–20mA	0 Hz = 4 mA, 100 Hz = 20 mA.
[131]	Reference 4–20mA	*Parameter 3-00 Reference Range [Min-Max]* 0% = 4 mA; 100% = 20 mA *Parameter 3-00 Reference Range [-Max-Max]* -100% = 4 mA; 0% = 12 mA; +100% = 20 mA.
[132]	Feedback 4–20mA	
[133]	Motor cur. 4–20mA	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. Example: Inverter normal current (11 kW) is 24 A. 160% = 38.4 A. Motor normal current is 22 A, the readout is 11.46 mA. $\frac{16\text{ mA} \times 22\,A}{38.4\,A} = 13.17\text{ mA}$ If the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{VLT,MAX} \times 100}{I_{Motor,Nom}} = \frac{38.4 \times 100}{22} = 175\,\%$
[134]	Torq.% lim 4–20mA	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[135]	Torq.% nom 4–20mA	The torque setting is related to the motor torque setting.
[136]	Power 4–20mA	Taken from *parameter 1-20 Motor Power [kW]*.

Option	Name	Description
[137]	Speed 4–20mA	Taken from *parameter 3-03 Maximum Reference*. 20 mA = value in *parameter 3-03 Maximum Reference*.
[138]	Torque 4–20mA	Torque reference related to 160% torque.
[139]	Bus ctrl.	An output value set from fieldbus process data. The output works independently of internal functions in the drive.
[140]	Bus ctrl. 4–20mA	An output value set from fieldbus process data. The output works independently of internal functions in the drive.
[141]	Bus ctrl t.o.	*Parameter 4-54 Warning Reference Low* defines the behavior of the analog output in case of fieldbus timeout.
[142]	Bus ctrl 4-20mA t.o.	*Parameter 4-54 Warning Reference Low* defines the behavior of the analog output in case of fieldbus timeout.
[147]	Main act val	
[148]	Main act val 4-20mA	
[149]	Torque % lim 4-20mA	Analog output at 0 torque is 12 mA. Motoring torque increases the output current to maximum torque limit 20 mA (set in *parameter 4-16 Torque Limit Motor Mode*). Generating torque decreases the output to torque limit in generator mode (set in *parameter 4-17 Torque Limit Generator Mode*) Example: *Parameter 4-16 Torque Limit Motor Mode* = 200% and *parameter 4-17 Torque Limit Generator Mode* = 200%. 20 mA = 200% motoring and 4 mA = 200% generating.
[150]	Max Out Fr 4-20mA	0 Hz = 0 mA, *parameter 4-19 Max Output Frequency* = 20 mA.
[158]	Motor Volt.	
[159]	Motor Volt. 4-20mA	

Parameter 6-71 Terminal X45/1 Min. Scale

Table 437: Parameter 6-71 Terminal X45/1 Min. Scale

6-71 Terminal X45/1 Min. Scale		
Default value: 0%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Scale the minimum output of the selected analog signal at terminal X45/1 as a percentage of the maximum signal value. For example, if 0 mA (or 0 Hz) is required at 25% of the maximum output value, then program 25%. Scaling values up to 100% can never exceed the corresponding setting in *parameter 6-72 Terminal X45/1 Max. Scale*.

Parameter 6-72 Terminal X45/1 Max. Scale

Table 438: Parameter 6-72 Terminal X45/1 Max. Scale

6-72 Terminal X45/1 Max. Scale		
Default value: 100%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Scale the maximum output of the selected analog signal at terminal X45/1. Set the value to the maximum value of the current signal output. Scale the output to give a current lower than 20 mA at full scale, or 20 mA at an output below 100% of the maximum signal value. If 20 mA is the required output current at a value between 0–100% of the full-scale output, program the percentage value in

the parameter, for example 50% = 20 mA. If a current 4–20 mA is required at maximum output (100%), calculate the percentage value as follows (example where required maximum output is 10 mA):

$$\frac{I_{RANGE}\,[mA]}{I_{DESIRED\,MAX}\,[mA]} \times 100\,\%$$

=

$$\frac{20 - 4\,mA}{10\,mA} \times 100\,\% \;=\; 160\,\%$$

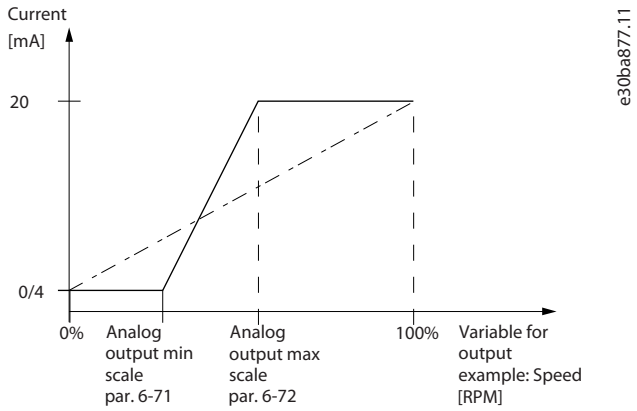


Illustration 71: Output Maximum Scale

Parameter 6-73 Terminal X45/1 Bus Control

Table 439: Parameter 6-73 Terminal X45/1 Bus Control

6-73 Terminal X45/1 Bus Control		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -2	Data type: N2	Change during operation: True

Holds the level of analog output 3 (terminal X45/1) if controlled by bus.

Parameter 6-74 Terminal X45/1 Output Timeout Preset

Table 440: Parameter 6-74 Terminal X45/1 Output Timeout Preset

6-74 Terminal X45/1 Output Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: -2	Data type: Uint16	Change during operation: True

Holds the preset level of analog output 3 (terminal X45/1). If there is a fieldbus timeout and a timeout function is selected in *parameter 6-70 Terminal X45/1 Output*, the output is preset to this level.

5.7.9 6-8* Analog Output 4 MCB 113

Parameters for configuring the scaling and limits for analog output 4, terminals X45/3 and X45/4. Analog outputs are current outputs: 0/4–20 mA. Resolution on analog output is 11 bit.

Parameter 6-80 Terminal X45/3 Output

Table 441: Parameter 6-80 Terminal X45/3 Output

6-80 Terminal X45/3 Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the function of terminal X45/3 as an analog current output.

Option	Name	Description
[0]*	No operation	Indicates no signal on the analog output.
[52]	MCO	
[100]	Output frequency	0 Hz = 0 mA; 100 Hz = 20 mA.
[101]	Reference	*Parameter 3-00 Reference Range [Min - Max]* 0% = 0 mA; 100% = 20 mA *Parameter 3-00 Reference Range [-Max - Max]* -100% = 0 mA; 0% = 10 mA; +100% = 20 mA.
[102]	Feedback	
[103]	Motor current	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. **Example:** Inverter normal current (11 kW) is 24 A. 160 %=38.4 A. Motor normal current is 22 A, the readout is 11.46 mA. $\frac{20\text{ mA} \times 22\,A}{38.4\,A} = 11.46\text{ mA}$ When the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{VLT,MAX} \times 100}{I_{Motor,Nom}} = \frac{38.4 \times 100}{22} = 175\,\%$
[104]	Torque rel to limit	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[105]	Torque relate to rated	The torque is related to the motor torque setting.
[106]	Power	Taken from *parameter 1-20 Motor Power [kW]*.
[107]	Speed	Taken from *parameter 3-03 Maximum Reference*. 20 mA equals the value in *parameter 3-03 Maximum Reference*.
[108]	Torque	Torque reference related to 160% torque.
[109]	Max out freq	0 Hz = 0 mA, *parameter 4-19 Max Output Frequency* = 20 mA.
[113]	PID clamped output	
[117]	Shaft power	
[118]	Shaft power 4–20mA	
[119]	Torque % lim	
[123]	Speed both dir	
[124]	Speed both dir 4–20mA	
[130]	Output freq. 4–20mA	0 Hz = 4 mA, 100 Hz = 20 mA.
[131]	Reference 4–20mA	*Parameter 3-00 Reference Range [Min-Max]* 0% = 4 mA; 100% = 20 mA *Parameter 3-00 Reference Range [-Max-Max]* -100% = 4 mA; 0% = 12 mA; +100% = 20 mA.

Option	Name	Description
[132]	Feedback 4–20mA	
[133]	Motor cur. 4–20mA	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. Example: Inverter normal current (11 kW) is 24 A. 160% = 38.4 A. Motor normal current is 22 A, the readout is 11.46 mA. $\frac{16\ \text{mA} \times 22\ A}{38.4\ A} = 13.17\ \text{mA}$ If the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{VLT,MAX} \times 100}{I_{Motor,Nom}} = \frac{38.4 \times 100}{22} = 175\ \%$
[134]	Torq.% lim 4–20mA	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[135]	Torq.% nom 4–20mA	The torque setting is related to the motor torque setting.
[136]	Power 4–20mA	Taken from *parameter 1-20 Motor Power [kW]*.
[137]	Speed 4–20mA	Taken from *parameter 3-03 Maximum Reference*. 20 mA = value in *parameter 3-03 Maximum Reference*.
[138]	Torque 4–20mA	Torque reference related to 160% torque.
[139]	Bus ctrl.	An output value set from fieldbus process data. The output works independently of internal functions in the drive.
[140]	Bus ctrl. 4–20mA	An output value set from fieldbus process data. The output works independently of internal functions in the drive.
[141]	Bus ctrl t.o.	*Parameter 4-54 Warning Reference Low* defines the behavior of the analog output in case of fieldbus timeout.
[142]	Bus ctrl 4-20mA t.o.	*Parameter 4-54 Warning Reference Low* defines the behavior of the analog output in case of fieldbus timeout.
[147]	Main act val	
[148]	Main act val 4-20mA	
[149]	Torque % lim 4-20mA	Analog output at 0 torque is 12 mA. Motoring torque increases the output current to maximum torque limit 20 mA (set in *parameter 4-16 Torque Limit Motor Mode*). Generating torque decreases the output to torque limit in generator mode (set in *parameter 4-17 Torque Limit Generator Mode*) Example: *Parameter 4-16 Torque Limit Motor Mode* = 200% and *parameter 4-17 Torque Limit Generator Mode* = 200%. 20 mA = 200% motoring and 4 mA = 200% generating.
[150]	Max Out Fr 4-20mA	0 Hz = 0 mA, *parameter 4-19 Max Output Frequency* = 20 mA.
[158]	Motor Volt.	
[159]	Motor Volt. 4-20mA	

Parameter 6-81 Terminal X45/3 Min. Scale

Table 442: Parameter 6-81 Terminal X45/3 Min. Scale

6-81 Terminal X45/3 Min. Scale		
Default value: 0%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Scales the minimum output of the selected analog signal on terminal X45/3. Scale the minimum value as a percentage of the maximum signal value, for example, 0 mA (or 0 Hz) is required at 25% of the maximum output value and 25% is programmed. The value can never exceed the corresponding setting in *parameter 6-82 Terminal X45/3 Max. Scale* if the value is below 100%. This parameter is active when VLT® Extended Relay Card MCB 113 is mounted in the drive.

Parameter 6-82 Terminal X45/3 Max. Scale

Table 443: Parameter 6-82 Terminal X45/3 Max. Scale

6-82 Terminal X45/3 Max. Scale		
Default value: 100%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Scale the maximum output of the selected analog signal at terminal X45/3. Set the value to the maximum value of the current signal output. Scale the output to give a current lower than 20 mA at full scale, or 20 mA at an output below 100% of the maximum signal value. If 20 mA is the required output current at a value between 0–100% of the full-scale output, program the percentage value in the parameter, for example 50% = 20 mA. If a current 4–20 mA is required at maximum output (100%), calculate the percentage value as follows (example where required maximum output is 10 mA):

$$\frac{I_{RANGE}\ [mA]}{I_{DESIRED\ MAX}\ [mA]} \times 100\,\%$$

=

$$\frac{20 - 4\ mA}{10\ mA} \times 100\,\% \ = \ 160\,\%$$

Parameter 6-83 Terminal X45/3 Bus Control

Table 444: Parameter 6-83 Terminal X45/3 Bus Control

6-83 Terminal X45/3 Bus Control		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -2	Data type: N2	Change during operation: True

Holds the level of analog output 4 (terminal X45/3) if controlled by bus.

Parameter 6-84 Terminal X45/3 Output Timeout Preset

Table 445: Parameter 6-84 Terminal X45/3 Output Timeout Preset

6-84 Terminal X45/3 Output Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: -2	Data type: Uint16	Change during operation: True

Holds the preset level of output 4 (X45/3). If there is a fieldbus timeout and a timeout function is selected in *parameter 6-80 Terminal X45/3 Output*, the output is preset to this level.

5.8 Parameter Group 7-** Controllers

5.8.1 Speed PID Droop

This feature implements precise torque sharing between multiple motors on a common mechanical shaft. Speed PID droop is useful for marine and mining applications where redundancy and higher dynamics are required. Speed PID droop allows to reduce inertia by utilizing multiple small motors instead of 1 large motor.

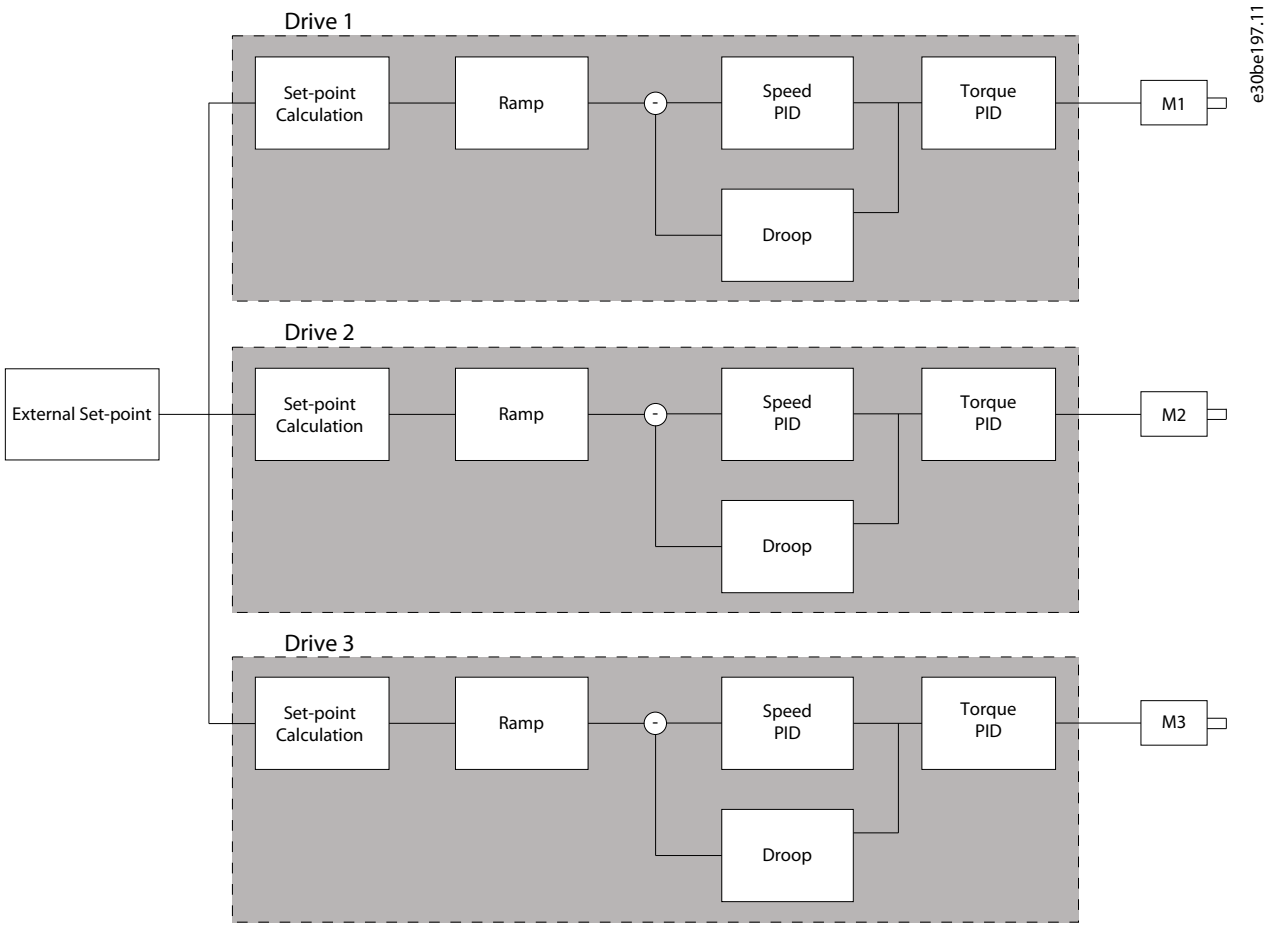


Illustration 72: Concept of Speed PID Droop

The value in *parameter 7-01 Speed PID Droop* ensures that the load is shared equally between the motors. If the torque on the motor is 100% of nominal motor torque, the drive reduces its output to this motor by 100% of the value in *parameter 7-01 Speed PID Droop*. If the torque is 50% of nominal motor torque, the drive reduces its output to this motor by 50% of the value in *parameter 7-01 Speed PID Droop*. This ensures that the motors share the load evenly. A side effect of using speed PID droop is that the actual shaft speed does not match the reference exactly. Speed PID droop is not efficient in low-speed applications because the adjustment range may be insufficient.

Use speed trim if the application requires the following features:

- Accurate speed (the actual shaft speed matches the reference speed).
- Precise speed adjustment down to 0 RPM.

Enabling PID droop

To enable speed PID droop:

- Run the drive in 1 of the following modes:
  - Flux closed loop (*parameter 1-01 Motor Control Principle*, *[3] Flux w/ motor feedb*).
  - Flux sensorless (*parameter 1-01 Motor Control Principle*, *[2] Flux sensorless*).
- Run the drive in speed mode (*parameter 1-00 Configuration Mode*, option *[0] Speed open loop* or *[1] Speed closed loop*).
- Ensure that *parameter 1-62 Slip Compensation* contains the default value (0%).
- Ensure that all drives in the torque sharing system use the same speed reference and start and stop signal.

- Ensure that all drives in the torque sharing system use the same parameter settings.
- Adjust the value in *parameter 7-01 Speed PID Droop*.

N O T I C E

Do not use overvoltage control when using the PID droop function (select *[0] Disabled* in *parameter 2-17 Over-voltage Control*).

N O T I C E

If the speed reference is lower than the value in *parameter 7-01 Speed PID Droop*, the drive makes the PID droop factor equal to the speed reference.

5.8.2 Speed Trim

The speed trim function is an add-on to the speed PID droop. The speed trim provides torque sharing with precise speed down to 0 RPM. The function requires wiring of analog signals.

In speed trim, the master drive runs normal speed PID without droop. The follower drives use the speed PID droop, but instead of reacting on their own load, they compare their own load to the load of other drives in the system. The follower drives then use that data as input for the speed PID droop. A setup with a single source, where the master drive sends information about torque to all followers, is limited by the number of available analog outputs on the master drive. It is possible to use a cascade principle which overcomes this limitation, but makes the control slower and less accurate. The master drive operates in speed mode. The follower drives operate in speed mode with the speed trim. The trim function uses torque data from all drives in the system.

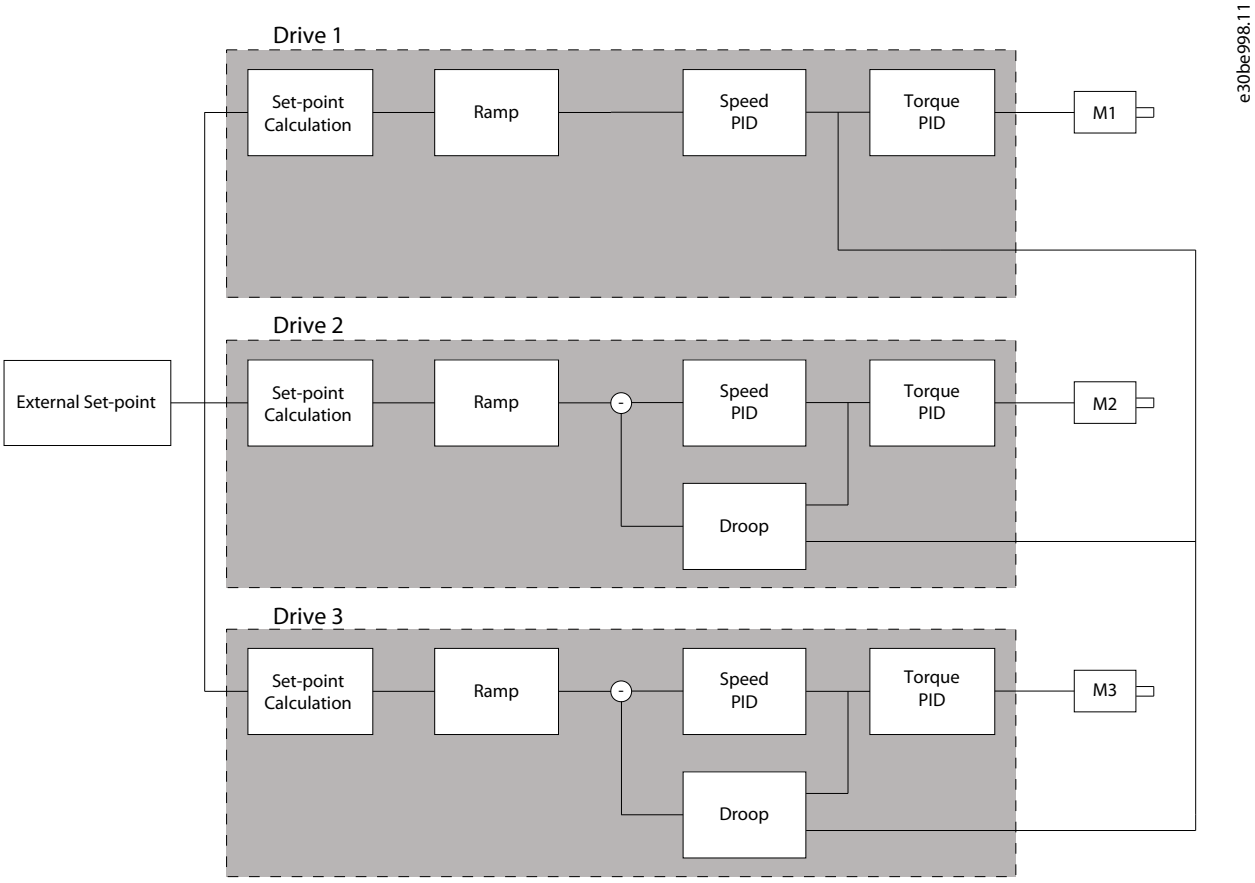


Illustration 73: Speed Trim

The drawing shows a single-source setup where the master sends the torque signal to all followers. The number of available analog outputs on the master limits this setup. To overcome the limitation of the number of analog outputs, use a cascade principle. The cascade principle makes the control slower and less accurate compared with the setup using analog outputs.

5.8.3 7-0* Speed PID Ctrl.

NOTICE

If separate encoders are used (FC 302 only), adjust the ramp-related parameters according to the gear ratio between the 2 encoders.

Parameter 7-00 Speed PID Feedback Source

Table 446: Parameter 7-00 Speed PID Feedback Source

7-00 Speed PID Feedback Source		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

Option	Name	Description
[0]	Motor feedb. P1-02	**NOTICE** This option is only available FC 302. Use the feedback source selected as motor feedback in *parameter 1-02 Flux Motor Feedback Source*.
[1]	24V encoder 32/33	Single signal generated from 24 V High Threshold Logic (HTL) encoder connected to terminals 32 and 33. Configure the 24 V encoder interface in *parameter group 5-7* 24V Encoder Input*. Program terminals 32/33 to *[0] No operation*.
[2]	MCB 102	This is only available for VLT® Encoder Option MCB 102. Configure the encoder interface in *parameter groups 17-0*, 17-1**, and *17-2**.
[3]	MCB 103	This is only available for VLT® Resolver Option MCB 103. Configure the resolver interface in *parameter group 17-5* Resolver Interface*.
[4]	MCO Encoder 1 X56	The MCO encoder 1 X56 is only available with motion control options MCO 305, MCO 350, and MCO 351. Configure the encoder interface in *parameter group 32-3* Encoder 1*.
[5]	MCO Encoder 2 X55	The MCO encoder 1 X56 is only available with motion control options MCO 305, MCO 350, and MCO 351. Configure the encoder interface in *parameter group 32-0* Encoder 2*.
[6]	Analog input 53	
[7]	Analog input 54	
[8]	Frequency input 29	**NOTICE** This option is only available FC 302.
[9]	Frequency input 33	

Option	Name	Description
[11]	MCB15X	
[12]	MCB 102 Absolute	The option is only available for VLT® Encoder Option MCB 102 module option with version 4.00 and newer and when *parameter 17-00 Encoders Connected* is set to *[1] Two Encoders*.
[13]	24V encoder 27/29	Single signal generated from 24 V High Threshold Logic (HTL) encoder connected to terminals 27 and 29. Configure the 24 V encoder interface in *parameter group 5-7* 24V Encoder Input*. Program terminals 27/29 to *[0] No operation*.

Parameter 7-01 Speed PID Droop

Table 447: Parameter 7-01 Speed PID Droop

7-01 Speed PID Droop		
Default value: 0 RPM	Parameter type: Range, 0 - 200 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

The droop function allows the drive to decrease the motor speed proportional to the load. The droop value is directly proportional to the load value. Use the droop function when several motors are mechanically connected and the load on motors can differ. Ensure that *parameter 1-62 Slip Compensation* has a default setting. Enter the droop value at 100% load.

Parameter 7-02 Speed PID Proportional Gain

Table 448: Parameter 7-02 Speed PID Proportional Gain

7-02 Speed PID Proportional Gain		
Default value: 0.015	Parameter type: Range, 0 - 1	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

Enter the speed controller proportional gain. The proportional gain amplifies the error (that is the deviation between the feedback signal and the setpoint). This parameter is used with *parameter 1-00 Configuration Mode [0] Speed open loop* and *[1] Speed closed loop control*. Quick control is obtained at high amplification. Increasing amplification makes the process less stable. For values with 4 decimals, use *parameter 30-83 Speed PID Proportional Gain*.

Parameter 7-03 Speed PID Integral Time

Table 449: Parameter 7-03 Speed PID Integral Time

7-03 Speed PID Integral Time		
Default value: Size related	Parameter type: Range, 1.0 - 20000 ms	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: True

Enter the speed controller integral time, which determines the time the internal PID control takes to correct errors. The greater the error, the more quickly the gain increases. The integral time causes a delay of the signal and therefore a dampening effect and can be used to eliminate steady-state speed error. Obtain quick control through a short integral time, though if the integral time is too short, the process becomes unstable. An excessively long integral time disables the integral action, leading to major deviations from the required reference, since the process regulator takes too long to regulate errors. This parameter is used with *[0] Speed open loop* and *[1] Speed closed loop control*, set in *parameter 1-00 Configuration Mode*.

Parameter 7-04 Speed PID Differentiation Time

Table 450: Parameter 7-04 Speed PID Differentiation Time

7-04 Speed PID Differentiation Time		
Default value: Size related	Parameter type: Range, 0 - 200 ms	Setup: All setups
Conversion index: -4	Data type: Uint16	Change during operation: True

Enter the speed controller differentiation time. The differentiator does not react to constant error. It provides gain proportional to the rate of change of the speed feedback. The quicker the error changes, the stronger the gain from the differentiator. The gain is proportional with the speed at which errors change. Setting this parameter to 0 disables the differentiator. This parameter is used with *parameter 1-00 Configuration Mode*, *[1] Speed closed loop control*.

Parameter 7-05 Speed PID Diff. Gain Limit

Table 451: Parameter 7-05 Speed PID Diff. Gain Limit

7-05 Speed PID Diff. Gain Limit		
Default value: 5	Parameter type: Range, 1 - 20	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Set a limit for the gain provided by the differentiator. Consider limiting the gain at higher frequencies. For example, set up a pure D-link at low frequencies and a constant D-link at higher frequencies. This parameter is used with *parameter 1-00 Configuration Mode*, *[1] Speed closed loop control*.

Parameter 7-06 Speed PID Lowpass Filter Time

Table 452: Parameter 7-06 Speed PID Lowpass Filter Time

7-06 Speed PID Lowpass Filter Time		
Default value: Size related	Parameter type: Range, 0.1 - 100 ms	Setup: All setups
Conversion index: -4	Data type: Uint16	Change during operation: True

N O T I C E

Severe filtering can be detrimental to dynamic performance. This parameter is used with *parameter 1-00 Configuration Mode*, *[1] Speed closed loop* and *[2] Torque control*. Adjust the filter time in flux sensorless to 3–5 ms.

Set a time constant for the speed control low-pass filter. The low-pass filter improves steady-state performance and dampens oscillations on the feedback signal. This is an advantage if there is a great amount of noise in the system. For example, if a time constant (τ) of 100 ms is programmed, the cut-off frequency for the low-pass filter is 1/0.1 = 10 RAD/s, corresponding to (10/2 x π) = 1.6 Hz. The PID regulator only regulates a feedback signal that varies by a frequency of less than 1.6 Hz. If the feedback signal varies by a higher frequency than 1.6 Hz, the PID regulator does not react. Practical settings of *parameter 7-06 Speed PID Lowpass Filter Time* taken from the number of pulses per revolutions from encoder:

Table 453: Speed PID Low-pass Filter Time

Encoder PPR	*Parameter 7-06 Speed PID Lowpass Filter Time* **[ms]**
512	10
1024	5
2048	2
4096	1

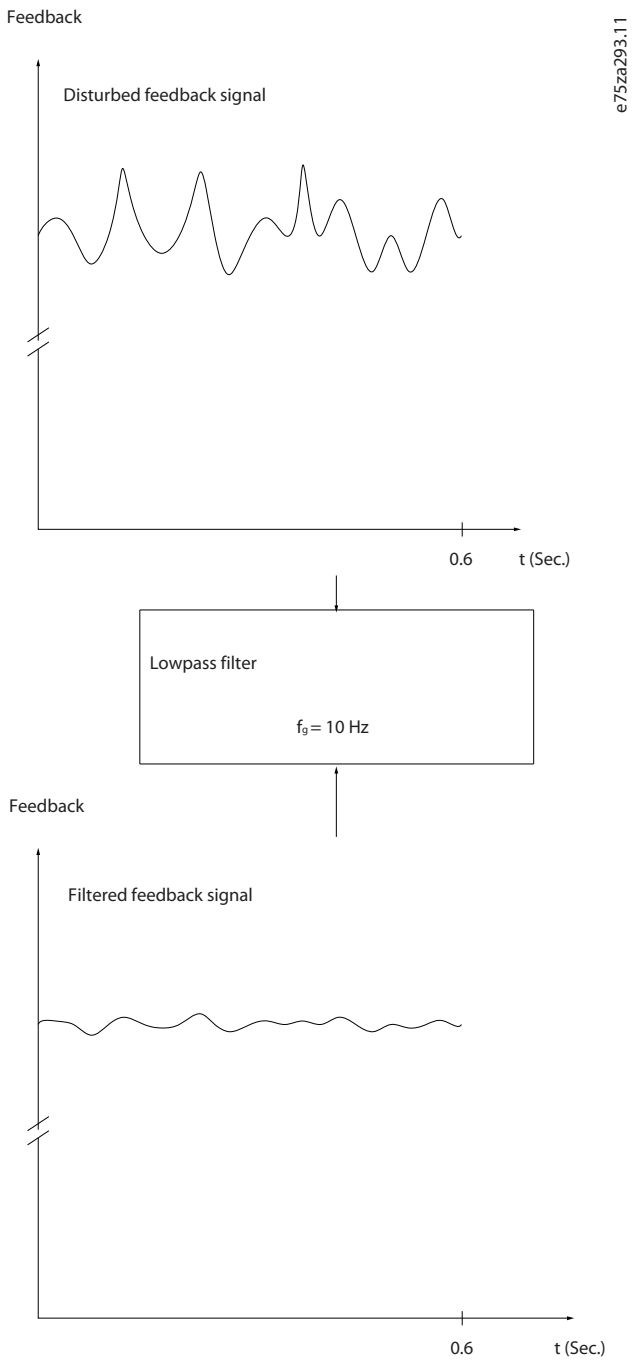


Illustration 74: Feedback Signal

Parameter 7-07 Speed PID Feedback Gear Ratio

Table 454: Parameter 7-07 Speed PID Feedback Gear Ratio

7-07 Speed PID Feedback Gear Ratio		
Default value: 1	Parameter type: Range, 0.0001 - 32.0000	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: False

The drive multiplies the speed feedback by this ratio.

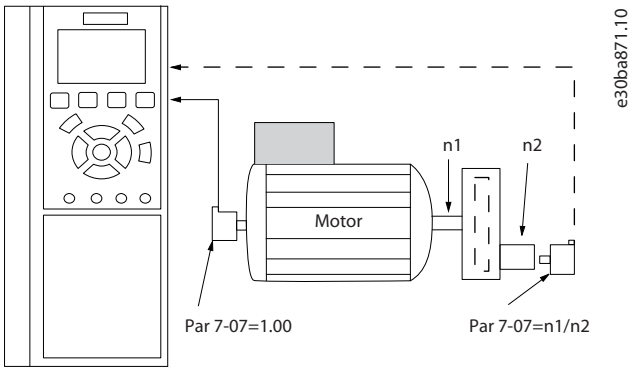


Illustration 75: Speed PID Feedback Gear Ratio

Parameter 7-08 Speed PID Feed Forward Factor

Table 455: Parameter 7-08 Speed PID Feed Forward Factor

7-08 Speed PID Feed Forward Factor		
Default value: 0%	Parameter type: Range, 0 - 500%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

The reference signal bypasses the speed controller by the amount specified. This feature increases the dynamic performance of the speed control loop.

Parameter 7-09 Speed PID Error Correction w/Ramp

Table 456: Parameter 7-09 Speed PID Error Correction w/Ramp

7-09 Speed PID Error Correction w/Ramp		
Default value: Size related	Parameter type: Range, 10 - 100000 RPM	Setup: All setups
Conversion index: 67	Data type: Uint32	Change during operation: True

The speed error between ramp and actual speed is held up against the setting in this parameter. If the speed error exceeds this parameter entry, the speed error is corrected via ramping in a controlled way.

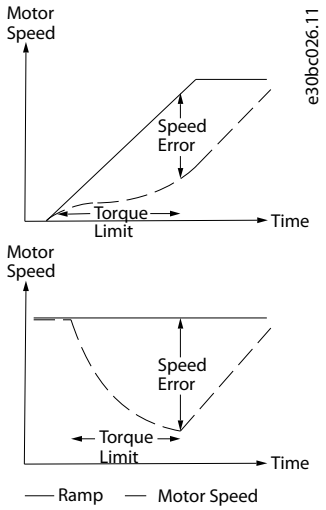


Illustration 76: Speed Error Between Ramp and Actual Speed

5.8.4 7-1* Torque PI Control

Parameters for configuring the torque PI control.

Parameter 7-10 Torque PI Feedback Source
Parameter 7-12 Torque PI Proportional Gain
Parameter 7-13 Torque PI Integration Time
Parameter 7-16 Torque PI Lowpass Filter Time

Table 457: Parameter 7-16 Torque PI Lowpass Filter Time

7-16 Torque PI Lowpass Filter Time		
Default value: 5 ms	Parameter type: Range, 0.1 - 100 ms	Setup: All setups
Conversion index: -4	Data type: Uint16	Change during operation: True

Enter the time constant for the torque control low-pass filter.

Parameter 7-18 Torque PI Feed Forward Factor

Table 458: Parameter 7-18 Torque PI Feed Forward Factor

7-18 Torque PI Feed Forward Factor		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the torque feed-forward factor value. The reference signal bypasses the torque controller by this value.

Parameter 7-19 Current Controller Rise Time

Table 459: Parameter 7-19 Current Controller Rise Time

7-19 Current Controller Rise Time		
Default value: Size related	Parameter type: Range, 15 - 100%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the value for the rise time of the current controller as a percentage of the control period.

5.8.5 7-2* Process Ctrl. Feedb.

Select the feedback sources for the process PID control,and how this feedback should be handled.

Parameter 7-20 Process CL Feedback 1 Resource

Table 460: Parameter 7-20 Process CL Feedback 1 Resource

7-20 Process CL Feedback 1 Resource		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The effective feedback signal is made up of the sum of up to 2 different input signals. Select which drive input should be treated as the source of the 1st of these signals. The 2nd input signal is defined in *parameter 7-22 Process CL Feedback 2 Resource*.

Option	Name	Description
[0]*	No function	
[1]	Analog input 53	
[2]	Analog input 54	
[3]	Frequency input 29	**NOTICE** This option is only available in FC 302.

Option	Name	Description
[4]	Frequency input 33	
[7]	Analog input X30/11	
[8]	Analog input X30/12	
[15]	Analog input X48/2	
[16]	Analog input X49/1	
[17]	Analog input X49/3	
[18]	Analog input X49/5	

Parameter 7-22 Process CL Feedback 2 Resource

Table 461: Parameter 7-22 Process CL Feedback 2 Resource

7-22 Process CL Feedback 2 Resource		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The effective feedback signal is made up of the sum of up to 2 different input signals. Select which drive input should be treated as the source of the 2nd of these signals. The 1st input signal is defined in *parameter 7-20 Process CL Feedback 1 Resource*.

Option	Name	Description
[0]*	No function	
[1]	Analog input 53	
[2]	Analog input 54	
[3]	Frequency input 29	**NOTICE** This option is only available in FC 302.
[4]	Frequency input 33	
[7]	Analog input X30/11	
[8]	Analog input X30/12	
[15]	Analog input X48/2	
[16]	Analog input X49/1	
[17]	Analog input X49/3	
[18]	Analog input X49/5	

5.8.6 7-3* Process PID Ctrl.

Parameter 7-30 Process PID Normal/ Inverse Control

Table 462: Parameter 7-30 Process PID Normal/ Inverse Control

7-30 Process PID Normal/ Inverse Control		
Default value: [0] Normal	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Normal and inverse controls are implemented by introducing a difference between the reference signal and the feedback signal.

Option	Name	Description
[0]*	Normal	Set the process to increase the output frequency.
[1]	Inverse	Set the process to decrease the output frequency.

Parameter 7-31 Process PID Anti Windup

Table 463: Parameter 7-31 Process PID Anti Windup

7-31 Process PID Anti Windup		
Default value: [1] On	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Normal and inverse controls are implemented by introducing a difference between the reference signal and the feedback signal.

Option	Name	Description
[0]	Off	Continue regulation of an error even when the output frequency cannot be increased or decreased.
[1]*	On	Cease regulation of an error when the output frequency can no longer be adjusted.

Parameter 7-32 Process PID Start Speed

Table 464: Parameter 7-32 Process PID Start Speed

7-32 Process PID Start Speed		
Default value: 0 RPM	Parameter type: Range, 0 - 6000 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Enter the motor speed to be attained as a start signal for commencement of PID control. When the power is switched on, the drive starts to ramp and then operates under speed open-loop control. When the process PID start speed is reached, the drive changes to process PID control.

Parameter 7-33 Process PID Proportional Gain

Table 465: Parameter 7-33 Process PID Proportional Gain

7-33 Process PID Proportional Gain		
Default value: 0.10	Parameter type: Range, 0 - 10	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

Enter the PID proportional gain. The proportional gain multiplies the error between the setpoint and the feedback signal.

Parameter 7-34 Process PID Integral Time

Table 466: Parameter 7-34 Process PID Integral Time

7-34 Process PID Integral Time		
Default value: 10000 s	Parameter type: Range, 0.01 - 10000 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the PID integral time. The integrator provides an increasing gain at a constant error between the setpoint and the feedback signal. The integral time is the time needed by the integrator to reach the same gain as the proportional gain.

Parameter 7-35 Process PID Differentiation Time

Table 467: Parameter 7-35 Process PID Differentiation Time

7-35 Process PID Differentiation Time		
Default value: 0 s	Parameter type: Range, 0 - 10 s	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

Enter the PID differentiation time. The differentiator does not react to a constant error, but provides a gain only when the error changes. The shorter the PID differentiation time, the stronger the gain from the differentiator.

Parameter 7-36 Process PID Diff. Gain Limit

Table 468: Parameter 7-36 Process PID Diff. Gain Limit

7-36 Process PID Diff. Gain Limit		
Default value: 5	Parameter type: Range, 1 - 50	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Enter a limit for the differentiator gain. If there is no limit, the differentiator gain increases when there are fast changes. To obtain a pure differentiator gain at slow changes and a constant differentiator gain where fast changes occur, limit the differentiator gain.

Parameter 7-38 Process PID Feed Forward Factor

Table 469: Parameter 7-38 Process PID Feed Forward Factor

7-38 Process PID Feed Forward Factor		
Default value: 0%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the PID feed-forward factor. The factor sends a constant fraction of the reference signal to bypass the PID control, so the PID control only affects the remaining fraction of the control signal. Any change to this parameter affects the motor speed. When the feed-forward factor is activated, it provides less overshoot and high dynamics when changing the setpoint. *Parameter 7-38 Process PID Feed Forward Factor* is active when *parameter 1-00 Configuration Mode* is set to *[3] Process*.

Parameter 7-39 On Reference Bandwidth

Table 470: Parameter 7-39 On Reference Bandwidth

7-39 On Reference Bandwidth		
Default value: 5%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the on-reference bandwidth. When the PID control error (the difference between the reference and the feedback) is less than the value of this parameter, the on-reference status bit is 1.

5.8.7 7-4* Advanced Process PID Ctrl.

N O T I C E

The following parameter is only available in FC 302:

– *Parameter 7-48 PCD Feed Forward*

This parameter group is only used if *parameter 1-00 Configuration Mode* is set to *[7] Extended PID speed CL* or *[8] Extended PID Speed OL*.

Parameter 7-40 Process PID I-part Reset

Table 471: Parameter 7-40 Process PID I-part Reset

7-40 Process PID I-part Reset		
Default value: [0] No	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the feedback source for the torque controller.

Option	Name	Description
[0]*	No	
[1]	Yes	Select *[1] Yes* to reset the I-part of the process PID controller. The selection automatically returns to *[0] No. Resetting* the I-part makes it possible to start from a well-defined point after changing something in the process, for example changing a textile roll.

Parameter 7-41 Process PID Output Neg. Clamp

Table 472: Parameter 7-41 Process PID Output Neg. Clamp

7-41 Process PID Output Neg. Clamp		
Default value: -100%	Parameter type: Range, -100 - par. 7-42 %	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Enter a negative limit for the process PID controller output.

Parameter 7-42 Process PID Output Pos. Clamp

Table 473: Parameter 7-42 Process PID Output Pos. Clamp

7-42 Process PID Output Pos. Clamp		
Default value: 100%	Parameter type: Range, par. 7-41 % - 100%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Enter a positive limit for the process PID controller output.

Parameter 7-43 Process PID Gain Scale at Min. Ref.

Table 474: Parameter 7-43 Process PID Gain Scale at Min. Ref.

7-43 Process PID Gain Scale at Min. Ref.		
Default value: -100%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Enter a scaling percentage to apply to the process PID output when operating at the minimum reference. The scaling percentage is adjusted linearly between the scale at minimum reference (*parameter 7-43 Process PID Gain Scale at Min. Ref.*) and the scale at maximum reference (*parameter 7-44 Process PID Gain Scale at Max. Ref.*).

Parameter 7-44 Process PID Gain Scale at Max. Ref.

Table 475: Parameter 7-44 Process PID Gain Scale at Max. Ref.

7-44 Process PID Gain Scale at Max. Ref.		
Default value: -100%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Enter a scaling percentage to apply to the process PID output when operating at the maximum reference. The scaling percentage is adjusted linearly between the scale at minimum reference (*parameter 7-43 Process PID Gain Scale at Min. Ref.*) and the scale at maximum reference (*parameter 7-44 Process PID Gain Scale at Max. Ref.*).

Parameter 7-45 Process PID Feed Fwd Resource

Table 476: Parameter 7-45 Process PID Feed Fwd Resource

7-45 Process PID Feed Fwd Resource		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	Select which drive input should be used as the feed-forward factor. The factor is added to the output of the PID controller. This increases dynamic performance.
[1]	Analog input 53	
[2]	Analog input 54	
[7]	Frequency input 29	**NOTICE** This option is only available in FC 302.
[8]	Frequency input 33	
[11]	Local bus reference	
[20]	Digital pot.meter	
[21]	Analog input X30/11	
[22]	Analog input X30/12	
[29]	Analog input X48/2	
[32]	Bus PCD	**NOTICE** This option is only available in FC 302. Selects a fieldbus reference configured by *parameter 8-02 Control Word Source*. Change *parameter 8-42 PCD Write Configuration* for the bus used to make the feed forward available in *parameter 7-48 PCD Feed Forward*. Use index 1 for feed forward [748] (and index 2 for reference [1682]).

Parameter 7-46 Process PID Feed Fwd Normal/Inv. Ctrl.

Table 477: Parameter 7-46 Process PID Feed Fwd Normal/Inv. Ctrl.

7-46 Process PID Feed Fwd Normal/Inv. Ctrl.		
Default value: [0] Normal	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Normal	Select *[0] Normal* to set the feed-forward factor to treat the FF resource as a positive value.
[1]	Inverse	Select *[1] Inverse* to treat the feed-forward resource as a negative value.

Parameter 7-48 PCD Feed Forward

Table 478: Parameter 7-48 PCD Feed Forward

7-48 PCD Feed Forward		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter contains the value of *parameter 7-45 Process PID Feed Fwd Resource*, *[32] Bus PCD*.

Parameter 7-49 Process PID Output Normal/Inv. Ctrl.

Table 479: Parameter 7-49 Process PID Output Normal/Inv. Ctrl.

7-49 Process PID Output Normal/Inv. Ctrl.		
Default value: [0] Normal	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Normal	Select *[0] Normal* to use the resulting output from the process PID controller as is.
[1]	Inverse	Select *[1] Inverse* to invert the resulting output from the process PID controller. This operation is performed after the feed-forward factor is applied.

5.8.8 7-5* Ext. Process PID Ctrl.

This parameter group is only used if *parameter 1-00 Configuration Mode* is set to *[7] Extended PID speed CL* or *[8] Extended PID Speed OL*.

Parameter 7-50 Process PID Extended PID

Table 480: Parameter 7-50 Process PID Extended PID

7-50 Process PID Extended PID		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	Disabled	Disable the extended parts of the process PID controller.
[1]*	Enabled	Enable the extended parts of the PID controller.

Parameter 7-51 Process PID Feed Fwd Gain

Table 481: Parameter 7-51 Process PID Feed Fwd Gain

7-51 Process PID Feed Fwd Gain		
Default value: 1	Parameter type: Range, 0 - 100	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

The feed forward is used to obtain the required level based on a well-known signal available. The PID controller then only takes care of the smaller part of the control, necessary because of unknown characters. The standard feed-forward factor in *parameter 7-38 Process PID Feed Forward Factor* is always related to the reference, whereas *parameter 7-51 Process PID Feed Fwd Gain* has more options. In winder applications, the feed-forward factor is typically the line speed of the system.

Parameter 7-52 Process PID Feed Fwd Ramp Up

Table 482: Parameter 7-52 Process PID Feed Fwd Ramp Up

7-52 Process PID Feed Fwd Ramp Up		
Default value: 0.01 s	Parameter type: Range, 0.01 - 10 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Controls the dynamics of the feed-forward signal when ramping up.

Parameter 7-53 Process PID Feed Fwd Ramp Down

Table 483: Parameter 7-53 Process PID Feed Fwd Ramp Down

7-53 Process PID Feed Fwd Ramp Down		
Default value: 0.01 s	Parameter type: Range, 0.01 - 10 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Controls the dynamics of the feed-forward signal when ramping down.

Parameter 7-56 Process PID Ref. Filter Time

Table 484: Parameter 7-56 Process PID Ref. Filter Time

7-56 Process PID Ref. Filter Time		
Default value: 0.001 s	Parameter type: Range, 0.001 - 1 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

Set a time constant for the reference first-order low-pass filter. The low-pass filter improves steady-state performance and dampens oscillations on the reference/feedback signals. However, severe filtering can be detrimental to dynamic performance.

Parameter 7-57 Process PID Fb. Filter Time

Table 485: Parameter 7-57 Process PID Fb. Filter Time

7-57 Process PID Fb. Filter Time		
Default value: 0.001 s	Parameter type: Range, 0.001 - 1 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

Set a time constant for the feedback first-order low-pass filter. The low-pass filter improves steady-state performance and dampens oscillations on the reference/ feedback signals. However, severe filtering can be detrimental to dynamic performance.

5.8.9 7-9* Position PI Ctrl.

Parameter 7-90 Position PI Feedback Source

Table 486: Parameter 7-90 Position PI Feedback Source

7-90 Position PI Feedback Source		
Default value: [0] Motor feedb. P1-02	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Select the feedback source for the position PI controller.

Option	Name	Description
[0]*	Motor feedb. P1-02	Use the feedback source selected as motor feedback in *parameter 1-02 Flux Motor Feedback Source*.
[1]	24V encoder 32/33	Single signal generated from 24 V High Threshold Logic (HTL) encoder connected to terminals 32 and 33. Configure the 24 V encoder interface in *parameter group 5.7* 24V Encoder Input*. Program terminals 32/33 to *[0] No operation*.
[2]	MCB 102	This is only available for VLT® Encoder Option MCB 102. Configure the encoder interface in *parameter groups 17-0*, 17-1*,* and *17-2**.
[3]	MCB 103	This is only available for VLT® Resolver Option MCB 103. Configure the resolver interface in *parameter group 17-5* Resolver Interface*.
[4]	MCO encoder 1 X56	The MCO encoder 1 X56 is only available with motion control options MCO 305, MCO 350, and MCO 351. Configure the encoder interface in *parameter group 32-3* Encoder 1*.
[5]	MCO encoder 2 X55	The MCO encoder 2 X55 is only available with motion control options MCO 305, MCO 350, and MCO 351. Configure the encoder interface in *parameter group 32-0* Encoder 2*.
[11]	MCB 15X	
[12]	MCB 102 absolute	The option is only available for VLT® Encoder Option MCB 102 with version 4.00 and newer and when *parameter 17-00 Encoders Connected* is set to *[1] Two Encoders*.
[13]	24V encoder 27/29	Single signal generated from 24 V High Threshold Logic (HTL) encoder connected to terminals 27 and 29. Configure the 24 V encoder interface in *parameter group 5.7* 24V Encoder Input*. Program terminals 27/29 to *[0] No operation*.
[20]	None	No position feedback is received. This means that actual position remains unchanged. For example, when the drive is used for operating a 2nd motor without change in position via setup change.

Parameter 7-91 Position PI Droop

Table 487: Parameter 7-91 Position PI Droop

7-91 Position PI Droop		
Default value: 0.0 °	Parameter type: Range, 0.0 - 360.0 °	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Enter the motor angle deviation at 100% load in a load sharing system. The system is 2 or more mechanically connected motors in positioning or synchronization mode. In positioning mode, configure *parameter 7-01 Speed PID Droop* to allow a speed deviation.

Parameter 7-92 Position PI Proportional Gain

Table 488: Parameter 7-92 Position PI Proportional Gain

7-92 Position PI Proportional Gain		
Default value: 0.0150	Parameter type: Range, 0.000 - 1.000	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX.

Enter the proportional gain for the position PI controller. Increasing the gain value makes the control more dynamic but less stable. 0=Off.

Parameter 7-93 Position PI Integral Time

Table 489: Parameter 7-93 Position PI Integral Time

7-93 Position PI Integral Time		
Default value: 20000.0 ms	Parameter type: Range, 1.0 - 20000.0 ms	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX.

Enter the integral time for the position PI controller. Decreasing the value makes the control more dynamic but less stable. 20000=Off.

Parameter 7-94 Position PI Feedback Scale Numerator

Table 490: Parameter 7-94 Position PI Feedback Scale Numerator

7-94 Position PI Feedback Scale Numerator		
Default value: 1	Parameter type: Range, -2000000000 - 2000000000	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX.

This parameter is the numerator in the equation which defines the gear ratio between the motor and the feedback device when the feedback device is not mounted on the motor shaft. Encoder revolutions =

$$\frac{\text{Par. } 7-94}{\text{Par. } 7-95} \times \text{Motor revolutions}$$

Parameter 7-95 Position PI Feebback Scale Denominator

Table 491: Parameter 7-95 Position PI Feebback Scale Denominator

7-95 Position PI Feebback Scale Denominator		
Default value: 1	Parameter type: Range, -2000000000 - 2000000000	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

See *parameter 7-94 Position PI Feedback Scale Numerator*.

Parameter 7-97 Position PI Max Speed Above Master

Table 492: Parameter 7-97 Position PI Max Speed Above Master

7-97 Position PI Max Speed Above Master		
Default value: 98%	Parameter type: Range, 0 - 110%	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Enter the value by which the follower speed is allowed to exceed the actual master speed. Valid only in synchronization mode.

Parameter 7-98 Position PI Feed Forward Factor

Table 493: Parameter 7-98 Position PI Feed Forward Factor

7-98 Position PI Feed Forward Factor		
Default value: 98%	Parameter type: Range, 0 - 110%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Enter the amount by which the speed reference calculated by the profile generator is allowed to bypass the position PI controller.

Parameter 7-99 Position PI Minimum Ramp Time

Table 494: Parameter 7-99 Position PI Minimum Ramp Time

7-99 Position PI Minimum Ramp Time		
Default value: 0.010 s	Parameter type: Range, 0.000 - 3600.000 s	Setup: All setups
Conversion index: -3	Data type: Uint32	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Enter the shortest ramp time for the output of the Position PI controller. Use this parameter to limit acceleration when correcting large position deviations, for example when starting synchronization with a running master or after recovering from an overload situation during positioning.

5.9 Parameter Group 8-** Communications and Options

5.9.1 8-0* General Settings

Parameter 8-01 Control Site

Table 495: Parameter 8-01 Control Site

8-01 Control Site		
Default value: [0] Digital and ctrl. word	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The setting in this parameter overrides the settings in *parameter 8-50 Coasting Select* to *parameter 8-56 Preset Reference Select*.

Option	Name	Description
[0]*	Digital and ctrl.word	Use both digital input and control word.
[1]	Digital only	Use digital inputs only.
[2]	Controlword only	Use control word only.

Parameter 8-02 Control Word Source

Table 496: Parameter 8-02 Control Word Source

8-02 Control Word Source		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the source of the control word: 1 of 2 serial interfaces or 4 installed options. During initial power-up, the drive automatically sets this parameter to *[3] Option A* if it detects a valid fieldbus option installed in slot A. When the option is removed, the drive detects a configuration change, sets *parameter 8-02 Control Word Source* to default setting *[1] FC RS485*, and trips. If an option is installed after initial power-up, the setting of *parameter 8-02 Control Word Source* does not change, but the drive trips and shows: *Alarm 67, Option Changed*. When retrofitting a bus option into a drive that did not have a bus option installed earlier, change the control to bus-based. This change is required for safety reasons to avoid an unintended change.

Option	Name	Description
[0]	None	
[1]	FC RS485	
[2]	FC USB	
[3]	Option A	
[4]	Option B	
[5]	Option C0	
[6]	Option C1	
[30]	External Can	
[35]	Option A fast	**NOTICE** This option is only available in FC 302.

Option	Name	Description
		Same as option *[3] Option A*. The reference is transferred faster and without jitter, which ensures more stability and dynamic control. Moreover, all other references are ignored, which means that the drive is controlled by the A-option reference only.
[37]	Option C0 fast	**NOTICE** This option is only available in FC 302. Same as option *[5] Option C0*. The reference is transferred faster and without jitter, which ensures more stability and dynamic control. Moreover, all other references are ignored, which means that the drive is controlled by the C-option reference only.

Parameter 8-03 Control Word Timeout Time

Table 497: 8-03 Control Word Timeout Time

8-03 Control Word Timeout Time		
Default value: 1 s	Parameter type: Range, 0.1 - 18000 s	Setup: 1 setup
Conversion index: -1	Data type: Uint32	Change during operation: True

Enter the maximum time expected to pass between the reception of 2 consecutive telegrams. If this time is exceeded, it indicates that the serial communication has stopped. The function selected in *parameter 8-04 Control Word Timeout Function* is then carried out. A valid control word triggers the timeout counter.

Parameter 8-04 Control Word Timeout Function

Table 498: Parameter 8-04 Control Word Timeout Function

8-04 Control Word Timeout Function		
Default value: Size related	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Select the timeout function. The timeout function activates when the control word fails to be updated within the time period specified in *parameter 8-03 Control Word Timeout Time*.

NOTICE

To change the setup after a timeout, configure as follows:

- 1. Set *parameter 0-10 Active Set-up* to *[9] Multi setup*.
- 2. Select the relevant link in *parameter 0-12 This Set-up Linked to*.

Option	Name	Description
[0]	Off	Resumes control via fieldbus (fieldbus or standard), using the most recent control word.
[1]	Freeze output	Freezes output frequency until communication resumes.
[2]	Stop	Stops with auto restart when communication resumes.
[3]	Jogging	Runs the motor at jog frequency until communication resumes.
[4]	Max. speed	Runs the motor at maximum frequency until communication resumes.
[5]	Stop and trip	Stops the motor, then resets the drive to restart:

Option	Name	Description
		• Via the fieldbus. • Via [Reset]. • Via a digital input.
[6]	Qstop and trip	**NOTICE** This option is only available with software version 48.XX. Stops the motor with the quick stop ramp (*parameter 3-81 Quick Stop Ramp Time*). Perform a reset to restart the drive.
[7]	Select setup 1	Changes the setup after a control word timeout. If communication resumes after a timeout, *parameter 8-05 End-of-Timeout Function* either resumes the setup used before the timeout, or retains the setup endorsed by the timeout function.
[8]	Select setup 2	See *[7] Select set-up 1*.
[9]	Select setup 3	See *[7] Select set-up 1*.
[10]	Select setup 4	See *[7] Select set-up 1*.
[26]	Trip	

Parameter 8-05 End-of-Timeout Function

Table 499: Parameter 8-05 End-of-Timeout Function

8-05 End-of-Timeout Function		
Default value: [1] Resume set-up	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Select the action after receiving a valid control word following a timeout. This parameter is active only when *parameter 8-04 Control Word Timeout Function* is set to:

- *[7] Setup 1*
- *[8] Setup 2*
- *[9] Setup 3*
- *[10] Setup 4*

Option	Name	Description
[0]	Hold set-up	Retains the setup selected in *parameter 8-04 Control Word Timeout Function* and shows a warning until *parameter 8-06 Reset Control Word Timeout* toggles. Then the drive resumes its original setup.
[1]*	Resume setup	Resumes the setup that was active before the timeout.

Parameter 8-06 Reset Control Word Timeout

Table 500: Parameter 8-06 Reset Control Word Timeout

8-06 Reset Control Word Timeout		
Default value: [0] Do not reset	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter is active only when *[0] Hold set-up* has been selected in *parameter 8-05 End-of-Timeout Function*.

Option	Name	Description
[0]*	Do not reset	Retains the setup specified in *parameter 8-04 Control Word Timeout Function*, following a control word timeout.
[1]	Do reset	Restores the drive to the original setup following a control word timeout. The drive resets and then immediately reverts to the *[0] Do not reset* setting.

Parameter 8-07 Diagnosis Trigger

Table 501: Parameter 8-07 Diagnosis Trigger

8-07 Diagnosis Trigger		
Default value: [0] Disable	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter has no function for DeviceNet.

Option	Name	Description
[0]*	Disable	
[1]	Trigger on alarms	
[2]	Trigger alarm/warn.	

Parameter 8-08 Readout Filtering

Table 502: Parameter 8-08 Readout Filtering

8-08 Readout Filtering		
Default value: Size related	Parameter type: Option, Array [1]	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Use this function if the speed feedback value readouts on the fieldbus fluctuate. Select *[1] Motor Data LP-Filter* if the function is required. A power cycle is required for changes to take effect.

Option	Name	Description
[0]	Motor data Std-Filt.	Normal fieldbus readouts.
[1]	Motor data LP-Filter	Filtered fieldbus readouts of the following parameters: • *Parameter 16-10 Power [kW]* • *Parameter 16-11 Power [hp]* • *Parameter 16-12 Motor Voltage* • *Parameter 16-14 Motor current* • *Parameter 16-16 Torque [Nm]* • *Parameter 16-17 Speed [RPM]* • *Parameter 16-22 Torque [%]* • *Parameter 16-25 Torque [Nm] High*

5.9.2 8-1* Ctrl. Word Settings

Parameter 8-10 Control Word Profile

Table 503: Parameter 8-10 Control Word Profile

8-10 Control Word Profile		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the interpretation of the control and status words corresponding to the installed fieldbus. Only the selections valid for the fieldbus installed in slot A are visible in the LCP display. For guidelines in selection of *[0] FC profile* and *[1] PROFIdrive profile*, refer to the product-specific design guide. For more guidelines in the selection of *[1] PROFIdrive profile*, refer to the Installation Guide for the installed fieldbus.

Option	Name	Description
[0]	FC profile	
[1]	PROFIdrive profile	
[3]	FC motion profile	**N O T I C E** This option is only available with software version 48.XX. Assigns motion-specific functions to various control and status word bits. This option is available when *[9] Positioning* or *[10] Synchronization* is selected in *parameter 1-00 Configuration Mode*.
[5]	ODVA	
[7]	CANopen DSP 402	
[8]	MCO	

Parameter 8-13 Configurable Status Word STW

Table 504: Parameter 8-13 Configurable Status Word STW

8-13 Configurable Status Word STW		
Default value: Size related	Parameter type: Option, Array [16]	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the interpretation of the control and status words corresponding to the installed fieldbus. Only the selections valid for the fieldbus installed in slot A are visible in the LCP display. For more guidelines in the selection of *[1] PROFIdrive profile*, refer to the Installation Guide for the installed fieldbus.

Option	Name	Description
[0]	No function	The input is always low.
[1]	Profile default	Dependent on the profile set in *parameter 8-10 Control Profile*.
[2]	Alarm 68 Only	The input goes high whenever *Alarm 68 Safe Stop Activated* is active and goes low whenever *Alarm 68 Safe Stop Activated* is not activated.
[3]	Trip excl Alarm 68	

Option	Name	Description
[4]	Position error	**NOTICE** This option is only available with software version 48.XX. The position is outside its limits set in *parameter 3-06 Minimum Position* and *parameter 3-07 Maximum Position*.
[5]	Position limit	**NOTICE** This option is only available with software version 48.XX. The position error exceeds the value in *parameter 4-71 Maximum Position* for the time set in *parameter 4-72 Position Error Timeout*.
[6]	Touch on target	**NOTICE** This option is only available with software version 48.XX. Target position is reached in touch probe position mode.
[7]	Touch activated	**NOTICE** This option is only available with software version 48.XX. Touch probe positioning is active. The drive monitors the touch probe sensor input.
[8]	Touch sensor found	**NOTICE** This option is only available with software version 48.XX. The touch sensor has been detected.
[9]	Vir. master on ref	**NOTICE** This option is only available with software version 48.XX. The virtual master is running on the set reference.
[10]	T18DI status	
[11]	T19DI status	
[12]	T27DI status	
[13]	T29DI status	
[14]	T32DI status	
[15]	T33DI status	
[16]	T37DI status	The input goes high whenever T37 has 0 V and goes low whenever T37 has 24 V.
[17]	X30/2 DI status	
[18]	X30/3 DI status	

Option	Name	Description
[19]	X30/4 DI status	
[20]	CTW timeout toggle inverse	
[21]	Thermal warning	
[22]	Execution distance extended	**NOTICE** This option is only available with software version 48.9X. Indicates that the offset execution distance (set in *parameter 17-95 Offset Execution Distance*) has been extended due to speed/ramp limitation.
[29]	Protection mode	
[30]	Brake fault (IGBT)	
[40]	Out of ref range	
[49]	Derate active	
[54]	Running	
[59]	On reference	
[60]	Comparator 0	
[61]	Comparator 1	
[62]	Comparator 2	
[63]	Comparator 3	
[64]	Comparator 4	
[65]	Comparator 5	
[66]	Comparator 6	
[67]	Comparator 7	
[68]	Comparator 8	
[69]	Comparator 9	
[70]	Logic rule 0	
[71]	Logic rule 1	
[72]	Logic rule 2	
[73]	Logic rule 3	
[74]	Logic rule 4	
[75]	Logic rule 5	
[76]	Logic rule 6	
[77]	Logic rule 7	
[78]	Logic rule 8	

Option	Name	Description
[79]	Logic rule 9	
[80]	SL digital out A	
[81]	SL digital out B	
[82]	SL digital out C	
[83]	SL digital out D	
[84]	SL digital out E	
[85]	SL digital out F	
[86]	ATEX ETR cur. alarm	
[87]	ATEX ETR freq. alarm	
[88]	ATEX ETR cur. warning	
[89]	ATEX ETR freq. warning	
[90]	Safe function active	
[91]	Safe opt. reset. req.	
[92]	IGBT-cooling	
[96]	Reverse after ramp	**NOTICE** This option is available only with software version 48.XX. Indicates if the direction of rotation should be reversed. Depends on whether the speed reference is positive or negative after the ramp specified in *parameter 16-48 Speed Ref. After Ramp [RPM]*.
[181]	Prev. maintenance	
[196]	Emcy mode is active	The drive is operating in emergency mode. See *parameter group 24-0* Emergency Mode*.
[197]	Emcy mode was active	The drive has been operating in emergency mode.
[198]	Emcy mode limits	During emergency mode operation, 1 of the critical alarms has been activated and suppressed by emergency mode. This may lead to reduced drive performance and expected operation lifetime before service is required.
[200]	User defined alerts	
[210]	Pos. set acknowledge	**NOTICE** This parameter is only available with software version 48.9X. Acknowledge activation of the set target position.
[231]	In power lim. mot.	**NOTICE** This option is only available in FC 302. See *parameter group 4-8* Power Limit*. Use this option in motor mode only.

Option	Name	Description
[232]	In power lim. gen.	**NOTICE** This option is only available in FC 302. See *parameter group 4-8* Power Limit*. Use this option in generating mode only.
[233]	In power limit	**NOTICE** This option is only available in FC 302. See *parameter group 4-8* Power Limit*. Use this option in both motor and generating modes.
[234]	Emcy m. OPR unexpected	Emergency mode is not operating as expected, for example, live zero monitoring on an analog input is activated.
[254]	Testing emcy mode	Emergency mode was activated in a special test mode where the drive stops on all alarms.

Parameter 8-14 Configurable Control Word CTW

Table 505: Parameter 8-14 Configurable Control Word CTW

8-14 Configurable Control Word CTW		
Default value: [1] Profile default	Parameter type: Option, Array [16]	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

This is an array parameter with 16 elements, 1 element for each bit in range 0–15. Each of the bits can be configured to any of the following options.

Option	Name	Description
[0]	None	The drive ignores the information in this bit.
[1]*	Profile default	Dependent on the profile set in *parameter 8-10 Control Profile*.
[2]	CTW valid, active low	If set to 1, the drive ignores the remaining bits of the control word.
[3]	Safe option reset	This function is only available in bits 12–15 of the control word if a safety option is mounted in the drive. The reset is executed on a 0⇒1 transition and resets the safety option as set in *parameter 42-24 Restart behavior*.
[4]	PID error inverse	Inverts the resulting error from the process PID controller. Available only if *parameter 1-00 Configuration Mode* is set to *[6] Surface Winder*, *[7] Extended PID Speed OL*, or *[8] Extended PID Speed CL*.
[5]	PID reset I part	Resets the I-part of the process PID controller. Equivalent to *parameter 7-40 Process PID I-part Reset*. Available only if *parameter 1-00 Configuration Mode* is set to *[6] Surface Winder*, *[7] Extended PID Speed OL*, or *[8] Extended PID Speed CL*.
[6]	PID enable	Enables the extended process PID controller. Equivalent to *parameter 7-50 Process PID Extended PID*. Available only if *parameter 1-00 Configuration Mode* is set to *[6] Surface Winder*, *[7] Extended PID Speed OL*, or *[8] Extended PID Speed CL*.
[7]	External interlock	
[10]	Bit 10 = 0>CTW timeout	

Option	Name	Description
[11]	Start homing	**NOTICE** This option is only available with software version 48.XX. Starts the homing function selected in *parameter 17-80 Homing Function*. Must remain high until homing is done, otherwise homing is aborted.
[12]	Activate touch	**NOTICE** This option is only available with software version 48.XX. Activates monitoring of the touch sensor input.
[13]	Sync. to pos mode	**NOTICE** This option is only available with software version 48.XX. Select positioning in synchronization mode.
[14]	Ramp 2	**NOTICE** This option is only available with software version 48.XX. Select between ramp 1 (*parameter group 3-4* Ramp 1*) and ramp 2 (*parameter group 3-5* Ramp 2*).
[15]	Relay 1	Control relay 1.
[16]	Relay 2	Control relay 1.
[17]	Speed mode	**NOTICE** This option is only available with software version 48.XX. Select the speed mode when *[9] Positioning* or *[10] Synchronization* is selected in *parameter 1-00 Configuration Mode*. Speed reference is set by reference resource 1 or fieldbus REF1 relative to *parameter 3-03 Maximum Reference*.
[18]	Enable vir. master	**NOTICE** This option is only available with software version 48.XX. Enable the signal for the virtual master function. The option is applicable when *[10] Synchronization* is selected in *parameter 1-00 Configuration Mode*.
[19]	Enable mast. offset	**NOTICE** This option is only available with software version 48.XX. Activates the master offset selected in *parameter 3-26 Master Offset* when *parameter 17-93 Master Offset Selection* has a selection from *[1] Absolute* to *[5] Relative Touch Sensor*.
[20]	Control word toggle command	Changes the sign of the set target position. For example, if the set target is 1000, the activation of this option changes the value to -1000.

Option	Name	Description
[21]	Target inverse	**NOTICE** This option is only available with software version 48.XX. Changes the sign of the set target position. For example, if the set target is 1000, the activation of this option changes the value to -1000.
[22]	Digital out 27	
[23]	Digital out 29	
[24]	Digital out X30/6	
[25]	Digital out X30/7	
[26]	Home sensor	**NOTICE** This option is only available with software version 48.XX. **NOTICE** Accuracy of the home position depends on the delay in transferring the signals. The home sensor is connected via fieldbus master.
[27]	Touch sensor	**NOTICE** This option is only available with software version 48.XX. **NOTICE** Accuracy of touch probe positioning depends on the delay in transferring the signals. The touch sensor is connected via fieldbus master.
[28]	Position vir. master	**NOTICE** This option is only available with software version 48.XX. Activates position-controlled virtual master when *[9] Positioning* or *[10] Synchronization* is selected in *parameter 1-00 Configuration Mode*. When the option is selected, the following occurs: • Target position is set by Fieldbus Pos Ref or preset target is as defined in *parameter 3-20 Preset Target*. • Speed is set relative to *parameter 3-27 Virtual Master Max Ref* by the source selected in *parameter 3-15 Reference Resource 1* or fieldbus REF1. • Acceleration and deceleration are set as defined in *parameter group 3-6* Ramp 3*.
[29]	Set master home	**NOTICE** This option is only available with software version 48.XX. Sets the actual master position as defined in *parameter 17-88 Master Home Position*.

Option	Name	Description
[30]	Set vir. mas. pos. to actual	**NOTICE** This option is only available with software version 48.XX. Bit for setting the virtual master position = the actual follower position. This is needed for setting the correct starting position for position-controlled virtual master ensuring that the virtual master ensuring that the virtual master position is aligned with the physical position of the follower.
[31]	Activate CAM table	**NOTICE** This option is only available with software version 48.XX. Signal for activating a new CAM table while running with bumpless transfer.
[32]	Halt	
[33]	Bit 10 = 0 > CTW TO always	
[78]	Reset preventive maintenance word	
[94]	Light load detection	Use this option to ensure drive runs in the direction which requires least energy (UPS capacity), during an emergency.
[95]	Evacuation mode	Use this function to operate the drive at reduced DC voltage for evacuating people in case of power failure.
[189]	Emergency mode	
[190]	Emcy mode ref bit 0	Enables a choice between 1 of the 8 preset references.
[191]	Emcy mode ref bit 1	Enables a choice between 1 of the 8 preset references.
[192]	Emcy mode ref bit 2	Enables a choice between 1 of the 8 preset references.
[195]	Test emcy mode	Emergency mode is activated in a special test mode where the drive stops on all alarms.
[231]	Power limit mot.	**NOTICE** This option is only available in FC 302. See *parameter group 4-8* Power Limit*. Use this option in the motor mode only.
[232]	Power limit gen.	**NOTICE** This option is only available in FC 302. See *parameter group 4-8* Power Limit*. Use this option in the generating mode only.

Option	Name	Description
[233]	Power limit both	**NOTICE** This option is only available in FC 302. See *parameter group 4-8* Power Limit*. Use this option in both the motor and the generating modes.
[234]	Light load+evacuation	**NOTICE** This option is only available in FC 302. Use this option to ensure that the drive runs in the direction which requires least energy (UPS capacity), during an emergency and to operate the drive at reduced DC-voltage for evacuating people in case of power failure.
[235]	Setup bit 0	
[236]	Setup bit 1	

Parameter 8-17 Configurable Alarm and Warning Word

Table 506: Parameter 8-17 Configurable Alarm and Warningword

8-17 Configurable Alarm and Warningword		
Default value: [0] Off	Parameter type: Option, Array [16]	Setup: All setups
Conversion index: –	Data type: Uint16	Change during operation: True

The configurable alarm and warning word has 16 bits (0–15). Each of those bits can be configured to any of the following options.

Option	Name	Description
[0]*	Off	
[1]	10 Volts low warning	
[2]	Live zero warning	
[3]	No motor warning	
[4]	Mains phase loss warning	
[5]	DC link voltage high warning	
[6]	DC link voltage low warning	
[7]	DC overvoltage warning	
[8]	DC undervoltage warning	
[9]	Inverter overloaded warning	
[10]	Motor ETR overtemp warning	
[11]	Motor thermistor overtemp warning	
[12]	Torque limit warning	
[13]	Over current warning	

Option	Name	Description
[14]	Earth fault warning	
[17]	Controlword timeout warning	
[19]	Discharge temp high warning	
[22]	Hoist mech brake warning	
[23]	Internal fans warning	
[24]	External fans warning	
[25]	Brake resistor short circuit warning	
[26]	Brake powerlimit warning	
[27]	Brake chopper short circuit warning	
[28]	Brake check warning	
[29]	Heatsink temperature warning	
[30]	Motor phase U warning	
[31]	Motor phase V warning	
[32]	Motor phase W warning	
[34]	Fieldbus communication warning	
[36]	Mains failure warning	
[40]	T27 overload warning	
[41]	T29 overload warning	
[45]	Earth fault 2 warning	
[47]	24V supply low warning	
[58]	AMA internal fault warning	
[59]	Current limit warning	
[60]	External interlock warning	
[61]	Feedback error warning	
[62]	Frequency max warning	
[64]	Voltage limit warning	
[65]	Controlboard overtemp warning	
[66]	Heatsink temp low warning	
[68]	Safe stop warning	
[73]	Safe stop autorestart warning	
[76]	Power unit setup warning	
[77]	Reduced powermode warning	

Option	Name	Description
[78]	Tracking error warning	
[89]	Mech brake sliding warning	
[10002]	Live zero error alarm	
[10003]	No motor alarm	
[10004]	Mains phase loss alarm	
[10007]	DC overvoltage alarm	
[10008]	DC undervoltage alarm	
[10009]	Inverter overload alarm	
[10010]	ETR overtemperature alarm	
[10011]	Thermistor overtemp alarm	
[10012]	Torque limit alarm	
[10013]	Overcurrent alarm	
[10014]	Earth fault alarm	
[10016]	Short circuit alarm	
[10017]	CTW timeout alarm	
[10022]	Hoist brake alarm	
[10026]	Brake powerlimit alarm	
[10027]	Brakechopper shortcircuit alarm	
[10028]	Brake check alarm	
[10029]	Heatsink temp alarm	
[10030]	Phase U missing alarm	
[10031]	Phase V missing alarm	
[10032]	Phase W missing alarm	
[10033]	Inrush fault alarm	
[10034]	Fieldbus com fault alarm	
[10036]	Mains failure alarm	
[10037]	Phase imbalance alarm	
[10038]	Internal fault	
[10039]	Heatsink sensor alarm	
[10045]	Earth fault 2 alarm	
[10046]	Powercard supply alarm	
[10047]	24V supply alarm	

Option	Name	Description
[10048]	1.8V supply low alarm	
[10049]	Speed limit alarm	
[10060]	Ext interlock alarm	
[10061]	Feedback error alarm	
[10063]	Mech brake low alarm	
[10065]	Controlboard overtemp alarm	
[10067]	Option config changed alarm	
[10068]	Safe stop alarm	
[10069]	Powercard temp alarm	
[10073]	Safestop auto restart alarm	
[10074]	PTC thermistor alarm	
[10075]	Illegal profile alarm	
[10078]	Tracking error alarm	
[10079]	Illegal PS config alarm	
[10081]	CSIV corrupt alarm	
[10082]	CSIV param error alarm	
[10084]	No safety option alarm	
[10090]	Feedback monitor alarm	
[10091]	AI54 settings alarm	
[10164]	ATEX ETR current lim alarm	
[10166]	ATEX ETR freq limit alarm	

Parameter 8-19 Product Code

Table 507: Parameter 8-19 Product Code

8-19 Product Code		
Default value: Size related	Parameter type: Range, 0 - 2147483647, Array [2]	Setup: 1 setup
Conversion index: 0	Data type: Uint32	Change during operation: True

Select 0 to read out the actual fieldbus product code according to the mounted fieldbus option. Select 1 to read out the actual vendor ID.

5.9.3 8-2* Counters

Parameter 8-20: Invalid Memory Write Counter

Table 508: Parameter 8-20: Invalid Memory Write Counter

8-20: Invalid Memory Write Counter		
Default value: 0	Parameter type: Range (0 - 65535)	4-setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

5.9.4 8-3* FC Port Settings

Parameter 8-30 Protocol

Table 509: Parameter 8-30 Protocol

8-30 Protocol		
Default value: [0] FC	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Select the protocol to be used. Changing protocol is not effective until after powering off the drive.

Option	Name	Description
[0]*	FC	
[1]	FC MC	
[2]	Modbus RTU	

Parameter 8-31 Address

Table 510: Parameter 8-31 Address

8-31 Address		
Default value: 1	Parameter type: Range, 1 - 247	Setup: 1 setup
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the address for the drive (standard) port. Valid range: Depends on the selected protocol.

Parameter 8-32 FC Port Baud Rate

Table 511: Parameter 8-32 FC Port Baud Rate

8-32 FC Port Baud Rate		
Default value: Size related	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	2400 Baud	Baud rate selection for the FC (standard) port.
[1]	4800 Baud	
[2]	9600 Baud	
[3]	19200 Baud	
[4]	38400 Baud	

Option	Name	Description
[5]	57600 Baud	
[6]	76800 Baud	
[7]	115200 Baud	

Parameter 8-33 Parity/Stop Bits

Table 512: Parameter 8-33 Parity/Stop Bits

8-33 Parity/Stop Bits		
Default value: [0] Even parity, 1 stop bit	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Even parity, 1 stop bit	
[1]	Odd parity, 1 stop bit	
[2]	No parity, 1 stop bit	
[3]	No parity, 2 stop bits	

Parameter 8-34 Estimated Cycle Time

Table 513: Parameter 8-34 Estimated Cycle Time

8-34 Estimated Cycle Time		
Default value: 0 ms	Parameter type: Range, 0 - 1000000 ms	Setup: 2 setups
Conversion index: -3	Data type: Uint32	Change during operation: True

In noisy environments, the interface may be blocked due to overload or bad frames. This parameter specifies the time between 2 consecutive frames on the network. If the interface does not detect valid frames in that time, it flushes the receive buffer.

Parameter 8-35 Minimum Response Delay

Table 514: Parameter 8-35 Minimum Response Delay

8-35 Minimum Response Delay		
Default value: 10 ms	Parameter type: Range, 1 - 10000 ms	Setup: 1 setup
Conversion index: -3	Data type: Uint16	Change during operation: True

Specify the minimum delay time between receiving a request and transmitting a response. This is used for overcoming modem turnaround delays.

Parameter 8-36 Max Response Delay

Table 515: Parameter 8-36 Max Response Delay

8-36 Max Response Delay		
Default value: Size related	Parameter type: Range, 11 - 10001 ms	Setup: 1 setup
Conversion index: -3	Data type: Uint16	Change during operation: True

Specify the maximum allowed delay time between transmitting a request and receiving a response. If a response from the drive exceeds the time setting, then it is discarded.

Parameter 8-37 Max Inter-Char Delay

Table 516: Parameter 8-37 Max Inter-Char Delay

8-37 Max Inter-Char Delay		
Default value: Size related	Parameter type: Range, 0.00 - 35.00 ms	Setup: 1 setup
Conversion index: -5	Data type: Uint16	Change during operation: True

Specify the maximum allowed time interval between receipt of 2 bytes. This parameter activates timeout if transmission is interrupted. This parameter is active only when *parameter 8-30 Protocol* is set to *[1] FC MC protocol*.

Parameter 8-39 Protocol/Profile Firmware Version

Table 517: Parameter 8-39 Protocol/Profile Firmware Version

8-39 Protocol/Profile Firmware Version		
Default value: 0	Parameter type: Range, 0 - 10, Array [8]	Setup: All setups
Conversion index: 0	Data type: VisibleString [10]	Change during operation: False

This parameter shows the firmware revision as follows:

- Index [0] = FC
- Index [1] = Modbus
- Index [2] = Metasys N2
- Index [3] = FLN
- Index [4] = BACnet
- Index [5] = Future native protocol
- Index [6] = PROFIdrive profile
- Index [7] = DS402 profile

5.9.5 8-4* FC MC Protocol Set

Parameter 8-40 Telegram Selection

Table 518: Parameter 8-40 Telegram Selection

8-40 Telegram Selection		
Default value: [1] Standard telegram 1	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[1]*	Standard telegram 1	Enables use of freely configurable telegrams or standard telegrams for the FC port.
[100]	None	
[101]	PPO 1	
[102]	PPO 2	
[103]	PPO 3	
[104]	PPO 4	
[105]	PPO 5	
[106]	PPO 6	
[107]	PPO 7	

Option	Name	Description
[108]	PPO 8	
[200]	Custom telegram 1	Enables use of freely configurable telegrams or standard telegrams for the FC port.
[202]	Custom telegram 3	

Parameter 8-41 Parameters for Signals

Table 519: Parameter 8-41 Parameters for Signals

8-41 Parameters for Signals		
Default value: [0] None	Parameter type: Option, Array [1000]	Setup: All setups
Conversion index: –	Data type: Uint16	Change during operation: False

Option	Name	Description
[0]*	None	
[15]	Readout: actual setup	
[302]	Minimum reference	
[303]	Maximum reference	
[312]	Catch up/slow down value	
[321]	Touch target	
[322]	Master scale numerator	
[323]	Master scale denominator	
[326]	Master offset	
[328]	Master offset speed ref	
[341]	Ramp 1 ramp up time	
[342]	Ramp 1 ramp down time	
[351]	Ramp 2 ramp up time	
[352]	Ramp 2 ramp down time	
[380]	Jog/homing ramp time	
[381]	Quick stop ramp time	
[411]	Motor speed low limit [RPM]	
[412]	Motor speed low limit [Hz]	
[413]	Motor speed high limit [RPM]	
[414]	Motor speed high limit [Hz]	
[416]	Torque limit motor mode	
[417]	Torque limit generator mode	
[482]	Power limit motor mode	

Option	Name	Description
[483]	Power limit generator mode	
[491]	Positive speed limit [RPM]	
[492]	Positive speed limit [Hz]	
[493]	Negative speed limit [RPM]	
[494]	Negative speed limit [Hz]	
[495]	Positive torque limit	
[496]	Negative torque limit	
[553]	Term. 29 high ref./feedb. value	
[558]	Term. 33 high ref./feedb. value	
[590]	Digital & relay bus control	
[593]	Pulse out #27 bus control	
[595]	Pulse out #29 bus control	
[597]	Pulse out #X30/6 bus control	
[615]	Terminal 53 high ref./feedb. value	
[625]	Terminal 54 high ref./feedb. value	
[653]	Term 42 output bus ctrl	
[663]	Terminal X30/8 bus control	
[673]	Terminal X54/1 bus control	
[683]	Terminal X54/3 bus control	
[702]	Speed PID proportional gain	
[703]	Speed PID integral time	
[708]	Speed PID feed forward factor	
[748]	PCD feed forward	
[890]	Bus jog 1 speed	
[891]	Bus jog 2 speed	
[1397]	Alert alarm word	
[1398]	Alert warning word	
[1399]	Alert status word	
[1472]	Legacy alarm word	
[1473]	Legacy warning word	
[1474]	Leg. ext. status word	
[1500]	Operating hours	

Option	Name	Description
[1501]	Running hours	
[1502]	kWh counter	
[1600]	Control word	
[1601]	Reference [unit]	
[1602]	Reference %	
[1603]	Status word	
[1605]	Main actual value [%]	
[1606]	Actual position	
[1607]	Target position	
[1608]	Position error	
[1609]	Custom readout	
[1610]	Power [kW]	
[1611]	Power [hp]	
[1612]	Motor voltage	
[1613]	Frequency	
[1614]	Motor current	
[1615]	Frequency [%]	
[1616]	Torque [Nm]	
[1617]	Speed [RPM]	
[1618]	Motor thermal	
[1619]	Thermistor sensor temperature	
[1620]	Motor angle	
[1621]	Torque [%] high res.	
[1622]	Torque [%]	
[1623]	Motor shaft power [kW]	
[1624]	Calibrated	
[1625]	Torque [Nm] high	
[1628]	Angle error	
[1630]	DC link voltage	
[1632]	Brake energy /s	
[1633]	Brake energy average	
[1634]	Heatsink temp.	

Option	Name	Description
[1635]	Inverter thermal	
[1638]	SL controller state	
[1639]	Control card temp.	
[1642]	Service log counter	
[1644]	Speed error [RPM]	
[1645]	Motor phase U current	
[1646]	Motor phase V current	
[1647]	Motor phase W current	
[1648]	Speed ref. after ramp [RPM]	
[1650]	External reference	
[1651]	Pulse reference	
[1652]	Feedback [Unit]	
[1653]	Digi pot reference	
[1657]	Feedback [RPM]	
[1660]	Digital input	
[1661]	Terminal 53 switch setting	
[1662]	Analog input 53	
[1663]	Terminal 54 switch setting	
[1664]	Analog input 54	
[1665]	Analog output 42 [mA]	
[1666]	Digital output [bin]	
[1667]	Freq. input #29 [Hz]	
[1668]	Freq. input #33 [Hz]	
[1669]	Pulse output #27 [Hz]	
[1670]	Pulse output #29 [Hz]	
[1671]	Relay output [bin]	
[1672]	Counter A	
[1673]	Counter B	
[1674]	Prec. stop counter	
[1675]	Analog in X30/11	
[1676]	Analog in X30/12	
[1677]	Analog out X30/8 [mA]	

Option	Name	Description
[1678]	Analog out X45/1 [mA]	
[1679]	Analog out X45/3 [mA]	
[1680]	Fieldbus CTW 1	
[1681]	Fieldbus sync. REF	
[1682]	Fieldbus REF 1	
[1683]	Fieldbus pos. REF	
[1684]	Comm. option STW	
[1685]	FC port CTW 1	
[1686]	FC port REF 1	
[1687]	Bus readout alarm/warning	
[1688]	Fieldbus torque FF	
[1689]	Configurable alarm/warning word	
[1690]	Alarm word	
[1691]	Alarm word 2	
[1692]	Warning word	
[1693]	Warning word 2	
[1694]	Ext. status word	
[1695]	Ext. status word 2	
[1696]	Maintenance word	
[1697]	Alarm word 3	
[1698]	Warning word 3	
[1782]	Home position	
[1783]	Homing speed	
[1788]	Master home position	
[1804]	Mech brake count	
[1820]	Commanded position	
[1821]	Master position	
[1823]	Virtual master pos.	
[1826]	Fieldbus sync. delta REF	
[1827]	Safe opt. est. speed	
[1828]	Safe opt. meas. speed	
[1829]	Safe opt. speed error	

Option	Name	Description
[1836]	Analog input X48/2 [mA]	
[1837]	Temp. input X48/4	
[1838]	Temp. input X48/7	
[1839]	Temp. input X48/10	
[1840]	Analog input X49/1	
[1841]	Analog input X49/3	
[1842]	Analog input X49/5	
[1843]	Analog out X49/7	
[1844]	Analog out X49/9	
[1845]	Analog out X49/11	
[1846]	X49 digital output [bin]	
[1860]	Digital input 2	
[1899]	Speed PID torque FF. [Nm]	
[3310]	Sync factor master	
[3311]	Sync factor slave	
[3440]	Digital inputs	
[3441]	Digital outputs	
[3450]	Actual position	
[3451]	Commanded position	
[3452]	Actual master position	
[3453]	Slave index position	
[3454]	Master index position	
[3455]	Curve position	
[3456]	Track error	
[3457]	Synchronizing error	
[3458]	Actual velocity	
[3459]	Actual master velocity	
[3460]	Synchronizing status	
[3461]	Axis status	
[3462]	Program status	
[3644]	Terminal X49/7 bus control	
[3654]	Terminal X49/9 bus control	

Option	Name	Description
[3664]	Terminal X49/11 bus control	
[4029]	B-EMF protection log readout	
[4280]	Safe option status	
[4282]	Safe control word	
[4283]	Safe status word	
[4285]	Active safe func.	
[4287]	Time until manual test	

Parameter 8-42 PCD Write Configuration

Table 520: Parameter 8-42 PCD Write Configuration

8-42 PCD Write Configuration		
Default value: Size related	Parameter type: Range, 0 - 9999, Array [64]	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Select the parameters to be assigned to the telegrams of the PCD. The number of available PCDs depends on the telegram type. The values in the PCDs are then written to the selected parameters as data values.

Parameter 8-43 PCD Read Configuration

Table 521: Parameter 8-43 PCD Read Configuration

8-43 PCD Read Configuration		
Default value: Size related	Parameter type: Range, 0 - 9999, Array [64]	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Select the parameters to be assigned to the PCDs of the telegrams. The number of available PCDs depends on the telegram type. PCDs contain the actual data values of the selected parameters.

Block Transfer Mode (BTM)

When Block Transfer Mode (BTM) is enabled, the parameters are written into a temporary buffer in the drive via the fieldbus. After wiring all the required parameters to the drive in BTM mode, a Commit command is sent to the drive. The drive ensures correct adaptation of the parameters.

Parameter 8-45 BTM Transaction Command

Table 522: Parameter 8-45 BTM Transaction Command

8-45 BTM Transaction Command		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

Option	Name	Description
[0]*	Off	
[1]	Write to active setup	

Option	Name	Description
[2]	Commit transaction	Commit all parameters that have been sent during BTM mode.
[3]	Clear error	When *parameter 8-46 BTM Transaction Status* shows an error (3–8), the parameter must be cleared by setting this value.
[4]	Write to setup 1	**NOTICE** This option is only available with software version 9.XX.
[5]	Write to setup 2	**NOTICE** This option is only available with software version 9.XX.
[6]	Write to setup 3	**NOTICE** This option is only available with software version 9.XX.
[7]	Write to setup 4	**NOTICE** This option is only available with software version 9.XX.
[8]	Cancel BTM transaction	**NOTICE** This option is only available with software version 9.XX. Abort any BTM activity. Parameters are not committed.

Parameter 8-46 BTM Transaction Status

Table 523: Parameter 8-46 BTM Transaction Status

8-46 BTM Transaction Status		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Off	
[1]	Transaction started	
[2]	Commit transaction	
[3]	Transaction timeout	
[4]	Err. non-existing par.	
[5]	Err. par. out of range	

Option	Name	Description
[6]	Transaction failed	
[7]	SO config check	
[8]	SO config check done	

Parameter 8-47 BTM Timeout

Table 524: Parameter 8-47 BTM Timeout

8-47 BTM Timeout		
Default value: 60 s	Parameter type: Range, 1 - 360 s	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: False

Select the BTM timeout after a BTM transaction has been started. Timeout is between each acyclic write of parameters.

Parameter 8-48 BTM Maximum Errors

Table 525: Parameter 8-48 BTM Maximum Errors

8-48 BTM Maximum Errors		
Default value: 21	Parameter type: Range, 0 - 21	Setup: 1 setup
Conversion index: 0	Data type: Uint8	Change during operation: True

Select the maximum allowed number of bulk transfer mode errors before aborting. If it is set to maximum, there is no abort.

Parameter 8-49 BTM Error Log

Table 526: Parameter 8-49 BTM Error Log

8-49 BTM Error Log		
Default value: Size related	Parameter type: Range, 0.000 - 9999.255, Array [22]	Setup: 1 setup
Conversion index: -3	Data type: Uint32	Change during operation: True

List of parameters that failed during bulk transfer mode. The value after the decimal break is the fault code (255 stands for no error).

5.9.6 8-5* Digital/Bus

Parameters for configuring the control word merging.

N O T I C E

These parameters are only active when *parameter 8-01 Control Site* is set to *[0] Digital and control word*.

Parameter 8-50 Coasting Select

Table 527: Parameter 8-50 Coasting Select

8-50 Coasting Select		
Default value: [3] Logic OR	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the trigger for the coasting function.

Option	Name	Description
[0]	Digital input	A digital input triggers the coasting function.
[1]	Bus	A serial communication port or the fieldbus triggers the coasting function.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the coasting function.
[3]*	Logic OR	The fieldbus/serial communication port or a digital input triggers the coasting function.

Parameter 8-51 Quick Stop Select

Table 528: Parameter 8-51 Quick Stop Select

8-51 Quick Stop Select		
Default value: [3] Logic OR	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the trigger for the quick stop function.

Option	Name	Description
[0]	Digital input	A digital input triggers the quick stop function.
[1]	Bus	A serial communication port or the fieldbus triggers the quick stop function.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the quick stop function.
[3]*	Logic OR	The fieldbus/serial communication port or a digital input triggers the quick stop function.

Parameter 8-52 DC Brake Select

Table 529: Parameter 8-52 DC Brake Select

8-52 DC Brake Select		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select control of the DC brake via the terminals (digital input) and/or via the fieldbus.

N O T I C E

When *parameter 1-10 Motor Construction* is set to *[1] PM non-salient SPM*, only selection *[0] Digital input* is available.

Option	Name	Description
[0]	Digital input	Activate a start command via a digital input.
[1]	Bus	Activate a start command via a serial communication port or fieldbus option.
[2]	Logic AND	Activate a start command via the fieldbus/serial communication port and also via 1 of the digital inputs.
[3]	Logic OR	Activate a start command via the fieldbus/serial communication port or via 1 of the digital inputs.

Parameter 8-53 Start Select

Table 530: Parameter 8-53 Start Select

8-53 Start Select		
Default value: [3] Logic OR	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the trigger for the start function.

Option	Name	Description
[0]	Digital input	A digital input triggers the start function.
[1]	Bus	A serial communication port or the fieldbus triggers the start function.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the start function.
[3]*	Logic OR	The fieldbus/serial communication port or a digital input triggers the start function.

Parameter 8-54 Reversing Select

Table 531: Parameter 8-54 Reversing Select

8-54 Reversing Select		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the trigger for the reversing function.

Option	Name	Description
[0]	Digital input	A digital input triggers the reversing function.
[1]	Bus	A serial communication port or the fieldbus triggers the reversing function.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the reversing function.
[3]	Logic OR	The fieldbus/serial communication port or a digital input triggers the reversing function.

Parameter 8-55 Set-up Select

Table 532: Parameter 8-55 Set-up Select

8-55 Set-up Select		
Default value: [3] Logic OR	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the trigger for the setup selection.

Option	Name	Description
[0]	Digital input	A digital input triggers the setup selection.
[1]	Bus	A serial communication port or the fieldbus triggers the setup selection.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the setup selection.
[3]*	Logic OR	The fieldbus/serial communication port or a digital input triggers the setup selection.

Parameter 8-56 Preset Reference Select

Table 533: Parameter 8-56 Preset Reference Select

8-56 Preset Reference Select		
Default value: [3] Logic OR	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the trigger for the preset reference selection.

Option	Name	Description
[0]	Digital input	A digital input triggers the preset reference selection.
[1]	Bus	A serial communication port or the fieldbus triggers the preset reference selection.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the preset reference selection.
[3]*	Logic OR	The fieldbus/serial communication port or a digital input triggers the preset reference selection.

Parameter 8-57 PROFIdrive OFF2 Select

Table 534: Parameter 8-57 PROFIdrive OFF2 Select

8-57 PROFIdrive OFF2 Select		
Default value: [3] Logic OR	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select control of the drive OFF2 selection via the terminals (digital input) and/or via the fieldbus. This parameter is active only when *parameter 8-01 Control Site* is set to *[0] Digital and ctrl. word* and *parameter 8-10 Control Word Profile* is set to *[1] PROFIdrive profile*.

Option	Name	Description
[0]	Digital input	
[1]	Bus	
[2]	Logic AND	
[3]*	Logic OR	

Parameter 8-58 PROFIdrive OFF3 Select

Table 535: Parameter 8-58 PROFIdrive OFF3 Select

8-58 PROFIdrive OFF3 Select		
Default value: [3] Logic OR	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select control of the drive OFF3 selection via the terminals (digital input) and/or via the fieldbus. This parameter is active only when *parameter 8-01 Control Site* is set to *[0] Digital and ctrl. word* and *parameter 8-10 Control Word Profile* is set to *[1] PROFIdrive profile*.

Option	Name	Description
[0]	Digital input	
[1]	Bus	
[2]	Logic AND	
[3]*	Logic OR	

5.9.7 8-8* FC Port Diagnostics

These parameters are used for monitoring the bus communication via the drive RS485 port terminals 68–69.

Parameter 8-80 Bus Message Count

Table 536: Parameter 8-80 Bus Message Count

8-80 Bus Message Count		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter shows the number of valid telegrams detected on the bus.

Parameter 8-81 Bus Error Count

Table 537: Parameter 8-81 Bus Error Count

8-81 Bus Error Count		
Default value: 0	Parameter type: Range, 0 - 0, Array [6]	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter shows the number of telegrams with faults (for example, CRC fault) detected on the bus.

Parameter 8-82 Slave Messages Rcvd

Table 538: Parameter 8-82 Slave Messages Rcvd

8-82 Slave Messages Rcvd		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter shows the number of valid telegrams addressed to the slave sent by the drive.

Parameter 8-83 Slave Error Count

Table 539: Parameter 8-83 Slave Error Count

8-83 Slave Error Count		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter shows the number of error telegrams which are not executed by the drive.

5.9.8 8-9* Bus Jog

Parameter 8-90 Bus Jog 1 Speed

Table 540: Parameter 8-90 Bus Jog 1 Speed

8-90 Bus Jog 1 Speed		
Default value: Size related	Parameter type: Range, 0 - Par. 4-13 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Enter the jog speed. Activate this fixed jog speed via the serial port or fieldbus option.

Parameter 8-91 Bus Jog 2 Speed

Table 541: Parameter 8-91 Bus Jog 2 Speed

8-91 Bus Jog 2 Speed		
Default value: Size related	Parameter type: Range, 0 - Par. 4-13 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Enter the jog speed. Activate this fixed jog speed via the serial port or fieldbus option.

5.10 Parameter Group 9-** PROFIBUS

Parameter 9-00 Setpoint

Table 542: Parameter 9-00 Setpoint

9-00 Setpoint		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation:

This parameter receives cyclic references from a master class 2. If the control priority is set to master class 2, the reference for the drive is taken from this parameter, whereas the cyclic reference is ignored.

Parameter 9-07 Actual Value

Table 543: Parameter 9-07 Actual Value

9-07 Actual Value		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation:

This parameter delivers the MAV for a master class 2. The parameter is valid if the control priority is set to master class 2.

Parameter 9-15 PCD Write Configuration

Table 544: Parameter 9-15 PCD Write Configuration

9-15 PCD Write Configuration		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint16	Change during operation: True

Select the parameters to be assigned to PCD 3–10 of the telegrams. The number of available PCDs depends on the telegram type. Values in PCD 3–10 are written to the selected parameters as data. For standard PROFIBUS telegrams, see *parameter 9-22 Telegram Selection*.

Option	Name	Description
[-]	None	
[109]	Mode of operation	
[302]	Minimum reference	
[303]	Maximum reference	
[312]	Catch up/slow down value	
[321]	Touch target	
[322]	Master scale numerator	
[323]	Master scale denominator	
[326]	Master Offset	
[328]	Master offset speed ref	
[341]	Ramp 1 ramp up time	
[342]	Ramp 1 ramp down time	
[351]	Ramp 2 ramp up time	
[352]	Ramp 2 ramp down time	
[361]	Ramp 3 ramp up time	
[362]	Ramp 3 ramp down time	
[380]	Jog/homing ramp time jog ramp time	
[381]	Quick stop ramp time	
[411]	Motor speed low limit [RPM]	
[412]	Motor speed low limit [Hz]	
[413]	Motor speed high limit [RPM]	
[414]	Motor speed high limit [Hz]	
[416]	Torque limit motor mode	
[417]	Torque limit generator mode	
[482]	Power limit motor mode	
[483]	Power limit generator mode	
[491]	Positive speed limit [RPM]	
[492]	Positive speed limit [Hz]	
[493]	Negative speed limit [RPM]	
[494]	Negative speed limit [Hz]	
[495]	Positive torque limit	
[496]	Negative torque limit	

Option	Name	Description
[553]	Term. 29 high ref./feedb. value	
[558]	Term. 33 high ref./feedb. value	
[590]	Digital & relay bus control	
[593]	Pulse out #27 bus control	
[595]	Pulse out #29 bus control	
[597]	Pulse out #30/6 bus control	
[615]	Terminal 53 high ref./feedb. value	
[625]	Terminal 54 high ref./feedb. value	
[653]	Term 42 output bus ctrl	
[663]	Terminal X30/8 bus control	
[673]	Terminal X45/1 bus control	
[683]	Terminal X45/3 bus control	
[702]	Speed PID proportional gain	
[703]	Speed PID integral time	
[708]	Speed PID feed forward factor	
[748]	PCD feed forward	
[890]	Bus jog 1 speed	
[891]	Bus jog 2 speed	
[1680]	Fieldbus CTW 1	
[1681]	Fieldbus sync. REF	
[1682]	Fieldbus REF 1	
[1683]	Fieldbus pos. REF	
[1685]	FC port CTW 1	
[1686]	FC port REF 1	
[1688]	Fieldbus torque FF.	
[1740]	Fieldbus sync. delta	
[1741]	Fieldbus profile velocity	
[1742]	Fieldbus velocity FF.	
[1743]	Fieldbus acceleration FF.	
[1744]	Fieldbus target velocity	
[1782]	Home position	
[1783]	Homing speed	

Option	Name	Description
[1788]	Master home position	
[3310]	Sync factor master	
[3311]	Sync factor slave	
[3401]	PCD 1 write to MCO	
[3402]	PCD 2 write to MCO	
[3403]	PCD 3 write to MCO	
[3404]	PCD 4 write to MCO	
[3405]	PCD 5 write to MCO	
[3406]	PCD 6 write to MCO	
[3407]	PCD 7 write to MCO	
[3408]	PCD 8 write to MCO	
[3409]	PCD 9 write to MCO	
[3410]	PCD 10 write to MCO	
[3644]	Terminal X49/7 bus control	
[3654]	Terminal X49/9 bus control	
[3664]	Terminal X49/11 bus control	
[4520]	Type	

Parameter 9-16 PCD Read Configuration

Table 545: Parameter 9-16 PCD Read Configuration

9-16 PCD Read Configuration		
Default value: Size related	Parameter type: Option, Array 156	Setup: All setups
Conversion index: –	Data type: Uint16	Change during operation: True

Select the parameters to be assigned to PCD 3–10 of the telegrams. The number of available PCDs depends on the telegram type. Values in PCD 3–10 are written to the selected parameters as data. For standard PROFIBUS telegrams, see *parameter 9-22 Telegram Selection*.

Option	Name	Description
[-]	None	
[15]	Readout: actual setup	
[1397]	Alert alarm word	
[1398]	Alert warning word	
[1399]	Alert status word	
[1472]	Legacy alarm word	
[1473]	Legacy warning word	

Option	Name	Description
[1474]	Leg. ext. status word	
[1500]	Operating hours	
[1501]	Running hours	
[1502]	kWh counter	
[1600]	Control word	
[1601]	Reference [unit]	
[1602]	Reference %	
[1603]	Status word	
[1605]	Main actual value [%]	
[1606]	Actual position	
[1607]	Target position	
[1608]	Position error	
[1609]	Custom readout	
[1610]	Power [kW]	
[1611]	Power [hp]	
[1612]	Motor voltage	
[1613]	Frequency	
[1614]	Motor current	
[1615]	Frequency [%]	
[1616]	Torque [Nm]	
[1617]	Speed [RPM]	
[1618]	Motor thermal	
[1619]	Thermistor sensor temperature	
[1620]	Motor angle	
[1621]	Torque [%] high res.	
[1622]	Torque [%]	
[1623]	Motor shaft power [kW]	
[1624]	Calibrated stator resistance	
[1625]	Torque [Nm] high	
[1628]	Angle error	
[1630]	DC link voltage	
[1632]	Brake energy /s	

Option	Name	Description
[1633]	Brake energy average	
[1634]	Heatsink temp.	
[1635]	Inverter thermal	
[1638]	SL controller state	
[1639]	Control card temp.	
[1642]	Service log counter	
[1644]	Speed error [RPM]	
[1645]	Motor phase U current	
[1646]	Motor phase V current	
[1647]	Motor phase W current	
[1648]	Speed ref. after ramp [RPM]	
[1650]	External reference	
[1651]	Pulse reference	
[1652]	Feedback[Unit]	
[1653]	Digi pot reference	
[1657]	Feedback [RPM]	
[1660]	Digital input	
[1661]	Terminal 53 switch setting	
[1662]	Analog input 53	
[1663]	Terminal 54 switch setting	
[1664]	Analog input 54	
[1665]	Analog output 42 [mA]	
[1666]	Digital output [bin]	
[1667]	Freq. input #29 [Hz]	
[1668]	Freq. input #33 [Hz]	
[1669]	Pulse output #27 [Hz]	
[1670]	Pulse output #29 [Hz]	
[1671]	Relay output [bin]	
[1672]	Counter A	
[1673]	Counter B	
[1674]	Prec. stop counter	
[1675]	Analog in X30/11	

Option	Name	Description
[1676]	Analog in X30/12	
[1677]	Analog out X30/8 [mA]	
[1678]	Analog out X45/1 [mA]	
[1679]	Analog out X45/3 [mA]	
[1684]	Comm. option STW	
[1687]	Bus readout alarm/warning	
[1689]	Configurable alarm/warning word	
[1690]	Alarm word	
[1691]	Alarm word 2	
[1692]	Warning word	
[1693]	Warning word 2	
[1694]	Ext. status word	
[1695]	Ext. status word 2	
[1696]	Maintenance word	
[1697]	Alarm word 3	
[1698]	Warning word 3	
[1804]	Mech brake count	
[1820]	Commanded position	
[1821]	Master position	
[1823]	Virtual master pos.	
[1824]	Marker pos. offset	
[1825]	Latched actual pos.	
[1826]	Actual velocity [pu/s]	
[1827]	Safe opt. est. speed	
[1828]	Safe opt. meas. speed	
[1829]	Safe opt. speed error	
[1836]	Analog input X48/2 [mA]	
[1837]	Temp. input X48/4	
[1838]	Temp. input X48/7	
[1839]	Temp. input X48/10	
[1840]	Analog input X49/1	
[1841]	Analog input X49/3	

Option	Name	Description
[1842]	Analog input X49/5	
[1843]	Analog input X49/7	
[1844]	Analog out X49/9	
[1845]	Analog out X49/11	
[1846]	X49 digital output [bin]	
[1860]	Digital input 2	
[1889]	Mode of operation display	
[1899]	Speed PID torque FF. [Nm]	
[3421]	PCD 1 read from MCO	
[3422]	PCD 2 read from MCO	
[3423]	PCD 3 read from MCO	
[3424]	PCD 4 read from MCO	
[3425]	PCD 5 read from MCO	
[3426]	PCD 6 read from MCO	
[3427]	PCD 7 read from MCO	
[3428]	PCD 8 read from MCO	
[3429]	PCD 9 read from MCO	
[3430]	PCD 10 read from MCO	
[3440]	Digital inputs	
[3441]	Digital outputs	
[3450]	Actual position	
[3451]	Commanded position	
[3452]	Actual master position	
[3453]	Slave index position	
[3454]	Master index position	
[3455]	Curve position	
[3456]	Track error	
[3457]	Synchronizing error	
[3458]	Actual velocity	
[3459]	Actual master velocity	
[3460]	Synchronizing status	
[3461]	Axis status	

Option	Name	Description
[3462]	Program status	
[3464]	MCO 302 status	
[3465]	MCO 302 control	
[3466]	SPI error counter	
[3470]	MCO alarm word 1	
[3471]	MCO alarm word 2	
[4029]	B-EMF protection log readout	
[4280]	Safe option status	
[4285]	Active safe func.	
[4521]	Status	
[4523]	Baseline failure	
[4590]	Stator [%]	
[4591]	Load [%]	
[4592]	Sensor 1 [%]	
[4593]	Sensor 1 [unit]	
[4594]	Sensor 2 [%]	
[4595]	Sensor 2 [unit]	
[4596]	Sensor 3 [%]	
[4597]	Sensor 3 [unit]	
[4598]	Sensor 4 [%]	
[4599]	Sensor 4 [unit]	

Parameter 9-18 Node Address

Table 546: Parameter 9-18 Node Address

9-18 Node Address		
Default value: 126	Parameter type: Range, 1 - size related	Setup: 1 setup
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the station address in this parameter or, alternatively, in the hardware switch. To adjust the station address in this parameter, set the hardware switch to 126 or 127 (that is all switches set to ON). Otherwise, this parameter shows the actual setting of the switch.

Parameter 9-19 Drive Unit System Number

Table 547: Parameter 9-19 Drive Unit System Number

9-19 Drive Unit System Number		
Default value: 1034	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Manufacturer-specific system ID.

Parameter 9-22 Telegram Selection

Table 548: Parameter 9-22 Telegram Selection

9-22 Telegram Selection		
Default value: [100] None	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Select a standard PROFIBUS telegram configuration for the drive as an alternative to the freely configurable telegrams in *parameter 9-15 PCD Write Configuration* and *parameter 9-16 PCD Read Configuration*.

Option	Name	Description
[1]	Standard telegram 1	
[100]*	None	
[101]	PPO 1	
[102]	PPO 2	
[103]	PPO 3	
[104]	PPO 4	
[105]	PPO 5	
[106]	PPO 6	
[107]	PPO 7	
[108]	PPO 8	
[200]	Custom telegram 1	
[202]	Custom telegram 3	

Parameter 9-23 Parameters for Signals

Table 549: Parameter 9-23 Parameters for Signals

9-23 Parameters for Signals		
Default value: [0] None	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint16	Change during operation: True

This parameter contains a list of signals available for selection in *parameter 9-15 PCD Write Configuration* and *parameter 9-16 PCD Read Configuration*.

Option	Name	Description
[0]*	None	
[109]	Mode of operation	
[302]	Minimum reference	
[303]	Maximum reference	
[312]	Catch up/slow down value	
[321]	Touch target	

Option	Name	Description
[322]	Master scale numerator	
[323]	Master scale denominator	
[326]	Master Offset	
[328]	Master offset speed ref	
[341]	Ramp 1 ramp up time	
[342]	Ramp 1 ramp down time	
[351]	Ramp 2 ramp up time	
[352]	Ramp 2 ramp down time	
[361]	Ramp 3 ramp up time	
[362]	Ramp 3 ramp down time	
[380]	Jog/homing ramp time jog ramp time	
[381]	Quick stop ramp time	
[411]	Motor speed low limit [RPM]	
[412]	Motor speed low limit [Hz]	
[413]	Motor speed high limit [RPM]	
[414]	Motor speed high limit [Hz]	
[416]	Torque limit motor mode	
[417]	Torque limit generator mode	
[482]	Power limit motor mode	
[483]	Power limit generator mode	
[491]	Positive speed limit [RPM]	
[492]	Positive speed limit [Hz]	
[493]	Negative speed limit [RPM]	
[494]	Negative speed limit [Hz]	
[495]	Positive torque limit	
[496]	Negative torque limit	
[553]	Term. 29 high ref./feedb. value	
[558]	Term. 33 high ref./feedb. value	
[590]	Digital & relay bus control	
[593]	Pulse out #27 bus control	
[595]	Pulse out #29 bus control	
[597]	Pulse out #30/6 bus control	

Option	Name	Description
[615]	Terminal 53 high ref./feedb. value	
[625]	Terminal 54 high ref./feedb. value	
[653]	Term 42 output bus ctrl	
[663]	Terminal X30/8 bus control	
[673]	Terminal X45/1 bus control	
[683]	Terminal X45/3 bus control	
[702]	Speed PID proportional gain	
[703]	Speed PID integral time	
[708]	Speed PID feed forward factor	
[748]	PCD feed forward	
[890]	Bus jog 1 speed	
[891]	Bus jog 2 speed	
[1397]	Alert alarm word	
[1398]	Alert warning word	
[1399]	Alert status word	
[1472]	Legacy alarm word	
[1473]	Legacy warning word	
[1474]	Leg. ext. status word	
[1500]	Operating hours	
[1501]	Running hours	
[1502]	kWh counter	
[1600]	Control word	
[1601]	Reference [unit]	
[1602]	Reference %	
[1603]	Status word	
[1605]	Main actual value [%]	
[1606]	Actual position	
[1607]	Target position	
[1608]	Position error	
[1609]	Custom readout	
[1610]	Power [kW]	
[1611]	Power [hp]	

Option	Name	Description
[1612]	Motor voltage	
[1613]	Frequency	
[1614]	Motor current	
[1615]	Frequency [%]	
[1616]	Torque [Nm]	
[1617]	Speed [RPM]	
[1618]	Motor thermal	
[1619]	Thermistor sensor temperature	
[1620]	Motor angle	
[1621]	Torque [%] high res.	
[1622]	Torque [%]	
[1623]	Motor shaft power [kW]	
[1624]	Calibrated stator resistance	
[1625]	Torque [Nm] high	
[1628]	Angle error	
[1630]	DC link voltage	
[1632]	Brake energy /s	
[1633]	Brake energy average	
[1634]	Heatsink temp.	
[1635]	Inverter thermal	
[1638]	SL controller state	
[1639]	Control card temp.	
[1642]	Service log counter	
[1644]	Speed error [RPM]	
[1645]	Motor phase U current	
[1646]	Motor phase V current	
[1647]	Motor phase W current	
[1648]	Speed ref. after ramp [RPM]	
[1650]	External reference	
[1651]	Pulse reference	
[1652]	Feedback[unit]	
[1653]	Digi pot reference	

Option	Name	Description
[1657]	Feedback [RPM]	
[1660]	Digital input	
[1661]	Terminal 53 switch setting	
[1662]	Analog input 53	
[1663]	Terminal 54 switch setting	
[1664]	Analog input 54	
[1665]	Analog output 42 [mA]	
[1666]	Digital output [bin]	
[1667]	Freq. input #29 [Hz]	
[1668]	Freq. input #33 [Hz]	
[1669]	Pulse output #27 [Hz]	
[1670]	Pulse output #29 [Hz]	
[1671]	Relay output [bin]	
[1672]	Counter A	
[1673]	Counter B	
[1674]	Prec. stop counter	
[1675]	Analog in X30/11	
[1676]	Analog in X30/12	
[1677]	Analog out X30/8 [mA]	
[1678]	Analog out X45/1 [mA]	
[1679]	Analog out X45/3 [mA]	
[1680]	Fieldbus CTW 1	
[1681]	Fieldbus sync. REF	
[1682]	Fieldbus REF 1	
[1683]	Fieldbus pos. REF	
[1684]	Comm. option STW	
[1685]	FC port CTW 1	
[1686]	FC port REF 1	
[1687]	Bus readout alarm/warning	
[1688]	Fieldbus torque FF.	
[1689]	Configurable alarm/warning word	
[1690]	Alarm word	

Option	Name	Description
[1691]	Alarm word 2	
[1692]	Alarm word	
[1693]	Alarm word 2	
[1694]	Ext. status word	
[1695]	Ext. status word 2	
[1696]	Maintenance word	
[1697]	Alarm word 3	
[1698]	Warning word 3	
[1740]	Fieldbus sync. delta	
[1741]	Fieldbus profile velocity	
[1742]	Fieldbus velocity FF.	
[1743]	Fieldbus acceleration FF.	
[1744]	Fieldbus target velocity	
[1782]	Home position	
[1783]	Homing speed	
[1788]	Master home position	
[1804]	Mech brake count	
[1820]	Commanded position	
[1821]	Master position	
[1823]	Virtual master pos.	
[1824]	Master pos. offset	
[1825]	Latched actual pos.	
[1826]	Actual velocity [pu/s]	
[1827]	Safe opt. est. speed	
[1828]	Safe opt. meas. speed	
[1829]	Safe opt. speed error	
[1836]	Analog input X48/2[mA]	
[1837]	Temp. input X48/4	
[1838]	Temp. input X48/7	
[1839]	Temp. input X48/10	
[1840]	Analog input X49/1	
[1841]	Analog input X49/3	

Option	Name	Description
[1842]	Analog input X49/5	
[1843]	Analog out X49/7	
[1844]	Analog out X49/9	
[1845]	Analog out X49/11	
[1846]	X49 Digital output [bin]	
[1860]	Digital input 2	
[1889]	Mode of operation display	
[1899]	Speed PID torque FF. [Nm]	
[3310]	Sync factor master	
[3311]	Sync factor slave	
[3401]	PCD 1 write to MCO	
[3402]	PCD 2 write to MCO	
[3403]	PCD 3 write to MCO	
[3404]	PCD 4 write to MCO	
[3405]	PCD 5 write to MCO	
[3406]	PCD 6 write to MCO	
[3407]	PCD 7 write to MCO	
[3408]	PCD 8 write to MCO	
[3409]	PCD 9 write to MCO	
[3410]	PCD 10 write to MCO	
[3421]	PCD 1 read from MCO	
[3422]	PCD 2 read from MCO	
[3423]	PCD 3 read from MCO	
[3424]	PCD 4 read from MCO	
[3425]	PCD 5 read from MCO	
[3426]	PCD 6 read from MCO	
[3427]	PCD 7 read from MCO	
[3428]	PCD 8 read from MCO	
[3429]	PCD 9 read from MCO	
[3430]	PCD 10 read from MCO	
[3440]	Digital inputs	
[3441]	Digital outputs	

Option	Name	Description
[3450]	Actual position	
[3451]	Commanded position	
[3452]	Actual master position	
[3453]	Slave index position	
[3454]	Master index position	
[3455]	Curve position	
[3456]	Track error	
[3457]	Synchronizing error	
[3458]	Actual velocity	
[3459]	Actual master velocity	
[3460]	Synchronizing status	
[3461]	Axis status	
[3462]	Program status	
[3464]	MCO 302 status	
[3465]	MCO 303 control	
[3466]	SPI error counter	
[3470]	MCO alarm word 1	
[3471]	MCO alarm word 2	
[3644]	Terminal X49/7 bus control	
[3654]	Terminal X49/9 bus control	
[3664]	Terminal X49/11 bus control	
[4029]	B-EMF protection log readout	
[4280]	Safe option status	
[4285]	Active safe func.	
[4520]	Type	
[4521]	Status	
[4523]	Baseline failure	
[4590]	Stator [%]	
[4591]	Load [%]	
[4592]	Sensor 1 [%]	
[4593]	Sensor 1 [unit]	
[4594]	Sensor 2 [%]	

Option	Name	Description
[4595]	Sensor 3 [unit]	
[4596]	Sensor 3 [%]	
[4597]	Sensor 3 [unit]	
[4598]	Sensor 4 [%]	
[4599]	Sensor 4 [unit]	

Parameter 9-27 Parameter Edit

Table 550: Parameter 9-27 Parameter Edit

9-27 Parameter Edit		
Default value: [1] Enabled	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint16	Change during operation: False

Parameters can be edited via:

- PROFIBUS
- The standard RS485 interface
- The LCP

Option	Name	Description
[0]	Disabled	
[1]*	Enabled	

Parameter 9-28 Process Control

Table 551: Parameter 9-28 Process Control

9-28 Process Control		
Default value: [1] Enable cyclic master	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: False

Process control (setting of control word, speed reference, and process data) is possible via either PROFIBUS or standard fieldbus, but not both simultaneously. Local control is always possible via the LCP. Control via process control is possible via either terminals or fieldbus depending on the settings in *parameter 8-50 Coasting Select* to *parameter 8-56 Preset Reference Select*.

Option	Name	Description
[0]	Disable	
[1]*	Enable cyclic master	

Parameter 9-44 Fault Message Counter

Table 552: Parameter 9-44 Fault Message Counter

9-44 Fault Message Counter		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation:

Indicates the number of fault events presently stored in *parameter 9-45 Fault Code*. The buffer capacity is maximum 8 error events. The buffer and counter are set to 0 by reset or power-up.

Parameter 9-45 Fault Code

Table 553: Parameter 9-45 Fault Code

9-45 Fault Code		
Default value: 0	Parameter type: Range, N/A	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation:

This buffer contains the alarm word for all alarms and warnings that have occurred since the last reset or power-up. The buffer capacity is maximum 8 error events.

Parameter 9-47 Fault Number

Table 554: Parameter 9-47 Fault Number

9-47 Fault Number		
Default value: 0	Parameter type: Range, N/A	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation:

This buffer contains the alarm word for all alarms and warnings that have occurred since the last reset or power-up. The buffer capacity is maximum 8 error events.

Parameter 9-52 Fault Situation Counter

Table 555: Parameter 9-52 Fault Situation Counter

9-52 Fault Situation Counter		
Default value: 0	Parameter type: Range, 0 - 1000	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation:

Indicates the number of fault events that have occurred since the last reset or power-up.

Table 556: Parameter 9-53 PROFIBUS Warning Word

9-53 PROFIBUS Warning Word		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: V2	Change during operation: True

This parameter shows PROFIBUS communication warnings.

Table 557: PROFIBUS Warning Word

Bit	Description
0	Connection with DP-master is not OK.
1	Not used.
2	FDL (fieldbus data link layer) is not OK.
3	Clear data command received.
4	Actual value is not updated.
5	Baud rate search.
6	PROFIBUS ASIC is not transmitting.
7	Initializing of PROFIBUS is not OK.

Bit	Description
8	Drive is tripped.
9	Internal CAN error.
10	Wrong configuration data from PLC.
11	Wrong ID sent by PLC.
12	Internal fault occurred.
13	Not configured.
14	Timeout active.
15	Warning 34, Fieldbus Fault is active.

Parameter 9-63 Actual Baud Rate

Table 558: Parameter 9-63 Actual Baud Rate

9-63 Actual Baud Rate		
Default value: [255] No baud rate found	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter shows the actual PROFIBUS baud rate. The PROFIBUS master automatically sets the baud rate.

Option	Name	Description
[0]	9,6 kbit/s	
[1]	19,2 kbit/s	
[2]	93,75 kbit/s	
[3]	187,5 kbit/s	
[4]	500 kbit/s	
[6]	1500 kbit/s	
[7]	3000 kbit/s	
[8]	6000 kbit/s	
[9]	12000 kbit/s	
[10]	31,25 kbit/s	
[11]	45,45 kbit/s	
[255]*	No baud rate found	

Table 559: Parameter 9-64 Device Identification

9-64 Device Identification		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation:

NOTICE

This parameter is not visible via LCP.

The device identification parameter. The data type is array [n] of unsigned16. The assignment of the 1st subindexes is defined and shown in the following table.

Index	Content	Value
[0]	Manufacturer	128 (for Danfoss)
[1]	Device type	1
[2]	Version	xxyy
[3]	Firmware date year	yyyy
[4]	Firmware date month	ddmm
[5]	No. of axes	Variable
[6]	Vendor specific: PB version	xxyy
[7]	Vendor specific: Database version	xxyy
[8]	Vendor specific: AOC version	xxyy
[9]	Vendor specific: MOC version	xxyy

Parameter 9-65 Profile Number

Table 560: Parameter 9-65 Profile Number

9-65 Profile Number		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: OctetString	Change during operation:

NOTICE

This parameter is not visible via LCP.

This parameter contains the profile identification. Byte 1 contains the profile number. Byte 2 contains the number of the profile.

Table 561: Parameter 9-67 Control Word 1

9-67 Control Word 1		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: V2	Change during operation:

This parameter accepts the control word from a master class 2 in the same format as PCD 1.

Parameter 9-68 Status Word 1

Table 562: Parameter 9-68 Status Word 1

9-68 Status Word 1		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: V2	Change during operation:

This parameter delivers the status word for a master class 2 in the same format as PCD 2.

Table 563: Parameter 9-70 Edit Set-up

9-70 Edit Set-up		
Default value: [1] Set-up 1	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the setup in which programming (change of data) is performed during operation. It is possible to program the 2 setups independently of the setup selected as the active setup. Parameter access from each master is directed to the setup selected by the individual master (cyclic, acyclic MCL1, 1st acyclic MCL2, 2nd acyclic MCL2, 3rd acyclic MCL2).

Option	Name	Description
[0]	Factory setup	
[1]*	Set-up 1	
[2]	Set-up 2	
[3]	Set-up 3	
[4]	Set-up 4	
[9]	Active set-up	

Parameter 9-71 PROFIBUS Save Data Values

Table 564: Parameter 9-71 PROFIBUS Save Data Values

9-71 PROFIBUS Save Data Values		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Parameter values changed via RS485 are not automatically stored in a non-volatile memory. Use this parameter to activate a function that stores parameter values in the EEPROM non-volatile memory, so changed parameter values are retained at power-down.

Option	Name	Description
[0]*	Off	
[1]	Store all setups	
[2]	Store all setups	

Parameter 9-72 PROFIBUSDriveReset

Table 565: Parameter 9-72 PROFIBUSDriveReset

9-72 PROFIBUSDriveReset		
Default value: [0] No action	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: False

N O T I C E

Resets the VLT® PROFIBUS DP-V1 MCA 101 option only.

Option	Name	Description
[0]*	No action	
[1]	Power-on reset	
[2]	Power-on reset prep	
[3]	Comm option reset	

Parameter 9-75 DO Identification

Table 566: Parameter 9-75 DO Identification

9-75 DO Identification		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation:

Provides information about the DO (direct object). This parameter is for PROFINET only.

Parameter 9-80 Defined Parameters (1)

Table 567: Parameter 9-80 Defined Parameters (1)

9-80 Defined Parameters (1)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

This parameter shows a list of all the defined drive parameters available for PROFIBUS.

Parameter 9-81 Defined Parameters (2)

Table 568: Parameter 9-81 Defined Parameters (2)

9-81 Defined Parameters (2)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

This parameter shows a list of all the defined drive parameters available for PROFIBUS.

Parameter 9-82 Defined Parameters (3)

Table 569: Parameter 9-82 Defined Parameters (3)

9-82 Defined Parameters (3)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

This parameter shows a list of all the defined drive parameters available for PROFIBUS.

Parameter 9-83 Defined Parameters (4)

Table 570: Parameter 9-83 Defined Parameters (4)

9-83 Defined Parameters (4)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

This parameter shows a list of all the defined drive parameters available for PROFIBUS.

Parameter 9-84 Defined Parameters (5)

Table 571: Parameter 9-84 Defined Parameters (5)

9-84 Defined Parameters (5)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

This parameter shows a list of all the defined drive parameters available for PROFIBUS.

Parameter 9-85 Defined Parameters (6)

Table 572: Parameter 9-85 Defined Parameters (6)

9-85 Defined Parameters (6)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

This parameter shows a list of all the defined drive parameters available for PROFIBUS.

Parameter 9-90 Changed Parameters (1)

Table 573: Parameter 9-90 Changed Parameters (1)

9-90 Changed Parameters (1)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

This parameters shows a list of all the drive parameters deviating from default setting.

Parameter 9-91 Changed Parameters (2)

Table 574: Parameter 9-91 Changed Parameters (2)

9-91 Changed Parameters (2)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

This parameters shows a list of all the drive parameters deviating from default setting.

Parameter 9-92 Changed Parameters (3)

Table 575: Parameter 9-92 Changed Parameters (3)

9-92 Changed Parameters (3)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

This parameters shows a list of all the drive parameters deviating from default setting.

Parameter 9-93 Changed Parameters (4)

Table 576: Parameter 9-93 Changed Parameters (4)

9-93 Changed Parameters (4)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

This parameters shows a list of all the drive parameters deviating from default setting.

Parameter 9-94 Changed Parameters (5)

Table 577: Parameter 9-94 Changed Parameters (5)

9-94 Changed Parameters (5)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

This parameters shows a list of all the drive parameters deviating from default setting.

Parameter 9-99 PROFIBUS Revision Counter

Table 578: Parameter 9-99 PROFIBUS Revision Counter

9-99 PROFIBUS Revision Counter		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation:

Readout of revision count.

5.11 Parameter Group 10-** CAN Fieldbus

5.11.1 10-0* Common Settings

Parameter 10-00 CAN Protocol

Table 579: Parameter 10-00 CAN Protocol

10-00 CAN Protocol		
Default value: Size related	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: False

The options available depend on the installed option card.

Option	Name	Description
[0]	CANopen	
[1]	DeviceNet	

Parameter 10-01 Baud Rate Select

Table 580: Parameter 10-01 Baud Rate Select

10-01 Baud Rate Select		
Default value: Size related	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the fieldbus transmission speed. The selection must correspond to the transmission speed of the master and of the other fieldbus nodes.

Option	Name	Description
[16]	10 Kbps	
[17]	20 Kbps	
[18]	50 Kbps	
[19]	100 Kbps	

Option	Name	Description
[20]	125 Kbps	
[21]	250 Kbps	
[22]	500 Kbps	

Parameter 10-02 MAC ID

Table 581: Parameter 10-02 MAC ID

10-02 MAC ID		
Default value: Size related	Parameter type: Range, [N/A]	Setup: 2 setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Select the station address. Every station connected to the same network must have an unambiguous address.

Parameter 10-05 Readout Transmit Error Counter

Table 582: Parameter 10-05 Readout Transmit Error Counter

10-05 Readout Transmit Error Counter		
Default value: 0	Parameter type: Range, 0 - 255	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

View the number of CAN control transmission errors since the last power-up.

Parameter 10-06 Readout Receive Error Counter

Table 583: Parameter 10-06 Readout Receive Error Counter

10-06 Readout Receive Error Counter		
Default value: 0	Parameter type: Range, 0 - 255	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

View the number of CAN control receipt errors since the last power-up.

Parameter 10-07 Readout Bus Off Counter

Table 584: Parameter 10-07 Readout Bus Off Counter

10-07 Readout Bus Off Counter		
Default value: 0	Parameter type: Range, 0 - 255	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

5.11.2 10-1* DeviceNet

Parameter 10-10 Process Data Type Selection

Table 585: Parameter 10-10 Process Data Type Selection

10-10 Process Data Type Selection		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the instance (telegram) for data transmission. The instances available depend on the setting of *parameter 8-10 Control Word Profile*. When *parameter 8-10 Control Word Profile* is set to *[0] FC Profile*, options *[0] INSTANCE 100/150* and *[1] INSTANCE 101/151* in this parameter are available. When *parameter 8-10 Control Word Profile* is set to *[5] ODVA*, options *[2] INSTANCE 20/70* and *[3] INSTANCE*

21/71 in this parameter are available. Instances 100/150 and 101/151 are Danfoss specific. Instances 20/70 and 21/71 are ODVA-specific AC motor profiles. For guidelines in telegram selection, refer to the VLT® DeciveNet MCA 104 Installation Guide.

N O T I C E

A change to this parameter is executed immediately.

Option	Name	Description
[0]	Instance 100/150	
[1]	Instance 101/151	
[2]	Instance 20/70	
[3]	Instance 21/71	
[6]	Instance 102/152	

Parameter 10-11 Process Data Config Write

Table 586: Parameter 10-11 Process Data Config Write

10-11 Process Data Config Write		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint16	Change during operation: True

Option	Name	Description
[-]	None	
[109]	Mode of operation	
[302]	Minimum reference	
[303]	Maximum reference	
[312]	Catch up/slow down value	
[321]	Touch target	
[322]	Master scale numerator	
[323]	Master scale denominator	
[326]	Master Offset	
[328]	Master offset speed ref	
[341]	Ramp 1 ramp up time	
[342]	Ramp 1 ramp down time	
[351]	Ramp 2 ramp up time	
[352]	Ramp 2 ramp down time	
[361]	Ramp 3 ramp up time	
[362]	Ramp 3 ramp down time	
[380]	Jog/homing ramp time jog ramp time	

Option	Name	Description
[381]	Quick stop ramp time	
[411]	Motor speed low limit [RPM]	
[412]	Motor speed low limit [Hz]	
[413]	Motor speed high limit [RPM]	
[414]	Motor speed high limit [Hz]	
[416]	Torque limit motor mode	
[417]	Torque limit generator mode	
[482]	Power limit motor mode	
[483]	Power limit generator mode	
[491]	Positive speed limit [RPM]	
[492]	Positive speed limit [Hz]	
[493]	Negative speed limit [RPM]	
[494]	Negative speed limit [Hz]	
[495]	Positive torque limit	
[496]	Negative torque limit	
[553]	Term. 29 high ref./feedb. value	
[558]	Term. 33 high ref./feedb. value	
[590]	Digital & relay bus control	
[593]	Pulse out #27 bus control	
[595]	Pulse out #29 bus control	
[597]	Pulse out #30/6 bus control	
[615]	Terminal 53 high ref./feedb. value	
[625]	Terminal 54 high ref./feedb. value	
[653]	Term 42 output bus ctrl	
[663]	Terminal X30/8 bus control	
[673]	Terminal X45/1 bus control	
[683]	Terminal X45/3 bus control	
[702]	Speed PID proportional gain	
[703]	Speed PID integral time	
[708]	Speed PID feed forward factor	
[748]	PCD feed forward	
[890]	Bus jog 1 speed	

Option	Name	Description
[891]	Bus jog 2 speed	
[1680]	Fieldbus CTW 1	
[1681]	Fieldbus sync. REF	
[1682]	Fieldbus REF 1	
[1683]	Fieldbus pos. REF	
[1685]	FC port CTW 1	
[1686]	FC port REF 1	
[1688]	Fieldbus torque FF.	
[1740]	Fieldbus sync. delta	
[1741]	Fieldbus profile velocity	
[1742]	Fieldbus velocity FF.	
[1743]	Fieldbus acceleration FF.	
[1744]	Fieldbus target velocity	
[1782]	Home position	
[1783]	Homing speed	
[1788]	Master home position	
[3310]	Sync factor master	
[3311]	Sync factor slave	
[3401]	PCD 1 write to MCO	
[3402]	PCD 2 write to MCO	
[3403]	PCD 3 write to MCO	
[3404]	PCD 4 write to MCO	
[3405]	PCD 5 write to MCO	
[3406]	PCD 6 write to MCO	
[3407]	PCD 7 write to MCO	
[3408]	PCD 8 write to MCO	
[3409]	PCD 9 write to MCO	
[3410]	PCD 10 write to MCO	
[3644]	Terminal X49/7 bus control	
[3654]	Terminal X49/9 bus control	
[3664]	Terminal X49/11 bus control	
[4520]	Type	

Parameter 10-12 Process Data Config Read

Table 587: Parameter 10-12 Process Data Config Read

10-12 Process Data Config Read		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint16	Change during operation: True

Option	Name	Description
[-]	None	
[15]	Readout: actual setup	
[1397]	Alert alarm word	
[1398]	Alert warning word	
[1399]	Alert status word	
[1472]	Legacy alarm word	
[1473]	Legacy warning word	
[1474]	Leg. ext. status word	
[1500]	Operating hours	
[1501]	Running hours	
[1502]	kWh counter	
[1600]	Control word	
[1601]	Reference [unit]	
[1602]	Reference %	
[1603]	Status word	
[1605]	Main actual value [%]	
[1606]	Actual position	
[1607]	Target position	
[1608]	Position error	
[1609]	Custom readout	
[1610]	Power [kW]	
[1611]	Power [hp]	
[1612]	Motor voltage	
[1613]	Frequency	
[1614]	Motor current	
[1615]	Frequency [%]	
[1616]	Torque [Nm]	
[1617]	Speed [RPM]	

Option	Name	Description
[1618]	Motor thermal	
[1619]	Thermistor sensor temperature	
[1620]	Motor angle	
[1621]	Torque [%] high res.	
[1622]	Torque [%]	
[1623]	Motor shaft power [kW]	
[1624]	Calibrated stator resistance	
[1625]	Torque [Nm] high	
[1628]	Angle error	
[1630]	DC link voltage	
[1632]	Brake energy /s	
[1633]	Brake energy average	
[1634]	Heatsink temp.	
[1635]	Inverter thermal	
[1638]	SL controller state	
[1639]	Control card temp.	
[1642]	Service log counter	
[1644]	Speed error [RPM]	
[1645]	Motor phase U current	
[1646]	Motor phase V current	
[1647]	Motor phase W current	
[1648]	Speed ref. after ramp [RPM]	
[1650]	External reference	
[1651]	Pulse reference	
[1652]	Feedback[Unit]	
[1653]	Digi pot reference	
[1657]	Feedback [RPM]	
[1660]	Digital input	
[1661]	Terminal 53 switch setting	
[1662]	Analog input 53	
[1663]	Terminal 54 switch setting	
[1664]	Analog input 54	

Option	Name	Description
[1665]	Analog output 42 [mA]	
[1666]	Digital output [bin]	
[1667]	Freq. input #29 [Hz]	
[1668]	Freq. input #33 [Hz]	
[1669]	Pulse output #27 [Hz]	
[1670]	Pulse output #29 [Hz]	
[1671]	Relay output [bin]	
[1672]	Counter A	
[1673]	Counter B	
[1674]	Prec. stop counter	
[1675]	Analog in X30/11	
[1676]	Analog in X30/12	
[1677]	Analog out X30/8 [mA]	
[1678]	Analog out X45/1 [mA]	
[1679]	Analog out X45/3 [mA]	
[1684]	Comm. option STW	
[1687]	Bus readout alarm/warning	
[1689]	Configurable alarm/warning word	
[1690]	Alarm word	
[1691]	Alarm word 2	
[1692]	Warning word	
[1693]	Warning word 2	
[1694]	Ext. status word	
[1695]	Ext. status word 2	
[1696]	Maintenance word	
[1697]	Alarm word 3	
[1698]	Warning word 3	
[1804]	Mech brake count	
[1820]	Commanded position	
[1821]	Master position	
[1823]	Virtual master pos.	
[1824]	Marker pos. offset	

Option	Name	Description
[1825]	Latched actual pos.	
[1826]	Actual velocity [pu/s]	
[1827]	Safe opt. est. speed	
[1828]	Safe opt. meas. speed	
[1829]	Safe opt. speed error	
[1836]	Analog input X48/2 [mA]	
[1837]	Temp. input X48/4	
[1838]	Temp. input X48/7	
[1839]	Temp. input X48/10	
[1840]	Analog input X49/1	
[1841]	Analog input X49/3	
[1842]	Analog input X49/5	
[1843]	Analog input X49/7	
[1844]	Analog out X49/9	
[1845]	Analog out X49/11	
[1846]	X49 digital output [bin]	
[1860]	Digital input 2	
[1889]	Mode of operation display	
[1899]	Speed PID torque FF. [Nm]	
[3421]	PCD 1 read from MCO	
[3422]	PCD 2 read from MCO	
[3423]	PCD 3 read from MCO	
[3424]	PCD 4 read from MCO	
[3425]	PCD 5 read from MCO	
[3426]	PCD 6 read from MCO	
[3427]	PCD 7 read from MCO	
[3428]	PCD 8 read from MCO	
[3429]	PCD 9 read from MCO	
[3430]	PCD 10 read from MCO	
[3440]	Digital inputs	
[3441]	Digital outputs	
[3450]	Actual position	

Option	Name	Description
[3451]	Commanded position	
[3452]	Actual master position	
[3453]	Slave index position	
[3454]	Master index position	
[3455]	Curve position	
[3456]	Track error	
[3457]	Synchronizing error	
[3458]	Actual velocity	
[3459]	Actual master velocity	
[3460]	Synchronizing status	
[3461]	Axis status	
[3462]	Program status	
[3464]	MCO 302 status	
[3465]	MCO 302 control	
[3466]	SPI error counter	
[3470]	MCO alarm word 1	
[3471]	MCO alarm word 2	
[4029]	B-EMF protection log readout	
[4280]	Safe option status	
[4285]	Active safe func.	
[4521]	Status	
[4523]	Baseline failure	
[4590]	Stator [%]	
[4591]	Load [%]	
[4592]	Sensor 1 [%]	
[4593]	Sensor 1 [unit]	
[4594]	Sensor 2 [%]	
[4595]	Sensor 2 [unit]	
[4596]	Sensor 3 [%]	
[4597]	Sensor 3 [unit]	
[4598]	Sensor 4 [%]	
[4599]	Sensor 4 [unit]	

Parameter 10-13 Warning Parameter

Table 588: Parameter 10-13 Warning Parameter

10-13 Warning Parameter		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

View a DeviceNet-specific warning word. One bit is assigned to every warning. Refer to the VLT® DeviceNet MCA 104 Installation Guide for further information.

Table 589: Warning Bits

Bit	Description
0	Bus not active
1	Explicit connection timeout
2	I/O connection
3	Retry limit reached
4	Actual is not updated
5	CAN bus off
6	I/O send error
7	Initialization error
8	No bus supply
9	Bus off
10	Error passive
11	Error warning
12	Duplicate MAC ID error
13	RX queue overrun
14	TX queue overrun
15	CAN overrun

Parameter 10-14 Net Reference

Table 590: Parameter 10-14 Net Reference

10-14 Net Reference		
Default value: [0] Off	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the reference source in instances 21/71 and 20/70.

Option	Name	Description
[0]*	Off	
[1]	On	

Parameter 10-15 Net Control

Table 591: Parameter 10-15 Net Control

10-15 Net Control		
Default value: [0] Off	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the control source in instances 21/71 and 20/70.

Option	Name	Description
[0]*	Off	
[1]	On	

5.11.3 10-2* COS Filters

Parameter 10-20 COS Filter 1

Table 592: Parameter 10-20 COS Filter 1

10-20 COS Filter 1		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Sets up the filter mask for the status word. When operating in COS (change-of-state), it is possible to filter out bits in the status word that should not be sent if they change.

Parameter 10-21 COS Filter 2

Table 593: Parameter 10-21 COS Filter 2

10-21 COS Filter 2		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Sets up the filter mask for the main actual value. When operating in COS (change-of-state), it is possible to filter out bits in the main actual value that should not be sent if they change.

Parameter 10-22 COS Filter 3

Table 594: Parameter 10-22 COS Filter 3

10-22 COS Filter 3		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Sets up the filter mask for PCD 3. When operating in COS (change-of-state), it is possible to filter out bits in PCD 3 that should not be sent if they change.

Parameter 10-23 COS Filter 4

Table 595: Parameter 10-23 COS Filter 4

10-23 COS Filter 4		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Sets up the filter mask for PCD 4. When operating in COS (change-of-state), it is possible to filter out bits in PCD 4 that should not be sent if they change.

5.11.4 10-3* Parameter Access

Parameter 10-30 Array Index

Table 596: Parameter 10-30 Array Index

10-30 Array Index		
Default value: 0	Parameter type: Range, 0 - 255	Setup: 2 setups
Conversion index: 0	Data type: Uint8	Change during operation: True

View array parameters. This parameter is only valid when a VLT® DeviceNet MCA 104 is installed.

Parameter 10-31 Store Data Values

Table 597: Parameter 10-31 Store Data Values

10-31 Store Data Values		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter is used to activate a function that stores all parameter values in the non-volatile memory, this retaining changed parameter values at power-down.

Option	Name	Description
[0]*	Off	
[1]	Store all setups	
[2]	Store all setups	

Parameter 10-32 Devicenet Revision

Table 598: Parameter 10-32 Devicenet Revision

10-32 Devicenet Revision		
Default value: Size related	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

The DeviceNet revision number. This parameter is used for EDS file creation.

Parameter 10-33 Store Always

Table 599: Parameter 10-33 Store Always

10-33 Store Always		
Default value: [0] Off	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter is used to select whether parameter data received via the DeviceNet option should always be stored in non-volatile memory.

Option	Name	Description
[0]*	Off	
[1]	On	

Parameter 10-34 DeviceNet Product Code

Table 600: Parameter 10-34 DeviceNet Product Code

10-34 DeviceNet Product Code		
Default value: Size related	Parameter type: Range, 0 - 65535	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

Use this parameter for reading out the actual DeviceNet product code.

Parameter 10-39 Devicenet F Parameters

Table 601: Parameter 10-39 Devicenet F Parameters

10-39 Devicenet F Parameters		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation:

Use this parameter to configure the drive via DeviceNet and build the EDS file.

5.11.5 10-5* CANopen

Parameter 10-50 Process Data Config Write

Table 602: Parameter 10-50 Process Data Config Write

10-50 Process Data Config Write		
Default value: Size related	Parameter type: Option, Array [81]	Setup: All setups
Conversion index: –	Data type: Uint16	Change during operation: True

Only elements [2] and [3] of this array can be selected. [0] and [1] are fixed.

Option	Name	Description
[-]	None	
[109]	Mode of operation	
[302]	Minimum reference	
[303]	Maximum reference	
[312]	Catch up/slow down value	
[321]	Touch target	
[322]	Master scale numerator	
[323]	Master scale denominator	
[326]	Master Offset	
[328]	Master offset speed ref	
[341]	Ramp 1 ramp up time	
[342]	Ramp 1 ramp down time	
[351]	Ramp 2 ramp up time	
[352]	Ramp 2 ramp down time	

Option	Name	Description
[361]	Ramp 3 ramp up time	
[362]	Ramp 3 ramp down time	
[380]	Jog/homing ramp time jog ramp time	
[381]	Quick stop ramp time	
[411]	Motor speed low limit [RPM]	
[412]	Motor speed low limit [Hz]	
[413]	Motor speed high limit [RPM]	
[414]	Motor speed high limit [Hz]	
[416]	Torque limit motor mode	
[417]	Torque limit generator mode	
[482]	Power limit motor mode	
[483]	Power limit generator mode	
[491]	Positive speed limit [RPM]	
[492]	Positive speed limit [Hz]	
[493]	Negative speed limit [RPM]	
[494]	Negative speed limit [Hz]	
[495]	Positive torque limit	
[496]	Negative torque limit	
[553]	Term. 29 high ref./feedb. value	
[558]	Term. 33 high ref./feedb. value	
[590]	Digital & relay bus control	
[593]	Pulse out #27 bus control	
[595]	Pulse out #29 bus control	
[597]	Pulse out #30/6 bus control	
[615]	Terminal 53 high ref./feedb. value	
[625]	Terminal 54 high ref./feedb. value	
[653]	Term 42 output bus ctrl	
[663]	Terminal X30/8 bus control	
[673]	Terminal X45/1 bus control	
[683]	Terminal X45/3 bus control	
[702]	Speed PID proportional gain	
[703]	Speed PID integral time	

Option	Name	Description
[708]	Speed PID feed forward factor	
[748]	PCD feed forward	
[890]	Bus jog 1 speed	
[891]	Bus jog 2 speed	
[1680]	Fieldbus CTW 1	
[1681]	Fieldbus sync. REF	
[1682]	Fieldbus REF 1	
[1683]	Fieldbus pos. REF	
[1685]	FC port CTW 1	
[1686]	FC port REF 1	
[1688]	Fieldbus torque FF.	
[1740]	Fieldbus sync. delta	
[1741]	Fieldbus profile velocity	
[1742]	Fieldbus velocity FF.	
[1743]	Fieldbus acceleration FF.	
[1744]	Fieldbus target velocity	
[1782]	Home position	
[1783]	Homing speed	
[1788]	Master home position	
[3310]	Sync factor master	
[3311]	Sync factor slave	
[3401]	PCD 1 write to MCO	
[3402]	PCD 2 write to MCO	
[3403]	PCD 3 write to MCO	
[3404]	PCD 4 write to MCO	
[3405]	PCD 5 write to MCO	
[3406]	PCD 6 write to MCO	
[3407]	PCD 7 write to MCO	
[3408]	PCD 8 write to MCO	
[3409]	PCD 9 write to MCO	
[3410]	PCD 10 write to MCO	
[3644]	Terminal X49/7 bus control	

Option	Name	Description
[3654]	Terminal X49/9 bus control	
[3664]	Terminal X49/11 bus control	
[4520]	Type	

Parameter 10-51 Process Data Config Read

Table 603: Parameter 10-51 Process Data Config Read

10-51 Process Data Config Read		
Default value: Size related	Parameter type: Option, Array [156]	Setup: All setups
Conversion index: –	Data type: Uint16	Change during operation: True

Only elements [2] and [3] of this array can be selected. [0] and [1] are fixed.

Option	Name	Description
[-]	None	
[15]	Readout: actual setup	
[1397]	Alert alarm word	
[1398]	Alert warning word	
[1399]	Alert status word	
[1472]	Legacy alarm word	
[1473]	Legacy warning word	
[1474]	Leg. ext. status word	
[1500]	Operating hours	
[1501]	Running hours	
[1502]	kWh counter	
[1600]	Control word	
[1601]	Reference [unit]	
[1602]	Reference %	
[1603]	Status word	
[1605]	Main actual value [%]	
[1606]	Actual position	
[1607]	Target position	
[1608]	Position error	
[1609]	Custom readout	
[1610]	Power [kW]	
[1611]	Power [hp]	

Option	Name	Description
[1612]	Motor voltage	
[1613]	Frequency	
[1614]	Motor current	
[1615]	Frequency [%]	
[1616]	Torque [Nm]	
[1617]	Speed [RPM]	
[1618]	Motor thermal	
[1619]	Thermistor sensor temperature	
[1620]	Motor angle	
[1621]	Torque [%] high res.	
[1622]	Torque [%]	
[1623]	Motor shaft power [kW]	
[1624]	Calibrated stator resistance	
[1625]	Torque [Nm] high	
[1628]	Angle error	
[1630]	DC link voltage	
[1632]	Brake energy /s	
[1633]	Brake energy average	
[1634]	Heatsink temp.	
[1635]	Inverter thermal	
[1638]	SL controller state	
[1639]	Control card temp.	
[1642]	Service log counter	
[1644]	Speed error [RPM]	
[1645]	Motor phase U current	
[1646]	Motor phase V current	
[1647]	Motor phase W current	
[1648]	Speed ref. after ramp [RPM]	
[1650]	External reference	
[1651]	Pulse reference	
[1652]	Feedback[Unit]	
[1653]	Digi pot reference	

Option	Name	Description
[1657]	Feedback [RPM]	
[1660]	Digital input	
[1661]	Terminal 53 switch setting	
[1662]	Analog input 53	
[1663]	Terminal 54 switch setting	
[1664]	Analog input 54	
[1665]	Analog output 42 [mA]	
[1666]	Digital output [bin]	
[1667]	Freq. input #29 [Hz]	
[1668]	Freq. input #33 [Hz]	
[1669]	Pulse output #27 [Hz]	
[1670]	Pulse output #29 [Hz]	
[1671]	Relay output [bin]	
[1672]	Counter A	
[1673]	Counter B	
[1674]	Prec. stop counter	
[1675]	Analog in X30/11	
[1676]	Analog in X30/12	
[1677]	Analog out X30/8 [mA]	
[1678]	Analog out X45/1 [mA]	
[1679]	Analog out X45/3 [mA]	
[1684]	Comm. option STW	
[1687]	Bus readout alarm/warning	
[1689]	Configurable alarm/warning word	
[1690]	Alarm word	
[1691]	Alarm word 2	
[1692]	Warning word	
[1693]	Warning word 2	
[1694]	Ext. status word	
[1695]	Ext. status word 2	
[1696]	Maintenance word	
[1697]	Alarm word 3	

Option	Name	Description
[1698]	Warning word 3	
[1804]	Mech brake count	
[1820]	Commanded position	
[1821]	Master position	
[1823]	Virtual master pos.	
[1824]	Marker pos. offset	
[1825]	Latched actual pos.	
[1826]	Actual velocity [pu/s]	
[1827]	Safe opt. est. speed	
[1828]	Safe opt. meas. speed	
[1829]	Safe opt. speed error	
[1836]	Analog input X48/2 [mA]	
[1837]	Temp. input X48/4	
[1838]	Temp. input X48/7	
[1839]	Temp. input X48/10	
[1840]	Analog input X49/1	
[1841]	Analog input X49/3	
[1842]	Analog input X49/5	
[1843]	Analog input X49/7	
[1844]	Analog out X49/9	
[1845]	Analog out X49/11	
[1846]	X49 digital output [bin]	
[1860]	Digital input 2	
[1889]	Mode of operation display	
[1899]	Speed PID torque FF. [Nm]	
[3421]	PCD 1 read from MCO	
[3422]	PCD 2 read from MCO	
[3423]	PCD 3 read from MCO	
[3424]	PCD 4 read from MCO	
[3425]	PCD 5 read from MCO	
[3426]	PCD 6 read from MCO	
[3427]	PCD 7 read from MCO	

Option	Name	Description
[3428]	PCD 8 read from MCO	
[3429]	PCD 9 read from MCO	
[3430]	PCD 10 read from MCO	
[3440]	Digital inputs	
[3441]	Digital outputs	
[3450]	Actual position	
[3451]	Commanded position	
[3452]	Actual master position	
[3453]	Slave index position	
[3454]	Master index position	
[3455]	Curve position	
[3456]	Track error	
[3457]	Synchronizing error	
[3458]	Actual velocity	
[3459]	Actual master velocity	
[3460]	Synchronizing status	
[3461]	Axis status	
[3462]	Program status	
[3464]	MCO 302 status	
[3465]	MCO 302 control	
[3466]	SPI error counter	
[3470]	MCO alarm word 1	
[3471]	MCO alarm word 2	
[4029]	B-EMF protection log readout	
[4280]	Safe option status	
[4285]	Active safe func.	
[4521]	Status	
[4523]	Baseline failure	
[4590]	Stator [%]	
[4591]	Load [%]	
[4592]	Sensor 1 [%]	
[4593]	Sensor 1 [unit]	

Option	Name	Description
[4594]	Sensor 2 [%]	
[4595]	Sensor 2 [unit]	
[4596]	Sensor 3 [%]	
[4597]	Sensor 3 [unit]	
[4598]	Sensor 4 [%]	
[4599]	Sensor 4 [unit]	

5.12 Parameter Group 12-** Ethernet

5.12.1 12-0* IP Settings

Parameter 12-01 IP Address

Table 604: Parameter 12-01 IP Address

12-01 IP Address		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: 1 setup
Conversion index: 0	Data type: OctetString	Change during operation: True

Configure the IP address of the option. Read-only if *parameter 12-00 IP Address Assignment* is set to *[1] DHCP*, *[2] BOOTP*, or via DIP switches. In POWERLINK, the IP address follows the last byte of *parameter 12-60 Node ID* and the 1st part is fixed to 192.168.100 (node ID).

Parameter 12-02 Subnet Mask

Table 605: Parameter 12-02 Subnet Mask

12-02 Subnet Mask		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: 1 setup
Conversion index: 0	Data type: OctetString	Change during operation: True

Configure the IP subnet mask of the option. Read-only if *parameter 12-00 IP Address Assignment* is set to *[1] DHCP* or *[2] BOOTP*. In POWERLINK, it is fixed to 255.255.255.0

Parameter 12-03 Default Gateway

Table 606: Parameter 12-03 Default Gateway

12-03 Default Gateway		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: 1 setup
Conversion index: 0	Data type: OctetString	Change during operation: True

Configure the IP default gateway of the option. Read-only if *parameter 12-00 IP Address Assignment* set to *[1] DHCP* or *[2] BOOTP*. In a non-routed network, this address is set to the IP address of the I/O device.

Parameter 12-04 DHCP Server

Table 607: Parameter 12-04 DHCP Server

12-04 DHCP Server		
Default value: 0	Parameter type: Range, 0 - 2147483647	Setup: 2 setups
Conversion index: 0	Data type: OctetString	Change during operation: True

NOTICE

A power cycle is necessary after setting the IP parameters manually.

This parameter is read-only. It shows the IP address of the found DHCP or BOOTP server.

Parameter 12-05 Lease Expires

Table 608: Parameter 12-05 Lease Expires

12-05 Lease Expires		
Default value: Size related	Parameter type: Range, Size related	Setup: All setups
Conversion index: 0	Data type: TimeDifferenceWithDateIndication	Change during operation: True

This parameter is read-only. It shows the lease time for the current DHCP-assigned IP address.

Parameter 12-06 Name Servers

Table 609: Parameter 12-06 Name Servers

12-06 Name Servers		
Default value: 0	Parameter type: Range, 0 -4294967295	Setup: All setups
Conversion index: 0	Data type: OctetString	Change during operation: True

IP addresses of the domain name servers. Can be automatically assigned when using DHCP.

Parameter 12-07 Domain Name

Table 610: Parameter 12-07 Domain Name

12-07 Domain Name		
Default value: 0	Parameter type: Range, 0 - 48	Setup: 1 setup
Conversion index: 0	Data type: VisibleString	Change during operation: True

Domain name of the attached network. Can be automatically assigned when using DHCP network.

Parameter 12-08 Host Name

Table 611: Parameter 12-08 Host Name

12-08 Host Name		
Default value: 0	Parameter type: Range, 0 - 48	Setup: 1 setup
Conversion index: 0	Data type: VisibleString	Change during operation: True

Logical (given) name of the option.

NOTICE

The display of the drive only shows the 1st 19 characters, but the remaining characters are stored in the drive. If hardware switches are different from all ON or all OFF, the switches have priority.

Parameter 12-09 Physical Address

Table 612: Parameter 12-09 Physical Address

12-09 Physical Address		
Default value: 0	Parameter type: Range, 0 - 17	Setup: 1 setup
Conversion index: 0	Data type: VisibleString	Change during operation: True

This parameter is read-only. It shows the physical (MAC) address of the option.

5.12.2 12-1* Ethernet Link Parameters

Parameter 12-10 Link Status

Table 613: Parameter 12-10 Link Status

12-10 Link Status		
Default value: [0] No link	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter is read-only. It shows the link status of the Ethernet ports. Index [0] is used for port 1, and index [1] is used for port 2. For EtherCAT, index [0] is for the in-port, and index [1] is for the out-port.

Option	Name	Description
[0]*	No link	
[1]	Link	

Parameter 12-11 Link Duration

Table 614: Parameter 12-11 Link Duration

12-11 Link Duration		
Default value: Size related	Parameter type: Range, Size related	Setup: All setups
Conversion index: 0	Data type: TimeDifferenceWithDateIndication	Change during operation: True

Shows the duration of the present link on each port in dd:hh:mm:ss.

Parameter 12-12 Auto Negotiation

Table 615: Parameter 12-12 Auto Negotiation

12-12 Auto Negotiation		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Configures auto negotiation of Ethernet link parameters, for each port: ON or OFF. Link Speed and Link Duplex can be configured in *parameter 12-13 Link Speed* and *parameter 12-14 Link Duplex*.

Option	Name	Description
[0]	Off	
[1]	On	

Parameter 12-13 Link Speed

Table 616: Parameter 12-13 Link Speed

12-13 Link Speed		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Forces the link speed for each prot in 10 Mbps or 100 Mbps. If *parameter 12-12 Auto Negotiation* is set to *[0] On*, this parameter is read-only and shows the actual link speed. If no link is present, None is shown.

Option	Name	Description
[0]	None	
[1]	10 Mbps	
[2]	100 Mbps	

Parameter 12-14 Link Duplex

Table 617: Parameter 12-14 Link Duplex

12-14 Link Duplex		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

N O T I C E

In POWERLINK, this parameter is locked to half duplex.

Forces the duplex for each port to full or half duplex. If *parameter 12-12 Auto Negotiation* is set to *[1] On*, this parameter is read-only.

Option	Name	Description
[0]	Half duplex	
[1]	Full duplex	

Parameter 12-18 Supervisor MAC

Table 618: Parameter 12-18 Supervisor MAC

12-18 Supervisor MAC		
Default value: 0	Parameter type: Range, 0 - 2147483647	Setup: All setups
Conversion index: 0	Data type: OctetString	Change during operation: True

MAC addresses of currently active supervisors.

Parameter 12-19 Supervisor IP Addr.

Table 619: Parameter 12-19 Supervisor IP Addr.

12-19 Supervisor IP Addr.		
Default value: 0	Parameter type: Range, 0 - 2147483647	Setup: All setups
Conversion index: 0	Data type: OctetString	Change during operation: True

IP addresses of currently active supervisors.

5.12.3 12-2* Process Data

Parameter 12-20 Control Instance

Table 620: Parameter 12-20 Control Instance

12-20 Control Instance		
Default value: Size related	Parameter type: Range, 0 - 255	Setup: 1 setup
Conversion index: 0	Data type: Uint8	Change during operation: True

This parameter is read-only. It shows the connection to the master.

- In Ethernet/IP: If no CIP connection is present, None is shown.
- In EtherCAT: If no connection is active, None is shown, otherwise it shows the active PDO.
- In POWERLINK: If no connection is active, None is shown, otherwise it shows the active PDO (23).

Parameter 12-21 Process Data Config Write

Table 621: Parameter 12-21 Process Data Config Write

12-21 Process Data Config Write		
Default value: Size related	Parameter type: Option, Array [81]	Setup: All setups
Conversion index: –	Data type: Uint16	Change during operation: True

Option	Name	Description
[-]	None	
[109]	Mode of operation	
[302]	Minimum reference	
[303]	Maximum reference	
[312]	Catch up/slow down value	
[321]	Touch target	
[322]	Master scale numerator	
[323]	Master scale denominator	
[326]	Master Offset	
[328]	Master offset speed ref	
[341]	Ramp 1 ramp up time	
[342]	Ramp 1 ramp down time	
[351]	Ramp 2 ramp up time	
[352]	Ramp 2 ramp down time	
[361]	Ramp 3 ramp up time	
[362]	Ramp 3 ramp down time	
[380]	Jog/homing ramp time jog ramp time	
[381]	Quick stop ramp time	
[411]	Motor speed low limit [RPM]	
[412]	Motor speed low limit [Hz]	
[413]	Motor speed high limit [RPM]	
[414]	Motor speed high limit [Hz]	
[416]	Torque limit motor mode	
[417]	Torque limit generator mode	
[482]	Power limit motor mode	

Option	Name	Description
[483]	Power limit generator mode	
[491]	Positive speed limit [RPM]	
[492]	Positive speed limit [Hz]	
[493]	Negative speed limit [RPM]	
[494]	Negative speed limit [Hz]	
[495]	Positive torque limit	
[496]	Negative torque limit	
[553]	Term. 29 high ref./feedb. value	
[558]	Term. 33 high ref./feedb. value	
[590]	Digital & relay bus control	
[593]	Pulse out #27 bus control	
[595]	Pulse out #29 bus control	
[597]	Pulse out #30/6 bus control	
[615]	Terminal 53 high ref./feedb. value	
[625]	Terminal 54 high ref./feedb. value	
[653]	Term 42 output bus ctrl	
[663]	Terminal X30/8 bus control	
[673]	Terminal X45/1 bus control	
[683]	Terminal X45/3 bus control	
[702]	Speed PID proportional gain	
[703]	Speed PID integral time	
[708]	Speed PID feed forward factor	
[748]	PCD feed forward	
[890]	Bus jog 1 speed	
[891]	Bus jog 2 speed	
[1680]	Fieldbus CTW 1	
[1681]	Fieldbus sync. REF	
[1682]	Fieldbus REF 1	
[1683]	Fieldbus pos. REF	
[1685]	FC port CTW 1	
[1686]	FC port REF 1	
[1688]	Fieldbus torque FF.	

Option	Name	Description
[1740]	Fieldbus sync. delta	
[1741]	Fieldbus profile velocity	
[1742]	Fieldbus velocity FF.	
[1743]	Fieldbus acceleration FF.	
[1744]	Fieldbus target velocity	
[1782]	Home position	
[1783]	Homing speed	
[1788]	Master home position	
[3310]	Sync factor master	
[3311]	Sync factor slave	
[3401]	PCD 1 write to MCO	
[3402]	PCD 2 write to MCO	
[3403]	PCD 3 write to MCO	
[3404]	PCD 4 write to MCO	
[3405]	PCD 5 write to MCO	
[3406]	PCD 6 write to MCO	
[3407]	PCD 7 write to MCO	
[3408]	PCD 8 write to MCO	
[3409]	PCD 9 write to MCO	
[3410]	PCD 10 write to MCO	
[3644]	Terminal X49/7 bus control	
[3654]	Terminal X49/9 bus control	
[3664]	Terminal X49/11 bus control	
[4520]	Type	

Parameter 12-22 Process Data Config Read

Table 622: Parameter 12-22 Process Data Config Read

12-22 Process Data Config Read		
Default value: Size related	Parameter type: Option, Array [156]	Setup: All setups
Conversion index: –	Data type: Uint16	Change during operation: True

Option	Name	Description
[0]	None	
[15]	Readout: actual setup	

Option	Name	Description
[1397]	Alert alarm word	
[1398]	Alert warning word	
[1399]	Alert status word	
[1472]	Legacy alarm word	
[1473]	Legacy warning word	
[1474]	Leg. ext. status word	
[1500]	Operating hours	
[1501]	Running hours	
[1502]	kWh counter	
[1600]	Control word	
[1601]	Reference [unit]	
[1602]	Reference %	
[1603]	Status word	
[1605]	Main actual value [%]	
[1606]	Actual position	
[1607]	Target position	
[1608]	Position error	
[1609]	Custom readout	
[1610]	Power [kW]	
[1611]	Power [hp]	
[1612]	Motor voltage	
[1613]	Frequency	
[1614]	Motor current	
[1615]	Frequency [%]	
[1616]	Torque [Nm]	
[1617]	Speed [RPM]	
[1618]	Motor thermal	
[1619]	Thermistor sensor temperature	
[1620]	Motor angle	
[1621]	Torque [%] high res.	
[1622]	Torque [%]	
[1623]	Motor shaft power [kW]	

Option	Name	Description
[1624]	Calibrated stator resistance	
[1625]	Torque [Nm] high	
[1628]	Angle error	
[1630]	DC link voltage	
[1632]	Brake energy /s	
[1633]	Brake energy average	
[1634]	Heatsink temp.	
[1635]	Inverter thermal	
[1638]	SL controller state	
[1639]	Control card temp.	
[1642]	Service log counter	
[1644]	Speed error [RPM]	
[1645]	Motor phase U current	
[1646]	Motor phase V current	
[1647]	Motor phase W current	
[1648]	Speed ref. after ramp [RPM]	
[1650]	External reference	
[1651]	Pulse reference	
[1652]	Feedback[Unit]	
[1653]	Digi pot reference	
[1657]	Feedback [RPM]	
[1660]	Digital input	
[1661]	Terminal 53 switch setting	
[1662]	Analog input 53	
[1663]	Terminal 54 switch setting	
[1664]	Analog input 54	
[1665]	Analog output 42 [mA]	
[1666]	Digital output [bin]	
[1667]	Freq. input #29 [Hz]	
[1668]	Freq. input #33 [Hz]	
[1669]	Pulse output #27 [Hz]	
[1670]	Pulse output #29 [Hz]	

Option	Name	Description
[1671]	Relay output [bin]	
[1672]	Counter A	
[1673]	Counter B	
[1674]	Prec. stop counter	
[1675]	Analog in X30/11	
[1676]	Analog in X30/12	
[1677]	Analog out X30/8 [mA]	
[1678]	Analog out X45/1 [mA]	
[1679]	Analog out X45/3 [mA]	
[1684]	Comm. option STW	
[1687]	Bus readout alarm/warning	
[1689]	Configurable alarm/warning word	
[1690]	Alarm word	
[1691]	Alarm word 2	
[1692]	Warning word	
[1693]	Warning word 2	
[1694]	Ext. status word	
[1695]	Ext. status word 2	
[1696]	Maintenance word	
[1697]	Alarm word 3	
[1698]	Warning word 3	
[1804]	Mech brake count	
[1820]	Commanded position	
[1821]	Master position	
[1823]	Virtual master pos.	
[1824]	Marker pos. offset	
[1825]	Latched actual pos.	
[1826]	Actual velocity [pu/s]	
[1827]	Safe opt. est. speed	
[1828]	Safe opt. meas. speed	
[1829]	Safe opt. speed error	
[1836]	Analog input X48/2 [mA]	

Option	Name	Description
[1837]	Temp. input X48/4	
[1838]	Temp. input X48/7	
[1839]	Temp. input X48/10	
[1840]	Analog input X49/1	
[1841]	Analog input X49/3	
[1842]	Analog input X49/5	
[1843]	Analog input X49/7	
[1844]	Analog out X49/9	
[1845]	Analog out X49/11	
[1846]	X49 digital output [bin]	
[1860]	Digital input 2	
[1889]	Mode of operation display	
[1899]	Speed PID torque FF. [Nm]	
[3421]	PCD 1 read from MCO	
[3422]	PCD 2 read from MCO	
[3423]	PCD 3 read from MCO	
[3424]	PCD 4 read from MCO	
[3425]	PCD 5 read from MCO	
[3426]	PCD 6 read from MCO	
[3427]	PCD 7 read from MCO	
[3428]	PCD 8 read from MCO	
[3429]	PCD 9 read from MCO	
[3430]	PCD 10 read from MCO	
[3440]	Digital inputs	
[3441]	Digital outputs	
[3450]	Actual position	
[3451]	Commanded position	
[3452]	Actual master position	
[3453]	Slave index position	
[3454]	Master index position	
[3455]	Curve position	
[3456]	Track error	

Option	Name	Description
[3457]	Synchronizing error	
[3458]	Actual velocity	
[3459]	Actual master velocity	
[3460]	Synchronizing status	
[3461]	Axis status	
[3462]	Program status	
[3464]	MCO 302 status	
[3465]	MCO 302 control	
[3466]	SPI error counter	
[3470]	MCO alarm word 1	
[3471]	MCO alarm word 2	
[4029]	B-EMF protection log readout	
[4280]	Safe option status	
[4285]	Active safe func.	
[4521]	Status	
[4523]	Baseline failure	
[4590]	Stator [%]	
[4591]	Load [%]	
[4592]	Sensor 1 [%]	
[4593]	Sensor 1 [unit]	
[4594]	Sensor 2 [%]	
[4595]	Sensor 2 [unit]	
[4596]	Sensor 3 [%]	
[4597]	Sensor 3 [unit]	
[4598]	Sensor 4 [%]	
[4599]	Sensor 4 [unit]	

Parameter 12-23 Process Data Config Write Size

Table 623: Parameter 12-23 Process Data Config Write Size

12-23 Process Data Config Write Size		
Default value: 16	Parameter type: Range, 8 - 32	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Use this parameter to configure the PCD write size in bits. Only values of multiples of 8 are valid.

Parameter 12-24 Process Data Config Read Size

Table 624: Parameter 12-24 Process Data Config Read Size

12-24 Process Data Config Read Size		
Default value: 16	Parameter type: Range, 8 - 32	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Use this parameter to configure the PCD read size in bits. Only values of multiples of 8 are valid.

Parameter 12-27 Master Address

Table 625: Parameter 12-27 Master Address

12-27 Master Address		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: OctetString	Change during operation: False

Parameter 12-28 Store Data Values

Table 626: Parameter 12-28 Store Data Values

12-28 Store Data Values		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter activates a function that stores all parameter values in the non-volatile memory (EEPROM) thus retaining parameter values at power-down. The parameter returns to *[0] Off*.

Option	Name	Description
[0]*	Off	
[1]	Store all setups	
[2]	Store all setups	

Parameter 12-29 Store Always

Table 627: Parameter 12-29 Store Always

12-29 Store Always		
Default value: [0] Off	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Activates a function that always stores received parameter data in the non-volatile memory (EEPROM).

Option	Name	Description
[0]*	Off	
[1]	On	

5.12.4 12-3* EtherNet/IP

Parameter 12-30 Warning Parameter

Table 628: Parameter 12-30 Warning Parameter

12-30 Warning Parameter		
Default value: 0	Parameter type: Range, 0 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter is read-only. It shows the EthetNet/IP-specific 16-bit status word.

Table 629: 16-Bit Status Word, EtherNet/IP

Bit	Description
0	Owned
1	Not used
2	Configured
3	Not used
4	Not used
5	Not used
6	Not used
7	Not used
8	Minor recoverable fault
9	Minor unrecoverable fault
10	Major recoverable fault
11	Major unrecoverable fault
12	Not used
13	Not used
14	Not used
15	Not used

Parameter 12-31 Net Reference

Table 630: Parameter 12-31 Net Reference

12-31 Net Reference		
Default value: [0] Off	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Shows the reference source in instance 21/71.

Option	Name	Description
[0]*	Off	
[1]	On	

Parameter 12-32 Net Control

Table 631: Parameter 12-32 Net Control

12-32 Net Control		
Default value: [0] Off	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Shows the control source in instance 21/71.

Option	Name	Description
[0]*	Off	
[1]	On	

Parameter 12-33 CIP Revision

Table 632: Parameter 12-33 CIP Revision

12-33 CIP Revision		
Default value: Size related	Parameter type: Range, 0 - 65535	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter is read-only. It shows the CIP version of the option software.

Parameter 12-34 CIP Product Code

Table 633: Parameter 12-34 CIP Product Code

12-34 CIP Product Code		
Default value: Size related	Parameter type: Range, 0 - 65535	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter is read-only. It shows the CIP product code.

Parameter 12-35 EDS Parameter

Table 634: Parameter 12-35 EDS Parameter

12-35 EDS Parameter		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation:

This parameter is used to configure the drive via DeviceNet and build the EDS-file.

Parameter 12-37 COS Inhibit Timer

Table 635: Parameter 12-37 COS Inhibit Timer

12-37 COS Inhibit Timer		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Read-only change-of-state inhibit timer. If the option is configured for COS operation, this inhibit timer can be configured in the forward open telegram to prevent that continuously changing PCD data generates extensive network traffic. The inhibit time is in ms. 0 = disabled.

Parameter 12-38 COS Filter

Table 636: Parameter 12-38 COS Filter

12-38 COS Filter		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Change-of-state PCD filters. Sets up a filter mask for each word of process data when operating in COS mode. Single bits in the PCDs can be filtered in/out.

5.12.5 12-4* Modbus TCP

Parameter 12-40 Status Parameter

Table 637: Parameter 12-40 Status Parameter

12-40 Status Parameter		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter is read-only. It shows the Modbus TCP-specific 16-bit status word.

Table 638: 16-Bit Status Word, Modbus TCP

Bit	Description	Bit = [0]	Bit = [1]
0	Link status port 1	Disconnected	Connected
1	Link status port 2	Disconnected	Connected
2	Link speed	0/10 Mbps	100 Mbps
3	Link duplex	Half	Full
4	Port 502 communication	No	Yes
5	UNUSED	–	–
6	Valid IP address	No	Yes
7	Modbus timeout (30 s)	No	Yes
8	Duplicate IP	No	Yes
9	Register 7 error	No	Yes
10	FTP server	Disabled	Enabled
11	HTTP server	Disabled	Enabled
12	SMTP server	Disabled	Enabled
13	Cable diagnosis	Disabled	Enabled
14	Auto crossover	Disabled	Enabled
15	IPMG	Disabled	Enabled

Parameter 12-41 Slave Message Count

Table 639: Parameter 12-41 Slave Message Count

12-41 Slave Message Count		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter is read-only. It shows the number of Modbus messages received and processed by the follower drive.

Parameter 12-42 Slave Exception Message Count

Table 640: Parameter 12-42 Slave Exception Message Count

12-42 Slave Exception Message Count		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter is read-only. It shows the number of Modbus messages for which the follower has sent an exception response.

5.12.6 12-4* Fieldbus Extension

Parameter 12-49 Ethernet Extended Status

Table 641: Parameter 12-49 Ethernet Extended Status

12-49 Ethernet Extended Status		
Default value: 0	Parameter type: Range, 0 - 0xFFFFFFFF	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

5.12.7 12-5* EtherCAT

Parameter 12-50 Configured Station Alias

Table 642: Parameter 12-50 Configured Station Alias

12-50 Configured Station Alias		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: False

Changes are first active after a power cycle. If the DIP switches are all set to ON or all to OFF, the display setting has priority over the DIP switch. Otherwise, the DIP switch settings have priority over the parameter. In this case, the parameter reflects the setting of the DIP switches. Changes to the DIP switch setting are active after a power-up.

Parameter 12-51 Configured Station Address

Table 643: Parameter 12-51 Configured Station Address

12-51 Configured Station Address		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter shows the configured station address. The parameter can only be set by the master at power-up.

Parameter 12-59 EtherCAT Status

Table 644: Parameter 12-59 EtherCAT Status

12-59 EtherCAT Status		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup:All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter contains status information on the EtherCAT interface. Each of the 32 bits is linked to a status information of the EtherCAT interface.

- Bits 0–7 contain information from ESC register 0x0130 (AL status).
- Bits 8–15 are reserved for future use.
- Bits 16–27 contain information from the ESC register 0x0110 and 0x0111 (DL status).
- Bits 28–31 are reserved for future use.

Table 645: Bit Interpretation

Bit	Description	Bit = [0]	Bit = [1]
0	EtherCAT statemachine state	–	Init State
1	EtherCAT statemachine state	–	Pre-OP
2	EtherCAT statemachine state	–	Safe-OP
3	EtherCAT statemachine state	–	Reserved
4	Reserved	–	–
5	Reserved	–	–
6	Reserved	–	–
7	Reserved	–	–
8	Reserved	–	–
9	Reserved	–	–
10	Reserved	–	–
11	Reserved	–	–
12	Reserved	–	–
13	Reserved	–	–
14	Reserved	–	–
15	Reserved	–	–
16	PDI operational	EEPROM not loaded, PDI not operational	EEPROM loaded correctly, PDI operational
17	PDI watchdog status	Watchdog expired	Watchdog reloaded
18	Enhanced link detection	Deactivated for all ports	Activated for all ports
19	–	–	Reserved
20	Physical link on port 0	No link	Link detected
21	Physical link on port 1	No link	Link detected

Bit	Description	Bit = [0]	Bit = [1]
22	Reserved	–	–
23	Reserved	–	–
24	Loop port 0	Open	Closed
25	Communication on port 0	No stable communication	Communication established
26	Loop port 1	Open	Closed
27	Communication on port 1	No stable communication	Communication established
28	Reserved	–	–
29	Reserved	–	–
30	Reserved	–	–
31	Reserved	–	–

5.12.8 12-6* Ethernet POWERLINK

Parameter 12-60 Node ID

Table 646: Parameter 12-60 Node ID

12-60 Node ID		
Default value: 1	Parameter type: Range, 1 - 239	Setup: 2 setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the node ID in this parameter or alternatively in the hardware switch. To adjust the node ID in this parameter, set the hardware switch to 0 or to 255 (all switches set to [ON] or to [OFF]). Otherwise, this parameter shows the actual setting of the switch. The settings of this parameter take effect at the next power-up cycle.

Table 647: Parameter 12-62 SDO Timeout

12-62 SDO Timeout		
Default value: 15000	Parameter type: Range, 0 - 2000000000	Setup: All setups
Conversion index: -3	Data type: Uint32	Change during operation: True

This parameter is the SDO Timeout in ms. The value of this parameter is read during communication initialization into Object 1300h.

Parameter 12-63 Basic Ethernet Timeout

Table 648: Parameter 12-63 Basic Ethernet Timeout

12-63 Basic Ethernet Timeout		
Default value: 5000.000	Parameter type: Range, 0 - 2000000.000 ms	Setup: All setups
Conversion index: -3	Data type: Uint32	Change during operation: True

This parameter is the basic Ethernet timeout in ms. This parameter is mapped to Object 1F99h. If the POWERLINK interface does not receive a SoC frame within the specified time, the interface shifts to standard Ethernet mode. This feature is available from version 2.00 of the POWERLINK interface.

Parameter 12-66 Threshold

Table 649: Parameter 12-66 Threshold

12-66 Threshold		
Default value: 15	Parameter type: Range, 0 - 2000000000	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter holds 6 threshold values. If 1 of these thresholds are exceeded, the POWERLINK interface exits operational mode. The parameters are set to optimal settings and should not be changed. The actual value of the counters can be read out via *parameter 12-67 Threshold Counters*.

Parameter 12-67 Threshold Counters

Table 650: Parameter 12-67 Threshold Counters

12-67 Threshold Counters		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter holds 6 counters. The counter reflects the actual value in the POWERLINK interface. Counters increase with a count of 8 at detection of an error and decrease with a count of 1 when no errors are detected. The values are read-only.

Parameter 12-68 Cumulative Counters

Table 651: Parameter 12-68 Cumulative Counters

12-68 Cumulative Counters		
Default value: 0	Parameter type: Range, 0 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Loss of SoC Cumulative. This parameter reflects the value in object 1C0Bh, sub-index 1.

Parameter 12-69 Ethernet POWERLINK Status

Table 652: Parameter 12-69 Ethernet POWERLINK Status

12-69 Ethernet POWERLINK Status		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter shows various status and error conditions for the Ethernet POWERLINK connection.

5.12.9 12-8* Other Ethernet Services

Parameter 12-80 FTP Server

Table 653: Parameter 12-80 FTP Server

12-80 FTP Server		
Default value: [0] Disabled	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Enables/disables the built-in FTP server.

Option	Name	Description
[0]*	Disabled	
[1]	Enabled	

Parameter 12-81 HTTP Server

Table 654: Parameter 12-81 HTTP Server

12-81 HTTP Server		
Default value: [0] Disabled	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Enables/disables the built-in HTTP (web) server.

Option	Name	Description
[0]*	Disabled	
[1]	Enabled	

Parameter 12-82 SMTP Service

Table 655: Parameter 12-82 SMTP Service

12-82 SMTP Service		
Default value: [0] Disabled	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Enables/disables the built-in SMTP (e-mail) service on the option.

Option	Name	Description
[0]*	Disabled	
[1]	Enabled	

Parameter 12-83 SNMP Agent

Table 656: Parameter 12-83 SNMP Agent

12-83 SNMP Agent		
Default value: [1] Enabled	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Use this parameter to either enable or disable the SNMP agent.

Option	Name	Description
[0]	Disabled	
[1]*	Enabled	

Parameter 12-84 Address Conflict Detection

Table 657: Parameter 12-84 Address Conflict Detection

12-84 Address Conflict Detection		
Default value: [1] Enabled	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Use this parameter to detect and resolve IP address conflict.

Option	Name	Description
[0]	Disabled	
[1]*	Enabled	

Table 658: Parameter 12-85 ACD Last Conflict

12-85 ACD Last Conflict		
Default value: 0	Parameter type: Range, 0 - 2147483647	Setup: 2 setups
Conversion index: 0	Data type: OctetString	Change during operation: True

The name of the IP address causing the most recent address conflict.

Parameter 12-89 Transparent Socket Channel Port

Table 659: Parameter 12-89 Transparent Socket Channel Port

12-89 Transparent Socket Channel Port		
Default value: Size related	Parameter type: Range, size related	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Configures the TCP port number for the transient socket channel. This enables FC telegrams to be sent transiently on Ethernet via TCP. The default value of 4000.0 indicates disabled.

5.12.10 12-9* Advanced Ethernet Services

Parameter 12-90 Cable Diagnostic

Table 660: Parameter 12-90 Cable Diagnostic

12-90 Cable Diagnostic		
Default value: [0] Disabled	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Enables/disables advanced cable diagnosis function. If enabled, the distance to cable errors can be read out in *parameter 12-93 Cable Error Length*. The parameter resumes to the default setting *[0] Disable* after the diagnostics have finished.

N O T I C E

The cable diagnostics function is only issued on ports where there is no link (see *parameter 12-10 Link Status*).

Option	Name	Description
[0]*	Disabled	
[1]	Enabled	

12-91 Auto Cross Over

Table 661: Parameter 12-91 Auto Cross Over

12-91 Auto Cross Over		
Default value: [1] Enabled	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

NOTICE

Disabling of the auto-crossover function requires crossed Ethernet cables for daisy-chaining the options.

Option	Name	Description
[0]	Disabled	
[1]*	Enabled	

Parameter 12-92 IGMP Snooping

Table 662: Parameter 12-92 IGMP Snooping

12-92 IGMP Snooping		
Default value: [1] Enabled	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

This function presents flooding of the Ethernet protocol stack by only forwarding multicast packets to ports that are a member of the multicast group.

Option	Name	Description
[0]	Disabled	
[1]*	Enabled	

Parameter 12-93 Cable Error Length

Table 663: Parameter 12-93 Cable Error Length

12-93 Cable Error Length		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

If cable diagnostics is enabled in *parameter 12-90 Cable Diagnostic*, the built-in switch is possible via time domain reflectometry (TDR). This is a measurement technique which detects common cabling problems such as open circuits, short circuits, and impedance mismatches or breaks in transmission cables. The distance from the option to the error is shown in meters with an accuracy of ±2 m (6.6 ft). The value 0 means no errors detected.

Parameter 12-94 Broadcast Storm Protection

Table 664: Parameter 12-94 Broadcast Storm Protection

12-94 Broadcast Storm Protection		
Default value: -1	Parameter type: Range, -1 - 20%	Setup: 2 setups
Conversion index: 0	Data type: Int8	Change during operation: True

The built-in switch is capable of protecting the switch system from receiving too many broadcast packages, which can use up network resources. The value indicates a percentage of the total bandwidth that is allowed for broadcast messages. Example: OFF means that the filter is disabled - all broadcast messages are passed through. The value 0% means that no broadcast messages are passed through. A value of 10% means that 10% of the total bandwidth is allowed for broadcast messages. If the amount of broadcast messages exceeds the 10% threshold, they are blocked.

Parameter 12-95 Inactivity Timeout

Table 665: Parameter 12-95 Inactivity Timeout

12-95 Inactivity Timeout		
Default value: 120	Parameter type: Range, 0 - 3600	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Applies to *parameter 12-94 Broadcast Storm Protection*, if the broadcast storm protection also includes multicast telegrams.

Parameter 12-96 Port Config

Table 666: Parameter 12-96 Port Config

12-96 Port Config		
Default value: Size related	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Enable or disable the port-mirroring function. The function is used for troubleshooting with a network analyzer tool.

Option	Name	Description
[0]	Normal	
[1]	Mirror port 1 to 2	
[2]	Mirror port 2 to 1	
[10]	Port 1 disabled	
[11]	Port 2 disabled	
[254]	Mirror int. port to 1	
[255]	Mirror int. port to 2	

Parameter 12-97 QoS Priority

Table 667: Parameter 12-97 QoS Priority

12-97 QoS Priority		
Default value: Size related	Parameter type: Range, 0 - 63	Setup: All setups
Conversion index: 0	Data type: Int8	Change during operation: True

Each index sets the DSCP value of different types of QoS prioritized messages.

Parameter 12-98 Interface Counters

Table 668: Parameter 12-98 Interface Counters

12-98 Interface Counters		
Default value: 4000	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter is read-only. Advanced interface counters from a built-in switch can be used for low-level troubleshooting. The parameter shows a sum of port 1 + port 2.

Parameter 12-99 Media Counters

Table 669: Parameter 12-99 Media Counters

12-99 Media Counters		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter is read-only. Advanced interface counters from a built-in switch can be used for low-level troubleshooting. The parameter shows a sum of port 1 + port 2.

5.13 Parameter Group 13-** Smart Logic Control

Smart logic control (SLC) is a sequence of user-defined actions (see *parameter 13-52 SL Controller 1 Action*) executed by the SLC when the associated user-defined event (see *parameter 13-51 SL Controller 1 Event*) is evaluated as true by the SLC. The condition for an event can be a particular status, or that the output from a logic rule or a comparator operand becomes true. That leads to an associated action as illustrated:

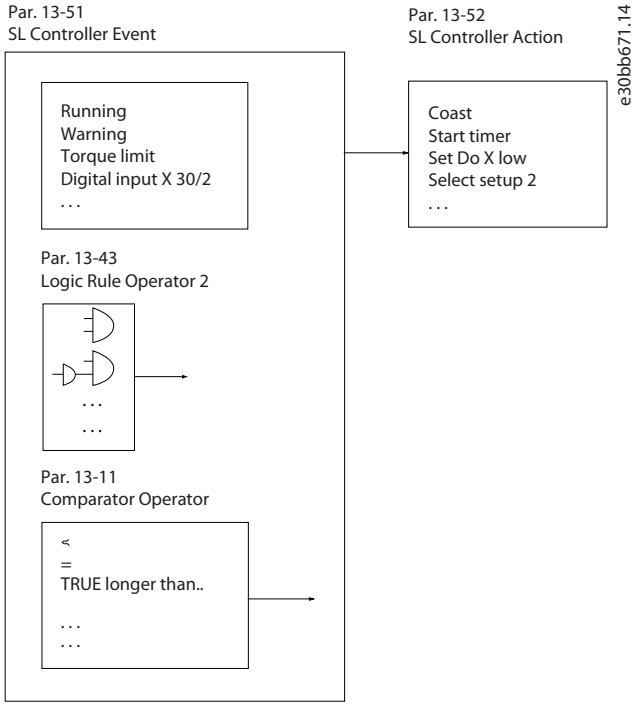


Illustration 77: Smart Logic Control (SLC)

Events and actions are each numbered and linked in pairs (states). This means that when the 1st event is fulfilled (becomes true), the 1st action is executed. After this, the conditions of the 2nd event are evaluated and if evaluated true, the 2nd action is executed, and so on. Only 1 event is evaluated at any time. If an event is evaluated as false, nothing happens (in the SLC) during the current scan interval and no other events are evaluated. This means that when the SLC starts, it evaluates the 1st event (and only the 1st event) in each scan interval. Only when the 1st event is evaluated as true, the SLC executes the 1st action and starts evaluating the 2nd event. It is possible to program 1–20 events and actions. When the last event/action has been executed, the sequence starts over again from the 1st event/action.

Four concurring sequences can be defined with each up to 20 event and action pairs. The sequences are executed at the same time but operate separately. For example, sequence 1 may have executed 3 actions, while sequence 2 still waits for its 1st event to occur. In this example, *parameter 13-00 SL Controller Mode [0]*, *parameter 13-01 Start Event [1]*, and *parameter 13-02 Stop Event [2]* correspond to sequence 1, sequence 2, sequence 3, and the like.

N O T I C E

Comparators Flip-Flops, timers, and logic rules are shared between sequences.

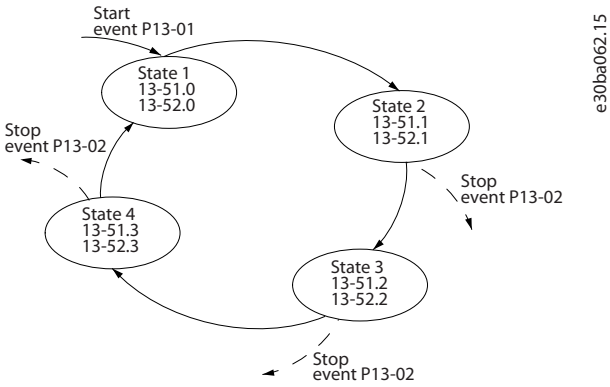


Illustration 78: Example of Events and Actions

Starting and stopping the SLC

Start and stop the SLC by selecting *[1] On* or *[0] Off* in *parameter 13-00 SL Controller Mode*. The SLC always starts in state 0 (where it evaluates event [0]). The SLC starts when the start event (defined in *parameter 13-01 Start Event*) is evaluated as true (provided that *[1] On* is selected in *parameter 13-00 SL Controller Mode*). The SLC stops when the stop event (*parameter 13-02 Stop Event*) is true. *Parameter 13-03 Reset SLC* resets all SLC parameters and starts programming from scratch.

N O T I C E
SLC is only active in auto-on mode, not hand-on mode.

5.13.1 13-0* SLC Settings

Use the SLC settings to activate, deactivate, and reset the smart logic control sequence. The logic functions and comparators are always running in the background, which opens for separate control of digital inputs and outputs.

Parameter 13-00 SL Controller Mode

Table 670: Parameter 13-00 SL Controller Mode

13-00 SL Controller Mode		
Default value: Size related	Parameter type: Option, Array [4]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

An array with 4 elements [0]–[3] is shown in the display.

Option	Name	Description
[0]	Off	Disables the smart logic controller.
[1]	On	Enables the smart logic controller.

Parameter 13-01 Start Event

Table 671: Parameter 13-01 Start Event

13-01 Start Event		
Default value: Size related	Parameter type: Option, Array [4]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the boolean (true or false) input to activate smart logic control.

Option	Name	Description
[0]	False	Select the boolean (true or false) input to activate smart logic control. Enters the fixed value *False*.
[1]	True	Enters the fixed value *True*.
[2]	Running	The motor runs.
[3]	In range	The motor runs within the programmed current and speed ranges set in *parameter 4-50 Warning Current Low* to *parameter 4-53 Warning Speed High*.
[4]	On reference	The motor runs on reference.
[5]	Torque limit	The torque limit set in *parameter 4-16 Torque Limit Motor Mode* or *parameter 4-17 Torque Limit Generator Mode* is exceeded.
[6]	Current limit	The motor current limit set in *parameter 4-18 Current Limit* is exceeded.
[7]	Out of current range	The motor current is outside the range set in *parameter 4-18 Current Limit*.
[8]	Below I_{low}	The motor current is lower than set in *parameter 4-50 Warning Current Low*.
[9]	Above I_{high}	The motor current is higher than set in *parameter 4-51 Warning Current High*.
[10]	Out of speed range	The speed is outside the range set in *parameter 4-52 Warning Speed Low* and *parameter 4-53 Warning Speed High*.
[11]	Below speed low	The output speed is lower than the setting in *parameter 4-52 Warning Speed Low*.
[12]	Above speed high	The output speed is higher than the setting in *parameter 4-53 Warning Speed High*.
[13]	Out of feedb. range	The feedback is outside the range set in *parameter 4-56 Warning Feedback Low* and *parameter 4-57 Warning Feedback High*.
[14]	Below feedb. low	The feedback is below the limit set in *parameter 4-56 Warning Feedback Low*.
[15]	Above feedb. high	The feedback is above the limit set in *parameter 4-57 Warning Feedback High*.
[16]	Thermal warning	The thermal warning turns on when the temperature exceeds the limit in the motor, the drive, the brake resistor, or the thermistor.
[17]	Mains out of range	The mains voltage is outside the specified voltage range.
[18]	Reversing	The output is high when the drive is running counterclockwise (the logical product of the status bits running AND reverse).
[19]	Warning	A warning is active.
[20]	Alarm (trip)	A (trip) alarm is active.
[21]	Alarm (trip lock)	A (trip lock) alarm is active.
[22]	Comparator 0	Use the result of comparator 0.
[23]	Comparator 1	Use the result of comparator 1.
[24]	Comparator 2	Use the result of comparator 2.
[25]	Comparator 3	Use the result of comparator 3.
[26]	Logic rule 0	Use the result of logic rule 0.
[27]	Logic rule 1	Use the result of logic rule 1.

Option	Name	Description
[28]	Logic rule 2	Use the result of logic rule 2.
[29]	Logic rule 3	Use the result of logic rule 3.
[33]	Digital input DI18	Use the result of digital input 18.
[34]	Digital input DI19	Use the result of digital input 19.
[35]	Digital input DI27	Use the result of digital input 27.
[36]	Digital input DI29	**NOTICE** This option is only available in FC 302. Use the result of digital input 29.
[37]	Digital input DI32	Use the result of digital input 32.
[38]	Digital input DI33	Use the result of digital input 33.
[39]	Start command	A start command is issued. This is the default option.
[40]	Drive stopped	A stop command (jog, stop, quick stop, coast) is issued - and not from SLC itself.
[41]	Reset trip	A reset is issued.
[42]	Auto-reset trip	An auto reset is performed.
[43]	OK key	[OK] is pressed. Only available on the graphical LCP.
[44]	Reset key	[Reset] is pressed. Only available on the graphical LCP.
[45]	Left key	[◁] is pressed. Only available on the graphical LCP.
[46]	Right key	[▷] is pressed. Only available on the graphical LCP.
[47]	Up key	[△] is pressed. Only available on the graphical LCP.
[48]	Down key	[▽] is pressed. Only available on the graphical LCP.
[50]	Comparator 4	Use the result of comparator 4.
[51]	Comparator 5	Use the result of comparator 5.
[60]	Logic rule 4	Use the result of logic rule 4.
[61]	Logic rule 5	Use the result of logic rule 5.
[76]	Digital input X30/2	Use the value of X30/2 (VLT® General Purpose I/O MCB 101).
[77]	Digital input X30/3	Use the value of X30/3 (VLT® General Purpose I/O MCB 101).
[78]	Digital input X30/4	Use the value of X30/4 (VLT® General Purpose I/O MCB 101).
[79]	Digital input X46/1	Use the value of X46/1 (VLT® Extended Relay Card MCB 113).
[80]	Digital input X46/3	Use the value of X46/3 (VLT® Extended Relay Card MCB 113).
[81]	Digital input X46/5	Use the value of X46/5 (VLT® Extended Relay Card MCB 113).
[82]	Digital input X46/7	Use the value of X46/7 (VLT® Extended Relay Card MCB 113).
[83]	Digital input X46/9	Use the value of X46/9 (VLT® Extended Relay Card MCB 113).

Option	Name	Description
[84]	Digital input X46/11	Use the value of X46/11 (VLT® Extended Relay Card MCB 113).
[85]	Digital input X46/13	Use the value of X46/13 (VLT® Extended Relay Card MCB 113).
[94]	RS Flipflop 0	See *parameter group 13-1* Comparators*.
[95]	RS Flipflop 1	See *parameter group 13-1* Comparators*.
[96]	RS Flipflop 2	See *parameter group 13-1* Comparators*.
[97]	RS Flipflop 3	See *parameter group 13-1* Comparators*.
[98]	RS Flipflop 4	See *parameter group 13-1* Comparators*.
[99]	RS Flipflop 5	See *parameter group 13-1* Comparators*.
[100]	RS Flipflop 6	See *parameter group 13-1* Comparators*.
[101]	RS Flipflop 7	See *parameter group 13-1* Comparators*.
[212]	Emergency mode	
[222]	Homing OK	
[223]	On target	
[224]	Position error	
[225]	Position limit	
[226]	Touch on target	
[227]	Touch activated.	
[228]	Comparator 6	Use the result of comparator 6.
[229]	Comparator 7	Use the result of comparator 7.
[230]	Comparator 8	Use the result of comparator 8.
[231]	Comparator 9	Use the result of comparator 9.
[232]	Logic rule 6	Use the result of logic rule 6.
[233]	Logic rule 7	Use the result of logic rule 7.
[234]	Logic rule 8	Use the result of logic rule 8.
[235]	Logic rule 9	Use the result of logic rule 9.
[238]	RS flipflop 8	See *parameter group 13-1* Comparators*.
[239]	RS flipflop 9	See *parameter group 13-1* Comparators*.

Parameter 13-02 Stop Event

Table 672: Parameter 13-02 Stop Event

13-02 Stop Event		
Default value: Size related	Parameter type: Option, Array [4]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the boolean (true or false) input to deactivate smart logic control.

Option	Name	Description
[0]	False	For descriptions of options *[0] False–[61] Logic rule 5*, see *parameter 13-01 Start Event*.
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current limit	
[7]	Out of current range	
[8]	Below I_{low}	
[9]	Above I_{high}	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL time-out 0	
[31]	SL time-out 1	

Option	Name	Description
[32]	SL timeout 2	
[33]	Digital input DI18	
[34]	Digital input DI19	
[35]	Digital input DI27	
[36]	Digital input DI29	**NOTICE** This option is only available in FC 302.
[37]	Digital input DI32	
[38]	Digital input DI33	
[39]	Start command	
[40]	Drive stopped	
[41]	Reset trip	
[42]	Auto-reset trip	
[43]	OK key	
[44]	Reset key	
[45]	Left key	
[46]	Right key	
[47]	Up key	
[48]	Down key	
[50]	Comparator 4	
[51]	Comparator 5	
[60]	Logic rule 4	
[61]	Logic rule 5	
[70]	SL time-out 3	Smart logic controller time 3 is timed out.
[71]	SL time-out 4	Smart logic controller time 4 is timed out.
[72]	SL time-out 5	Smart logic controller time 5 is timed out.
[73]	SL time-out 6	Smart logic controller time 6 is timed out.
[74]	SL time-out 7	Smart logic controller time 7 is timed out.
[75]	Start command given	
[76]	Digital input X30/2	
[77]	Digital input X30/3	
[78]	Digital input X30/4	

Option	Name	Description
[79]	Digital input X46/1	
[80]	Digital input X46/3	
[81]	Digital input X46/5	
[82]	Digital input X46/7	
[83]	Digital input X46/9	
[84]	Digital input X46/11	
[85]	Digital input X46/13	
[90]	ATEX ETR cur. warning	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If the *alarm 164, ATEX ETR cur.lim.alarm* is active, the output is 1.
[91]	ATEX ETR cur. alarm	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 166, ATEX ETR freq.lim.alarm* is active, the output is 1.
[92]	ATEX ETR freq. warning	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 163, ATEX ETR cur.lim.warning* is active, the output is 1.
[93]	ATEX ETR freq. alarm	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *warning 165, ATEX ETR freq.lim.warning* is active, the output is 1.
[94]	RS flipflop 0	See *parameter group 13-1* Comparators*.
[95]	RS flipflop 1	See *parameter group 13-1* Comparators*.
[96]	RS flipflop 2	See *parameter group 13-1* Comparators*.
[97]	RS flipflop 3	See *parameter group 13-1* Comparators*.
[98]	RS flipflop 4	See *parameter group 13-1* Comparators*.
[99]	RS flipflop 5	See *parameter group 13-1* Comparators*.
[100]	RS flipflop 6	See *parameter group 13-1* Comparators*.
[101]	RS flipflop 7	See *parameter group 13-1* Comparators*.
[102]	Relay 1	
[103]	Relay 2	
[104]	Relay 3	X47/VLT® Extended Relay Card MCB 113.
[105]	Relay 4	X47/VLT® Extended Relay Card MCB 113.
[106]	Relay 5	X47/VLT® Extended Relay Card MCB 113.
[107]	Relay 6	X47/VLT® Extended Relay Card MCB 113.
[108]	Relay 7	X34/VLT® Relay Card MCB 105.
[109]	Relay 8	X34/VLT® Relay Card MCB 105.
[110]	Relay 9	X34/VLT® Relay Card MCB 105.
[212]	Emergency mode	
[222]	Homing OK	

Option	Name	Description
[223]	On target	
[224]	Position error	
[225]	Position limit	
[226]	Touch on target	
[227]	Touch activated	
[228]	Comparator 6	
[229]	Comparator 7	
[230]	Comarator 8	
[231]	Comparator 9	
[232]	Logic rule 6	
[233]	Logic rule 7	
[234]	Logic rule 8	
[235]	Logic rule 9	
[236]	SL time-out 8	
[237]	SL time-out 9	
[238]	RS flipflop 8	
[239]	RS flipflop 9	
[240]	SL digital output A	
[241]	SL digital output B	
[242]	SL digital output C	
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

Parameter 13-03 Reset SLC

Table 673: Parameter 13-03 Reset SLC

13-03 Reset SLC		
Default value: [0] D0 not reset SLC	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Do not reset SLC	Retain programmed settings in *parameter group 13-** Smart Logic*
[1]	Reset SLC	Reset all parameters in *parameter group 13-** Smart Logic*

5.13.2 13-1* Comparators

Comparators are used for comparing continuous variables (that is output frequency, output current, analog input, and so on) to fixed preset values.

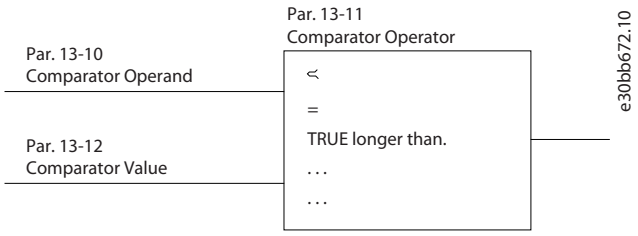


Illustration 79: Comparators

There are digital values that are compared to fixed time values. See the explanation in *parameter 13-10 Comparator Operand*. Comparators are evaluated once in each scan interval. Use the result (true or false) directly. All parameters in this parameter group are array parameters with index 0–9. Select index 0 to program comparator 0, select index 1 to program comparator 1, and so on.

Parameter 13-10 Comparator Operand

Table 674: Parameter 13-10 Comparator Operand

13-10 Comparator Operand		
Default value: Size related	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Options *[1] Reference %* to *[31] Counter B* are variables which are compared based on their values. Options *[50] FALSE* to *[186] Drive in auto mode* are digital values (true/false) where the comparison is based on the amount of time during which they are set to true or false. See *parameter 13-11 Comparator Operator*.

Option	Name	Description
[0]	DISABLED	The comparator is disabled.
[1]	Reference %	The resulting remote reference in %.
[2]	Feedback %	[RPM] or [Hz], as set in *parameter 0-02 Motor Speed Unit*.
[3]	Motor speed	[RPM] or [Hz], as set in *parameter 0-02 Motor Speed Unit*.
[4]	Motor current	
[5]	Motor torque	
[6]	Motor power	
[7]	Motor voltage	
[8]	DC-link voltage	
[9]	Motor thermal	The value is in %.
[10]	Drive thermal	The value is in %.
[11]	Heat sink temp.	The value is in %.
[12]	Analog input AI53	The value is in %.
[13]	Analog input AI54	The value is in %.
[14]	Analog input AIFB10	AIFB10 is internal 10 V supply.
[15]	Analog input AIS24V	AIS24V is a 24 V switch mode power supply.

Option	Name	Description
[17]	Analog input AICCT	Value is in [°]. AICCT is control card temperature.
[18]	Pulse input FI29	**NOTICE** This option is only available in FC 302. The value is in %.
[19]	Pulse input FI33	The value is in %.
[20]	Alarm number	Shows the actual alarm number. **NOTICE** With this selection, it is not possible to use < and > as comparator operators. **NOTICE** Several alarms/warnings can be present at the same time. As the alarm/warning numbers are not grouped in a predefined order, defining a range is not relevant.
[21]	Warning number	Shows the actual warning number. **NOTICE** With this selection, it is not possible to use < and > as comparator operators. **NOTICE** Several alarms/warnings can be present at the same time. As the alarm/warning numbers are not grouped in a predefined order, defining a range is not relevant.
[22]	Analog input X30/11	
[23]	Analog input X30/12	
[30]	Counter A	
[31]	Counter B	
[32]	Process PID error	Value of the PID error (*parameter 18-90 Process PID Error*).
[33]	Process PID Output	Value of the PID output (*parameter 18-91 Process PID Output*).
[34]	Analog input X48/2	
[35]	Temp input X48/4	
[36]	Temp input X48/7	
[37]	Temp input X48/10	
[39]	Safe opt. speed error	
[43]	Analog input X49/1	
[44]	Analog input X49/3	

Option	Name	Description
[45]	Analog input X49/5	
[50]	FALSE	Use to enter the fixed value *False* in the comparator.
[51]	TRUE	Use to enter *True* in the comparator.
[52]	Control ready	The control board receives supply voltage.
[53]	Drive ready	The drive is ready for operation and applies a signal on the control board.
[54]	Running	The motor runs.
[55]	Reversing	The output is active when the drive runs counterclockwise (the logical product of the status bits running AND reverse).
[56]	In range	The motor runs within the programmed current and speed ranges set in *parameter 4-50 Warning Current Low* to *parameter 4-53 Warning Speed High*.
[60]	On reference	The motor runs on reference.
[61]	Below reference, low	The motor runs at a reference which is less than the value in *parameter 4-54 Warning Reference Low*.
[62]	Above ref, high	The motor runs at a reference which exceeds the value in *parameter 4-55 Warning Reference High*.
[65]	Torque limit	The torque exceeds the value in *parameter 4-16 Torque Limit Motor Mode* or *parameter 4-17 Torque Limit Generator Mode*.
[66]	Current limit	The motor current exceeds the value in *parameter 4-18 Current Limit*.
[67]	Out of current range	The motor current is outside the range set in *parameter 4-18 Current Limit*.
[68]	Below I low	The motor current is lower than the value in *parameter 4-50 Warning Current Low*.
[69]	Above I high	The motor current is higher than the value in *parameter 4-51 Warning Current High*.
[70]	Out of speed range	The speed is outside the range set in *parameter 4-52 Warning Speed Low* and *parameter 4-53 Warning Speed High*.
[71]	Below speed low	The output speed is lower than the value in *parameter 4-52 Warning Speed Low*.
[72]	Above speed high	The output speed is higher than the value in *parameter 4-53 Warning Speed High*.
[75]	Out of feedack range	The feedback is outside the range set in *parameter 4-56 Warning Feedback Low* and *parameter 4-57 Warning Feedback High*.
[76]	Below feedback low	The feedback is lower than the limit set in *parameter 4-56 Warning Feedback Low*.
[77]	Above feedback high	The feedback exceeds the limit set in *parameter 4-57 Warning Feedback High*.
[80]	Thermal warning	This operand becomes true when the drive detects any thermal warning, for instance when the temperature exceeds the limit in the motor, the drive, the brake resistor, or thermistor.
[82]	Mains out of range	The mains voltage is outside the specified voltage range.
[85]	Warning	If a warning is triggered, this operand gets the warning number.
[86]	Alarm (trip)	A trip alarm is active.
[87]	Alarm (trip lock)	A trip lock alarm is active.
[90]	Bus OK	Active communication (no timeout) via the serial communication port.

Option	Name	Description
[91]	Torque limit & stop	If the drive has received a stop signal and is at the torque limit, the signal is logic 0.
[92]	Brake fault (IGBT)	The brake IGBT is short-circuited.
[93]	Mech. brake control	The mechanical brake is active.
[94]	Safe stop active	**NOTICE** This option is only available in FC 302.
[100]	Comparator 0	The result of comparator 0.
[101]	Comparator 1	The result of comparator 1.
[102]	Comparator 2	The result of comparator 2.
[103]	Comparator 3	The result of comparator 3.
[104]	Comparator 4	The result of comparator 4.
[105]	Comparator 5	The result of comparator 5.
[106]	Comparator 6	The result of comparator 6.
[107]	Comparator 7	The result of comparator 7.
[108]	Comparator 8	The result of comparator 8.
[109]	Comparator 9	The result of comparator 9.
[110]	Logic rule 0	The result of logic rule 0.
[111]	Logic rule 1	The result of logic rule 1.
[112]	Logic rule 2	The result of logic rule 2.
[113]	Logic rule 3	The result of logic rule 3.
[114]	Logic rule 4	The result of logic rule 4.
[115]	Logic rule 5	The result of logic rule 5.
[116]	Logic rule 6	The result of logic rule 6.
[117]	Logic rule 7	The result of logic rule 7.
[118]	Logic rule 8	The result of logic rule 8.
[119]	Logic rule 9	The result of logic rule 9.
[120]	SL time-out 0	The result of the SLC timer 0.
[121]	SL time-out 1	The result of the SLC timer 1.
[122]	SL time-out 2	The result of the SLC timer 2.
[123]	SL time-out 3	The result of the SLC timer 3.
[124]	SL time-out 4	The result of the SLC timer 4.
[125]	SL time-out 5	The result of the SLC timer 5.

Option	Name	Description
[126]	SL time-out 6	The result of the SLC timer 6.
[127]	SL time-out 7	The result of the SLC timer 7.
[128]	SL time-out 8	The result of the SLC timer 8.
[129]	SL time-out 9	The result of the SLC timer 9.
[130]	Digital input DI18	Digital input 18 (high=true).
[131]	Digital input DI19	Digital input 19 (high=true).
[132]	Digital input DI27	Digital input 27 (high=true).
[133]	Digital input DI29	Digital input 29 (high=true)
[134]	Digital input DI32	Digital input 32 (high=true).
[135]	Digital input DI33	Digital input 33 (high=true).
[136]	RS flipflop 0	
[137]	RS flipflop 1	
[138]	RS flipflop 2	
[139]	RS flipflop 3	
[140]	RS flipflop 4	
[141]	RS flipflop 5	
[142]	RS flipflop 6	
[143]	RS flipflop 7	
[144]	RS flipflop 8	
[145]	RS flipflop 9	
[150]	SL digital output A	Use the result of the SLC output A.
[151]	SL digital output B	Use the result of the SLC output B.
[152]	SL digital output C	Use the result of the SLC output C.
[153]	SL digital output D	Use the result of the SLC output D.
[154]	SL digital output E	Use the result of the SLC output E.
[155]	SL digital output F	Use the result of the SLC output F.
[160]	Relay 1	Relay 1 is active.
[161]	Relay 2	Relay 2 is active.
[162]	Relay 3	
[163]	Relay 4	
[164]	Relay 5	
[165]	Relay 6	

Option	Name	Description
[166]	Relay 7	
[167]	Relay 8	
[168]	Relay 9	
[180]	Local reference active	Active when *parameter 3-13 Reference Site* is *[2] Local* or when *parameter 3-13 Reference Site* is *[0] Linked to hand/auto*, at the same time as the LCP is in hand-on mode.
[181]	Remote reference active	Active when *parameter 3-13 Reference Site* is *[1] Remote* or *[0] Linked to hand/auto*, while the LCP is in auto-on mode.
[182]	Start command	Active when there is an active start command and no stop command.
[183]	Drive stopped	A stop command (jog, stop, qstop, coast) is issued – and not from the SLC itself.
[185]	Drive in hand mode	Active when the drive is in hand-on mode.
[186]	Drive in auto mode	Active when the drive is in auto-on mode.
[187]	Start command given	
[190]	Digital input X30/2	
[191]	Digital input X30/3	
[192]	Digital input X30/4	
[193]	Digital input X46/1	
[194]	Digital input X46/3	
[195]	Digital input X46/5	
[196]	Digital input X46/7	
[197]	Digital input X46/9	
[198]	Digital input X46/11	
[199]	Digital input X46/13	
[212]	Emergency mode	
[222]	Homing OK	**NOTICE** This option is only available with software version 48.2X and newer. Homing is completed with the selected homing function (*parameter 17-80 Homing Function*).
[223]	On target	**NOTICE** This option is only available with software version 48.2X and newer. Positioning is completed and the on-target signal is sent when the actual position is within *parameter 3-05 On Reference Window* for the duration of *parameter 3-09 On Target Time* and the actual speed does not exceed *parameter 3-05 On Reference Window*.

Option	Name	Description
[224]	Position error	**NOTICE** This option is only available with software version 48.2X and newer. The position error exceeds the value in *parameter 4-71 Maximum Position Error* for the time set in *parameter 4-72 Position Error Timeout*.
[225]	Position limit	**NOTICE** This option is only available with software version 48.2X and newer. The position is outside the limits set in *parameter 3-06 Minimum Position* and *parameter 3-07 Maximum Position*.
[226]	Touch on target	**NOTICE** This option is only available with software version 48.2X and newer. Target position is reached in touch probe position mode.
[227]	Touch activated	**NOTICE** This option is only available with software version 48.2X and newer. Touch probe positioning is active. The drive monitors the touch probe sensor input.
[249]	Therm. sensor temp.	

Parameter 13-11 Comparator Operator

Table 675: Parameter 13-11 Comparator Operator

13-11 Comparator Operator		
Default value: Size related	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the operator to be used in the comparison. This is an array parameter containing comparator operators 0–5.

Option	Name	Description
[0]	<	**NOTICE** If *[20] Alarm number* or *[21] Warning number* is selected in *parameter 3-10 Comparator Operand*, *[0]* < cannot be selected in this parameter. The result of the evaluation is true when the variable selected in *parameter 13-10 Comparator Operand* is smaller than the fixed value in *parameter 13-12 Comparator Value*. The result is false if the variable selected in *parameter 13-10 Comparator Operand* is greater than the fixed value in *parameter 13-12 Comparator Value*.
[1]	≈ (equal)	The result of the evaluation is true when the variable selected in *parameter 13-10 Comparator Operand* is approximately equal to the fixed value in *parameter 13-12 Comparator Value*.

Option	Name	Description
[2]	>	**N O T I C E** If *[20] Alarm number* or *[21] Warning number* is selected in *parameter 3-10 Comparator Operand*, *[2] >* cannot be selected in this parameter. Inverse logic of option *[0]* <.
[5]	TRUE longer than..	
[6]	FALSE longer-than..	
[7]	TRUE shorter than..	
[8]	FALSE shorter than..	

Parameter 13-12 Comparator Value

Table 676: Parameter 13-12 Comparator Value

13-12 Comparator Value		
Default value: Size related	Parameter type: Range, -100000.000 - 100000, Array [10]	Setup: 2 setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the trigger level for the variable that is monitored by this comparator. This is an array parameter containing comparator values 0–9.

5.13.2.1 RS FlipFlops

The reset/set flipflops hold the signal until set/reset.

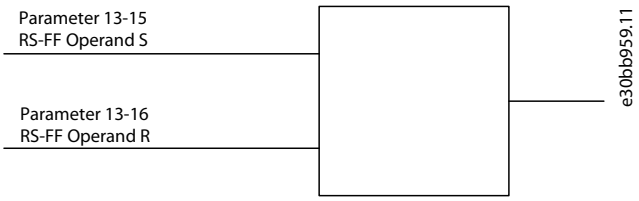


Illustration 80: Reset/Set Flipflops

Two parameters are used and the output can be used in the logic rules and as events.

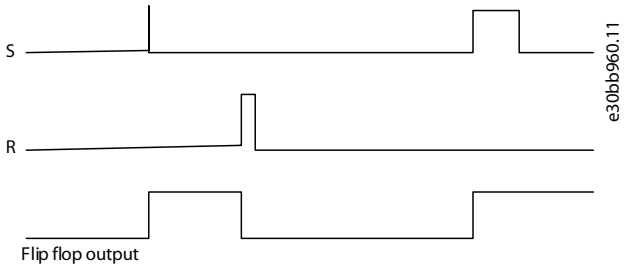


Illustration 81: Flipflop Outputs

The 2 operators can be selected from a long list. As a special case, the same digital input can be used as both set and reset, making it possible to use the same digital input as start/stop. The following settings can be used to set up the same digital input (for example, DI32) as start/stop.

Table 677: Operators

Parameter	Setting	Notes
Parameter 13-00 SL Controller Mode	*[1] On*	–
Parameter 13-01 Start Event [0]	*True*	–
Parameter 13-02 Stop Event [0]	*False*	–
Parameter 13-40 Logic Rule Boolean 1 [0]	*[37] Digital input DI32*	–
Parameter 13-42 Logic Rule Boolean 2 [0]	*[2] Running*	–
Parameter 13-41 Logic Rule Operator 1 [0]	*[3] AND NOT*	–
Parameter 13-40 Logic Rule Boolean 1 [1]	*[37] Digital input DI32*	–
Parameter 13-42 Logic Rule Boolean 2 [1]	*[2] Running*	–
Parameter 13-41 Logic Rule Operator 1 [1]	*[1] AND*	–
Parameter 13-15 RS-FF Operand S [0]	*[26] Logic rule 0*	Output from *parameter 13-41 Log ic Rule Operator 1* [0].
Parameter 13-16 RS-FF Operand R [0]	*[27] Logic rule 1*	Output from *parameter 13-41 Log ic Rule Operator 1* [1].
Parameter 13-51 SL Controller 1 Event [0]	*[94] RS Flipflop 0*	Output from *parameter 13-15 RSFF Operand S* and *parameter 13-16 RSFF Operand R*.
Parameter 13-52 SL Controller 1 Action [0]	*[22] Run*	–
Parameter 13-51 SL Controller 1 Event [1]	*[27] Logic rule 1*	–
Parameter 13-52 SL Controller 1 Action [1]	*[24] Stop*	–

Parameter 13-15 RS-FF Operand S

Table 678: Parameter 13-15 RS-FF Operand S

13-15 RS-FF Operand S		
Default value: Size related	Parameter Type: option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	False	
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	

Option	Name	Description
[5]	Torque limit	
[6]	Current limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL time-out 0	
[31]	SL time-out 1	
[32]	SL time-out 2	
[33]	Digital input DI18	
[34]	Digital input DI19	
[35]	Digital input DI27	

Option	Name	Description
[36]	Digital input DI29	**NOTICE** This option is only available in FC 302.
[37]	Digital input DI32	
[38]	Digital input DI33	
[39]	Start command	
[40]	Drive stopped	
[41]	Reset trip	
[42]	Auto-reset trip	
[43]	OK key	[OK] is pressed. Only available on the graphical LCP.
[44]	Reset key	[Reset] is pressed. Only available on the graphical LCP.
[45]	Left key	[◁] is pressed. Only available on the graphical LCP.
[46]	Right key	[▷] is pressed. Only available on the graphical LCP.
[47]	Up key	[△] is pressed. Only available on the graphical LCP.
[48]	Down key	[▽] is pressed. Only available on the graphical LCP.
[50]	Comparator 4	
[51]	Comparator 5	
[60]	Logic rule 4	
[61]	Logic rule 5	
[70]	SL time-out 3	
[71]	SL time-out 4	
[72]	SL time-out 5	
[73]	SL time-out 6	
[74]	SL time-out 7	
[75]	Start command given	
[76]	Digital input X30/2	
[77]	Digital input X30/3	
[78]	Digital input X30/4	
[79]	Digital input 46/1	
[80]	Digital input 46/3	
[81]	Digital input 46/5	
[82]	Digital input 46/7	

Option	Name	Description
[83]	Digital input 46/9	
[84]	Digital input 46/11	
[85]	Digital input X46/13	
[90]	ATEX ETR cur. warning	
[91]	ATEX ETR cur. alarm	
[92]	ATEX ETR freq. warning	
[93]	ATEX ETR freq. alarm	
[94]	RS Flipflop 0	
[95]	RS Flipflop 1	
[96]	RS Flipflop 2	
[97]	RS Flipflop 3	
[98]	RS Flipflop 4	
[99]	RS Flipflop 5	
[100]	RS Flipflop 6	
[101]	RS Flipflop 7	
[102]	Relay 1	
[103]	Relay 2	
[104]	Relay 3	X47/VLT® Extended Relay Card MCB 113.
[105]	Relay 4	X47/VLT® Extended Relay Card MCB 113.
[106]	Relay 5	X47/VLT® Extended Relay Card MCB 113.
[107]	Relay 6	X47/VLT® Extended Relay Card MCB 113.
[108]	Relay 7	X34/VLT® Relay Card MCB 105.
[109]	Relay 8	X34/VLT® Relay Card MCB 105.
[110]	Relay 9	X34/VLT® Relay Card MCB 105.
[212]	Emergency mode	
[222]	Homing OK	**NOTICE** This option is only available with software version 48.2X and newer. Homing is completed with the selected homing function (*parameter 17-80 Homing Function*).
[223]	On target	**NOTICE** This option is only available with software version 48.2X and newer.

Option	Name	Description
		Positioning is completed and the on-target signal is sent when the actual position is within *parameter 3-05 On Reference Window* for the duration of *parameter 3-09 On Target Time* and the actual speed does not exceed *parameter 3-05 On Reference Window*.
[224]	Position error	**NOTICE** This option is only available with software version 48.2X and newer. The position error exceeds the value in *parameter 4-71 Maximum Position Error* for the time set in *parameter 4-72 Position Error Timeout*.
[225]	Position limit	**NOTICE** This option is only available with software version 48.2X and newer. The position is outside the limits set in *parameter 3-06 Minimum Position* and *parameter 3-07 Maximum Position*.
[226]	Touch on target	**NOTICE** This option is only available with software version 48.2X and newer. Target position is reached in touch probe position mode.
[227]	Touch activated	Touch probe positioning active. The drive monitors the touch probe sensor input.
[228]	Comparator 6	
[229]	Comparator 7	
[230]	Comparator 8	
[231]	Comparator 9	
[232]	Logic rule 6	
[233]	Logic rule 7	
[234]	Logic rule 8	
[235]	Logic rule 9	
[236]	SL time-out 8	
[237]	SL time-out 9	
[238]	RS flipflop 8	
[239]	RS flipflop 9	
[240]	SL digital output A	
[241]	SL digital output B	
[242]	SL digital output C	

Option	Name	Description
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

Parameter 13-16 RS-FF Operand R

Table 679: Parameter 13-16 RS-FF Operand R

13-16 RS-FF Operand R		
Default value: Size related	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	False	
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	

Option	Name	Description
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL time-out 0	
[31]	SL time-out 1	
[32]	SL time-out 2	
[33]	Digital input DI18	
[34]	Digital input DI19	
[35]	Digital input DI27	
[36]	Digital input DI29	**NOTICE** This option is only available in FC 302.
[37]	Digital input DI32	
[38]	Digital input DI33	
[39]	Start command	
[40]	Drive stopped	
[41]	Reset trip	
[42]	Auto-reset trip	
[43]	OK key	[OK] is pressed. Only available on the graphical LCP.
[44]	Reset key	[Reset] is pressed. Only available on the graphical LCP.
[45]	Left key	[◁] is pressed. Only available on the graphical LCP.
[46]	Right key	[▷] is pressed. Only available on the graphical LCP.
[47]	Up key	[△] is pressed. Only available on the graphical LCP.
[48]	Down key	[▽] is pressed. Only available on the graphical LCP.
[50]	Comparator 4	
[51]	Comparator 5	
[60]	Logic rule 4	
[61]	Logic rule 5	

Option	Name	Description
[70]	SL time-out 3	
[71]	SL time-out 4	
[72]	SL time-out 5	
[73]	SL time-out 6	
[74]	SL time-out 7	
[75]	Start command given	
[76]	Digital input X30/2	
[77]	Digital input X30/3	
[78]	Digital input X30/4	
[79]	Digital input 46/1	
[80]	Digital input 46/3	
[81]	Digital input 46/5	
[82]	Digital input 46/7	
[83]	Digital input 46/9	
[84]	Digital input 46/11	
[85]	Digital input X46/13	
[90]	ATEX ETR cur. warning	
[91]	ATEX ETR cur. alarm	
[92]	ATEX ETR freq. warning	
[93]	ATEX ETR freq. alarm	
[94]	RS Flipflop 0	
[95]	RS Flipflop 1	
[96]	RS Flipflop 2	
[97]	RS Flipflop 3	
[98]	RS Flipflop 4	
[99]	RS Flipflop 5	
[100]	RS Flipflop 6	
[101]	RS Flipflop 7	
[102]	Relay 1	
[103]	Relay 2	
[104]	Relay 3	X47/VLT® Extended Relay Card MCB 113.
[105]	Relay 4	X47/VLT® Extended Relay Card MCB 113.

Option	Name	Description
[106]	Relay 5	X47/VLT® Extended Relay Card MCB 113.
[107]	Relay 6	X47/VLT® Extended Relay Card MCB 113.
[108]	Relay 7	X34/VLT® Relay Card MCB 105.
[109]	Relay 8	X34/VLT® Relay Card MCB 105.
[110]	Relay 9	X34/VLT® Relay Card MCB 105.
[212]	Emergency mode	
[222]	Homing OK	**NOTICE** This option is only available with software version 48.2X and newer. Homing is completed with the selected homing function (*parameter 17-80 Homing Function*).
[223]	On target	**NOTICE** This option is only available with software version 48.2X and newer. Positioning is completed and the on-target signal is sent when the actual position is within *parameter 3-05 On Reference Window* for the duration of *parameter 3-09 On Target Time* and the actual speed does not exceed *parameter 3-05 On Reference Window*.
[224]	Position error	**NOTICE** This option is only available with software version 48.2X and newer. The position error exceeds the value in *parameter 4-71 Maximum Position Error* for the time set in *parameter 4-72 Position Error Timeout*.
[225]	Position limit	**NOTICE** This option is only available with software version 48.2X and newer. The position is outside the limits set in *parameter 3-06 Minimum Position* and *parameter 3-07 Maximum Position*.
[226]	Touch on target	**NOTICE** This option is only available with software version 48.2X and newer. Target position is reached in touch probe position mode.
[227]	Touch activated	**NOTICE** This option is only available with software version 48.2X and newer. Touch probe positioning active. The drive monitors the touch probe sensor input.
[228]	Comparator 6	

Option	Name	Description
[229]	Comparator 7	
[230]	Comparator 8	
[231]	Comparator 9	
[232]	Logic rule 6	
[233]	Logic rule 7	
[234]	Logic rule 8	
[235]	Logic rule 9	
[236]	SL time-out 8	
[237]	SL time-out 9	
[238]	RS flipflop 8	
[239]	RS flipflop 9	
[240]	SL digital output A	
[241]	SL digital output B	
[242]	SL digital output C	
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

5.13.3 13-2* Timers

Use the result (true or false) from timers directly to define an event (see *parameter 13-51 SL Controller Event*), or as boolean input in a logic rule (see *parameter 13-40 Logic Rule Boolean 1*, *parameter 13-42 Logic Rule Boolean 2*, or *parameter 13-44 Logic Rule Boolean 3*). A timer is only false when started by an action (for example *[29] Start timer 1*) until the timer value entered in this parameter has elapsed. Then it becomes true again. All parameters in this parameter group are array parameters with index 0–9. Select index 0 to program timer 0, select index 1 to program timer 1, and so on.

Parameter 13-20 SL Controller Time

Table 680: Parameter 13-20 SL Controller Timer

13-20 SL Controller Timer		
Default value: Size related	Parameter type: Range, 0 - 0, Array [10]	Setup: 1 setup
Conversion index: -3	Data type: Timediff w/o DateID	Change during operation: True

Enter the value to define the duration of the false output from the programmed timer. A timer is only false if it is started by an action (that is *[29] Start timer 1*) and until the given timer value has elapsed.

5.13.4 13-4* Logic Rules

Combine up to 3 boolean inputs (true/false inputs) from timers, comparators, digital inputs, status bits, and events using the logical operators AND, OR, and NOT. Select boolean inputs for the calculation in *parameter 13-40 Logic Rule Boolean 1*, *parameter 13-42 Logic Rule Boolean 2*, and *parameter 13-44 Logic Rule Boolean 3*. Define the operators used to logically combine the selected inputs in *parameter 13-41 Logic Rule Operator 1* and *parameter 13-43 Logic Rule Operator 2*.

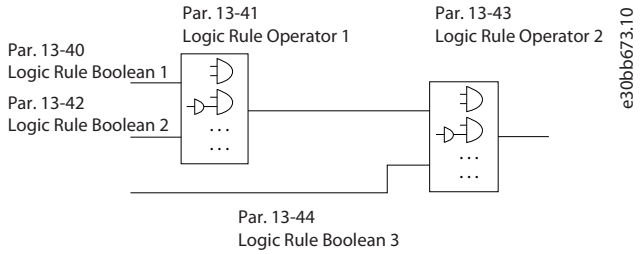


Illustration 82: Logic Rules

Priority of calculation

The results of *parameter 13-40 Logic Rule Boolean 1*, *parameter 13-41 Logic Rule Operator 1*, and *parameter 13-42 Logic Rule Boolean 2* are calculated first. The outcome (true/false) of this calculation is combined with the settings of *parameter 13-43 Logic Rule Operator 2* and *parameter 13-44 Logic Rule Boolean 3*, yielding the final result (true/false) of the logic rule.

Parameter 13-40 Logic Rule Boolean 1

Table 681: Parameter 13-40 Logic Rule Boolean 1

13-40 Logic Rule Boolean 1		
Default value: Size related	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data Type: Uint8	Change during operation: True

Option	Name	Description
[0]	False	Select the 1st boolean (true or false) input for the selected logic rule. See *parameter 13-01 Start Event* and *parameter 13-02 Stop Event* for more information.
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	

Option	Name	Description
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL time-out 0	
[31]	SL time-out 1	
[32]	SL time-out 2	
[33]	Digital input DI18	
[34]	Digital input DI19	
[35]	Digital input DI27	
[36]	Digital input DI29	**NOTICE** This option is only available in FC 302.
[37]	Digital input DI32	
[38]	Digital input DI33	
[39]	Start command	
[40]	Drive stopped	
[41]	Reset trip	
[42]	Auto-reset trip	
[43]	OK key	[OK] is pressed. Only available on the graphical LCP.
[44]	Reset key	[Reset] is pressed. Only available on the graphical LCP.
[45]	Left key	[◁] is pressed. Only available on the graphical LCP.
[46]	Right key	[▷] is pressed. Only available on the graphical LCP.
[47]	Up key	[△] is pressed. Only available on the graphical LCP.
[48]	Down key	[▽] is pressed. Only available on the graphical LCP.

Option	Name	Description
[50]	Comparator 4	Use the result of comparator 4.
[51]	Comparator 5	Use the result of comparator 5.
[60]	Logic rule 4	Use the result of logic rule 4.
[61]	Logic rule 5	Use the result of logic rule 5.
[70]	SL time-out 3	
[71]	SL time-out 4	
[72]	SL time-out 5	
[73]	SL time-out 6	
[74]	SL time-out 7	
[75]	Start command given	
[76]	Digital input X30/2	
[77]	Digital input X30/3	
[78]	Digital input X30/4	
[79]	Digital input X46/1	
[80]	Digital input X46/3	
[81]	Digital input X46/5	
[82]	Digital input X46/7	
[83]	Digital input X46/9	
[84]	Digital input X46/11	
[85]	Digital input X46/13	
[90]	ATEX ETR cur. warning	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 164, ATEX ETR cur.lim.alarm* is active, the output is 1.
[91]	ATEX ETR cur. alarm	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 166, ATEX ETR freq.lim.alarm* is active, the output is 1.
[92]	ATEX ETR freq. warning	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 163, ATEX ETR cur.lim.warning* is active, the output is 1.
[93]	ATEX ETR freq. alarm	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *warning 165, ATEX ETR freq.lim.warning* is active, the output is 1.
[94]	RS Flipflop 0	See *parameter group 13-1* Comparators*.
[95]	RS Flipflop 1	See *parameter group 13-1* Comparators*.
[96]	RS Flipflop 2	See *parameter group 13-1* Comparators*.
[97]	RS Flipflop 3	See *parameter group 13-1* Comparators*.
[98]	RS Flipflop 4	See *parameter group 13-1* Comparators*.
[99]	RS Flipflop 5	See *parameter group 13-1* Comparators*.

Option	Name	Description
[100]	RS Flipflop 6	See *parameter group 13-1* Comparators*.
[101]	RS Flipflop 7	See *parameter group 13-1* Comparators*.
[102]	Relay 1	
[103]	Relay 2	
[104]	Relay 3	X47/VLT® Extended Relay Card MCB 113.
[105]	Relay 4	X47/VLT® Extended Relay Card MCB 113.
[106]	Relay 5	X47/VLT® Extended Relay Card MCB 113.
[107]	Relay 6	X47/VLT® Extended Relay Card MCB 113.
[108]	Relay 7	X34/VLT® Relay Card MCB 105.
[109]	Relay 8	X34/VLT® Relay Card MCB 105.
[110]	Relay 9	X34/VLT® Relay Card MCB 105.
[212]	Emergency mode	
[222]	Homing OK	**NOTICE** This option is only available with software version 48.2X or newer. Homing is completed with the selected homing function (*parameter 17-80 Homing Function*).
[223]	On target	**NOTICE** This option is only available with software version 48.2X or newer. Positioning is completed and the on target signal is sent when the actual position is within *parameter 3-05 On Reference Window* for the duration of *parameter 3-09 On Target Time* and the actual speed does not exceed *parameter 3-05 On Reference Window*.
[224]	Position error	**NOTICE** This option is only available with software version 48.2X or newer. The position error exceeds the value in *parameter 4-71 Maximum Position Error* for the time set in *parameter 4-72 Position Error Timeout*.
[225]	Position limit	**NOTICE** This option is only available with software version 48.2X or newer. The position is outside the limits set in *parameter 3-06 Minimum Position* and *parameter 3-07 Maximum Position*.
[226]	Touch on target	**NOTICE** This option is only available with software version 48.2X or newer.

Option	Name	Description
		Target position is reached in touch probe position mode.
[227]	Touch activated	Touch probe positioning is active. The drive monitors the touch probe sensor input.
[228]	Comparator 6	
[229]	Comparator 7	
[230]	Comparator 8	
[231]	Comparator 9	
[232]	Logic rule 6	
[233]	Logic rule 7	
[234]	Logic rule 8	
[235]	Logic rule 9	
[236]	SL time-out 8	
[237]	SL time-out 9	
[238]	RS flipflop 8	
[239]	RS flipflop 9	
[240]	SL digital output A	
[241]	SL digital output B	
[242]	SL digital output C	
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

Parameter 13-41 Logic Rule Operator 1

Table 682: Parameter 13-41 Logic Rule Operator 1

13-41 Logic Rule Operator 1		
Default value: Size related	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the 1st logical operator to use on the boolean inputs from *parameter 13-40 Logic Rule Boolean 1* and *parameter 13-42 Logic Rule Boolean 2*. Parameter numbers in square brackets stand for the boolean inputs of parameters in *parameter group 13-** Smart Logic Control*.

Option	Name	Description
[0]	DISABLED	Ignores • *Parameter 13-42 Logic Rule Boolean 2.* • *Parameter 13-43 Logic Rule Operator 2.* • *Parameter 13-44 Logic Rule Boolean 3.*
[1]	AND	Evaluates the expression [13-40] AND [13-42].

Option	Name	Description
[2]	OR	Evaluates the expression [13-40] OR [13-42].
[3]	AND NOT	Evaluates the expression [13-40] AND NOT [13-42].
[4]	OR NOT	Evaluates the expression [13-40] OR NOT [13-42].
[5]	NOT AND	Evaluates the expression NOT [13-40] AND [13-42].
[6]	NOT OR	Evaluates the expression NOT [13-40] OR [13-42].
[7]	NOT AND NOT	Evaluates the expression NOT [13-40] AND NOT [13-42].
[8]	NOT OR NOT	Evaluates the expression NOT [13-40] OR NOT [13-42].

Parameter 13-42: Logic Rule Boolean 2

Table 683: Parameter 13-42 Logic Rule Boolean 2

13-42 Logic Rule Boolean 2		
Default value: Size related	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	False	Select the 2nd boolean (true or false) input for the selected logic rule. See *parameter 13-01 Start Event* and *parameter 13-02 Stop Event* for more information.
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	

Option	Name	Description
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL time-out 0	
[31]	SL time-out 1	
[32]	SL time-out 2	
[33]	Digital input DI18	
[34]	Digital input DI19	
[35]	Digital input DI27	
[36]	Digital input DI29	**NOTICE** This option is only available in FC 302.
[37]	Digital input DI32	
[38]	Digital input DI33	
[39]	Start command	
[40]	Drive stopped	
[41]	Reset trip	
[42]	Auto-reset trip	
[43]	OK key	[OK] is pressed. Only available on the graphical LCP.
[44]	Reset key	[Reset] is pressed. Only available on the graphical LCP.
[45]	Left key	[◁] is pressed. Only available on the graphical LCP.
[46]	Right key	[▷] is pressed. Only available on the graphical LCP.
[47]	Up key	[△] is pressed. Only available on the graphical LCP.
[48]	Down key	[▽] is pressed. Only available on the graphical LCP.

Option	Name	Description
[50]	Comparator 4	Use the result of comparator 4.
[51]	Comparator 5	Use the result of comparator 5.
[60]	Logic rule 4	Use the result of logic rule 4.
[61]	Logic rule 5	Use the result of logic rule 5.
[70]	SL time-out 3	
[71]	SL time-out 4	
[72]	SL time-out 5	
[73]	SL time-out 6	
[74]	SL time-out 7	
[75]	Start command given	
[76]	Digital input X30/2	
[77]	Digital input X30/3	
[78]	Digital input X30/4	
[79]	Digital input X46/1	
[80]	Digital input X46/3	
[81]	Digital input X46/5	
[82]	Digital input X46/7	
[83]	Digital input X46/9	
[84]	Digital input X46/11	
[85]	Digital input X46/13	
[90]	ATEX ETR cur. warning	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 164, ATEX ETR cur.lim.alarm* is active, the output is 1.
[91]	ATEX ETR cur. alarm	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 166, ATEX ETR freq.lim.alarm* is active, the output is 1.
[92]	ATEX ETR freq. warning	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 163, ATEX ETR cur.lim.warning* is active, the output is 1.
[93]	ATEX ETR freq. alarm	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *warning 165, ATEX ETR freq.lim.warning* is active, the output is 1.
[94]	RS Flipflop 0	See *parameter group 13-1* Comparators*.
[95]	RS Flipflop 1	See *parameter group 13-1* Comparators*.
[96]	RS Flipflop 2	See *parameter group 13-1* Comparators*.
[97]	RS Flipflop 3	See *parameter group 13-1* Comparators*.
[98]	RS Flipflop 4	See *parameter group 13-1* Comparators*.
[99]	RS Flipflop 5	See *parameter group 13-1* Comparators*.

Option	Name	Description
[100]	RS Flipflop 6	See *parameter group 13-1* Comparators*.
[101]	RS Flipflop 7	See *parameter group 13-1* Comparators*.
[102]	Relay 1	
[103]	Relay 2	
[104]	Relay 3	X47/VLT® Extended Relay Card MCB 113.
[105]	Relay 4	X47/VLT® Extended Relay Card MCB 113.
[106]	Relay 5	X47/VLT® Extended Relay Card MCB 113.
[107]	Relay 6	X47/VLT® Extended Relay Card MCB 113.
[108]	Relay 7	X34/VLT® Relay Card MCB 105.
[109]	Relay 8	X34/VLT® Relay Card MCB 105.
[110]	Relay 9	X34/VLT® Relay Card MCB 105.
[212]	Emergency mode	
[222]	Homing OK	**NOTICE** This option is only available with software version 48.2X or newer. Homing is completed with the selected homing function (*parameter 17-80 Homing Function*).
[223]	On target	**NOTICE** This option is only available with software version 48.2X or newer. Positioning is completed and the on target signal is sent when the actual position is within *parameter 3-05 On Reference Window* for the duration of *parameter 3-09 On Target Time* and the actual speed does not exceed *parameter 3-05 On Reference Window*.
[224]	Position error	**NOTICE** This option is only available with software version 48.2X or newer. The position error exceeds the value in *parameter 4-71 Maximum Position Error* for the time set in *parameter 4-72 Position Error Timeout*.
[225]	Position limit	**NOTICE** This option is only available with software version 48.2X or newer. The position is outside the limits set in *parameter 3-06 Minimum Position* and *parameter 3-07 Maximum Position*.
[226]	Touch on target	**NOTICE** This option is only available with software version 48.2X or newer.

Option	Name	Description
		Target position is reached in touch probe position mode.
[227]	Touch activated	Touch probe positioning is active. The drive monitors the touch probe sensor input.
[228]	Comparator 6	
[229]	Comparator 7	
[230]	Comparator 8	
[231]	Comparator 9	
[232]	Logic rule 6	
[233]	Logic rule 7	
[234]	Logic rule 8	
[235]	Logic rule 9	
[236]	SL time-out 8	
[237]	SL time-out 9	
[238]	RS flipflop 8	
[239]	RS flipflop 9	
[240]	SL digital output A	
[241]	SL digital output B	
[242]	SL digital output C	
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

Parameter 13-43 Logic Rule Operator 2

Table 684: Parameter 13-43 Logic Rule Operator 2

13-43 Logic Rule Operator 2		
Default value: Size related	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the 2nd logical operator to be used on the boolean input calculated in:

- *Parameter 13-40 Logic Rule Boolean 1.*
- *Parameter 13-41 Logic Rule Operator 1.*
- *Parameter 13-42 Logic Rule Boolean 2.*

[13-44] signifies the boolean input of *parameter 13-44 Logic Rule Boolean 3*. [13-40/13-42] signifies the boolean input calculated in:

- *Parameter 13-40 Logic Rule Boolean 1.*
- *Parameter 13-41 Logic Rule Operator 1.*
- *Parameter 13-42 Logic Rule Boolean 2.*

Option	Name	Description
[0]	DISABLED	
[1]	AND	
[2]	OR	
[3]	AND NOT	
[4]	OR NOT	
[5]	NOT AND	
[6]	NOT OR	
[7]	NOT AND NOT	
[8]	NOT OR NOT	

Parameter 13-44 Logic Rule Boolean 3

Table 685: Parameter 13-44 Logic Rule Boolean 3

13-44 Logic Rule Boolean 3		
Default value: Size related	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	False	Select the 3rd boolean (true or false) input for the selected logic rule. See *parameter 13-01 Start Event* (options *[0] False–[61] Logic rule 5*) and *parameter 13-02 Stop Event* (options *[70] SL Time-out 3–[75] Start command given*) for more information.
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	

Option	Name	Description
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL time-out 0	
[31]	SL time-out 1	
[32]	SL time-out 2	
[33]	Digital input DI18	
[34]	Digital input DI19	
[35]	Digital input DI27	
[36]	Digital input DI29	**NOTICE** This option is only available in FC 302.
[37]	Digital input DI32	
[38]	Digital input DI33	
[39]	Start command	
[40]	Drive stopped	
[41]	Reset trip	
[42]	Auto-reset trip	
[43]	OK key	[OK] is pressed. Only available on the graphical LCP.
[44]	Reset key	[Reset] is pressed. Only available on the graphical LCP.
[45]	Left key	[◂] is pressed. Only available on the graphical LCP.

Option	Name	Description
[46]	Right key	[▹] is pressed. Only available on the graphical LCP.
[47]	Up key	[▵] is pressed. Only available on the graphical LCP.
[48]	Down key	[▿] is pressed. Only available on the graphical LCP.
[50]	Comparator 4	Use the result of comparator 4.
[51]	Comparator 5	Use the result of comparator 5.
[60]	Logic rule 4	Use the result of logic rule 4.
[61]	Logic rule 5	Use the result of logic rule 5.
[70]	SL time-out 3	
[71]	SL time-out 4	
[72]	SL time-out 5	
[73]	SL time-out 6	
[74]	SL time-out 7	
[75]	Start command given	
[76]	Digital input X30/2	
[77]	Digital input X30/3	
[78]	Digital input X30/4	
[79]	Digital input X46/1	
[80]	Digital input X46/3	
[81]	Digital input X46/5	
[82]	Digital input X46/7	
[83]	Digital input X46/9	
[84]	Digital input X46/11	
[85]	Digital input X46/13	
[90]	ATEX ETR cur. warning	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 164, ATEX ETR cur.lim.alarm* is active, the output is 1.
[91]	ATEX ETR cur. alarm	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 166, ATEX ETR freq.lim.alarm* is active, the output is 1.
[92]	ATEX ETR freq. warning	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 163, ATEX ETR cur.lim.warning* is active, the output is 1.
[93]	ATEX ETR freq. alarm	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *warning 165, ATEX ETR freq.lim.warning* is active, the output is 1.
[94]	RS Flipflop 0	See *parameter group 13-1* Comparators*.
[95]	RS Flipflop 1	See *parameter group 13-1* Comparators*.
[96]	RS Flipflop 2	See *parameter group 13-1* Comparators*.

Option	Name	Description
[97]	RS Flipflop 3	See *parameter group 13-1* Comparators*.
[98]	RS Flipflop 4	See *parameter group 13-1* Comparators*.
[99]	RS Flipflop 5	See *parameter group 13-1* Comparators*.
[100]	RS Flipflop 6	See *parameter group 13-1* Comparators*.
[101]	RS Flipflop 7	See *parameter group 13-1* Comparators*.
[102]	Relay 1	
[103]	Relay 2	
[104]	Relay 3	X47/VLT® Extended Relay Card MCB 113.
[105]	Relay 4	X47/VLT® Extended Relay Card MCB 113.
[106]	Relay 5	X47/VLT® Extended Relay Card MCB 113.
[107]	Relay 6	X47/VLT® Extended Relay Card MCB 113.
[108]	Relay 7	X34/VLT® Relay Card MCB 105.
[109]	Relay 8	X34/VLT® Relay Card MCB 105.
[110]	Relay 9	X34/VLT® Relay Card MCB 105.
[212]	Emergency mode	
[222]	Homing OK	**NOTICE** This option is only available with software version 48.2X or newer. Homing is completed with the selected homing function (*parameter 17-80 Homing Function*).
[223]	On target	**NOTICE** This option is only available with software version 48.2X or newer. Positioning is completed and the on target signal is sent when the actual position is within *parameter 3-05 On Reference Window* for the duration of *parameter 3-09 On Target Time* and the actual speed does not exceed *parameter 3-05 On Reference Window*.
[224]	Position error	**NOTICE** This option is only available with software version 48.2X or newer. The position error exceeds the value in *parameter 4-71 Maximum Position Error* for the time set in *parameter 4-72 Position Error Timeout*.
[225]	Position limit	**NOTICE** This option is only available with software version 48.2X or newer. The position is outside the limits set in *parameter 3-06 Minimum Position* and *parameter 3-07 Maximum Position*.

Option	Name	Description
[226]	Touch on target	**NOTICE** This option is only available with software version 48.2X or newer. Target position is reached in touch probe position mode.
[227]	Touch activated	Touch probe positioning is active. The drive monitors the touch probe sensor input.
[228]	Comparator 6	
[229]	Comparator 7	
[230]	Comparator 8	
[231]	Comparator 9	
[232]	Logic rule 6	
[233]	Logic rule 7	
[234]	Logic rule 8	
[235]	Logic rule 9	
[236]	SL time-out 8	
[237]	SL time-out 9	
[238]	RS flipflop 8	
[239]	RS flipflop 9	
[240]	SL digital output A	
[241]	SL digital output B	
[242]	SL digital output C	
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

5.13.5 13-5* States

Parameter 13-51 SL Controller Event

Table 686: Parameter 13-51 SL Controller Event

13-51 SL Controller Event		
Default value: Size related	Parameter type: Option, Array [20]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	False	Select the boolean input (true or false) to define the smart logic controller event. See *parameter 13-01 Start Event* (options *[0] False–[61] Logic rule 5*) and *parameter 13-02 Stop Event* (options *[70] SL Time-out 3–[74] SL Time-out 7*) for more information.
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL time-out 0	

Option	Name	Description
[31]	SL time-out 1	
[32]	SL time-out 2	
[33]	Digital input DI18	
[34]	Digital input DI19	
[35]	Digital input DI27	
[36]	Digital input DI29	**NOTICE** This option is only available in FC 302.
[37]	Digital input DI32	
[38]	Digital input DI33	
[39]	Start command	
[40]	Drive stopped	
[41]	Reset trip	
[42]	Auto-reset trip	
[43]	OK key	[OK] is pressed. Only available on the graphical LCP.
[44]	Reset key	[Reset] is pressed. Only available on the graphical LCP.
[45]	Left key	[◁] is pressed. Only available on the graphical LCP.
[46]	Right key	[▷] is pressed. Only available on the graphical LCP.
[47]	Up key	[△] is pressed. Only available on the graphical LCP.
[48]	Down key	[▽] is pressed. Only available on the graphical LCP.
[50]	Comparator 4	Use the result of comparator 4.
[51]	Comparator 5	Use the result of comparator 5.
[60]	Logic rule 4	Use the result of logic rule 4.
[61]	Logic rule 5	Use the result of logic rule 5.
[70]	SL time-out 3	
[71]	SL time-out 4	
[72]	SL time-out 5	
[73]	SL time-out 6	
[74]	SL time-out 7	
[75]	Start command given	
[76]	Digital input X30/2	
[77]	Digital input X30/3	

Option	Name	Description
[78]	Digital input X30/4	
[79]	Digital input X46/1	
[80]	Digital input X46/3	
[81]	Digital input X46/5	
[82]	Digital input X46/7	
[83]	Digital input X46/9	
[84]	Digital input X46/11	
[85]	Digital input X46/13	
[90]	ATEX ETR cur. warning	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 164, ATEX ETR cur.lim.alarm* is active, the output is 1.
[91]	ATEX ETR cur. alarm	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 166, ATEX ETR freq.lim.alarm* is active, the output is 1.
[92]	ATEX ETR freq. warning	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 163, ATEX ETR cur.lim.warning* is active, the output is 1.
[93]	ATEX ETR freq. alarm	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *warning 165, ATEX ETR freq.lim.warning* is active, the output is 1.
[94]	RS Flipflop 0	See *parameter group 13-1* Comparators*.
[95]	RS Flipflop 1	See *parameter group 13-1* Comparators*.
[96]	RS Flipflop 2	See *parameter group 13-1* Comparators*.
[97]	RS Flipflop 3	See *parameter group 13-1* Comparators*.
[98]	RS Flipflop 4	See *parameter group 13-1* Comparators*.
[99]	RS Flipflop 5	See *parameter group 13-1* Comparators*.
[100]	RS Flipflop 6	See *parameter group 13-1* Comparators*.
[101]	RS Flipflop 7	See *parameter group 13-1* Comparators*.
[102]	Relay 1	
[103]	Relay 2	
[104]	Relay 3	X47/VLT® Extended Relay Card MCB 113.
[105]	Relay 4	X47/VLT® Extended Relay Card MCB 113.
[106]	Relay 5	X47/VLT® Extended Relay Card MCB 113.
[107]	Relay 6	X47/VLT® Extended Relay Card MCB 113.
[108]	Relay 7	X34/VLT® Relay Card MCB 105.
[109]	Relay 8	X34/VLT® Relay Card MCB 105.
[110]	Relay 9	X34/VLT® Relay Card MCB 105.
[212]	Emergency mode	

Option	Name	Description
[222]	Homing OK	**NOTICE** This option is only available with software version 48.2X or newer. Homing is completed with the selected homing function (*parameter 17-80 Homing Function*).
[223]	On target	**NOTICE** This option is only available with software version 48.2X or newer. Positioning is completed and the on target signal is sent when the actual position is within *parameter 3-05 On Reference Window* for the duration of *parameter 3-09 On Target Time* and the actual speed does not exceed *parameter 3-05 On Reference Window*.
[224]	Position error	**NOTICE** This option is only available with software version 48.2X or newer. The position error exceeds the value in *parameter 4-71 Maximum Position Error* for the time set in *parameter 4-72 Position Error Timeout*.
[225]	Position limit	**NOTICE** This option is only available with software version 48.2X or newer. The position is outside the limits set in *parameter 3-06 Minimum Position* and *parameter 3-07 Maximum Position*.
[226]	Touch on target	**NOTICE** This option is only available with software version 48.2X or newer. Target position is reached in touch probe position mode.
[227]	Touch activated	Touch probe positioning is active. The drive monitors the touch probe sensor input.
[228]	Comparator 6	
[229]	Comparator 7	
[230]	Comparator 8	
[231]	Comparator 9	
[232]	Logic rule 6	
[233]	Logic rule 7	
[234]	Logic rule 8	
[235]	Logic rule 9	
[236]	SL time-out 8	
[237]	SL time-out 9	

Option	Name	Description
[238]	RS flipflop 8	
[239]	RS flipflop 9	
[240]	SL digital output A	
[241]	SL digital output B	
[242]	SL digital output C	
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

Parameter 13-52 SL Controller Action

Table 687: Parameter 13-52 SL Controller Action

13-52 SL Controller Action		
Default value: Size related	Parameter type: Option, Array [20]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the action corresponding to the SLC event. Actions are executed when the corresponding event (defined in *parameter 13-51 SL Controller 1 Event*) is evaluated as true.

Option	Name	Description
[0]	DISABLED	
[1]	No action	
[2]	Select set-up 1	Changes the active setup (*parameter 0-10 Active Set-up*) to 1. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via a fieldbus.
[3]	Select set-up 2	Changes the active setup (*parameter 0-10 Active Set-up*) to 2. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via a fieldbus.
[4]	Select set-up 3	Changes the active setup (*parameter 0-10 Active Set-up*) to 3. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via a fieldbus.
[5]	Select set-up 4	Changes the active setup (*parameter 0-10 Active Set-up*) to 4. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via a fieldbus.
[10]	Select preset ref 0	Selects preset reference 0. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[11]	Select preset ref 1	Selects preset reference 1. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[12]	Select preset ref 2	Selects preset reference 2. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[13]	Select preset ref 3	Selects preset reference 3. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[14]	Select preset ref 4	Selects preset reference 4. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.

Option	Name	Description
[15]	Select preset ref 5	Selects preset reference 5. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[16]	Select preset ref 6	Selects preset reference 6. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[17]	Select preset ref 7	Selects preset reference 7. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[18]	Select ramp 1	Selects ramp 1.
[19]	Select ramp 2	Selects ramp 2.
[20]	Select ramp 3	Selects ramp 3.
[21]	Select ramp 4	Selects ramp 4.
[22]	Run	Issues a start command to the drive.
[23]	Run reverse	Issues a start reverse command to the drive.
[24]	Stop	Issues a stop command to the drive.
[25]	Qstop	Issues a quick stop command to the drive.
[26]	Dcstop	Issues a DC stop command to the drive.
[27]	Coast	The drive coasts immediately. All stop commands including the coast command stop the SLC.
[28]	Freeze output	Freezes the output frequency of the drive.
[29]	Start timer 0	Starts timer 0, see *parameter 13-20 SL Controller Timer* for further description.
[30]	Start timer 1	Starts timer 1, see *parameter 13-20 SL Controller Timer* for further description.
[31]	Start timer 2	Starts timer 2, see *parameter 13-20 SL Controller Timer* for further description.
[32]	Set digital out A low	Any output with smart logic output A is low.
[33]	Set digital out B low	Any output with smart logic output B is low.
[34]	Set digital out C low	Any output with smart logic output C is low.
[35]	Set digital out D low	Any output with smart logic output D is low.
[36]	Set digital out E low	Any output with smart logic output E is low.
[37]	Set digital out F low	Any output with smart logic output F is low.
[38]	Set digital out A high	Any output with smart logic output A is high.
[39]	Set digital out B high	Any output with smart logic output B is high.
[40]	Set digital out C high	Any output with smart logic output C is high.
[41]	Set digital out D high	Any output with smart logic output D is high.
[42]	Set digital out E high	Any output with smart logic output E is high.
[43]	Set digital out F high	Any output with smart logic output F is high.
[60]	Reset Counter A	Resets counter A to 0.
[61]	Reset Counter B	Resets counter B to 0.

Option	Name	Description
[62]	Counter A (up)	
[63]	Counter A (down)	
[64]	Counter B (up)	
[65]	Counter B (down)	
[70]	Start timer 3	Starts timer 3, see *parameter 13-20 SL Controller Timer* for further description.
[71]	Start timer 4	Starts timer 4, see *parameter 13-20 SL Controller Timer* for further description.
[72]	Start timer 5	Starts timer 5, see *parameter 13-20 SL Controller Timer* for further description.
[73]	Start timer 6	Starts timer 6, see *parameter 13-20 SL Controller Timer* for further description.
[74]	Start timer 7	Starts timer 7, see *parameter 13-20 SL Controller Timer* for further description.
[120]	Start homing	**NOTICE** This option is available only with software version 48.20 and newer. Activates the homing mode and starts the homing function selected in *parameter 17-80 Homing Function*. Must remain active until the homing is completed otherwise the homing is aborted.
[121]	Stop homing	**NOTICE** This option is available only with software version 48.20 and newer. Deactivates the homing mode, an active homing function is aborted if the homing is not completed.
[122]	Enable reference	**NOTICE** This option is available only with software version 48.20 and newer. Sets the enable reference mode.
[123]	Disable reference	**NOTICE** This option is available only with software version 48.20 and newer. Disables the enable reference mode.
[124]	Relative position	**NOTICE** This option is available only with software version 48.20 and newer. Selects the relative position mode instead of the absolute position mode.
[125]	Absolute position	**NOTICE** This option is available only with software version 48.20 and newer.

Option	Name	Description
		Selects the absolute position mode instead of the relative position mode.
[126]	Activate touch	**NOTICE** This option is available only with software version 48.20 and newer. Activates the touch probe positioning mode.
[127]	Deactivate touch	**NOTICE** This option is available only with software version 48.20 and newer. Deactivates the touch probe positioning mode.
[128]	Target inverse	**NOTICE** This option is available only with software version 48.20 and newer. Changes the sign of the active target position value.
[129]	Target	**NOTICE** This option is available only with software version 48.20 and newer. The active target position is not changed.
[130]	Act. speed mode	**NOTICE** This option is available only with software version 48.20 and newer. Activates the speed mode when option *[9] Positioning* or option *[10] Synchronization* is selected in *parameter 1-00 Configuration Mode*.
[131]	Deact. speed mode	**NOTICE** This option is available only with software version 48.20 and newer. Deactivates the speed mode and activates the option selected in *parameter 1-00 Configuration Mode*.

Parameter 13-53 SL Controller 2 Event

Table 688: Parameter 13-53 SL Controller 2 Event

13-53 SL Controller 2 Event		
Default value: Size related	Parameter type: Option, Array [20]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	False	Select the boolean input (true or false) to define the smart logic controller event. See *parameter 13-01 Start Event* (options *[0] False–[61] Logic rule 5*) and *parameter 13-02 Stop Event* (options *[70] SL Time-out 3–[74] SL Time-out 7*) for more information.
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL time-out 0	

Option	Name	Description
[31]	SL time-out 1	
[32]	SL time-out 2	
[33]	Digital input DI18	
[34]	Digital input DI19	
[35]	Digital input DI27	
[36]	Digital input DI29	**NOTICE** This option is only available in FC 302.
[37]	Digital input DI32	
[38]	Digital input DI33	
[39]	Start command	
[40]	Drive stopped	
[41]	Reset trip	
[42]	Auto-reset trip	
[43]	OK key	[OK] is pressed. Only available on the graphical LCP.
[44]	Reset key	[Reset] is pressed. Only available on the graphical LCP.
[45]	Left key	[◁] is pressed. Only available on the graphical LCP.
[46]	Right key	[▷] is pressed. Only available on the graphical LCP.
[47]	Up key	[△] is pressed. Only available on the graphical LCP.
[48]	Down key	[▽] is pressed. Only available on the graphical LCP.
[50]	Comparator 4	Use the result of comparator 4.
[51]	Comparator 5	Use the result of comparator 5.
[60]	Logic rule 4	Use the result of logic rule 4.
[61]	Logic rule 5	Use the result of logic rule 5.
[70]	SL time-out 3	
[71]	SL time-out 4	
[72]	SL time-out 5	
[73]	SL time-out 6	
[74]	SL time-out 7	
[75]	Start command given	
[76]	Digital input X30/2	
[77]	Digital input X30/3	

Option	Name	Description
[78]	Digital input X30/4	
[79]	Digital input X46/1	
[80]	Digital input X46/3	
[81]	Digital input X46/5	
[82]	Digital input X46/7	
[83]	Digital input X46/9	
[84]	Digital input X46/11	
[85]	Digital input X46/13	
[90]	ATEX ETR cur. warning	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 164, ATEX ETR cur.lim.alarm* is active, the output is 1.
[91]	ATEX ETR cur. alarm	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 166, ATEX ETR freq.lim.alarm* is active, the output is 1.
[92]	ATEX ETR freq. warning	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 163, ATEX ETR cur.lim.warning* is active, the output is 1.
[93]	ATEX ETR freq. alarm	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *warning 165, ATEX ETR freq.lim.warning* is active, the output is 1.
[94]	RS Flipflop 0	See *parameter group 13-1* Comparators*.
[95]	RS Flipflop 1	See *parameter group 13-1* Comparators*.
[96]	RS Flipflop 2	See *parameter group 13-1* Comparators*.
[97]	RS Flipflop 3	See *parameter group 13-1* Comparators*.
[98]	RS Flipflop 4	See *parameter group 13-1* Comparators*.
[99]	RS Flipflop 5	See *parameter group 13-1* Comparators*.
[100]	RS Flipflop 6	See *parameter group 13-1* Comparators*.
[101]	RS Flipflop 7	See *parameter group 13-1* Comparators*.
[102]	Relay 1	
[103]	Relay 2	
[104]	Relay 3	X47/VLT® Extended Relay Card MCB 113.
[105]	Relay 4	X47/VLT® Extended Relay Card MCB 113.
[106]	Relay 5	X47/VLT® Extended Relay Card MCB 113.
[107]	Relay 6	X47/VLT® Extended Relay Card MCB 113.
[108]	Relay 7	X34/VLT® Relay Card MCB 105.
[109]	Relay 8	X34/VLT® Relay Card MCB 105.
[110]	Relay 9	X34/VLT® Relay Card MCB 105.
[212]	Emergency mode	

Option	Name	Description
[222]	Homing OK	**NOTICE** This option is only available with software version 48.2X or newer. Homing is completed with the selected homing function (*parameter 17-80 Homing Function*).
[223]	On target	**NOTICE** This option is only available with software version 48.2X or newer. Positioning is completed and the on target signal is sent when the actual position is within *parameter 3-05 On Reference Window* for the duration of *parameter 3-09 On Target Time* and the actual speed does not exceed *parameter 3-05 On Reference Window*.
[224]	Position error	**NOTICE** This option is only available with software version 48.2X or newer. The position error exceeds the value in *parameter 4-71 Maximum Position Error* for the time set in *parameter 4-72 Position Error Timeout*.
[225]	Position limit	**NOTICE** This option is only available with software version 48.2X or newer. The position is outside the limits set in *parameter 3-06 Minimum Position* and *parameter 3-07 Maximum Position*.
[226]	Touch on target	**NOTICE** This option is only available with software version 48.2X or newer. Target position is reached in touch probe position mode.
[227]	Touch activated	Touch probe positioning is active. The drive monitors the touch probe sensor input.
[228]	Comparator 6	
[229]	Comparator 7	
[230]	Comparator 8	
[231]	Comparator 9	
[232]	Logic rule 6	
[233]	Logic rule 7	
[234]	Logic rule 8	
[235]	Logic rule 9	
[236]	SL time-out 8	
[237]	SL time-out 9	

Option	Name	Description
[238]	RS flipflop 8	
[239]	RS flipflop 9	
[240]	SL digital output A	
[241]	SL digital output B	
[242]	SL digital output C	
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

Parameter 13-54 SL Controller 2 Action

Table 689: Parameter 13-54 SL Controller 2 Action

13-54 SL Controller 2 Action		
Default value: Size related	Parameter type: Option, Array [20]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the action corresponding to the SLC event. Actions are executed when the corresponding event (defined in *parameter 13-53 SL Controller 2 Event*) is evaluated as true.

Option	Name	Description
[0]	DISABLED	
[1]	No action	
[2]	Select set-up 1	Changes the active setup (*parameter 0-10 Active Set-up*) to 1. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via a fieldbus.
[3]	Select set-up 2	Changes the active setup (*parameter 0-10 Active Set-up*) to 2. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via a fieldbus.
[4]	Select set-up 3	Changes the active setup (*parameter 0-10 Active Set-up*) to 3. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via a fieldbus.
[5]	Select set-up 4	Changes the active setup (*parameter 0-10 Active Set-up*) to 4. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via a fieldbus.
[10]	Select preset ref 0	Selects preset reference 0. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[11]	Select preset ref 1	Selects preset reference 1. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[12]	Select preset ref 2	Selects preset reference 2. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[13]	Select preset ref 3	Selects preset reference 3. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[14]	Select preset ref 4	Selects preset reference 4. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.

Option	Name	Description
[15]	Select preset ref 5	Selects preset reference 5. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[16]	Select preset ref 6	Selects preset reference 6. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[17]	Select preset ref 7	Selects preset reference 7. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[18]	Select ramp 1	Selects ramp 1.
[19]	Select ramp 2	Selects ramp 2.
[20]	Select ramp 3	Selects ramp 3.
[21]	Select ramp 4	Selects ramp 4.
[22]	Run	Issues a start command to the drive.
[23]	Run reverse	Issues a start reverse command to the drive.
[24]	Stop	Issues a stop command to the drive.
[25]	Qstop	Issues a quick stop command to the drive.
[26]	Dcstop	Issues a DC stop command to the drive.
[27]	Coast	The drive coasts immediately. All stop commands including the coast command stop the SLC.
[28]	Freeze output	Freezes the output frequency of the drive.
[29]	Start timer 0	Starts timer 0, see *parameter 13-20 SL Controller Timer* for further description.
[30]	Start timer 1	Starts timer 1, see *parameter 13-20 SL Controller Timer* for further description.
[31]	Start timer 2	Starts timer 2, see *parameter 13-20 SL Controller Timer* for further description.
[32]	Set digital out A low	Any output with smart logic output A is low.
[33]	Set digital out B low	Any output with smart logic output B is low.
[34]	Set digital out C low	Any output with smart logic output C is low.
[35]	Set digital out D low	Any output with smart logic output D is low.
[36]	Set digital out E low	Any output with smart logic output E is low.
[37]	Set digital out F low	Any output with smart logic output F is low.
[38]	Set digital out A high	Any output with smart logic output A is high.
[39]	Set digital out B high	Any output with smart logic output B is high.
[40]	Set digital out C high	Any output with smart logic output C is high.
[41]	Set digital out D high	Any output with smart logic output D is high.
[42]	Set digital out E high	Any output with smart logic output E is high.
[43]	Set digital out F high	Any output with smart logic output F is high.
[60]	Reset Counter A	Resets counter A to 0.
[61]	Reset Counter B	Resets counter B to 0.

Option	Name	Description
[62]	Counter A (up)	
[63]	Counter A (down)	
[64]	Counter B (up)	
[65]	Counter B (down)	
[70]	Start timer 3	Starts timer 3, see *parameter 13-20 SL Controller Timer* for further description.
[71]	Start timer 4	Starts timer 4, see *parameter 13-20 SL Controller Timer* for further description.
[72]	Start timer 5	Starts timer 5, see *parameter 13-20 SL Controller Timer* for further description.
[73]	Start timer 6	Starts timer 6, see *parameter 13-20 SL Controller Timer* for further description.
[74]	Start timer 7	Starts timer 7, see *parameter 13-20 SL Controller Timer* for further description.
[120]	Start homing	**NOTICE** This option is available only with software version 48.20 and newer. Activates the homing mode and starts the homing function selected in *parameter 17-80 Homing Function*. Must remain active until the homing is completed otherwise the homing is aborted.
[121]	Stop homing	**NOTICE** This option is available only with software version 48.20 and newer. Deactivates the homing mode, an active homing function is aborted if the homing is not completed.
[122]	Enable reference	**NOTICE** This option is available only with software version 48.20 and newer. Sets the enable reference mode.
[123]	Disable reference	**NOTICE** This option is available only with software version 48.20 and newer. Disables the enable reference mode.
[124]	Relative position	**NOTICE** This option is available only with software version 48.20 and newer. Selects the relative position mode instead of the absolute position mode.
[125]	Absolute position	**NOTICE** This option is available only with software version 48.20 and newer.

Option	Name	Description
		Selects the absolute position mode instead of the relative position mode.
[126]	Activate touch	**NOTICE** This option is available only with software version 48.20 and newer. Activates the touch probe positioning mode.
[127]	Deactivate touch	**NOTICE** This option is available only with software version 48.20 and newer. Deactivates the touch probe positioning mode.
[128]	Target inverse	**NOTICE** This option is available only with software version 48.20 and newer. Changes the sign of the active target position value.
[129]	Target	**NOTICE** This option is available only with software version 48.20 and newer. The active target position is not changed.
[130]	Act. speed mode	**NOTICE** This option is available only with software version 48.20 and newer. Activates the speed mode when option *[9] Positioning* or option *[10] Synchronization* is selected in *parameter 1-00 Configuration Mode*.
[131]	Deact. speed mode	**NOTICE** This option is available only with software version 48.20 and newer. Deactivates the speed mode and activates the option selected in *parameter 1-00 Configuration Mode*.

Parameter 13-55 SL Controller 3 Event

Table 690: Parameter 13-55 SL Controller 3 Event

13-55 SL Controller 3 Event		
Default value: Size related	Parameter type: Option, Array [20]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	False	Select the boolean input (true or false) to define the smart logic controller event. See *parameter 13-01 Start Event* (options *[0] False–[61] Logic rule 5*) and *parameter 13-02 Stop Event* (options *[70] SL Time-out 3–[74] SL Time-out 7*) for more information.
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL time-out 0	

Option	Name	Description
[31]	SL time-out 1	
[32]	SL time-out 2	
[33]	Digital input DI18	
[34]	Digital input DI19	
[35]	Digital input DI27	
[36]	Digital input DI29	
[37]	Digital input DI32	
[38]	Digital input DI33	
[39]	Start command	
[40]	Drive stopped	
[41]	Reset trip	
[42]	Auto-reset trip	
[43]	OK key	[OK] is pressed. Only available on the graphical LCP.
[44]	Reset key	[Reset] is pressed. Only available on the graphical LCP.
[45]	Left key	[◁] is pressed. Only available on the graphical LCP.
[46]	Right key	[▷] is pressed. Only available on the graphical LCP.
[47]	Up key	[△] is pressed. Only available on the graphical LCP.
[48]	Down key	[▽] is pressed. Only available on the graphical LCP.
[50]	Comparator 4	Use the result of comparator 4.
[51]	Comparator 5	Use the result of comparator 5.
[60]	Logic rule 4	Use the result of logic rule 4.
[61]	Logic rule 5	Use the result of logic rule 5.
[70]	SL time-out 3	
[71]	SL time-out 4	
[72]	SL time-out 5	
[73]	SL time-out 6	
[74]	SL time-out 7	
[75]	Start command given	
[76]	Digital input X30/2	
[77]	Digital input X30/3	
[78]	Digital input X30/4	
[79]	Digital input X46/1	

Option	Name	Description
[80]	Digital input X46/3	
[81]	Digital input X46/5	
[82]	Digital input X46/7	
[83]	Digital input X46/9	
[84]	Digital input X46/11	
[85]	Digital input X46/13	
[90]	ATEX ETR cur. warning	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 164, ATEX ETR cur.lim.alarm* is active, the output is 1.
[91]	ATEX ETR cur. alarm	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 166, ATEX ETR freq.lim.alarm* is active, the output is 1.
[92]	ATEX ETR freq. warning	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 163, ATEX ETR cur.lim.warning* is active, the output is 1.
[93]	ATEX ETR freq. alarm	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *warning 165, ATEX ETR freq.lim.warning* is active, the output is 1.
[94]	RS Flipflop 0	See *parameter group 13-1* Comparators*.
[95]	RS Flipflop 1	See *parameter group 13-1* Comparators*.
[96]	RS Flipflop 2	See *parameter group 13-1* Comparators*.
[97]	RS Flipflop 3	See *parameter group 13-1* Comparators*.
[98]	RS Flipflop 4	See *parameter group 13-1* Comparators*.
[99]	RS Flipflop 5	See *parameter group 13-1* Comparators*.
[100]	RS Flipflop 6	See *parameter group 13-1* Comparators*.
[101]	RS Flipflop 7	See *parameter group 13-1* Comparators*.
[102]	Relay 1	
[103]	Relay 2	
[104]	Relay 3	X47/VLT® Extended Relay Card MCB 113.
[105]	Relay 4	X47/VLT® Extended Relay Card MCB 113.
[106]	Relay 5	X47/VLT® Extended Relay Card MCB 113.
[107]	Relay 6	X47/VLT® Extended Relay Card MCB 113.
[108]	Relay 7	X34/VLT® Relay Card MCB 105.
[109]	Relay 8	X34/VLT® Relay Card MCB 105.
[110]	Relay 9	X34/VLT® Relay Card MCB 105.
[212]	Emergency mode	

Option	Name	Description
[222]	Homing OK	**NOTICE** This option is only available with software version 48.2X or newer. Homing is completed with the selected homing function (*parameter 17-80 Homing Function*).
[223]	On target	**NOTICE** This option is only available with software version 48.2X or newer. Positioning is completed and the on target signal is sent when the actual position is within *parameter 3-05 On Reference Window* for the duration of *parameter 3-09 On Target Time* and the actual speed does not exceed *parameter 3-05 On Reference Window*.
[224]	Position error	**NOTICE** This option is only available with software version 48.2X or newer. The position error exceeds the value in *parameter 4-71 Maximum Position Error* for the time set in *parameter 4-72 Position Error Timeout*.
[225]	Position limit	**NOTICE** This option is only available with software version 48.2X or newer. The position is outside the limits set in *parameter 3-06 Minimum Position* and *parameter 3-07 Maximum Position*.
[226]	Touch on target	**NOTICE** This option is only available with software version 48.2X or newer. Target position is reached in touch probe position mode.
[227]	Touch activated	Touch probe positioning is active. The drive monitors the touch probe sensor input.
[228]	Comparator 6	
[229]	Comparator 7	
[230]	Comparator 8	
[231]	Comparator 9	
[232]	Logic rule 6	
[233]	Logic rule 7	
[234]	Logic rule 8	
[235]	Logic rule 9	
[236]	SL time-out 8	
[237]	SL time-out 9	

Option	Name	Description
[238]	RS flipflop 8	
[239]	RS flipflop 9	
[240]	SL digital output A	
[241]	SL digital output B	
[242]	SL digital output C	
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

Parameter 13-56 SL Controller 3 Action

Table 691: Parameter 13-56 SL Controller 3 Action

13-56 SL Controller 3 Action		
Default value: Size related	Parameter type: Option, Array [20]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the action corresponding to the SLC event. Actions are executed when the corresponding event (defined in *parameter 13-55 SL Controller 3 Event*) is evaluated as true.

Option	Name	Description
[0]	DISABLED	
[1]	No action	
[2]	Select set-up 1	Changes the active setup (*parameter 0-10 Active Set-up*) to 1. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via a fieldbus.
[3]	Select set-up 2	Changes the active setup (*parameter 0-10 Active Set-up*) to 2. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via a fieldbus.
[4]	Select set-up 3	Changes the active setup (*parameter 0-10 Active Set-up*) to 3. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via a fieldbus.
[5]	Select set-up 4	Changes the active setup (*parameter 0-10 Active Set-up*) to 4. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via a fieldbus.
[10]	Select preset ref 0	Selects preset reference 0. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[11]	Select preset ref 1	Selects preset reference 1. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[12]	Select preset ref 2	Selects preset reference 2. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[13]	Select preset ref 3	Selects preset reference 3. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[14]	Select preset ref 4	Selects preset reference 4. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.

Option	Name	Description
[15]	Select preset ref 5	Selects preset reference 5. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[16]	Select preset ref 6	Selects preset reference 6. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[17]	Select preset ref 7	Selects preset reference 7. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[18]	Select ramp 1	Selects ramp 1.
[19]	Select ramp 2	Selects ramp 2.
[20]	Select ramp 3	Selects ramp 3.
[21]	Select ramp 4	Selects ramp 4.
[22]	Run	Issues a start command to the drive.
[23]	Run reverse	Issues a start reverse command to the drive.
[24]	Stop	Issues a stop command to the drive.
[25]	Qstop	Issues a quick stop command to the drive.
[26]	Dcstop	Issues a DC stop command to the drive.
[27]	Coast	The drive coasts immediately. All stop commands including the coast command stop the SLC.
[28]	Freeze output	Freezes the output frequency of the drive.
[29]	Start timer 0	Starts timer 0, see *parameter 13-20 SL Controller Timer* for further description.
[30]	Start timer 1	Starts timer 1, see *parameter 13-20 SL Controller Timer* for further description.
[31]	Start timer 2	Starts timer 2, see *parameter 13-20 SL Controller Timer* for further description.
[32]	Set digital out A low	Any output with smart logic output A is low.
[33]	Set digital out B low	Any output with smart logic output B is low.
[34]	Set digital out C low	Any output with smart logic output C is low.
[35]	Set digital out D low	Any output with smart logic output D is low.
[36]	Set digital out E low	Any output with smart logic output E is low.
[37]	Set digital out F low	Any output with smart logic output F is low.
[38]	Set digital out A high	Any output with smart logic output A is high.
[39]	Set digital out B high	Any output with smart logic output B is high.
[40]	Set digital out C high	Any output with smart logic output C is high.
[41]	Set digital out D high	Any output with smart logic output D is high.
[42]	Set digital out E high	Any output with smart logic output E is high.
[43]	Set digital out F high	Any output with smart logic output F is high.
[60]	Reset Counter A	Resets counter A to 0.
[61]	Reset Counter B	Resets counter B to 0.

Option	Name	Description
[62]	Counter A (up)	
[63]	Counter A (down)	
[64]	Counter B (up)	
[65]	Counter B (down)	
[70]	Start timer 3	Starts timer 3, see *parameter 13-20 SL Controller Timer* for further description.
[71]	Start timer 4	Starts timer 4, see *parameter 13-20 SL Controller Timer* for further description.
[72]	Start timer 5	Starts timer 5, see *parameter 13-20 SL Controller Timer* for further description.
[73]	Start timer 6	Starts timer 6, see *parameter 13-20 SL Controller Timer* for further description.
[74]	Start timer 7	Starts timer 7, see *parameter 13-20 SL Controller Timer* for further description.
[120]	Start homing	**NOTICE** This option is available only with software version 48.20 and newer. Activates the homing mode and starts the homing function selected in *parameter 17-80 Homing Function*. Must remain active until the homing is completed otherwise the homing is aborted.
[121]	Stop homing	**NOTICE** This option is available only with software version 48.20 and newer. Deactivates the homing mode, an active homing function is aborted if the homing is not completed.
[122]	Enable reference	**NOTICE** This option is available only with software version 48.20 and newer. Sets the enable reference mode.
[123]	Disable reference	**NOTICE** This option is available only with software version 48.20 and newer. Disables the enable reference mode.
[124]	Relative position	**NOTICE** This option is available only with software version 48.20 and newer. Selects the relative position mode instead of the absolute position mode.
[125]	Absolute position	**NOTICE** This option is available only with software version 48.20 and newer.

Option	Name	Description
		Selects the absolute position mode instead of the relative position mode.
[126]	Activate touch	**NOTICE** This option is available only with software version 48.20 and newer. Activates the touch probe positioning mode.
[127]	Deactivate touch	**NOTICE** This option is available only with software version 48.20 and newer. Deactivates the touch probe positioning mode.
[128]	Target inverse	**NOTICE** This option is available only with software version 48.20 and newer. Changes the sign of the active target position value.
[129]	Target	**NOTICE** This option is available only with software version 48.20 and newer. The active target position is not changed.
[130]	Act. speed mode	**NOTICE** This option is available only with software version 48.20 and newer. Activates the speed mode when option *[9] Positioning* or option *[10] Synchronization* is selected in *parameter 1-00 Configuration Mode*.
[131]	Deact. speed mode	**NOTICE** This option is available only with software version 48.20 and newer. Deactivates the speed mode and activates the option selected in *parameter 1-00 Configuration Mode*.

Parameter 13-57 SL Controller 4 Event

Table 692: Parameter 13-57 SL Controller 4 Event

13-57 SL Controller 4 Event		
Default value: Size related	Parameter type: Option, Array [20]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	False	Select the boolean input (true or false) to define the smart logic controller event. See *parameter 13-01 Start Event* (options *[0] False–[61] Logic rule 5*) and *parameter 13-02 Stop Event* (options *[70] SL Time-out 3–[74] SL Time-out 7*) for more information.
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL time-out 0	

Option	Name	Description
[31]	SL time-out 1	
[32]	SL time-out 2	
[33]	Digital input DI18	
[34]	Digital input DI19	
[35]	Digital input DI27	
[36]	Digital input DI29	**NOTICE** This option is only available in FC 302.
[37]	Digital input DI32	
[38]	Digital input DI33	
[39]	Start command	
[40]	Drive stopped	
[41]	Reset trip	
[42]	Auto-reset trip	
[43]	OK key	[OK] is pressed. Only available on the graphical LCP.
[44]	Reset key	[Reset] is pressed. Only available on the graphical LCP.
[45]	Left key	[◁] is pressed. Only available on the graphical LCP.
[46]	Right key	[▷] is pressed. Only available on the graphical LCP.
[47]	Up key	[△] is pressed. Only available on the graphical LCP.
[48]	Down key	[▽] is pressed. Only available on the graphical LCP.
[50]	Comparator 4	Use the result of comparator 4.
[51]	Comparator 5	Use the result of comparator 5.
[60]	Logic rule 4	Use the result of logic rule 4.
[61]	Logic rule 5	Use the result of logic rule 5.
[70]	SL time-out 3	
[71]	SL time-out 4	
[72]	SL time-out 5	
[73]	SL time-out 6	
[74]	SL time-out 7	
[75]	Start command given	
[76]	Digital input X30/2	
[77]	Digital input X30/3	

Option	Name	Description
[78]	Digital input X30/4	
[79]	Digital input X46/1	
[80]	Digital input X46/3	
[81]	Digital input X46/5	
[82]	Digital input X46/7	
[83]	Digital input X46/9	
[84]	Digital input X46/11	
[85]	Digital input X46/13	
[90]	ATEX ETR cur. warning	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 164, ATEX ETR cur.lim.alarm* is active, the output is 1.
[91]	ATEX ETR cur. alarm	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 166, ATEX ETR freq.lim.alarm* is active, the output is 1.
[92]	ATEX ETR freq. warning	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 163, ATEX ETR cur.lim.warning* is active, the output is 1.
[93]	ATEX ETR freq. alarm	Available if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *warning 165, ATEX ETR freq.lim.warning* is active, the output is 1.
[94]	RS Flipflop 0	See *parameter group 13-1* Comparators*.
[95]	RS Flipflop 1	See *parameter group 13-1* Comparators*.
[96]	RS Flipflop 2	See *parameter group 13-1* Comparators*.
[97]	RS Flipflop 3	See *parameter group 13-1* Comparators*.
[98]	RS Flipflop 4	See *parameter group 13-1* Comparators*.
[99]	RS Flipflop 5	See *parameter group 13-1* Comparators*.
[100]	RS Flipflop 6	See *parameter group 13-1* Comparators*.
[101]	RS Flipflop 7	See *parameter group 13-1* Comparators*.
[102]	Relay 1	
[103]	Relay 2	
[104]	Relay 3	X47/VLT® Extended Relay Card MCB 113.
[105]	Relay 4	X47/VLT® Extended Relay Card MCB 113.
[106]	Relay 5	X47/VLT® Extended Relay Card MCB 113.
[107]	Relay 6	X47/VLT® Extended Relay Card MCB 113.
[108]	Relay 7	X34/VLT® Relay Card MCB 105.
[109]	Relay 8	X34/VLT® Relay Card MCB 105.
[110]	Relay 9	X34/VLT® Relay Card MCB 105.
[212]	Emergency mode	

Option	Name	Description
[222]	Homing OK	**NOTICE** This option is only available with software version 48.2X or newer. Homing is completed with the selected homing function (*parameter 17-80 Homing Function*).
[223]	On target	**NOTICE** This option is only available with software version 48.2X or newer. Positioning is completed and the on target signal is sent when the actual position is within *parameter 3-05 On Reference Window* for the duration of *parameter 3-09 On Target Time* and the actual speed does not exceed *parameter 3-05 On Reference Window*.
[224]	Position error	**NOTICE** This option is only available with software version 48.2X or newer. The position error exceeds the value in *parameter 4-71 Maximum Position Error* for the time set in *parameter 4-72 Position Error Timeout*.
[225]	Position limit	**NOTICE** This option is only available with software version 48.2X or newer. The position is outside the limits set in *parameter 3-06 Minimum Position* and *parameter 3-07 Maximum Position*.
[226]	Touch on target	**NOTICE** This option is only available with software version 48.2X or newer. Target position is reached in touch probe position mode.
[227]	Touch activated	Touch probe positioning is active. The drive monitors the touch probe sensor input.
[228]	Comparator 6	
[229]	Comparator 7	
[230]	Comparator 8	
[231]	Comparator 9	
[232]	Logic rule 6	
[233]	Logic rule 7	
[234]	Logic rule 8	
[235]	Logic rule 9	
[236]	SL time-out 8	
[237]	SL time-out 9	

Option	Name	Description
[238]	RS flipflop 8	
[239]	RS flipflop 9	
[240]	SL digital output A	
[241]	SL digital output B	
[242]	SL digital output C	
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

Parameter 13-58 SL Controller 4 Action

Table 693: Parameter 13-58 SL Controller 4 Action

13-58 SL Controller 4 Action		
Default value: Size related	Parameter type: Option, Array [20]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the action corresponding to the SLC event. Actions are executed when the corresponding event (defined in *parameter 13-57 SL Controller 4 Event*) is evaluated as true.

Option	Name	Description
[0]	DISABLED	
[1]	No action	
[2]	Select set-up 1	Changes the active setup (*parameter 0-10 Active Set-up*) to 1. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via a fieldbus.
[3]	Select set-up 2	Changes the active setup (*parameter 0-10 Active Set-up*) to 2. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via a fieldbus.
[4]	Select set-up 3	Changes the active setup (*parameter 0-10 Active Set-up*) to 3. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via a fieldbus.
[5]	Select set-up 4	Changes the active setup (*parameter 0-10 Active Set-up*) to 4. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via a fieldbus.
[10]	Select preset ref 0	Selects preset reference 0. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[11]	Select preset ref 1	Selects preset reference 1. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[12]	Select preset ref 2	Selects preset reference 2. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[13]	Select preset ref 3	Selects preset reference 3. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[14]	Select preset ref 4	Selects preset reference 4. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.

Option	Name	Description
[15]	Select preset ref 5	Selects preset reference 5. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[16]	Select preset ref 6	Selects preset reference 6. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[17]	Select preset ref 7	Selects preset reference 7. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[18]	Select ramp 1	Selects ramp 1.
[19]	Select ramp 2	Selects ramp 2.
[20]	Select ramp 3	Selects ramp 3.
[21]	Select ramp 4	Selects ramp 4.
[22]	Run	Issues a start command to the drive.
[23]	Run reverse	Issues a start reverse command to the drive.
[24]	Stop	Issues a stop command to the drive.
[25]	Qstop	Issues a quick stop command to the drive.
[26]	Dcstop	Issues a DC stop command to the drive.
[27]	Coast	The drive coasts immediately. All stop commands including the coast command stop the SLC.
[28]	Freeze output	Freezes the output frequency of the drive.
[29]	Start timer 0	Starts timer 0, see *parameter 13-20 SL Controller Timer* for further description.
[30]	Start timer 1	Starts timer 1, see *parameter 13-20 SL Controller Timer* for further description.
[31]	Start timer 2	Starts timer 2, see *parameter 13-20 SL Controller Timer* for further description.
[32]	Set digital out A low	Any output with smart logic output A is low.
[33]	Set digital out B low	Any output with smart logic output B is low.
[34]	Set digital out C low	Any output with smart logic output C is low.
[35]	Set digital out D low	Any output with smart logic output D is low.
[36]	Set digital out E low	Any output with smart logic output E is low.
[37]	Set digital out F low	Any output with smart logic output F is low.
[38]	Set digital out A high	Any output with smart logic output A is high.
[39]	Set digital out B high	Any output with smart logic output B is high.
[40]	Set digital out C high	Any output with smart logic output C is high.
[41]	Set digital out D high	Any output with smart logic output D is high.
[42]	Set digital out E high	Any output with smart logic output E is high.
[43]	Set digital out F high	Any output with smart logic output F is high.
[60]	Reset Counter A	Resets counter A to 0.
[61]	Reset Counter B	Resets counter B to 0.

Option	Name	Description
[62]	Counter A (up)	
[63]	Counter A (down)	
[64]	Counter B (up)	
[65]	Counter B (down)	
[70]	Start timer 3	Starts timer 3, see *parameter 13-20 SL Controller Timer* for further description.
[71]	Start timer 4	Starts timer 4, see *parameter 13-20 SL Controller Timer* for further description.
[72]	Start timer 5	Starts timer 5, see *parameter 13-20 SL Controller Timer* for further description.
[73]	Start timer 6	Starts timer 6, see *parameter 13-20 SL Controller Timer* for further description.
[74]	Start timer 7	Starts timer 7, see *parameter 13-20 SL Controller Timer* for further description.
[120]	Start homing	**NOTICE** This option is available only with software version 48.20 and newer. Activates the homing mode and starts the homing function selected in *parameter 17-80 Homing Function*. Must remain active until the homing is completed otherwise the homing is aborted.
[121]	Stop homing	**NOTICE** This option is available only with software version 48.20 and newer. Deactivates the homing mode, an active homing function is aborted if the homing is not completed.
[122]	Enable reference	**NOTICE** This option is available only with software version 48.20 and newer. Sets the enable reference mode.
[123]	Disable reference	**NOTICE** This option is available only with software version 48.20 and newer. Disables the enable reference mode.
[124]	Relative position	**NOTICE** This option is available only with software version 48.20 and newer. Selects the relative position mode instead of the absolute position mode.
[125]	Absolute position	**NOTICE** This option is available only with software version 48.20 and newer.

Option	Name	Description
		Selects the absolute position mode instead of the relative position mode.
[126]	Activate touch	**NOTICE** This option is available only with software version 48.20 and newer. Activates the touch probe positioning mode.
[127]	Deactivate touch	**NOTICE** This option is available only with software version 48.20 and newer. Deactivates the touch probe positioning mode.
[128]	Target inverse	**NOTICE** This option is available only with software version 48.20 and newer. Changes the sign of the active target position value.
[129]	Target	**NOTICE** This option is available only with software version 48.20 and newer. The active target position is not changed.
[130]	Act. speed mode	**NOTICE** This option is available only with software version 48.20 and newer. Activates the speed mode when option *[9] Positioning* or option *[10] Synchronization* is selected in *parameter 1-00 Configuration Mode*.
[131]	Deact. speed mode	**NOTICE** This option is available only with software version 48.20 and newer. Deactivates the speed mode and activates the option selected in *parameter 1-00 Configuration Mode*.

5.13.6 13-9* User-defined Alerts and Readouts

Parameters in this group allow the configuration of application-specific triggers for triggering the drive to perform a certain action, show the status on the LCP, and represent it accordingly in *parameter 13-97 Alert Alarm Word*, *parameter 13-98 Alert Warning Word*, and *parameter 13-99 Alert Status Word*. In *parameter 13-91 Alert Action*, it is possible to select drive functionalities such as *info only*, *stop*, *running to max*, and *force drive to trip*.

Use the following parameters to configure the drive to show a message and perform an action when a specific event occurs:

- *Parameter 13-90 Alert Trigger* – the event that triggers the user-defined action and message.
- *Parameter 13-91 Alert Action* – the action that the drive performs when the event defined in *parameter 13-90 Alert Trigger* occurs.
- *Parameter 13-92 Alert Text* – the text that the drive shows in the display when the event defined in *parameter 13-90 Alert Trigger* occurs.

For example, consider the following use case: If there is an active signal on digital input 32, the drive shows the message *Valve 5 open* and ramps down to a stop. To achieve this configuration, make the following settings:

- *Parameter 13-90 Alert Trigger = [37] Digital input DI32*.
- *Parameter 13-91 Alert Action = [5] Stop & warning*.
- *Parameter 13-92 Alert Text = Valve 5 open*.

Actions reflected in *parameter 16-03 Status Word* and alert parameters

When an action containing trip is selected and triggered, the drive trips, bit 3 in the basic status word is set, and the corresponding hex value is shown in *parameter 13-97 Alert Alarm Word*.

The alarm for *User Alert* is logged as alarm value = 124 in *parameter 15-30 Fault Log: Error Code*, index [0]–[9].

When an action containing warning info is selected and triggered, bit 7 in the basic status word is set, and the corresponding hex value is shown in *parameter 13-98 Alert Warning Word*.

Other actions selected are not indicated in the basic status word, but the corresponding hex value is shown in *parameter 13-99 Alert Status Word*.

Example of setting up digital inputs as triggers, actions, and readouts

Refer to the following table to understand the 3 examples in this section.

Table 694: Example of Setting up Triggers, Actions, and Readouts

ID	Name	Setup 1
1390.0	Alert Trigger	[34] Digital input DI19
1390.1	Alert Trigger	[37] Digital input DI32
1390.2	Alert Trigger	[0] False
1390.3	Alert Trigger	[0] False
1390.4	Alert Trigger	[0] False
1390.5	Alert Trigger	[0] False
1390.6	Alert Trigger	[0] False
1390.7	Alert Trigger	[0] False
1390.8	Alert Trigger	[38] Digital input DI33
1390.9	Alert Trigger	[0] False
1391.0	Alert Action	[0] Info
1391.1	Alert Action	[1] Warning
1391.2	Alert Action	[0] Info
1391.3	Alert Action	[0] Info
1391.4	Alert Action	[0] Info
1391.5	Alert Action	[0] Info
1391.6	Alert Action	[0] Info
1391.7	Alert Action	[0] Info
1391.8	Alert Action	[12] Trip
1391.9	Alert Action	[0] Info
1392.0	Alert Text	Dig In 19
1392.1	Alert Text	Dig In 32

ID	Name	Setup 1
1392.2	Alert Text	User Alert
1392.3	Alert Text	User Alert
1392.4	Alert Text	User Alert
1392.5	Alert Text	User Alert
1392.6	Alert Text	User Alert
1392.7	Alert Text	User Alert
1392.8	Alert Text	Dig In 33
1392.9	Alert Text	User Alert

Example 1: In *parameter 13-90 Alert Trigger*, index [0], DI19 is selected as trigger. The digital value is 0000 0001. The corresponding action, Info, is set in *parameter 13-91 Alert Action*, index [0] and is shown as 1 hex in *parameter 13-99 Alert Status Word*.

Example 2: In *parameter 13-90 Alert Trigger*, index [1], DI32 is selected as trigger. The digital value is 0000 0010. The corresponding action, Warning, is set in *parameter 13-91 Alert Action*, index [1] and is shown as 2 hex in *parameter 13-98 Alert Warning Word*.

Example 3: In *parameter 13-90 Alert Trigger*, index [8], DI33 is selected as trigger. The digital value is 0001 0000 0000. The corresponding action, Trip, is set in *parameter 13-91 Alert Action*, index [8] and is shown as 100 hex in *parameter 13-97 Alert Alarm Word*.

When 1 of the 3 digital inputs shown in this example is activated, the text shown in the LCP is the one defined in *parameter 13-92 Alert Text*, index [0], [1], and [8].

N O T I C E

The action setting of an active trigger cannot be changed. For example, if DI19 is selected as trigger and the input is high, the action cannot be changed from *Stop* to *Jog*.

Parameter 13-90 Alert Trigger

Table 695: Parameter 13-90 Alert Trigger

13-90 Alert Trigger		
Default value: [0] False	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the event that triggers the user-defined action and message.

Option	Name	Description
[0]*	False	
[1]	True	
[18]	Reversing	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	

Option	Name	Description
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL time-out 0	
[31]	SL time-out 1	
[32]	SL time-out 2	
[33]	Digital input DI18	
[34]	Digital input DI19	
[35]	Digital input DI27	
[36]	Digital input DI29	**NOTICE** This option is only available in FC 302.
[37]	Digital input DI32	
[38]	Digital input DI33	
[50]	Comparator 4	
[51]	Comparator 5	
[60]	Logic rule 4	
[61]	Logic rule 5	
[70]	SL time-out 3	
[71]	SL time-out 4	
[72]	SL time-out 5	
[73]	SL time-out 6	
[74]	SL time-out 7	
[94]	RS flipflop 0	
[95]	RS flipflop 1	
[96]	RS flipflop 2	
[97]	RS flipflop 3	
[98]	RS flipflop 4	
[99]	RS flipflop 5	
[100]	RS flipflop 6	
[101]	RS flipflop 7	
[228]	Comparator 6	
[229]	Comparator 7	

Option	Name	Description
[230]	Comparator 8	
[231]	Comparator 9	
[232]	Logic rule 6	
[233]	Logic rule 7	
[234]	Logic rule 8	
[235]	Logic rule 9	
[236]	SL time-out 8	
[237]	SL time-out 9	
[238]	RS flipflop 8	
[239]	RS flipflop 9	

Parameter 13-91 Alert Action

Table 696: Parameter 13-91 Alert Action

13-91 Alert Action		
Default value: [0] Info	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

N O T I C E

For safety reasons, this parameter cannot be changed when there is an active alarm.

Select the action that the drive performs when the event defined in *parameter 13-90 Alert Trigger* occurs.

Option	Name	Description
[0]*	Info	
[1]	Warning	
[2]	Freeze output	
[3]	Freeze output & warn	
[4]	Stop	
[5]	Stop & warning	
[6]	Jogging	
[7]	Jogging & warning	
[8]	Max speed	
[9]	Max speed & warn	
[10]	Stop and trip	
[11]	Stop and w manual reset	

Option	Name	Description
[12]	Trip	
[13]	Trip w manual reset	
[14]	Trip lock	

Parameter 13-92 Alert Text

Table 697: Parameter 13-92 Alert Text

13-92 Alert Text		
Default value: Size related	Parameter type: Range, 0 - 20, Array [10]	Setup: 2 setups
Conversion index: 0	Data type: VisStr 20	Change during operation: True

Enter the text that the drive shows in the display when the event is defined in *parameter 13-90 Alert Trigger* occurs.

Parameter 13-97 Alert Alarm Word

Table 698: Parameter 13-97 Alert Alarm Word

13-97 Alert Alarm Word		
Default value: 0	Parameter type: Range, 0 - 3FF hex	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Shows the alarm word of a user-defined alarm in hex code.

Parameter 13-98 Alert Warning Word

Table 699: Parameter 13-98 Alert Warning Word

13-98 Alert Warning Word		
Default value: 0	Parameter type: Range, 0 - 3FF hex	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Shows the warning word of a user-defined alarm in hex code.

Parameter 13-99 Alert Status Word

Table 700: Parameter 13-99 Alert Status Word

13-99 Alert Status Word		
Default value: 0	Parameter type: Range, 0 - 3FF hex	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Shows the status word of a user-defined alarm in hex code.

5.14 Parameter Group 14-** Special Functions

5.14.1 14-0* Inverter Switching

Parameter 14-00 Switching Pattern

Table 701: Parameter 14-00 Switching Pattern

14-00 Switching Pattern		
Default value: [1] SFAVM	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the switching pattern: 60° AVM or SFAVM.

NOTICE

The drive may adjust the switching pattern automatically to avoid a trip.

Option	Name	Description
[0]	60 AVM	
[1]*	SFAVM	

Parameter 14-01 Switching Frequency

Table 702: Parameter 14-01 Switching Frequency

14-01 Switching Frequency		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the drive switching frequency. Changing the switching frequency reduces acoustic noise from the motor. Default values depend on power size.

NOTICE

The output frequency value of the drive must never exceed 10% of the switching frequency. When the motor is running, adjust the switching frequency in *parameter 14-01 Switching Frequency* to minimize motor noise.

NOTICE

To avoid a trip, the drive can adjust the switching frequency automatically.

Option	Name	Description
[0]	1.0 kHz	
[1]	1.5 kHz	Default switching frequency for 355–1200 kW [500–1600 hp], 690 V.
[2]	2.0 kHz	Default switching frequency for 250–800 kW [350–1075 hp], 400 V, and 37–315 kW [50–450 hp], 690 V.
[3]	2.5 kHz	
[4]	3.0 kHz	Default switching frequency for 18.5–37 kW [25–50 hp], 200 V, and 37–200 kW [50–300 hp], 400 V.
[5]	3.5 kHz	
[6]	4.0 kHz	Default switching frequency for 5.5–15 kW [7.5–20 hp], 200 V, and 11–30 kW [15-40], 400 V.
[7]	5.0 kHz	Default switching frequency for 0.25–3.7 kW [0.34–5 hp], 200 V, and 0.37–7.5 kW [0.5–10 hp], 400 V.
[8]	6.0 kHz	
[9]	7.0 kHz	
[10]	8.0 kHz	
[11]	10.0 kHz	

Option	Name	Description
[12]	12.0 kHz	
[13]	14.0 kHz	
[14]	16.0 kHz	

Parameter 14-02 Switching Pattern Shift Frequency

Table 703: Parameter 14-02 Switching Pattern Shift Frequency

14-02 Switching Pattern Shift Frequency		
Default value: 15 Hz	Parameter type: Range, 15 - 590 Hz	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Set the frequency where the switching pattern shifts between SFAVM and 60 AVM. Set a value to keep high-speed motors in SFAVM mode during ramp-up and during low-speed operation. The value to set is motor-dependent. The pattern shift frequency can be set when *parameter 14-00 Switching Pattern* is set to *[0] 60 AVM*.

Parameter 14-03 Overmodulation

Table 704: Parameter 14-03 Overmodulation

14-03 Overmodulation		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

N O T I C E

Overmodulation leads to increased torque ripple as harmonics increase.

Option	Name	Description
[0]	Off	Select *[0] Off* for no overmodulation of the output voltage to avoid torque ripple on the motor shaft. This feature may be useful for applications such as grinding machines.
[1]	On	Select *[1] On* to enable the overmodulation function for the output voltage. This is the right option when it is required that the output voltage is higher than 95% of the input voltage (typically when running over-synchronously). The output voltage is increased according to the degree of overmodulation. Control in flux control principle provides an output current of up to 98% of the input current, regardless of *parameter 14-03 Overmodulation*.
[2]	User defined	Modulation index refers to the relation between motor voltage and DC-link voltage. High overmodulation increases the motor voltage and optimizes the motor torque and efficiency by reducing the motor current. A high modulation index increases the risk of torque ripple on the motor shaft. In applications where the torque ripple occur, it can be beneficial to disable the overmodulation. It is possible to configure the setup in the range defined in *parameter 40-55 Modulation Index*.

Parameter 14-04 Acoustic Noise Reduction

Table 705: Parameter 14-04 Acoustic Noise Reduction

14-04 Acoustic Noise Reduction		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Off	No change of the acoustic motor switching noise.
[1]	On	Select to reduce the acoustic noise from the motor.

Parameter 14-05 PWM Generation

Table 706: Parameter 14-05 PWM Generation

14-05 PWM Generation		
Default value: [0] Standard	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Use this parameter in VVC+ and U/f mode only. When running with low ratio between switch frequency and output frequency (especially close to or <10:1), it is possible to improve the resolution of the PWM modulation and optimize the output voltage.

Option	Name	Description
[0]*	Standard	Use this setting for standard motors.
[1]	Double update	Updates the PWM pattern twice per switch period. Select this option to achieve a more optimal sinus-wave and slight increase of the output voltage.

Parameter 14-06 Dead Time Compensation

Table 707: Parameter 14-06 Dead Time Compensation

14-06 Dead Time Compensation		
Default value: [1] On	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	Off	No compensation.
[1]*	On	Activates dead-time compensation.

5.14.2 14-1* Mains On/Off

N O T I C E

The following parameter is only available in FC 302:

- *Parameter 14-16 Kin. Back-up Gain*

Parameters for configuring mains failure monitoring and handling. If a mains failure appears, the drive tries to continue in a controlled way until the power in the DC link is exhausted.

Parameter 14-10 Mains Failure

Table 708: Parameter 14-10 Mains Failure

14-10 Mains Failure		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

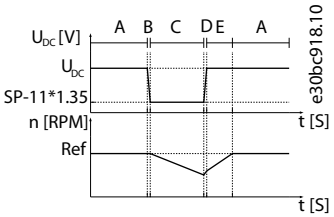
When *parameter 1-00 Configuration Mode* is set to *[2] Torque*, the following options are inactive:

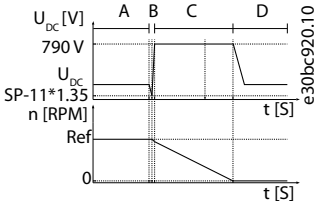
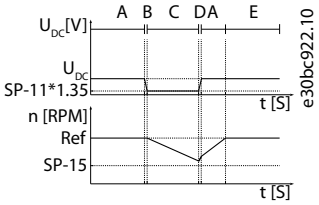
- *[1] Ctrl. ramp-down*
- *[2] Ctrl. ramp-down, trip*
- *[5] Kinetic back-up, trip*
- *[7] Kin. back-up, trip w recovery*

N O T I C E

This parameter cannot be changed while the motor is running.

Parameter 14-10 Mains Failure is typically used where short mains interruptions (voltage dips) are present. At 100% load and a short voltage interruption, the DC voltage on the main capacitors drops quickly. For larger drives, it only takes a few milliseconds before the DC level drops to about 373 V DC, and the IGBTs cut off and lose the control of the motor. When mains is restored, and the IGBTs start again, the output frequency and voltage vector do not correspond to the speed/frequency of the motor, and the result is normally an overvoltage or overcurrent, mostly resulting in a trip lock. *Parameter 14-10 Mains Failure* can be programmed to avoid this situation. Select the function according to which the drive must act when the threshold in *parameter 14-11 Mains Fault Voltage Level* is reached.

Option	Name	Description
[0]*	No function	The drive does not compensate for a mains interruption. The voltage on the DC link drops quickly and motor control is lost within milliseconds to seconds. This situation results in a trip lock.
[1]	Ctrl. ramp-down	Control of the motor remains with the drive, and the drive performs a controlled ramp down from *parameter 14-11 Mains Fault Voltage Level*. If *parameter 2-10 Brake Function* is *[0] Off* or *[2] AC brake*, the ramp follows the overvoltage ramping. If *parameter 2-10 Brake Function* is *[1] Resistor Brake*, the ramp follows the setting in *parameter 3-81 Quick Stop Ramp Time*. This selection is useful in pump applications, where the inertia is low and the friction is high. When mains is restored, the output frequency ramps the motor up to the reference speed. If the mains interruption is prolonged, the controlled ramp down may bring the output frequency down to 0 RPM, and when the mains is restored, the application is ramped up from 0 RPM to the previous reference speed via the normal ramp-up. If the energy in the DC link disappears before the motor is ramped to 0, the motor is coasted. **Limitation:** See the introduction text in this parameter.
[2]	Ctrl. ramp-down, trip	The functionality is the same as in *[1] Ctrl. ramp-down*, except in this option a reset is necessary for starting up after power-up.
[3]	Coasting	Centrifuges can run for 1 hour without supply. In those situations, it is possible to select a coast function at mains interruption, together with a flying start, which occurs when the mains is restored.
[4]	Kinetic back-up	Kinetic back-up ensures that the drive keeps running as long as there is energy in the system due to the inertia from motor and load. This is done by converting the mechanical energy to the DC link and maintaining control of the drive and motor. This can extend the controlled operation, depending on the inertia in the system. For fans, it is typically several seconds; for pumps up to 2 s; and for compressors only for a fraction of a second. Many industry applications can extend controlled operation for many seconds, which is often enough time for the mains to return.  **Illustration 83: Kinetic Back-up**

Op-tion	Name	Description
		A Normal operation B Mains failure C Kinetic back-up D Mains return E Normal operation: Ramping The DC level during *[4] Kinetic backup* equals *parameter 14-11 Mains Fault Voltage Level* x 1.35. If the mains does not return, U_{DC} is maintained as long as possible by ramping the speed down towards 0 RPM. Finally, the drive coasts. If the mains returns while in kinetic back-up mode, U_{DC} increases above *parameter 14-11 Mains Fault Voltage Level* x 1.35. This is detected in 1 of the following ways: • If U_{DC} > *parameter 14-11 Mains Fault Voltage Level* x 1.35 x 1.05. • If the speed is above the reference. This is relevant if the mains comes back at a lower level than before, for example *parameter 14-11 Mains Fault Voltage Level* x 1.35 x 1.02. This does not fulfill the criterion in point 1, and the drive tries to reduce U_{DC} to *parameter 14-11 Mains Fault Voltage Level* x 1.35 by increasing the speed. This cannot be done as the mains cannot be lowered. • If running mechanically. The same mechanism as in point 2 applies, but the inertia prevents the speed from going above the reference speed. This leads to the motor running mechanically until the speed is above the reference speed and the situation in point 2 occurs. Instead of waiting for that criterion, point 3 is introduced.
[5]	Kinetic back-up, trip	The difference between kinetic back-up with and without trip is that the latter always ramps down to 0 RPM and trips, regardless of whether mains returns or not. The function does not detect if mains returns. This is the reason for the relatively high level on the DC link during ramp-down.  **Illustration 84: Kinetic Back-up Trip** A Normal operation B Mains failure C Kinetic back-up D Trip
[6]	Alarm	
[7]	Kin. back-up, trip w recovery	This option is valid in VVC+ only. Kinetic back-up with recovery combines the features of kinetic back-up and kinetic back-up with trip. This feature makes it possible to select between kinetic back-up and kinetic back-up with trip, based on a recovery speed, configurable in *parameter 14-15 Kin. Back-up Trip Recovery Level*. If mains does not return, the drive ramps down to 0 RPM and trips. If mains returns while in kinetic back-up at a speed above the value in *parameter 14-15 Kin. Back-up Trip Recovery Level*, normal operation is resumed. This is equal to *[4] Kinetic Back-up*. The DC level during *[7] Kin. back-up, trip w recovery* is *parameter 14-11 Mains Fault Voltage Level* x 1.35.  **Illustration 85: Kinetic Back-up Trip w/Recovery, Mains Returns Above** *Parameter 14-15 Kin. Back-up Trip Recovery Level*

Option	Name	Description

A	Normal operation	D	Mains return
B	Mains Failure	E	Normal operation: Ramping
C	Kinetic back-up		

If mains returns while in kinetic back-up at a speed below *parameter 14-15 Kin. Back-up Trip Recovery Level*, the drive ramps down to 0 RPM using the ramp and then trips. If the ramp is slower than the system ramping down on its own, the ramping is done mechanically and U_{DC} is at the normal level ($U_{DC,m}$ x 1.35).

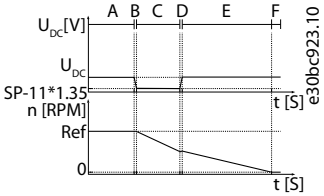


Illustration 86: Kinetic Back-up Trip w/Recovery, Slow Ramp, Mains Returns Below *Parameter 14-15 Kin. Back-up Trip Recovery Level*

A	Normal operation	D	Mains return
B	Mains failure	E	Kinetic back-up, ramping to trip
C	Kinetic back-up	F	Trip

If the ramp is quicker than the ramp-down speed of the application, the ramping generates current. This results in a higher U_{DC}, which is limited using the brake chopper/resistor brake.

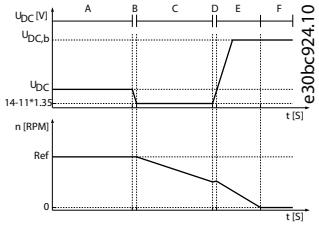


Illustration 87: Kinetic Back-up Trip w/Recovery, Quick Ramp, Mains Returns Below *Parameter 14-15 Kin. Back-up Trip Recovery Level*

A	Normal operation	D	Mains return
B	Mains failure	E	Kinetic back-up ramping to trip
C	Kinetic back-up	F	Trip

[9]	Kinetic back-up, coast	The purpose of this function is to avoid mains failure trips (*Alarm 36*), for example, where mains is weak or can be disturbed by other motors being started directly. When the drive detects mains failure, the drive ramps down the motor using kinetic back-up and coasts the drive. The drive remains coasted for the time set in *parameter 40-14 Mains Loss Duration* - the actual ramp-down time in KB. If mains returns after that time, the drive ramps up again. When *parameter 40-14 Mains Loss Duration* = 60, the drive immediately restarts the ramp up if the start command is still valid from PLC and mains voltage is back. When *parameter 40-14 Mains Loss Duration* = <60, the drive waits for the timer in *parameter 40-14 Mains Loss Duration* to expire before restarting ramp up.

Option	Name	Description
		This delay prevents an unintentional restart if the drive detects that mains is back at an acceptable level, but not being consistently back.
[10]	Quick ramp-down	The purpose of this function is to handle mains drop in low inertia applications, where the drive must continue running to make a ride-through by reducing the speed until the grid returns to full voltage. During the voltage drop, the speed ramps down using *parameter 3-81 Quick Stop Ramp Time* until voltage returns. After that, normal ramp up is used. The DC link is not regulated since this is not possible in a low-inertia application without any generative power in the motor/load. The selection is valid for IPM and SPM motors in Flux. To ensure that the function is activated, set *parameter 14-11 Mains Failure Voltage Level* higher than the expected voltage drop level. The quick ramp down must be set fast enough to endure a significant load drop to allow the control to run at reduced voltage, and it must be slow enough not to reach standstill before voltage returns - if possible. If speed reaches 0, it stays there until voltage returns and ramps up. If an alarm is required at standstill, it can be programmed in the SLC. An optional delay, set in *parameter 40-14 Mains Loss Duration*, can be activated before ramping up to bypass and ripple on the DC link when power returns.

Parameter 14-11 Mains Fault Voltage Level

Table 709: Parameter 14-11 Mains Fault Voltage Level

14-11 Mains Fault Voltage Level		
Default value: Size related	Parameter type: Range, 100 - 800 V	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter defines the threshold voltage at which the function in *parameter 14-10 Mains Failure* is activated. Select the detection level depending on the supply quality. For a supply of 380 V, set *parameter 14-11 Mains Fault Voltage Level* to 342 V. This results in a DC detection level of 462 V (*parameter 14-11 Mains Fault Voltage Level* x 1.35).

NOTICE

Converting from VLT 5000 to FC 300: Even though the setting of the mains voltage at mains fault is the same for VLT 5000 and FC 300, the detection level is different. Use the following formula to obtain the same detection level as in VLT 5000: *Parameter 14-11 Mains Fault Voltage Level* (VLT 5000 level) = value used in VLT 5000 x1.35/sqrt(2).

Parameter 14-12 Response to Mains Imbalance

Table 710: Parameter 14-12 Response to Mains Imbalance

14-12 Response to Mains Imbalance		
Default value: [0] Trip lock	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

NOTICE

Make sure that the setting in *parameter 0-03 Regional Setting* matches the actual grid.

Operation under severe mains imbalance conditions reduces the lifetime of the motor. Conditions are considered severe if the motor is operated continuously near nominal load (for example, a pump or a fan running near full speed). Select the level of operation when mains imbalance conditions occur. Options *[5] Fast trip lock* to *[7] Fast warning* are based on a principle which enures detection of a missing mains phase within 2 s and responds according to the selection. See *parameter 14-17 Fast Mains Phase Loss* and *parameter 14-18 Fast Mains Phase Loss Min Power*. A minimum load on the drive of 2% nominal power is required for detection of missing mains phase.

Option	Name	Description
[0]*	Trip Lock	A trip lock is triggered upon a mains phase imbalance.
[1]	Warning	A warning is issued upon a mains phase imbalance.
[2]	Disabled	Mains failure detection is disabled.
[3]	Derate	The drive derates upon a mains phase imbalance.
[4]	Trip	The drive trips.
[5]	Fast Trip Lock	A trip lock occurs when a mains input phase is missing.
[6]	Fast Trip	The drive trips when a mains input phase is missing.
[7]	Fast Warning	A warning occurs when a mains input phase is missing.

Parameter 14-14 Kin. Back-up Time-up

Table 711: Parameter 14-14 Kin. Back-up Time-up

14-14 Kin. Back-up Time-up		
Default value: 60 s	Parameter type: Range, 0 - 60 s	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

This parameter defines the kinetic back-up timeout in flux mode when running on low voltage grids. If the supply voltage does not exceed the value defined in *parameter 14-11 Mains Fault Voltage Level* +5% within the specified time, the drive automatically runs a controlled ramp-down profile before stop.

Parameter 14-15 Kin. Back-up Trip Recovery Level

Table 712: Parameter 14-15 Kin. Back-up Trip Recovery Level

14-15 Kin. Back-up Trip Recovery Level		
Default value: Size related	Parameter type: Range, 0 - 60000.000 Reference- FeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Uint32	Change during operation: True

This parameter specifies the kinetic back-up trip recovery level. The unit is defined in *parameter 0-02 Motor Speed Unit*.

Parameter 14-16 Kin. Back-up Gain

Table 713: Parameter 14-16 Kin. Back-up Gain

14-16 Kin. Back-up Gain		
Default value: 100%	Parameter type: Range, 0 - 500%	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Enter the kinetic back-up gain value in percent.

Parameter 14-17 Fast Mains Phase Loss Level

Table 714: Parameter 14-17 Fast Mains Phase Loss Level

14-17 Fast Mains Phase Loss Level		
Default value: 100	Parameter type: Range, 0 - 500	Setup: All setups
Conversion index: -3	Data type: Uint32	Change during operation: True

Set the level at which the functions Fast Mains Phase Loss Trip or Fast Mains Phase Loss Warning (see *parameter 14-12 Response to Mains Imbalance*) should be activated.

NOTICE

A lower level than default might cause false alarms as it increases sensitivity.

Parameter 14-18 Fast Mains Phase Loss Min Power

Table 715: Parameter 14-18 Fast Mains Phase Loss Min Power

14-18 Fast Mains Phase Loss Min Power		
Default value: 2	Parameter type: Range, 0 - 100	Setup: All setups
Conversion index: -3	Data type: Uint32	Change during operation: True

Set the minimum power level (% of nominal power) at which the functions Fast Mains Phase Loss Trip or Fst Mains Phase Loss Warning (see *parameter 14-12 Response to Mains Imbalance*) should be activated.

NOTICE

A minimum power level of 2% is a prerequisite for the Fast Mains Phase Loss function to work.

5.14.3 14-2* Trip Reset

Parameters for configuring auto reset handling, special trip handling, and control card self-test or initialization.

Parameter 14-20 Reset Mode

Table 716: Parameter 14-20 Reset Mode

14-20 Reset Mode		
Default value: [0] Manual reset	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the reset function after tripping. Once reset, the drive can be restarted.

NOTICE

The motor may start without warning. If the specified number of automatic resets is reached within 10 minutes, the drive enters *[0] Manual reset* mode. After the manual reset is performed, the setting of *parameter 14-20 Reset Mode* returns to the original selection. If the number of automatic resets are not reached within 10 minutes, or when a manual reset is performed, the internal automatic reset counter returns to 0.

Option	Name	Description
[0]*	Manual reset	Select *[0] Manual reset* to perform a reset via [Reset] or via the digital inputs.
[1]	Automatic reset x 1	Select *[1]-[12] Automatic reset* x 1… x20 to perform 1–20 automatic resets after tripping.
[2]	Automatic reset x 2	
[3]	Automatic reset x 3	
[4]	Automatic reset x 4	
[5]	Automatic reset x 5	
[6]	Automatic reset x 6	
[7]	Automatic reset x 7	
[8]	Automatic reset x 8	

Option	Name	Description
[9]	Automatic reset x 9	
[10]	Automatic reset x 10	
[11]	Automatic reset x 15	
[12]	Automatic reset x 20	
[13]	Infinite auto reset	Select this option for continuous resetting after tripping.
[14]	Reset at power-up	

Parameter 14-21 Automatic Restart Time

Table 717: Parameter 14-21 Automatic Restart Time

14-21 Automatic Restart Time		
Default value: Size related	Parameter type: Range, 0 - 3600 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the time interval from trip to start of the automatic reset function. This parameter is active when *parameter 14-20 Reset Mode* is set to *[1]–[13] Automatic reset*.

Parameter 14-22 Operation Mode

Table 718: Parameter 14-22 Operation Mode

14-22 Operation Mode		
Default value: [0] Normal operation	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Use this parameter to specify normal operation, to perform tests, or to initialize all parameters except *parameter 15-03 Power Up's*, *parameter 15-04 Over Temp's*, and *parameter 15-05 Over Volt's*. This function is active only when the power is cycled to the drive. Select *[0] Normal operation* for normal operation of the drive with the motor in the selected application. Select *[1] Control card test* to test the analog and digital inputs and outputs and the +10 V control voltage. The test requires a test connector with internal connections. Use the following procedure for the control card test:

- Select *[1] Control card test*.
- Disconnect the mains supply and wait for the indicator light in the display to go out.
- Set switches S201 (A53) and S202 (A54) to ON/I.
- Insert the test plug.
- Connect to mains supply.
- Carry out various tests.
- The results are shown on the LCP and the drive moved into an infinite loop.
- *Parameter 14-22 Operation Mode* is automatically set to normal operation. Carry out a power cycle to start up in normal operation after a control card test.

If the test is OK	LCP readout: Control card OK. Disconnect the mains supply and remove the test plug. The green indicator light on the control card lights up.
If the test fails	LCP readout: Control card I/O failure. Replace the drive or control card. The red indicator light on the control card is turned on. Test plugs (connect the following terminals to each other): 18 - 27 - 32; 19 - 29 - 33; 42 - 53 - 54.

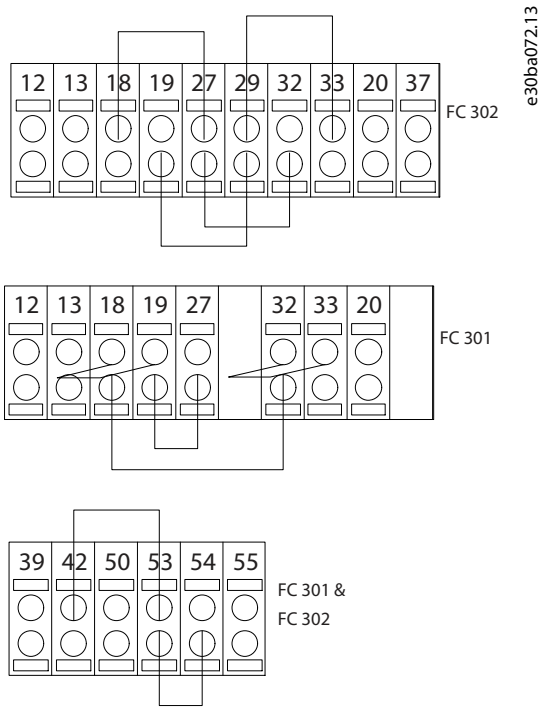


Illustration 88: Test Plugs

Select *[2] Initialisation* to reset all parameter values to default settings, except for: *Parameter 15-03 Power Up's*, *parameter 15-04 Over Temp's*, and *parameter 15-05 Over Volt's*. The drive resets during the next power-up. *Parameter 14-22 Operation Mode* also returns to the default setting *[0] Normal operation*.

Option	Name	Description
[0]*	Normal operation	
[1]	Control card test	Remember to set switches S201 (A53) and S202 (A54) as specified in the parameter description when performing a control card test. Otherwise, the test fails.
[2]	Initialisation	Select this option to perform initialization. This option does not clear the service logs.
[3]	Boot mode	
[5]	Clear service logs	**N O T I C E** Save the log information using MCT 10 Set-up Software before clearing the service logs. Select this option and perform a power cycle to clear the log.
[6]	Clear param. log	

Parameter 14-24 Trip Delay at Current Limit

Table 719: Parameter 14-24 Trip Delay at Current Limit

14-24 Trip Delay at Current Limit		
Default value: 60 s	Parameter type: Range, 0 - 60 s	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the current limit trip delay in s. When the output current reaches the current limit (*parameter 4-18 Current Limit*), a warning is triggered. When the current limit warning has been continuously present for the period specified in this parameter, the drive trips. To run continuously in current limit without tripping, set the parameter to 60 s. Thermal monitoring of the drive remains active.

Parameter 14-25 Trip Delay at Torque Limit

Table 720: Parameter 14-25 Trip Delay at Torque Limit

14-25 Trip Delay at Torque Limit		
Default value: 60 s	Parameter type: Range, 0 - 60 s	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the torque limit trip delay in s. When the output torque reaches the torque limits (*parameter 4-16 Torque Limit Motor Mode* and *parameter 4-17 Torque Limit Generator Mode*), a warning is triggered. When the torque limit warning has been continuously present for the period specified in this parameter, the drive trips. Disable the trip delay by setting the parameter to 60 s. Thermal monitoring of the drive remains active.

Parameter 14-26 Trip Delay at Inverter Fault

Table 721: Parameter 14-26 Trip Delay at Inverter Fault

14-26 Trip Delay at Inverter Fault		
Default value: Size related	Parameter type: Range, 0 - 35 s	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

When the drive detects an overvoltage in the set time, a trip is effected after the set time. If the value is 0, protection mode is disabled.

N O T I C E

Disable protection mode in hoisting applications.

5.14.4 14-3* Current Limit Control

N O T I C E

The following parameters are only available in FC 302:

- *Parameter 14-33 Torque Change Detection*
- *Parameter 14-36 Field-weakening Function*
- *Parameter 14-37 Fieldweakening Speed*
- *Paraneter 14-38 Field Weakening Controller Gain*
- *Parameter 14-39 Torque Change Threshold Limit*

The drive features an integral current limit controller, which is activated when the motor current, and thus the torque, is higher than the torque limits set in *parameter 4-16 Torque Limit Motor Mode* and *parameter 4-17 Torque Limit Generator Mode*. When the current limit is reached during motor operation or regenerative operation, the drive tries to reduce torque below the preset torque limits as quickly as possible without losing control of the motor. While the current control is active, the drive can only be stopped by setting a digital input to *[2] Coast inverse* or *[3] Coast and reset inv*. Any signals on terminals 18–33 are not active until the drive is no longer near the current limit. By using a digital input set to *[2] Coast inverse* or *[3] Coast and reset inv.*, the motor does not use the ramp-down time, since the drive is coasted. If a quick stop is necessary, use the mechanical brake control function along with an external electro-mechanical brake attached to the application.

Parameter 14-30 Current Lim Ctrl, Proportional Gain

Table 722: Parameter 14-30 Current Lim Ctrl, Proportional Gain

14-30 Current Lim Ctrl, Proportional Gain		
Default value: 100%	Parameter type: Range, 0 - 500%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Enter the proportional gain value for the current limit controller. Selection of a high value makes the controller react faster. Too high a setting leads to controller instability.

Parameter 14-31 Current Lim Ctrl, Integration Time

Table 723: Parameter 14-31 Current Lim Ctrl, Integration Time

14-31 Current Lim Ctrl, Integration Time		
Default value: Size related	Parameter type: Range, 0.002 - 2 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: False

Controls the current limit control integration time. Setting it to a lower value makes it react faster. A setting too low leads to controller instability.

Parameter 14-32 Current Lim Ctrl, Filter Time

Table 724: Parameter 14-32 Current Lim Ctrl, Filter Time

14-32 Current Lim Ctrl, Filter Time		
Default value: Size related	Parameter type: Range, 1 - 100 ms	Setup: All setups
Conversion index: -4	Data type: Uint16	Change during operation: True

Controls the current limit control low-pass filter. This makes it possible to react to peak values or to average values. When selecting average values, it is sometimes possible to run with higher output current and instead trip on the hardware limit for current. However, the control reacts slower as it does not react on immediate values.

Parameter 14-33 Torque Change Detection

Table 725: Parameter 14-33 Torque Change Detection

14-33 Torque Change Detection		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Disabled	
[1]	Enable	Use this function in VVC+, flux, and in speed mode. The torque load is minimum 15% of nominal torque and the actual speed equals to the reference. *Parameter 14-39 Torque Change Threshold Limit* is used for threshold limit generation.

Parameter 14-34 Stall Protection Adjustment Factor

Table 726: Parameter 14-34 Stall Protection Adjustment Factor

14-34 Stall Protection Adjustment Factor		
Default value: 100%	Parameter type: Range, 50 - 200%	Setup: All setups
Conversion index: -4	Data type: Uint16	Change during operation: True

Set this parameter to avoid overvoltage and overcurrent alarms occurring in the field-weakening area. Decrease the setting to reduce risk of overcurrent and overvoltage trips. Increase the setting if the stall protection is overprotecting and the torque is too low, for example, due to wrong motor data.

N O T I C E

This parameter is active when *parameter 14-35 Stall Protection* is set to *[1] Enabled* and *parameter 14-36 Field-weakening Function* is set to *[1] 1/x*.

Parameter 14-35 Stall Protection

Table 727: Parameter 14-35 Stall Protection

14-35 Stall Protection		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

N O T I C E

This parameter is active in flux mode only.

Option	Name	Description
[0]	Disabled	Disables stall protection in field weakening flux mode and might cause the motor to be lost.
[1]*	Enabled	Enables stall protection in field weakening flux mode.

Parameter 14-36 Field-weakening Function

Table 728: Parameter 14-36 Field-weakening Function

14-36 Field-weakening Function		
Default value: [0] Auto	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the field-weakening function mode in flux mode.

Option Number	Option Name	Description
[0]*	Auto	In this mode, the drive calculates the optimal torque output. Measured DC-link voltage determines the phase-to-phase motor voltage. Magnetizing reference is based on the actual voltage and utilizes the information about the model of the motor.
[1]	1/x	The drive reduces torque output. The drive sets the magnetizing reference inversely proportional to the speed using a static curve that shows the relationship between DC-link voltage and the speed.

Parameter 14-37 Fieldweakening Speed

Table 729: Parameter 14-37 Fieldweakening Speed

14-37 Fieldweakening Speed		
Default value: Size related	Parameter type: Range, 10 - 60000 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Enter the start speed for option *[1] [1/x]* in *parameter 14-36 Fieldweakening Function*.

Parameter 14-38 Field Weakening Controller Gain

Table 730: Parameter 14-38 Field Weakening Controller Gain

14-38 Field Weakening Controller Gain		
Default value: 20%	Parameter type: Range, 10 - 100%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Set the integral gain for the field weakening controller.

Parameter 14-39 Torque Change Threshold Limit

Table 731: Parameter 14-39 Torque Change Threshold Limit

14-39 Torque Change Threshold Limit		
Default value: 20%	Parameter type: Range, 10 - 100%	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Set the torque change threshold limit in % of the actual torque. When the actual torque exceeds the torque threshold value, the drive trips within 10 ms.

5.14.5 14-4* Energy Optimizing

Parameters for adjusting the energy optimization level in both variable torque (VT) and automatic energy optimization (AEO) mode in *parameter 1-03 Torque Characteristics*.

Parameter 14-40 VT Level

Table 732: Parameter 14-40 VT Level

14-40 VT Level		
Default value: 66%	Parameter type: Range, 40 - 90%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

N O T I C E

This parameter is not active when *parameter 1-10 Motor Construction* is set to *[1] PM non-salient SPM*.

Enter the level of motor magnetization at low speed. Selection of a low value reduces energy loss in the motor but also reduces load capability.

Parameter 14-41 AEO Minimum Magnetisation

Table 733: Parameter 14-41 AEO Minimum Magnetisation

14-41 AEO Minimum Magnetisation		
Default value: Size related	Parameter type: Range, 30 - 200%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

N O T I C E

This parameter is not active when *parameter 1-10 Motor Construction* is set to *[1] PM non-salient SPM*.

Enter the minimum allowable magnetization for AEO. Selection of a low value reduces energy loss in the motor but can also reduce resistance to sudden load changes.

Parameter 14-42 Minimum AEO Frequency

Table 734: Parameter 14-42 Minimum AEO Frequency

14-42 Minimum AEO Frequency		
Default value: Size related	Parameter type: Range, 0 - 255 Hz	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

N O T I C E

This parameter is not active when *parameter 1-10 Motor Construction* is set to *[1] PM non-salient SPM*.

Enter the minimum frequencyat which the automatic energy optimization (AEO)is to be active.

Parameter 14-43 Motor Cosphi

Table 735: Parameter 14-43 Motor Cosphi

14-43 Motor Cosphi		
Default value: Size related	Parameter type: Range, 0.40 - 0.95	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

The Cos(phi) setpoint is automatically set for optimum AEO performance. This parameter should normally not be altered. However, in some situations it may be necessary to enter a new value to fine-tune.

Parameter 14-44 d-axis Reference Gain

Table 736: Parameter 14-44 d-axis Reference Gain

14-44 d-axis Reference Gain		
Default value: 100%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Adjustment parameter for the d-axis current. 100% indicates maximum torque per ampere value based on motor parameters. Increasing the maximum torque can improve the power factor of the machine, which may increase the current consumption. The adjustment parameter allows to:

- Adjust minimum current consumption, allowing for tolerances in the motor parameters.
- Obtain the optimal balance between current consumption and power factor of the machine at a given point of operation.

Parameter 14-46 PROFIEnergy Times

Table 737: Parameter 14-46 PROFIEnergy Times

14-46 PROFIEnergy Times		
Default value: Size related	Parameter type: Range, 0 - 0x7fffffff, Array [3]	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Parameter with an array of 3. *[0] Time to pause*, *[1] Time min stay*, *[2] Time regular operate*.

Parameter 14-47 PROFIEnergy State

Table 738: Parameter 14-47 PROFIEnergy State

14-47 PROFIEnergy State		
Default value: [255] Ready to operate	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: False

Option	Name	Description
[1]	LCP off	
[4]	Internal fan off	
[7]	Gatedrive off	
[10]	Mains off	
[13]	External fan off	
[255]*	Ready to operate	

Parameter 14-48 PROFIEnergy Desired State

Table 739: Parameter 14-48 PROFIEnergy Desired State

14-48 PROFIEnergy Desired State		
Default value: [255] Ready to operate	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: False

Option	Name	Description
[1]	LCP off	
[4]	Internal fan off	
[7]	Gatedrive off	
[10]	Mains off	
[13]	External fan off	
[255]*	Ready to operate	

Parameter 14-49 PROFIEnergy Info

Table 740: Parameter 14-49 PROFIEnergy Info

14-49 PROFIEnergy Info		
Default value: 0	Parameter type: Range, 0 - 0x7ffffff, Array [115]	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Read-out information about PROFIEnergy.

5.14.6 14-5* Environment

AMA and Motor Filters

The following table details the recommended AMA options when motor filters are connected between drive and motor. AMA is independent of the selection made in *parameter 1-00 Configuration Mode* and *parameter 1-01 Motor Control Principle*.

Table 741: Motor Filter Types

Motor construction	Filter type	
	MCC 102 dU/dt Filters	**MCC 101 Sine-wave Filters and MCC 201 All-mode Filters**
	Valid P1-29 AMA options	
ASM and SPM	*[1] Complete AMA*	*[2] Reduced AMA*
	[2] Reduced AMA	*[4] Enable reduced AMA II*
	[4] Enable reduced AMA II	–
IPM	*[1] Complete AMA*	*[2] Reduced AMA*
	[2] Reduced AMA	AMA II not available
	AMA II not available	–

N O T I C E

The following parameter is only available in FC 302:

- *Parameter 14-59 Actual Number of Inverter Units*

N O T I C E

Perform a power cycle after changing any of the parameters in this parameter group.

Use these parameters when operating the drive under special environmental conditions.

Parameter 14-50 RFI Filter

Table 742: Parameter 14-50 RFI Filter

14-50 RFI Filter		
Default value: [1] On	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: False

Turn the RFI filter on or off. The RFI filter ensures that the drive complies with EMC standards. Select *[0] Off* only when the drive is connected to an isolated mains source (IT mains).

Option	Name	Description
[0]	Off	
[1]*	On	

Parameter 14-51 DC-link Compensation

Table 743: Parameter 14-51 DC-link Compensation

14-51 DC-link Compensation		
Default value: [1] On	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

The rectified AC-DC voltage in the DC link of the drive is associated with voltage ripples. These ripples can increase in magnitude with increased load. These ripples are undesirable because they can generate current and torque ripples. A compensation method is used to reduce these voltage ripples in the DC link. In general, DC-link compensation is recommended for most applications, but pay attention when operating in field weakening as it can generate speed oscillations at the motor shaft. In field weakening, turn off DC-link compensation.

Option	Name	Description
[0]	Off	Disables DC-link compensation.
[1]*	On	Enables DC-link compensation.
[2]	Advanced	Improved compensation of DC-link ripple caused by mains frequency and phase imbalance. **N O T I C E** *Parameter 0-03 Regional Setting* must be set correctly according to the actual mains grid.

Parameter 14-52 Fan Control

Table 744: Parameter 14-52 Fan Control

14-52 Fan Control		
Default value: [0] Auto	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the minimum speed of the main fan.

Option	Name	Description
[0]*	Auto	Select *[0] Auto* to run fan only when internal temperature in the drive is in the range 35 °C (95 °F) to approximately 55 °C (131 °F). The fan runs at low speed below 35 °C (95 °F), and at full speed at approximately 55 °C (131 °F).
[1]	On 50%	The fan always runs at 50% speed or above. The fan runs at 50% speed at 35 °C (95 °F), and at full speed at approximately 55 °C (131 °F).
[2]	On 75%	The fan always runs at 75% speed or above. The fan runs at 75% speed at 35 °C (95 °F), and at full speed at approximately 55 °C (131 °F).
[3]	On 100%	The fan always runs at 100% speed.
[4]	Auto (Low temp env.)	This option is the same as *[0] Auto*, but with special considerations around and below 0 °C (32 °F). In option *[0] Auto* there is a risk that the fan starts running around 0 °C as the drive detects a sensor fault and thus protects the drive while reporting *warning 66, Heat sink Temperature Low*. Option *[4] Auto (Low temp env.)* can be used in very cold environments and prevents the negative effects of this further cooling and avoids *warning 66, Heat sink Temperature Low*.

Parameter 14-53 Fan Monitor

Table 745: Parameter 14-53 Fan Monitor

14-53 Fan Monitor		
Default value: [1] Warning	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the drive action if a fan fault is detected.

Option	Name	Description
[0]	Disabled	
[1]*	Warning	
[2]	Trip	

Parameter 14-55 Output Filter

Table 746: Parameter 14-55 Output Filter

14-55 Output Filter		
Default value: [0] No filter	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

⚠ C A U T I O N ⚠

OVERHEATING OF FILTER OR AC DRIVE

Incorrect setting of *parameter 14-55 Output Filter* can lead to overheating and cause equipment damage and personal injury.

- Always set *parameter 14-55 Output Filter* to *[2] Sine-wave fixed* when using a sine-wave filter.

N O T I C E

This parameter cannot be adjusted while the motor is running.

N O T I C E

Reset the drive after selecting *[2] Sine-wave filter fixed*.

Select the type of output filter connected.

Option	Name	Description
[0]*	No filter	Set the parameter when VLT® MCC 102 dU/dt filters or VLT® MCC 105 high-frequency common-mode filters are connected to the drive.
[1]	Sine-wave filter	**N O T I C E** **COMPATIBILITY SETTING** Set the option to support backward compatibility with the VLT® 5000–8000 Series drives. – Do not use the setting when VLT® MCC 101 Sine-wave Filters and VLT® MCC 201 All-mode Filters are connected. Use the setting for backward compatibility purposes. Set *parameter 14-56 Capacitance Output Filter* and *parameter 14-57 Inductance Output Filter*. Setting the parameter does not limit the range of the switching frequency.
[2]	Sine-Wave Filter Fixed	**N O T I C E** **SINE-WAVE FILTER FIXED SETTING** Ensures that the filter is operated within the safe range of switching frequencies. – Use the setting only for VLT® MCC 101 Sine-wave Filters. When setting the option for VLT® MCC 101 Sine-wave filters, the parameter sets a minimum allowed limit to the switching frequency and ensures the filter is operated within the safe range of switching frequencies. The option supports all control principle operations of the filter. Set *parameter 14-56 Capacitance Output Filter* and

Option	Name	Description
		parameter 14-57 Inductance Output Filter. Setting the option allows the modulation pattern to be set to stator flux asynchronous vector modulation (SFAVM), which reduces the acoustic switching noise from the filter.
[5]	All-mode Filter	**NOTICE** This option is only available in FC 302. **NOTICE** **ALL-MODE FILTERING** Enables all-mode filter operating condition and ensures that the filter is operated within the safe range of switching frequencies. – Use this setting only for VLT® MCC 201 All-Mode Filters. When setting the option for VLT® MCC 201 All-mode Filter, the parameter enables all-mode filter operating conditions, which include settings for a minimum allowed limit to the switching frequency and ensure the filter is operated within the safe range of switching frequencies. The option supports all control principle operations of the filter. Set *Parameter 14-56 Capacitance Output Filter* and *parameter 14-57 Inductance Output Filter*. Setting the option allows the modulation pattern to be set to stator flux asynchronous vector modulation (SFAVM), which reduces the acoustic switching noise from the filter.

Parameter 14-56 Capacitance Output Filter

Table 747: Parameter 14-56 Capacitance Output Filter

14-56 Capacitance Output Filter		
Default value: 2.0 uF	Parameter type: Range, 0.1 - 6500 uF	Setup: All setups
Conversion index: -	Data type: Uint16	Change during operation: False

Set the C_y (capacitance) value of the output filter in uF, when using VLT® MCC 101 Sine-wave filter and VLT® MCC 201 All-mode filter. See the filter product label for the capacitance value. The value is the equivalent star-connected capacitance of the filter. When the filters are installed in parallel, enter the combined capacitance value of the paralleled filter. The value is the equivalent star-connected capacitance (C_y) of the filter multiplied by the number of installed paralleled filters.

NOTICE

SETTING FOR VLT® MCC 101 SINE-WAVE FILTER AND VLT® MCC 201 ALL-MODE FILTER

Enables accurate flux compensation when option [2] Flux sensorless or option [3] Flux w/motor feedback is selected in *parameter 1-01 Motor Control Principle*.

– Enter the correct capacitance value of the connected filter.

Parameter 14-57 Inductance Output Filter

Table 748: Parameter 14-57 Inductance Output Filter

14-57 Inductance Output Filter		
Default value: 7	Parameter type: Range, 0.1 - 6500	Setup: All setups
Conversion index: -	Data type: Uint16	Change during operation: False

Set the inductance of the output filter in mH, when using VLT® MCC 101 Sine-wave Filter and VLT® MCC 201 All-mode Filter. See the product label of the filter for the value of inductance. When filters are installed in parallel, enter the combined inductance value of

the installed paralleled filters. The inductance value in the parameter is the inductance value of the filter divided by the number of paralleled filters.

NOTICE

SETTING FOR VLT® MCC 201 ALL-MODE AND VLT® MCC 101 SINE-WAVE FILTERS

Enables accurate flux control compensation when option *[2] Flux Sensorless* or option *[3] Flux w/Motor Feedback* is selected in *parameter 1-01 Motor Control Principle*.

– Enter the correct inductance value of the connected filter.

Parameter 14-59 Actual Number of Inverter Units

Table 749: Parameter 14-59 Actual Number of Inverter Units

14-59 Actual Number of Inverter Units		
Default value: Size related	Parameter type: Range, 1 - 1	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

Set the actual number of power units.

5.14.7 14-6* Auto Derate

This parameter group contains parameters for derating the drive if there is high temperature.

Parameter 14-60 Function at Over Temperature

Table 750: Parameter 14-60 Function at Over Temperature

14-60 Function at Over Temperature		
Default value: [0] Trip	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

If either heat sink or control card temperature exceeds a factory-programmed temperature limit, a warning is activated. If the temperature increases further, select whether the drive should trip (trip lock) or derate the output current.

Option	Name	Description
[0]*	Trip	The drive trips (trip lock) and generates an alarm. Cycle power to reset the alarm. The motor restarts when the heat sink temperature has dropped below the alarm limit.
[1]	Derate	If the critical temperature is exceeded, the output current is reduced until the allowable temperature has been reached.

No trip at inverter overload

In some systems, the drive has not been sized properly to yield the current needed in all points of the operational flow-head characteristic. At these points, the motor needs a current higher than the rated current of the drive. The drive can yield 110% of the rated current continuously for 60 s. If still overloaded, the drive normally trips (causing the motor to stop by coasting) and issues an alarm.

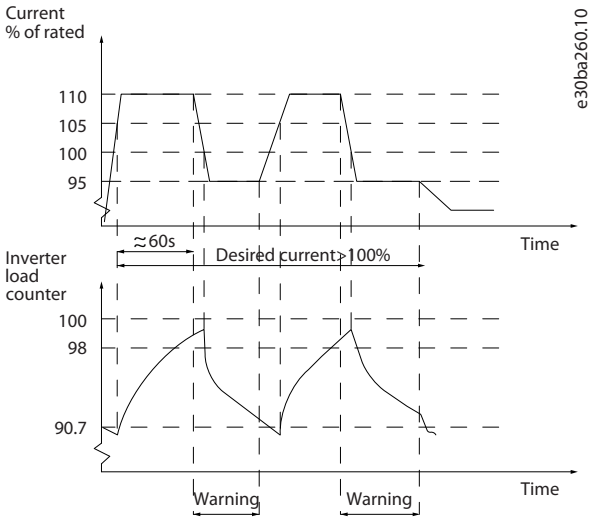


Illustration 89: Output Current in Overload Condition

If the motor is unable to run continuously with the demanded capacity, run it at reduced speed for a while.

Select *parameter 14-61 Function at Inverter Overload* to automatically reduce motor speed until the output current is below 100% of the rated current (set in *parameter 14-62 Inv. Overload Derate Current*). *Parameter 14-61 Function at Inverter Overload* is an alternative to letting the drive trip.

The drive estimates the load on the power section with an inverter load counter, which causes a warning at 98% and a reset of the warning at 90%. At the value 100%, the drive trips and issues an alarm. Status for the counter can be read in *parameter 16-35 Inverter Thermal*.

If *parameter 14-61 Function at Inverter Overload* is set to *[3] Derate*, the motor speed is reduced when the counter exceeds 98%, and stays reduced until the counter has dropped below 90.7%. If *parameter 14-62 Inv. Overload Derate Current* is set to for example 95%, a steady overload causes the pump speed to fluctuate between values corresponding to 110% and 95% of rated output current for the drive.

Parameter 14-61 Function at Inverter Overload

Table 751: Parameter 14-61 Function at Inverter Overload

14-61 Function at Inverter Overload		
Default value: [0] Trip	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Use if there is a steady overload beyond the thermal limits (110% for 60 s).

Option	Name	Description
[0]*	Trip	Select *[0] Trip* to make the drive trip and issue an alarm.
[1]	Derate	Reduces the motor speed to decrease the load on the power section and allowing it to cool down.

Parameter 14-62 Inv. Overload Derate Current

Table 752: Parameter 14-62 Inv. Overload Derate Current

14-62 Inv. Overload Derate Current		
Default value: 95%	Parameter type: Range, 50 - 100%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the current level (in % of rated output current for the drive) when running with reduced motor speed after load on the drive has exceeded the allowable limit (110% for 60 s).

5.14.8 14-7* Compatibility

Parameters for compatibility of VLT 3000 and VLT 5000 with FC 300.

Parameter 14-72 Legacy Alarm Word

Table 753: Parameter 14-72 Legacy Alarm Word

14-72 Legacy Alarm Word		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Readout of the alarm word corresponding to VLT 5000.

Parameter 14-73 Legacy Warning Word

Table 754: Parameter 14-73 Legacy Warning Word

14-73 Legacy Warning Word		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Readout of the warning word corresponding to VLT 5000.

Parameter 14-74 Leg. Ext. Status Word

Table 755: Parameter 14-74 Leg. Ext. Status Word

14-74 Leg. Ext. Status Word		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Readout of the external status word corresponding to VLT 5000.

5.14.9 14-8* Options

Parameter 14-80 Option Supplied by External 24VDC

Table 756: Parameter 14-80 Option Supplied by External 24VDC

14-80 Option Supplied by External 24VDC		
Default value: [1] Yes	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: False

N O T I C E

To make the parameter change function, perform a power cycle.

Option	Name	Description
[0]	No	Select this option to use the 24 V DC supply of the drive.
[1]*	Yes	Select this option if a 24 V DC external supply is used to power the option. Inputs/outputs are galvanically isolated from the drive when operated from an external supply.

Parameter 14-88 Option Data Storage

Table 757: Parameter 14-88 Option Data Storage

14-88 Option Data Storage		
Default value: 0	Parameter type: Range, 0 - 65535, Array [24]	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter stores information about options over a power cycle.

Parameter 14-89 Option Detection

Table 758: Parameter 14-89 Option Detection

14-89 Option Detection		
Default value: [0] Protect option config.	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

Selects the behavior of the drive when a change in the option configuration is detected.

Option	Name	Description
[0]*	Protect option config.	Freezes the current settings and prevents unwanted changes when missing or defective options are detected.
[1]	Enable option change	Changes drive settings and is used when modifying the system configuration. This parameter setting returns to *[0] Protect option config.* after an option change.

5.14.10 14-9* Fault Settings

Parameter 14-90 Fault Level

Table 759: Parameter 14-90 Fault Level

14-90 Fault Level		
Default value: Size related	Parameter type: Option, Array [28]	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

This is an array parameter with 26 elements. Each of the bits can be configured to any of the following options. Use this parameter to customize fault levels.

Option	Name	Description
[0]	Off	Use *[0] Off* with caution as it ignores all warnings and alarms for the selected source.
[1]	Warning	
[2]	Trip	Changing a fault level from default option *[3] Trip Lock* to *[2] Trip* leads to the automatic reset of the alarm. For alarms involving overcurrent, the drive has a hardware protection that issues a 3-minute recovery after 2 consecutive overcurrent incidents. This hardware protection cannot be overruled.
[3]	Trip lock	
[4]	Trip w. delayed reset	This option adds a delay between automatic resets, otherwise it is the same as option *[2] Trip*. The delay prevents a situation where reset is attempted repeatedly for an overcurrent situation. Hardware protection of the drive forces the 3-minute recovery time after 2 consecutive overcurrents (within a short time window).

Table 760: Selection of Action when Selected Alarm Appears

Failure	Alarm	Element in parameter 14-90 Fault Level	Off	Warning	Trip	Trip lock	Trip with delayed reset
10 V low	1	1490.0	X	D	–	–	–
24 V supply low	47	1490.1	X	–	–	D	–
1.8 V supply low	48	1490.2	X	–	–	D	–
Voltage limit	64	1490.3	X	D	–	–	–
Ground fault during ramping	14	1490.4	–	–	D	X	–
Ground fault 2 during continuous operation	45	1490.5	–	–	D	X	–
Torque limit	12	1490.6	X	D	–	–	–
Overcurrent	13	1490.7	–	–	X	D	–
Short circuit	16	1490.8	–	–	X	D	–
Heat sink temperature	29	1490.9	–	–	X	D	–
Heat sink sensor	39	1490.10	–	–	X	D	–
Control card temperature	65	1490.11	–	–	X	D	–
Power card temperature	69	1490.12	–	(1)	X	D	–
Heat sink temperature(2)	244	1490.13	–	–	X	D	–
Heat sink sensor(2)	245	1490.14	–	–	X	D	–
Power card temperature(2)	247	1490.15	–	–	X	D	–
Motor phase U missing	30	1490.16	–	–	X	D	–
Motor phase V missing	31	1490.16	–	–	X	D	–
Motor phase W missing	32	1490.16	–	–	X	D	–
Derag limit fault	100	1490.17	–	–	–	D	–
Inverter overload	9	1490.18	–	–	–	D	–
Current limit(3)	59	1490.19	X	D	–	–	–
Locked rotor	99	1490.20	–	–	D	X	–
AIC earth fault	407	1490.21	X	X	X	D	X
DC-link voltage out of range	404	1490.22	X	X	X	D	X
Mains contactor fault	300	1490.23	X	X	X	D	X
Not used	x	1490.24	X	X	X	D	X

Failure	Alarm	Element in parameter 14-90 Fault Level	Off	Warning	Trip	Trip lock	Trip with delayed reset
Fan contactor	431	1490.25	–	–	X	D	–
Inrush fault	33	1490.26	X	X	X	D	X
Fieldbus fault	34	1490.27	X	D	–	–	–

[1] In small and medium power drives, *alarm 69, Power card temperature* is only a warning.

[2] Only high-power drives.

[3] Warning 59 is configured in 1490.19. The current limit warning can be disabled by choice. The alarm cannot be configured.

VLT® Motion Control Tool MCT 10 has the element numbers listed in the column ID. Use this table with MCT 10 to get information about specific fault levels.

5.15 Parameter Group 15-** Drive Information

5.15.1 15-0* Operating Data

Parameter 15-00 Operating Hours

Table 761: Parameter 15-00 Operating Hours

15-00 Operating Hours		
Default value: 0 h	Parameter type: Range, 0 - 2147483647 h	Setup: All setups
Conversion index: 74	Data type: Uint32	Change during operation: False

View for how many hours the drive has run. The value is saved when the drive is turned off.

Parameter 15-01 Running Hours

Table 762: Parameter 15-01 Running Hours

15-01 Running Hours		
Default value: 0 h	Parameter type: Range, 0 - 2147483647 h	Setup: All setups
Conversion index: 74	Data type: Uint32	Change during operation: False

View how many hours the motor has run. Reset the counter in *parameter 15-07 Reset Running Hours Counter*. The value is saved when the drive is turned off.

Parameter 15-02 kWh Counter

Table 763: Parameter 15-02 kWh Counter

15-02 kWh Counter		
Default value: 0 kWh	Parameter type: Range, 0 - 2147483647 kWh	Setup: All setups
Conversion index: 75	Data type: Uint32	Change during operation: False

Register the power consumption of the motor as an average value over 1 hour. Reset the counter in *parameter 15-06 Reset kWh Counter*.

Parameter 15-03 Power Up's

Table 764: Parameter 15-03 Power Up's

15-03 Power Up's		
Default value: 0	Parameter type: Range, 0 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

View the number of times the drive has been powered up.

Parameter 15-04 Over Temp's

Table 765: Parameter 15-04 Over Temp's

15-04 Over Temp's		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View the number of drive temperature faults.

Parameter 15-05 Over Volt's

Table 766: Parameter 15-05 Over Volt's

15-05 Over Volt's		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View the number of drive overvoltages.

Parameter 15-06 Reset kWh Counter

Table 767: Parameter 15-06 Reset kWh Counter

15-06 Reset kWh Counter		
Default value: [0] Do not reset	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Do not reset	No reset of the kWh counter is required.
[1]	Reset counter	Press [OK] to reset the kWh counter to 0 (see *parameter 15-02 kWh Counter*).

Parameter 15-07 Reset Running Hours Counter

Table 768: Parameter 15-07 Reset Running Hours Counter

15-07 Reset Running Hours Counter		
Default value: [0] Do not reset	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Do not reset	
[1]	Reset counter	To reset the running hours counter to 0, select *[1] Reset* and press [OK] (see *parameter 15-01 Running Hours*). This parameter cannot be selected via the serial port, RS485. Select *[0] Do not reset* if no reset of the running-hours counter is required.

5.15.2 15-1* Data Log Settings

The data log enables continuous logging of up to 4 data sources (*parameter 15-10 Logging Source*) at individual rates (*parameter 15-11 Logging Interval*). A trigger event (*parameter 15-12 Trigger Event*) and window (*parameter 15-14 Samples Before Trigger*) are used to start and stop the logging conditionally.

Parameter 15-10 Logging Source

Table 769: Parameter 15-10 Logging Source

15-10 Logging Source		
Default value: [0] None	Parameter type: Option, Array [4]	Setup: 2 setups
Conversion index: -	Data type: Uint16	Change during operation: True

Select the variables to be logged.

Option	Name	Description
[0]*	None	
[15]	Readout: Actual setup	
[1397]	Alert alarm word	
[1398]	Alert warning word	
[1399]	Alert status word	
[1472]	Legacy alarm word	
[1473]	Legacy warning word	
[1474]	Leg. ext. status word	
[1600]	Control word	
[1601]	Reference [Unit]	
[1602]	Reference %	
[1603]	Status word	
[1606]	Actual position	
[1607]	Target position	This option is only available with software version 48.XX.
[1608]	Position error	This option is only available with software version 48.XX.
[1610]	Power [kW]	
[1611]	Power [hp]	
[1612]	Motor voltage	
[1613]	Frequency	
[1614]	Motor current	

Option	Name	Description
[1616]	Torque [Nm]	
[1617]	Speed [RPM]	
[1618]	Motor thermal	
[1620]	Motor angle	
[1621]	Torque [%] high res.	
[1622]	Torque [%]	
[1624]	Calibrated stator resistance	
[1625]	Torque [Nm] high	
[1628]	Angle error	This option is only available with software version 48.XX.
[1630]	DC link voltage	
[1632]	Brake energy /s	
[1633]	Brake energy average	
[1634]	Heatsink temp.	
[1635]	Inverter thermal	
[1645]	Motor phase U current	
[1646]	Motor phase V current	
[1647]	Motor phase W current	
[1648]	Speed ref. after ramp [RPM]	
[1650]	External reference	
[1651]	Pulse reference	
[1652]	Feedback[Unit]	
[1657]	Feedback [RPM]	
[1660]	Digital input	
[1662]	Analog input 53	
[1664]	Analog input 54	
[1665]	Analog output 42 [mA]	
[1666]	Digital output [bin]	
[1675]	Analog in X30/11	
[1676]	Analog in X30/12	
[1677]	Analog out X30/8 [mA]	
[1687]	Bus readout alarm/warning	
[1689]	Configurable alarm/warning word	

Option	Name	Description
[1690]	Alarm word	
[1692]	Warning word	
[1694]	Ext. status word	
[1695]	Ext. status word 2	
[1697]	Alarm word 3	
[1698]	Warning word 3	
[1820]	Commanded position	
[1821]	Master position	
[1823]	Virtual master pos.	
[1827]	Safe opt. est. speed	
[1828]	Safe opt. meas. speed	
[1829]	Safe opt. speed error	
[1840]	Analog input X49/1	
[1841]	Analog input X49/3	
[1842]	Analog input X49/5	
[1843]	Analog out X49/7	
[1844]	Analog out X49/9	
[1845]	Analog out X49/11	
[1846]	X49 digital output [bin]	
[1860]	Digital input 2	
[1899]	Speed PID torque FF. [Nm]	
[3110]	Bypass status word	
[3466]	SPI error counter	
[3470]	MCO alarm word 1	
[3471]	MCO alarm word 2	

Parameter 15-11 Logging Interval

Table 770: Parameter 15-11 Logging Interval

15-11 Logging Interval		
Default value: Size related	Parameter type: Range, 0.000 - 0.000, Array [4]	Setup: 2 setups
Conversion index: -3	Data type: Time diff wo DateID [4]	Change during operation: True

Enter the interval in ms between each sampling of the variables to be logged.

Parameter 15-12 Trigger Event

Table 771: Parameter 15-12 Trigger Event

15-12 Trigger Event		
Default value: [0] False	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

Select the trigger event. When the trigger event occurs, a window is applied to freeze the log. The log then retains a specified percentage of samples before the occurrence of the trigger event (*parameter 15-14 Samples Before Trigger*).

Option	Name	Description
[0]*	False	
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	

Option	Name	Description
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[33]	Digital input DI18	
[34]	Digital input DI19	
[35]	Digital input DI27	
[36]	Digital input DI29	**NOTICE** This option is only available in FC 302.
[37]	Digital input DI32	
[38]	Digital input DI33	
[50]	Comparator 4	
[51]	Comparator 5	
[60]	Logic rule 4	
[61]	Logic rule 5	

Parameter 15-13 Logging Mode

Table 772: Parameter 15-13 Logging Mode

15-13 Logging Mode		
Default value: [0] Log always	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Log always	Select *[0] Log always* for continuous logging.
[1]	Log once on trigger	Select *[1] Log once on trigger* to start and stop logging conditionally using *parameter 15-12 Trigger Event* and *parameter 15-14 Samples Before Trigger*.

Parameter 15-14 Samples Before Trigger

Table 773: Parameter 15-14 Samples Before Trigger

15-14 Samples Before Trigger		
Default value: 50	Parameter type: Range, 0 - 100	Setup: 2 setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Before a trigger event, enter the percentage of all samples which should be retained in the log. See also *parameter 15-12 Trigger Event* and *parameter 15-13 Logging Mode*.

Parameter 15-15 Info Message: "Service Log Full"

Table 774: Parameter 15-15 Info Message: "Service Log Full"

15-15 Info Message: "Service Log Full"		
Default value: [0] Disabled	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

See Service log. By enabling this parameter, a text message is shown in the drive when the service log runs full: *Clear logs, Service log full: 28 [M26]*. The message recommends to clear the log.

Option	Name	Description
[0]*	Disabled	
[1]	Enabled	Enable message.

Parameter 15-17 Service Log Trigger Alarm

Table 775: Parameter 15-17 Service Log Trigger Alarm

15-17 Service Log Trigger Alarm		
Default Value: 0	Parameter Type: Range, 0 - 9.999	Setup: 1 setup
Conversion Index: -	Data Type: Uint8	Change during operation: True

The service log is triggered by a set of factory-defined critical alarms. By using this parameter, an additional alarm to trigger the service log can be defined. The service log registers 11 parameters. 8 parameters are fixed and 3 parameters are user-defined. The 3 user-defined parameters can be configured using the display line parameters *0-20 Display Line 1.1 Small*, *0-21 Display Line 1.2 Small*, and *Display Line 1.3 Small*. All 11 parameters are logged upon a trigger event.

5.15.3 Service Log

The service log function saves detailed log information of a 5-second interval when alarms occur. Service technicians can analyze this information to troubleshoot and optimize the drive.

The drive can save up to 24 service log records in the flash memory. To receive a warning when the service log is full, set *parameter 15-15 Info Message: "Service Log Full"* to *[1] Enable*. To read the current number of records in the memory, check *parameter 16-42 Service Log Counter*.

Sampling rate

There are 2 periods with different sampling rates:

- Slow samples: 20 samples at a rate of 250 ms resulting in 5 s of history before the trip.
- Fast samples: 50 samples at a rate of 5 ms resulting in 250 ms of detailed history before the trip.

N O T I C E

To enable the real-time clock (RTC) stamp, use the real-time clock module. If real-time clock is not available, the operating time in *parameter 15-32 Fault Log: Time* is recorded.

Table 776: Logged Channels

Polling	Color	Name
CH 1	Light gray	Frequency
CH 2	Dark gray	Speed [RPM]
CH 3	Red	Reference [%]
CH 4	Orange	DC-link voltage
CH 5	Yellow	Motor current

Polling	Color	Name
CH 6	Khaki	Motor voltage
CH 7	Light green	Control word
CH 8	Light blue	Status word
CH 9	Dark blue	[20] Operating hours
CH 10	Purple	[21] Running hours
CH 11	Magenta	[22] kWh counter

Channels 1–8 are fixed channels with unfiltered signals and cannot be changed. Channels 9–11 are filtered and refer to *parameters 0–20* to *0–22*, which are reflected in the 3 upper lines in the LCP.

5.15.4 Clearing the Service Log

The flash memory stores up to 24 records. To save new logs, clear the service log memory.

Save the service log records using the VLT® Motion Control Tool MCT 10 before clearing the service log.

The service log is stored in EEPROM in the control card and will be erased by initialization, that is when changing the power card. Before changing the power card:

- Click the Service Log icon to read the service log from the drive.
- Copy parameters to a project in MCT 10.
- Save the parameters including the service log in the project.
  - When loading the parameters back into the drive, the service log is not included.

Clear the service log after a commissioning to remove any alarms that occurred during testing.

Procedure

1. Select option *[5] Clear Service Log* in *parameter 14-22 Operation Mode*.
2. Power cycle the drive. Clearing the service log extends the power-up time by approximately 1 s.

5.15.5 Service Log Indication

Parameter 16-42 Service Log Counter shows the number of service logs stored in the memory.

The drive indicates a full service log memory in 1 of the following ways:

- The LCP shows the message: *Clear logs Service log full: 28 [M26]*.
- Bit 25 is set high in *parameter 16-96 Maintenance Word* (0x2000000).

Performing the drive initialization does not clear the service log memory.

5.15.6 Reading the Service Log Information

See the VLT® Motion Control Tool MCT 10 to read the service log information.

Procedure

1. Open the MCT 10 software.
2. Select a drive.
3. Select the Service Log plug-in.

4. Click *Read from drive*.

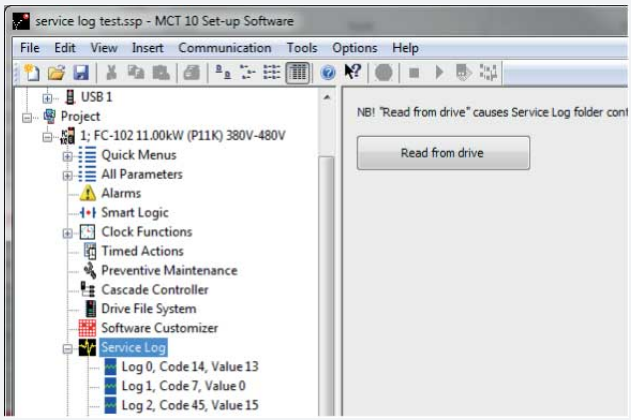


Illustration 90: MCT 10, Read From Drive

The service log view in MCT 10 looks as shown in Illustration 91. Use the cursor to view the detailed readings at a specific time.

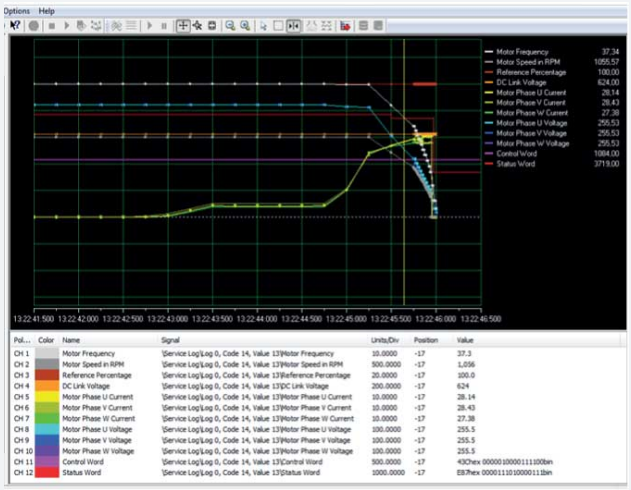


Illustration 91: Service Log View, 5 s

Use the zoom function to focus on the last 250 ms before the fault.

5.15.7 Alarms that Trigger a Service Log Record

Table 777: Alarms Triggering a Service Log Record

#	Alarm title
4	Mains phase loss
5	DC voltage high
6	DC voltage low
7	DC overvolt
8	DC undervolt
9	Inverter overld.
10	Motor ETR over
12	Torque limit

#	Alarm title
13	Over current
14	Earth (ground) fault
16	Short circuit
18	Start failed
25	Brake resistor
26	Brake overload
27	Brake IGBT
28	Brake check
30	U phase loss
31	V phase loss
32	W phase loss
36	Mains failure
37	Phase imbalance
44	Earth (ground) fault AL44
45	Earth (ground) fault 2
59	Current

N O T I C E

If an alarm has 2 states (warning/alarm), it only triggers a service log record when going into the alarm state.

5.15.8 15-2* Historic Log

View up to 50 logged data items via the array parameters in this parameter group. Data is logged every time an event occurs (not to be confused with SLC events). Events in this context are defined as a change in 1 of the following areas:

- Digital inputs
- Digital outputs
- Warning word
- Alarm word
- Status word
- Control word
- Extended status word

Events are logged with value and time stamp in ms. The time interval between 2 events depends on how often events occur (maximum once every scan time). Data logging is continuous, but if an alarm occurs, the log is saved and the values can be viewed on the display. This feature is useful, for example when carrying out service following a trip. View the historic log contained in this parameter via the serial communication port or via the display.

Parameter 15-20 Historic Log: Event

Table 778: Parameter 15-20 Historic Log: Event

15-20 Historic Log: Event		
Default value: 0	Parameter type: Range, 0 - 255, Array [50]	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

View the event type of the logged events.

Parameter 15-21 Historic Log: Value

Table 779: Parameter 15-21 Historic Log: Value

15-21 Historic Log: Value		
Default value: 0	Parameter type: Range, 0 - 2147483647, Array [50]	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

View the value of the logged event. Interpret the event values as below:

Digital input	Decimal value. See *parameter 16-60 Digital Input* for a description after converting to binary value.
Digital output (not monitored in this SW release)	Decimal value. See *parameter 16-66 Digital Output [bin]* for a description after converting to binary value.
Warning word	Decimal value. See *parameter 16-92 Warning Word* for a description.
Alarm word	Decimal value. See *parameter 16-90 Alarm Word* for a description.
Status word	Decimal value. See *parameter 16-03 Status Word* for a description after converting to binary value.
Control word	Decimal value. See *parameter 16-00 Control Word* for a description.
Extended status word	Decimal value. See *parameter 16-94 Ext. Status Word* for a description.

Parameter 15-22 Historic Log: Time

Table 780: Parameter 15-22 Historic log: Time

15-22 Historic log: Time		
Default value: 0 ms	Parameter type: Range, 0 - 2147483647 ms, Array [50]	Setup: All setups
Conversion index: -3	Data type: Uint32	Change during operation: False

View the time at which the logged event occurred. Time is measured in ms since the drive was started. The maximum value corresponds to approximately 24 days, which means that the count restarts at 0 after this period.

5.15.9 15-3* Alarm Log

Parameters in this group are array parameters where up to 10 fault logs can be viewed. 0 is the most recent logged data and 9 is the oldest. Fault codes, values, and time stamp can be viewed for all logged data.

Parameter 15-30 Fault Log: Error Code

Table 781: Parameter 15-30 Fault Log: Error Code

15-30 Fault Log: Error Code		
Default value: 0	Parameter type: Range, 0 - 65535, Array [10]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View the fault code and look up its meaning in 7 Troubleshooting.

Parameter 15-31 Fault Log: Value

Table 782: Parameter 15-31 Fault Log: Value

15-31 Fault Log: Value		
Default value: 0	Parameter type: Range, -32767 - 32767, Array [10]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View an extra description of the error. This parameter is mostly used with *alarm 38, internal fault*.

Parameter 15-32 Fault Log: Time

Table 783: Parameter 15-32 Fault Log: Time

15-32 Fault Log: Time		
Default Value: 0 s	Parameter Type: Range, 0 - 2147483647, Array [10]	Setup: All setups
Conversion Index: 0	Data Type: Uint32	Change during operation: False

View the time when the logged event occurred. Time is measured in s from start-up of the drive.

Parameter 15-33 Fault Log: Date and Time

Table 784: Parameter 15-33 Fault Log: Date and Time

15-33 Fault Log: Date and Time		
Default value: Size related	Parameter type: Range, 0 - 0, Array [10]	Setup: All setups
Conversion index: 0	Data type: TimeOfDay	Change during operation: False

Array parameter; Date & Time 0–9: This parameter shows when the logged event occurred.

5.15.10 15-4* Drive Identification

N O T I C E

The following parameter is only available in FC 302:

- *Parameter 15-58 Smart Setup Filename*

Parameters containing read-only information about the hardware and software configuration of the drive.

Parameter 15-40 FC Type

Table 785: Parameter 15-40 FC Type

15-40 FC Type		
Default value: 0	Parameter type: Range, 0 - 6	Setup: All setups
Conversion index: 0	Data type: VisStr[6]	Change during operation: False

View the drive type. The readout is identical to the drive power field of the type code definition, characters 1–6.

Parameter 15-41 Power Section

Table 786: Parameter 15-41 Power Section

15-41 Power Section		
Default value: 0	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

View the power section. The readout is identical to the drive power field of the type code definition, characters 7–10.

Parameter 15-42 Voltage

Table 787: Parameter 15-42 Voltage

15-42 Voltage		
Default value: 0	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

View the voltage. The readout is identical to the drive power field of the type code definition, characters 11-12.

Parameter 15-43 Software Version

Table 788: Parameter 15-43 Software Version

15-43 Software Version		
Default value: 0	Parameter type: Range, 0 - 5	Setup: All setups
Conversion index: 0	Data type: VisStr[5]	Change during operation: False

View the combined SW version (or package version) consisting of power SW and control SW.

Parameter 15-44 Ordered Typecode String

Table 789: Parameter 15-44 Ordered Typecode String

15-44 Ordered Typecode String		
Default value: 0	Parameter type: Range, 0 - 40	Setup: All setups
Conversion index: 0	Data type: VisStr[40]	Change during operation: False

View the type code string used for reordering the drive in its original configuration.

Parameter 15-45 Actual Typecode String

Table 790: Parameter 15-45 Actual Typecode String

15-45 Actual Typecode String		
Default value: 0	Parameter type: Range, 0 - 40	Setup: All setups
Conversion index: 0	Data type: VisStr[40]	Change during operation: False

View the actual type code string.

Parameter 15-46 Frequency Converter Ordering No

Table 791: Parameter 15-46 Frequency Converter Ordering No

15-46 Frequency Converter Ordering No		
Default value: 0	Parameter type: Range, 0 - 8	Setup: All setups
Conversion index: 0	Data type: VisStr[8]	Change during operation: False

View the 8-digit code number used for reordering the drive in its original configuration. To restore the order number after the power card exchange, see *parameter 14-29 Service Code*.

Parameter 15-47 Power Card Ordering No

Table 792: Parameter 15-47 Power Card Ordering No

15-47 Power Card Ordering No		
Default value: 0	Parameter type: Range, 0 - 8	Setup: All setups
Conversion index: 0	Data type: VisStr[8]	Change during operation: False

View the power card code number.

Parameter 15-48 LCP ID No

Table 793: Parameter 15-48 LCP ID No

15-48 LCP ID No		
Default value: 0	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

View the LCP ID number.

Parameter 15-49 SW ID Control Card

Table 794: Parameter 15-49 SW ID Control Card

15-49 SW ID Control Card		
Default value: 0	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

View the control card software version number.

Parameter 15-50 SW ID Power Card

Table 795: Parameter 15-50 SW ID Power Card

15-50 SW ID Power Card		
Default value: 0	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

View the power card software version number.

Parameter 15-51 Frequency Converter Serial Number

Table 796: Parameter 15-51 Frequency Converter Serial Number

15-51 Frequency Converter Serial Number		
Default value: 0	Parameter type: Range, 0 - 10	Setup: All setups
Conversion index: 0	Data type: VisStr[10]	Change during operation: False

View the drive serial number.

Parameter 15-53 Power Card Serial Number

Table 797: Parameter 15-53 Power Card Serial Number

15-53 Power Card Serial Number		
Default value: 0	Parameter type: Range, 0 - 19	Setup: All setups
Conversion index: 0	Data type: VisStr[19]	Change during operation: False

View the power card serial number.

Parameter 15-54 Config File Name

Table 798: Parameter 15-54 Config File Name

15-54 Config File Name		
Default value: Size related	Parameter type: Range, 0 - 16, Array [8]	Setup: All setups
Conversion index: 0	Data type: VisStr[16]	Change during operation: False

Shows the special configuration file names.

Parameter 15-58 Smart Setup Filename

Table 799: Parameter 15-58 Smart Setup Filename

15-58 Smart Setup Filename		
Default value: Size related	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[16]	Change during operation: True

Shows the SmartStart file name.

Parameter 15-59 Filename

Table 800: Parameter 15-59 Filename

15-59 Filename		
Default value: Size related	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[16]	Change during operation: False

Shows the currently used customer-specific initial values (CSIV) file name.

5.15.11 15-6* Option Ident.

This read-only parameter group contains information about the hardware and software configuration of the options installed in slots A, B, C0, and C1.

Parameter 15-60 Option Mounted

Table 801: Parameter 15-60 Option Mounted

15-60 Option Mounted		
Default value: 0	Parameter type: Range, 0 - 30, Array [8]	Setup: All setups
Conversion index: 0	Data type: VisStr[30]	Change during operation: False

Shows the type of installed option.

Parameter 15-61 Option SW Version

Table 802: Parameter 15-61 Option SW Version

15-61 Option SW Version		
Default value: 0	Parameter type: Range, 0 - 20, Array [8]	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

View the installed option software version.

Parameter 15-62 Option Ordering No

Table 803: Parameter 15-62 Option Ordering No

15-62 Option Ordering No		
Default value: 0	Parameter type: Range, 0 - 8, Array [8]	Setup: All setups
Conversion index: 0	Data type: VisStr[8]	Change during operation: False

Shows the code number for the installed options.

Parameter 15-63 Option Serial No

Table 804: Parameter 15-63 Option Serial No

15-63 Option Serial No		
Default value: 0	Parameter type: Range, 0 - 18, Array [8]	Setup: All setups
Conversion index: 0	Data type: VisStr[18]	Change during operation: False

View the installed option serial number.

Parameter 15-70 Option in Slot A

Table 805: Parameter 15-70 Option in Slot A

15-70 Option in Slot A		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: 0	Data type: VisStr[30]	Change during operation: False

View the type code string for the option installed in slot A and a translation of the type code string. For example, for type code string *AX*, the translation is *No option*.

Parameter 15-71 Slot A Option SW Version

Table 806: Parameter 15-71 Slot A Option SW Version

15-71 Slot A Option SW Version		
Default value: 0	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

View the software version for the option installed in slot A.

Parameter 15-72 Option in Slot B

Table 807: Parameter 15-72 Option in Slot B

15-72 Option in Slot B		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: 0	Data type: VisStr[30]	Change during operation: False

View the type code string for the option installed in slot B and a translation of the type code string. For example, for type code string *BX*, the translation is *No option*.

Parameter 15-73 Slot B SW Version

Table 808: Parameter 15-73 Slot B SW Version

15-73 Slot B SW Version		
Default value: 0	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

View the software version for the option installed in slot B.

Parameter 15-74 Option in Slot C0/E0

Table 809: Parameter 15-74 Option in Slot C0/E0

15-74 Option in Slot C0/E0		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: 0	Data type: VisStr[30]	Change during operation: False

View the type code string for the option installed in slot C and a translation of the type code string. For example, for type code string *CXXXX*, the translation is *No option*.

Parameter 15-75 Slot C0/E0 Option SW Version

Table 810: Parameter 15-75 Slot C0/E0 Option SW Version

15-75 Slot C0/E0 Option SW Version		
Default value: 0	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

View the software version for the option installed in slot C.

Parameter 15-76 Option in Slot C1/E1

Table 811: Parameter 15-76 Option in Slot C1/E1

15-76 Option in Slot C1/E1		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: 0	Data type: VisStr[30]	Change during operation: False

View the type code string for the option installed in slot C1 and a translation of the type code string. For example, for type code string CXXXX, the translation is *No option*.

Parameter 15-77 Slot C1/E1 Option SW Version

Table 812: Parameter 15-77 Slot C1/E1 Option SW Version

15-77 Slot C1/E1 Option SW Version		
Default value: 0	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

Shows the software version for the installed option in option slot C.

5.15.12 15-8* Operating Data II

Parameter 15-80 Fan Running Hours

Table 813: Parameter 15-80 Fan Running Hours

15-80 Fan Running Hours		
Default value: 0 h	Parameter type: Range, 0 - 2147483647 h	Setup: All setups
Conversion index: 74	Data type: Uint32	Change during operation: True

View for how many hours the heat sink fan has run (increments for every hour). The value is saved when the drive is turned off.

Parameter 15-81 Preset Fan Running Hours

Table 814: Parameter 15-81 Preset Fan Running Hours

15-81 Preset Fan Running Hours		
Default value: 0 h	Parameter type: Range, 0 - 99999 h	Setup: All setups
Conversion index: 74	Data type: Uint32	Change during operation: True

Enter the preset fan running hours counter, see *parameter 15-80 Fan Running Hours*. This parameter cannot be selected via the serial port RS485.

Parameter 15-87 kWh Counter Hires

Table 815: Parameter 15-87 kWh Counter Hires

15-87 kWh Counter Hires		
Default value: 0 kWh	Parameter type: Range, 0 - 2147483647 kWh	Setup: All setups
Conversion index: 75	Data type: Uint32	Change during operation: False

Register the power consumption of the motor as an average value over 1 hour. Reset the counter in *parameter 15-06 Reset kWh Counter*. The decimal places are reset at power-up.

Parameter 15-89 Configuration Change Counter

Table 816: Parameter 15-89 Configuration Change Counter

15-89 Configuration Change Counter		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

5.15.13 15-9* Parameter Info

Parameter 15-92 Defined Parameters

Table 817: Parameter 15-92 Defined Parameters

15-92 Defined Parameters		
Default value: 0	Parameter type: Range, 0 - 9999, Array [1000]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View a list of all defined parameters in the drive. The list ends with 0.

Parameter 15-93 Modified Parameters

Table 818: Parameter 15-93 Modified Parameters

15-93 Modified Parameters		
Default value: 0	Parameter type: Range, 0 - 9999, Array [1000]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View a list of the parameters that have been changed from their default setting. The list ends with 0. Changes may not be visible until up to 30 s after implementation.

Parameter 15-94 Extended Version

Table 819: Parameter 15-94 Extended Version

15-94 Extended Version		
Default value: Size related	Parameter type: Range, 0 - 65, Array [10]	Setup: All setups
Conversion index: 0	Data type: VisibleString	Change during operation: True

INPUT MISSING

Parameter 15-98 Drive Identification

Table 820: Parameter 15-98 Drive Identification

15-98 Drive Identification		
Default value: 0	Parameter type: Range, 0 - 40	Setup: All setups
Conversion index: 0	Data type: VisStr[40]	Change during operation: False

This parameter contains data used by the VLT® Motion Control Tool MCT 10.

Parameter 15-99 Parameter Metadata

Table 821: Parameter 15-99 Parameter Metadata

15-99 Parameter Metadata		
Default value: 0	Parameter type: Range, 0 - 9999, Array [35]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

This parameter contains data used by the VLT® Motion Control Tool MCT 10.

5.16 Parameter Group 16-** Data Readouts

5.16.1 16-0* General Status

Parameter 16-00 Control Word

Table 822: Parameter 16-00 Control Word

16-00 Control Word		
Default Value: 0	Parameter Type: Range, 0 - 65535	Setup: All setups
Conversion Index: 0	Data Type: V2	Change during operation: False

View the control word sent to the drive via the serial communication port in hex code.

Parameter 16-01 Reference [Unit]

Table 823: Parameter 16-01 Reference [Unit]

16-01 Reference [Unit]		
Default value: 0 ReferenceFeedbackUnit	Parameter type: Range, -999999 ReferenceFeedbackUnit - 999999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

View the present reference value applied on impulse or analog basis in the unit resulting from the configuration selected in *parameter 1-00 Configuration Mode* (Hz, Nm, or RPM).

Parameter 16-02 Reference %

Table 824: Parameter 16-02 Reference %

16-02 Reference %		
Default value: 0%	Parameter type: Range, -200 - 200%	Setup: All setups
Conversion index: -1	Data type: Int16	Change during operation: False

View the total reference. The total reference is the sum of digital, analog, preset, bus, and freeze references plus catch up and slow down.

Parameter 16-03 Status Word

Table 825: Parameter 16-03 Status Word

16-03 Status Word		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: V2	Change during operation: False

View the status word sent from the drive via the serial communication port in hex code.

Parameter 16-05 Main Actual Value [%]

Table 826: Parameter 16-05 Main Actual Value [%]

16-05 Main Actual Value [%]		
Default value: 0%	Parameter type: Range, -100 - 100%	Setup: All setups
Conversion index: -2	Data type: N2	Change during operation: False

View the 2-byte word sent with the status word to the fieldbus master reporting the main actual value.

Parameter 16-06 Actual Position

Table 827: Parameter 16-06 Actual Position

16-06 Actual Position		
Default value: 0 CustomReadoutUnit2	Parameter type: Range, -2000000000 CustomReadoutUnit2 - 2000000000 CustomReadoutUnit2	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: False

Shows the actual position in position units defined in *parameter group 17-7* Position Scaling*. The value is based on the encoder feedback in closed loop or on the angle calculated by the motor control in open loop. For information about configuring the readouts, see *parameter group 17-7* Position Scaling*.

Parameter 16-07 Target Position

Table 828: Parameter 16-07 Target Position

16-07 Target Position		
Default value: 0 CustomReadoutUnit2	Parameter type: Range, -2000000000 CustomReadoutUnit2 - 2000000000 CustomReadoutUnit2	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: False

N O T I C E

This parameter is only valid with sofware version 48.XX.

Shows the actual end target position for the active positioning command in position units. Position units are defined in *parameter group 17-7* Position Scaling*.

Parameter 16-08 Position Error

Table 829: Parameter 16-08 Position Error

16-08 Position Error		
Default value: 0 CustomReadoutUnit2	Parameter type: Range, -2000000000 CustomReadoutUnit2 - 2000000000 CustomReadoutUnit2	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: False

NOTICE

This parameter is only valid with sofware version 48.XX.

Shows the actual position error in position units defined in *parameter group 17-7* Position Scaling*. Position error is the difference between the actual position and the commanded position. The position error is the input for the position PI controller.

Parameter 16-09 Customer Readout

Table 830: Parameter 16-09 Customer Readout

16-09 Customer Readout		
Default value: 0 CustomReadoutUnit	Parameter type: Range, 0 CustomReadoutUnit - 999999.99 CustomReadoutUnit	Setup: All setups
Conversion index: -2	Data type: Int32	Change during operation: False

View the value of custom readout from *parameter 0-30 Unit for Userdefined Readout* to *parameter 0-32 Custom Readout Max Value*.

5.16.2 16-1* Motor Status

NOTICE

The following parameter is only available in FC 302:

- *Parameter 16-24 Calibrated Stator Resistance*

Parameter 16-10 Power [kW]

Table 831: Parameter 16-10 Power [kW]

16-10 Power [kW]		
Default value: 0 kW	Parameter type: Range, 0 - 10000 kW	Setup: All setups
Conversion index: 1	Data type: Int32	Change during operation: False

Shows motor power in kW. The value shown is calculated based on the actual motor voltage and motor current. The value is filtered, and therefore approximately 1.3 s may pass from when an input value changes to when the data readout values change. The resolution of readout value on fieldbus is in 10-W steps. The base unit is in W.

Parameter 16-11 Power [hp]

Table 832: Parameter 16-11 Power [hp]

16-11 Power [hp]		
Default value: 0 hp	Parameter type: Range, 0 - 10000 hp	Setup: All setups
Conversion index: -2	Data type: Int32	Change during operation: False

Shows motor power in hp. The value shown is calculated based on the actual motor voltage and motor current. The value is filtered, and therefore approximately 1.3 ms may pass from when an input value changes to when the data readout values change.

Parameter 16-12 Motor Voltage

Table 833: Parameter 16-12 Motor Voltage

16-12 Motor Voltage		
Default value: 0 V	Parameter type: Range, 0 - 6000 V	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: False

View the motor voltage, a calculated value used for controlling the motor.

Parameter 16-13 Frequency

Table 834: Parameter 16-13 Frequency

16-13 Frequency		
Default value: 0 Hz	Parameter type: Range, 0 - 6500 Hz	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: False

View the motor frequency without resonance damping.

Parameter 16-14 Motor Current

Table 835: Parameter 16-14 Motor Current

16-14 Motor Current		
Default value: 0 A	Parameter type: Range, 0 - 10000 A	Setup: All setups
Conversion index: -2	Data type: Int32	Change during operation: False

View the motor current measured as an average value, I_{RMS}. The value is filtered, and thus approximately 1.3 s may pass from when an input value changes to when the data readout values change.

Parameter 16-15 Frequency [%]

Table 836: Parameter 16-15 Frequency [%]

16-15 Frequency [%]		
Default value: 0%	Parameter type: Range, -100 - 100%	Setup: All setups
Conversion index: -2	Data type: N2	Change during operation: False

View a 2-byte word reporting the actual motor frequency (without resonance damping) as a percentage (scale 0000–4000 hex) of *parameter 4-19 Max Output Frequency*. Set *parameter 9-16 PCD Read Configuration* index 1 to send it with the status word instead of the MAV.

Parameter 16-16 Torque [Nm]

Table 837: Parameter 16-16 Torque [Nm]

16-16 Torque [Nm]		
Default value: 0 Nm	Parameter type: Range, -3000 - 3000 Nm	Setup: All setups
Conversion index: -1	Data type: Int16	Change during operation: False

View the torque value with sign, applied to the motor shaft. Linearity is not exact between 160% motor current and torque in relation to the rated torque. Some motors supply more than 160% torque. Therefore, the minimum value and the maximum value depend on the maximum motor current and the motor used. The value is filtered, and thus approximately 30 ms may pass from when an input changes value to when the data readout values change. In flux control principle, this readout is compensated for in *parameter 1-68 Motor Inertia* for improved accuracy.

Parameter 16-17 Speed [RPM]

Table 838: Parameter 16-17 Speed [RPM]

16-17 Speed [RPM]		
Default value: 0 RPM	Parameter type: Range, -30000 - 30000 Nm	Setup: All setups
Conversion index: 67	Data type: Int32	Change during operation: False

View the actual motor RPM. In open-loop or closed-loop process control, the motor RPM is estimated. In speed closed-loop modes, the motor RPM is measured.

Parameter 16-18 Motor Thermal

Table 839: Parameter 16-18 Motor Thermal

16-18 Motor Thermal		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

View the calculated thermal load on the motor. The cutout limit is 100%. The basis for calculation is the ETR function selected in *parameter 1-90 Motor Thermal Protection*.

Parameter 16-19 Thermistor Sensor Temperature

Table 840: Parameter 16-19 Thermistor Sensor Temperature

16-19 Thermistor Sensor Temperature		
Default value: 0 °C	Parameter type: Range, 0 - 0 °C	Setup: All setups
Conversion index: 100	Data type: Int16	Change during operation: False

Returning the actual temperature on KTY sensor built into the motor. See *parameter group 1-9* Motor Temperature*.

Parameter 16-20 Motor Angle

Table 841: Parameter 16-20 Motor Angle

16-20 Motor Angle		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

View the current encoder/resolver angle offset relative to the index position. The value range of 0–65535 corresponds to 0–2xpi (radian).

Parameter 16-21 Torque [%] High Res.

Table 842: Parameter 16-21 Torque [%] High Res.

16-21 Torque [%] High Res.		
Default value: 0%	Parameter type: Range, -200 - 200%	Setup: All setups
Conversion index: -1	Data type: Int16	Change during operation: False

The value shown is the torque in percent of nominal torque, with sign and 0.1% resolution, applied to the motor shaft.

Parameter 16-22 Torque [%]

Table 843: Parameter 16-22 Torque [%]

16-22 Torque [%]		
Default value: 0%	Parameter type: Range, -200 - 200%	Setup: All setups
Conversion index: 1	Data type: Int16	Change during operation: False

The value shown is the torque in percent of nominal torque, with sign, applied to the motor shaft.

Parameter 16-23 Motor Shaft Power [kW]

Table 844: Parameter 16-23 Motor Shaft Power [kW]

16-23 Motor Shaft Power [kW]		
Default value: 0 kW	Parameter type: Range, 0 - 10000 kW	Setup: All setups
Conversion index: -1	Data type: Int32	Change during operation: True

Readout of the mechanical power applied to the motor shaft. The base unit is in W.

Parameter 16-24 Calibrated Stator Resistance

Table 845: Parameter 16-24 Calibrated Stator Resistance

16-24 Calibrated Stator Resistance		
Default value: 0.0000 Ohm	Parameter type: Range, 0.0000 - 100.0000 Ohm	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: True

Shows the calibrated stator resistance.

Parameter 16-25 Torque [Nm] High

Table 846: Parameter 16-25 Torque [Nm] High

16-25 Torque [Nm] High		
Default value: 0 Nm	Parameter type: Range, -200000000 - 200000000 Nm	Setup: All setups
Conversion index: -1	Data type: Int32	Change during operation: False

View the torque value with sign, applied to the motor shaft. Some motors supply more than 160% torque. Therefore, the minimum value and the maximum value depend on the maximum motor current as well as the motor used. This specific readout has been adapted to be able to show higher values than the standard readout in *parameter 16-16 Torque [Nm]*.

Parameter 16-28 Angle Error

Table 847: Parameter 16-28 Angle Error

16-28 Angle Error		
Default value: 0 °	Parameter type: Range, -180 - 180 °	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: False

Readout of the deviation between sensorless rotor angle estimation by motor controller and real rotor angle based on encoder reading. The parameter is only activated if options in *parameter 1-01 Motor Control Principle* is set to *[2] Flux Sensorless* and *parameter 1-10 Motor Construction* is set to *[1] PM, non salient SPM* or *[2] PM, salient IPM*. The encoder source used for comparison must be selected in *parameter 7-00 Speed PID Feedback Source*. To obtain an accurate reading of *parameter 16-28 Angle Error*, the motor angle offset must be set in *parameter 1-41 Motor Angle Offset*. Rotor detection is configured in *parameter 7-90 Position PI Feedback Source*, which is activated using the setting in *parameter 1-70 Start Mode* in Flux with motor feedback. *Parameter 7-90 Position PI Feedback Source* must be set to *[0] Motor feedb.P1-02*. The encoder is then only used for comparison while position control is based on the estimated sensorless position. This enables the measurement of the accuracy of position control in sensorless mode.

5.16.3 16-3* Drive Status

N O T I C E

The following parameters are only available in FC 302:

- *Parameter 16-31 System Temp.*
- *Parameter 16-49 Current Fault Source*

Parameter 16-30 DC Link Voltage

Table 848: Parameter 16-30 DC Link Voltage

16-30 DC Link Voltage		
Default value: 0 V	Parameter type: Range, 0 - 10000 V	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View a measured value. The value is filtered with a 30 ms time constant.

Parameter 16-31 System Temp.

Table 849: Parameter 16-31 System Temp.

16-31 System Temp.		
Default value: 0 °C	Parameter type: Range, -128 - 127 °C	Setup: All setups
Conversion index: 100	Data type: Int8	Change during operation: True

Shows the highest internal system temperature. In the smaller enclosure sizes (A–C), the system temperature matches the control card temperature measurement in *parameter 16-39 Control Card Temp*. In the larger enclosure sizes (D–F), the system temperature is the highest temperature measured on hardware components with temperature sensors, for example, the power card(s).

Parameter 16-32 Brake Energy /s

Table 850: Parameter 16-32 Brake Energy /s

16-32 Brake Energy /s		
Default value: 0 kW	Parameter type: Range, 0 - 10000 kW	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

View the brake power transmitted to an external brake resistor, stated as an instant value.

Parameter 16-33 Brake Energy Average

Table 851: Parameter 16-33 Brake Energy Average

16-33 Brake Energy Average		
Default value: 0 kW	Parameter type: Range, 0 - 10000 kW	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

View the brake power transmitted to an external brake resistor. The mean power is calculated on an average level based on the selected time period within *parameter 2-13 Brake Power Monitoring*.

Parameter 16-34 Heatsink Temp.

Table 852: Parameter 16-34 Heatsink Temp.

16-34 Heatsink Temp.		
Default value: 0 °C	Parameter type: Range, 0 - 255 °C	Setup: All setups
Conversion index: 100	Data type: Uint8	Change during operation: False

View the drive heat sink temperature. The cutout limit is 90 ±5 °C (194 ±9 °F), and the motor cuts back in at 60 ±5 °C (140 ±9 °F).

Parameter 16-35 Inverter Thermal

Table 853: Parameter 16-35 Inverter Thermal

16-35 Inverter Thermal		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

View the percentage load on the inverter.

Parameter 16-36 Inv. Nom. Current

Table 854: Parameter 16-36 Inv. Nom. Current

16-36 Inv. Nom. Current		
Default value: Size related	Parameter type: Range, 0.01 - 10000 A	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: False

View the inverter nominal current, which must match the nameplate data on the connected motor. The data is used for calculation of torque, motor overload protection, and so on.

Parameter 16-37 Inv. Max. Current

Table 855: Parameter 16-37 Inv. Max. Current

16-37 Inv. Max. Current		
Default value: Size related	Parameter type: Range, 0.01 - 10000 A	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: False

View the inverter maximum current, which must match the nameplate data on the connected motor. The data is used for calculation of torque, motor overload protection, and so on.

Parameter 16-38 SL Controller State

Table 856: Parameter 16-38 SL Controller State

16-38 SL Controller State		
Default value: 0	Parameter type: Range, 0 - 100, Array [4]	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

View the state of the event under execution by the SL controller.

Parameter 16-39 Control Card Temp.

Table 857: Parameter 16-39 Control Card Temp.

16-39 Control Card Temp.		
Default value: 0 °C	Parameter type: Range, 0 - 100 °C	Setup: All setups
Conversion index: 100	Data type: Uint8	Change during operation: False

View the temperature on the control card, stated in °C.

Parameter 16-40 Logging Buffer Full

Table 858: Parameter 16-40 Logging Buffer Full

16-40 Logging Buffer Full		
Default value: [0] No	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

View whether the logging buffer is full (see *parameter group 15-1* Data Log Settings*). The logging buffer is never full when *parameter 15-13 Logging Mode* is set to *[0] Log always*.

Option	Name	Description
[0]*	No	
[1]	Yes	

Parameter 16-41 Performance Maintenance

Table 859: Parameter 16-41 Performance Maintenance

16-41 Performance Maintenance		
Default value: 0	Parameter type: Range, 0 - 2147483647	Setup: All setups
Conversion index: 0	Data type: VisStr[50]	Change during operation: True

Parameter 16-42 Service Log Counter

Table 860: Parameter 16-42 Service Log Counter

16-42 Service Log Counter		
Default value: 0	Parameter type: Range, 0 - 24	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Shows the number of service logs stored in the ServiceLog file. If the ServiceLog file is full, clear the logged data by selecting option *[5] Clear* service logs in *parameter 14-22 Operation Mode*. The logged data is deleted on the next power-up.

Parameter 16-43 Timed Actions Status

Table 861: Parameter 16-43 Timed Actions Status

16-43 Timed Actions Status		
Default value: [0] Timed actions auto	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the times actions view.

Option	Name	Description
[0]*	Timed actions auto	
[1]	Timed actions disabled	
[2]	Constant on action	
[3]	Constant off actions	

Parameter 16-44 Speed Error [RPM]

Table 862: Parameter 16-44 Speed Error [RPM]

16-44 Speed Error [RPM]		
Default value: 0 RPM	Parameter type: Range, -30000 - 30000 RPM	Setup: All setups
Conversion index: 67	Data type: Int32	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX.

Shows the difference between the speed reference and the actual speed.

Parameter 16-45 Motor Phase U Current

Table 863: Parameter 16-45 Motor Phase U Current

16-45 Motor Phase U Current		
Default value: 0 A	Parameter type: Range, 0 - 10000 A	Setup: All setups
Conversion index: -2	Data type: Int32	Change during operation: True

Shows the motor phase U_{RMS} current. Facilitates monitoring of imbalance in the motor currents, detection of weak motor cables or imbalance in motor windings.

Parameter 16-46 Motor Phase V Current

Table 864: Parameter 16-46 Motor Phase V Current

16-46 Motor Phase V Current		
Default value: 0 A	Parameter type: Range, 0 - 10000 A	Setup: All setups
Conversion index: -2	Data type: Int32	Change during operation: True

Shows the motor phase V_{RMS} current. Facilitates monitoring of imbalance in the motor currents, detection of weak motor cables or imbalance in motor windings.

Parameter 16-47 Motor Phase W Current

Table 865: Parameter 16-47 Motor Phase W Current

16-47 Motor Phase W Current		
Default value: 0 A	Parameter type: Range, 0 - 10000 A	Setup: All setups
Conversion index: -2	Data type: Int32	Change during operation: True

Shows the motor phase W_{RMS} current. Facilitates monitoring of imbalance in the motor currents, detection of weak motor cables or imbalance in motor windings.

Parameter 16-48 Speed Ref. After Ramp [RPM]

Table 866: Parameter 16-48 Speed Ref. After Ramp [RPM]

16-48 Speed Ref. After Ramp [RPM]		
Default value: 0 RPM	Parameter type: Range, -30000 - 30000 RPM	Setup: All setups
Conversion index: 67	Data type: Int32	Change during operation: False

This parameter specifies the reference given to the drive after the speed ramp.

Parameter 16-49 Current Fault Source

Table 867: Parameter 16-49 Current Fault Source

16-49 Current Fault Source		
Default value: 0	Parameter type: Range, 0 - 8	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Value indicates source of current faults including short circuit, overcurrent, and imbalance of supply voltage (from left):

- 1–4 Inverter
- 5–8 Rectifier
- 0 No fault recorded

5.16.4 16-5* Ref. & Feedb.

Parameter 16-50 External Reference

Table 868: Parameter 16-50 External Reference

16-50 External Reference		
Default value: 0	Parameter type: Range, -200 - 200	Setup: All setups
Conversion index: -1	Data type: Int16	Change during operation: False

View the total reference, the sum of digital, analog, preset, fieldbus, and freeze references, plus catch up and slow down.

Parameter 16-51 Pulse Reference

Table 869: Parameter 16-51 Pulse Reference

16-51 Pulse Reference		
Default value: 0	Parameter type: Range, -200 - 200	Setup: All setups
Conversion index: -1	Data type: Int16	Change during operation: False

View the reference value from programmed digital inputs. The readout can also reflect the impulses from an incremental encoder.

Parameter 16-52 Feedback[Unit]

Table 870: Parameter 16-52 Feedback[Unit]

16-52 Feedback[Unit]		
Default value: 0 ReferenceFeedback-Unit	Parameter type: Range, -999999.999 ReferenceFeed-backUnit - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

View the feedback unit resulting from the selection of unit and scaling in *parameter 3-00 Reference Range*, *parameter 3-01 Reference/ Feedback Unit*, *parameter 3-02 Minimum Reference*, and *parameter 3-03 Maximum Reference*.

Parameter 16-53 Digi Pot Reference

Table 871: Parameter 16-53 Digi Pot Reference

16-53 Digi Pot Reference		
Default Value: 0	Parameter Type: Range, -200 - 200	Setup: All setups
Conversion Index: -2	Data Type: Int16	Change during operation: False

View the contribution of the digital potentiometer to the actual reference.

Parameter 16-57 Feedback [RPM]

Table 872: Parameter 16-57 Feedback [RPM]

16-57 Feedback [RPM]		
Default Value: 0 RPM	Parameter Type: Range, -30000 - 30000 RPM	Setup: All setups
Conversion Index: 67	Data Type: Int32	Change during operation: False

Readout parameter where the actual motor RPM from the feedback source can be read in both closed loop and open loop. The feedback source is selected in *parameter 7-00 Speed PID Feedback Source*.

5.16.5 16-6* Inputs and Outputs

N O T I C E

The following parameters are only available in FC 302:

- *Parameter 16-67 Freq. Input #29 [Hz]*
- *Parameter 16-70 Pulse Output #29 [Hz]*

Parameter 16-60 Digital Input

Table 873: Parameter 16-60 Digital Input

16-60 Digital Input		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View the signal states from the active digital inputs. Example: Input 18 corresponds to bit number 5, 0 = no signal, 1 = connected signal. Bit 6 works in the opposite way, on = 0, off = 1 (Safe Torque Off input).

Table 874: Active Digital Inputs

Bit	Input
0	Digital input terminal 33.
1	Digital input terminal 32.
2	Digital input terminal 29.
3	Digital input terminal 27.
4	Digital input terminal 19.
5	Digital input terminal 18.
6	Digital input terminal 37.
7	Digital input VLT® General Purpose I/O MCB 101 terminal X30/4.
8	Digital input VLT® General Purpose I/O MCB 101 terminal X30/3.
9	Digital input VLT® General Purpose I/O MCB 101 terminal X30/2.
Bit 10–63	Reserved for future terminals.

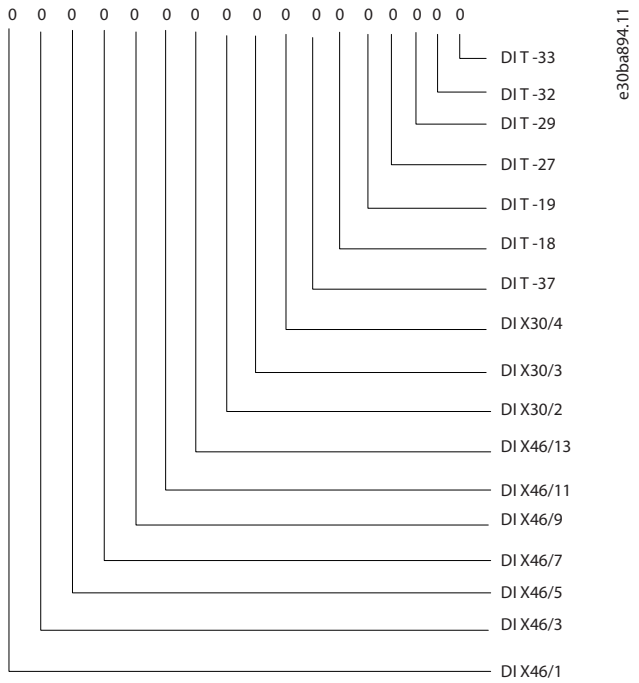


Illustration 92: Relay Settings

Parameter 16-61 Terminal 53 Switch Setting

Table 875: Parameter 16-61 Terminal 53 Switch Setting

16-61 Terminal 53 Switch Setting		
Default value: [0] Current	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

View the setting of input terminal 53.

Option	Name	Description
[0]*	Current	
[1]	Voltage	

Parameter 16-62 Analog Input 53

Table 876: Parameter 16-62 Analog Input 53

16-62 Analog Input 53		
Default value: 0	Parameter type: Range, -20 - 20	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

View the actual value at input 53.

Parameter 16-63 Terminal 54 Switch Setting

Table 877: Parameter 16-63 Terminal 54 Switch Setting

16-63 Terminal 54 Switch Setting		
Default value: [0] Current	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

View the setting of terminal 54.

Option	Name	Description
[0]*	Current	
[1]	Voltage	

Parameter 16-64 Analog Input 54

Table 878: Parameter 16-64 Analog Input 54

16-64 Analog Input 54		
Default value: 0	Parameter type: Range, -20 - 20	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

View the actual value at input 54.

Parameter 16-65 Analog Output 42 [mA]

Table 879: Parameter 16-65 Analog Output 42 [mA]

16-65 Analog Output 42 [mA]		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: False

View the actual value at output 42 in mA. The value shown reflects the selection in *parameter 6-50 Terminal 42 Output*.

Parameter 16-66 Digital Output [bin]

Table 880: Parameter 16-66 Digital Output [bin]

16-66 Digital Output [bin]		
Default value: 0	Parameter type: Range, 0 - 15	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: False

View the binary value of all digital outputs.

Parameter 16-67 Freq. Input #29 [Hz]

Table 881: Parameter 16-67 Freq. Input #29 [Hz]

16-67 Freq. Input #29 [Hz]		
Default value: 0	Parameter type: Range, 0 - 130000	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: False

View the actual frequency rate on terminal 29.

Parameter 16-68 Freq. Input #33 [Hz]

Table 882: Parameter 16-68 Freq. Input #33 [Hz]

16-68 Freq. Input #33 [Hz]		
Default value: 0	Parameter type: Range, 0 - 130000	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: False

View the actual value of the frequency applied at terminal 33 as an impulse input.

Parameter 16-69 Pulse Output #27 [Hz]

Table 883: Parameter 16-69 Pulse Output #27 [Hz]

16-69 Pulse Output #27 [Hz]		
Default value: 0	Parameter type: Range, 0 - 40000	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: False

View the actual value of pulses applied to terminal 27 in digital output mode.

Parameter 16-70 Pulse Output #29 [Hz]

Table 884: Parameter 16-70 Pulse Output #29 [Hz]

16-70 Pulse Output #29 [Hz]		
Default value: 0	Parameter type: Range, 0 - 40000	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: False

View the actual value of pulses at terminal 29 in digital output mode.

Parameter 16-71 Relay Output [bin]

Table 885: Parameter 16-71 Relay Output [bin]

16-71 Relay Output [bin]		
Default value: 0	Parameter type: Range, 0 - 511	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: False

View the settings of all relays.

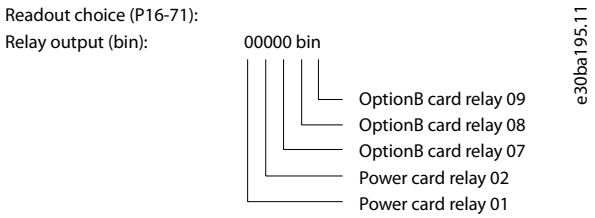


Illustration 93: Relay Settings

Parameter 16-72 Counter A

Table 886: Parameter 16-72 Counter A

16-72 Counter A		
Default value: 0	Parameter type: Range, -2147483648 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

View the present value of counter A. Counters are useful as comparator operands, see *parameter 13-10 Comparator Operand*. Reset or change the value either via digital inputs (*parameter group 5-1* Digital Inputs*) or by using an SLC action (*parameter 13-52 SL Controller Action*).

Parameter 16-73 Counter B

Table 887: Parameter 16-73 Counter B

16-73 Counter B		
Default value: 0	Parameter type: Range, -2147483648 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

View the present value of counter B. Counters are useful as comparator operands, see *parameter 13-10 Comparator Operand*. Reset or change the value either via digital inputs (*parameter group 5-1* Digital Inputs*) or by using an SLC action (*parameter 13-52 SL Controller Action*).

Parameter 16-74 Prec. Stop Counter

Table 888: Parameter 16-74 Prec. Stop Counter

16-74 Prec. Stop Counter		
Default value: 0	Parameter type: Range, 0 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Returns the actual counter value of precise counter (*parameter 1-84 Precise Stop Counter Value*).

Parameter 16-75 Analog In X30/11

Table 889: Parameter 16-75 Analog In X30/11

16-75 Analog In X30/11		
Default value: 0	Parameter type: Range, -20 - 20	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

View the actual value at input X30/11 of VLT® General Purpose I/O MCB 101.

Parameter 16-76 Analog In X30/12

Table 890: Parameter 16-76 Analog In X30/12

16-76 Analog In X30/12		
Default value: 0	Parameter type: Range, -20 - 20	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

View the actual value at input X30/12 of VLT® General Purpose I/O MCB 101.

Parameter 16-77 Analog Out X30/8 [mA]

Table 891: Parameter 16-77 Analog Out X30/8 [mA]

16-77 Analog Out X30/8 [mA]		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: False

View the actual value at input X30/8 in mA.

Parameter 16-78 Analog Out X45/1 [mA]

Table 892: Parameter 16-78 Analog Out X45/1 [mA]

16-78 Analog Out X45/1 [mA]		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: False

Shows the actual output value at terminal X45/1. The value shown reflects the selection in *parameter 6-70 Terminal X45/1 Output*.

Parameter 16-79 Analog Out X45/3 [mA]

Table 893: Parameter 16-79 Analog Out X45/3 [mA]

16-79 Analog Out X45/3 [mA]		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: False

Shows the actual output value at terminal X45/3. The value shown reflects the selection in *parameter 6-80 Terminal X45/3 Output*.

5.16.6 16-8* Fieldbus & FC Port

Parameter 16-80 Fieldbus CTW 1

Table 894: Parameter 16-80 Fieldbus CTW 1

16-80 Fieldbus CTW 1		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: V2	Change during operation: False

View the 2-byte control word (CTW) received from the bus-master. Interpretation of the CTW depends on the fieldbus option installed and the CTW profile selected in *parameter 8-10 Control Word Profile*. For more information, refer to the relevant fieldbus manual.

Parameter 16-82 Fieldbus REF 1

Table 895: Parameter 16-82 Fieldbus REF 1

16-82 Fieldbus REF 1		
Default value: 0	Parameter type: Range, -200 - 200	Setup: All setups
Conversion index: 0	Data type: N2	Change during operation: False

View the 2-byte word sent with the control word form the bus-master to set the reference value. For more information, refer to the relevant fieldbus manual.

Table 896: Parameter 16-83 Fieldbus Pos. REF

16-83 Fieldbus Pos. REF		
Default value: 0 Custom- ReadoutUni t2	Parameter type: Range, -2147483648 - 2147483647 CustomReadoutUnit2	Setup: All setups
Conversion index: 0	Data type: N2	Change during operation: False

N O T I C E

This parameter is only valid with software 48.XX.

Shows the 32-bit position reference sent in PCD 2 and PCD 3. In parameters related to PCD 2 and PCD 3, select *[1683] Fieldbus Pos REF* for the fieldbus which is used by the drive. The value is in position units defined in *parameter group 17-7* Position Scaling*.

Parameter 16-84 Comm. Option STW

Table 897: Parameter 16-84 Comm. Option STW

16-84 Comm. Option STW		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: V2	Change during operation: False

Show the status word of the extended fieldbus communication option. For more information, refer to the relevant fieldbus manual.

Parameter 16-85 FC Port CTW 1

Table 898: Parameter 16-85 FC Port CTW 1

16-85 FC Port CTW 1		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: V2	Change during operation: False

View the 2-byte control word (CTW) received from the fieldbus master. Interpretation of the control word depends on the fieldbus option installed and the control word profile selected in *parameter 8-10 Control Word Profile*.

Parameter 16-86 FC Port REF 1

Table 899: Parameter 16-86 FC Port REF 1

16-86 FC Port REF 1		
Default value: 0	Parameter type: Range, -200 - 200	Setup: All setups
Conversion index: 0	Data type: N2	Change during operation: False

View the 2-byte status word (STW) sent to the fieldbus master. Interpretation of the status word depends on the fieldbus option installed and the control word profile selected in *parameter 8-10 Control Word Profile*.

Parameter 16-87 Bus Readout Alarm/Warning

Table 900: Parameter 16-87 Bus Readout Alarm/Warning

16-87 Bus Readout Alarm/Warning		
Default value: 0	Parameter type: Range, 0 - 65535, Array [3]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Alarm and warning numbers in hex as shown in the alarm log. The high byte contains the alarm, the low byte contains the warning. The alarm number is the 1st that occurred after the last reset.

Parameter 16-88 Fieldbus Torque FF

Table 901: Parameter 16-88 Fieldbus Torque FF

16-88 Fieldbus Torque FF		
Default value: 0	Parameter type: Range, -200 - 200	Setup: 1 setup
Conversion index: 0	Data type: N2	Change during operation: True

A PCD write reference parameter. This parameter allows the PLC to adjust the Torque FF over the fieldbus continuously as a percentage of motor nominal torque, see *parameter 1-26 Motor Cont. Rated Torque*.

Parameter 16-89 Configurable Alarm/Warning Word

Table 902: Parameter 16-89 Configurable Alarm/Warning Word

16-89 Configurable Alarm/Warning Word		
Default Value: 0	Parameter Type: Range, 0 - 65535	Setup: All setups
Conversion Index: 0	Data Type: Uint16	Change during operation: False

This alarm/warning word is configured in parameter *8-17 Configurable Alarm and Warningword* to match the actual requirements.

5.16.7 16-9* Diagnosis Readouts

For details of bit descriptions, refer to Table 1436.

Parameter 16-90 Alarm Word

Table 903: Parameter 16-90 Alarm Word

16-90 Alarm Word		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Show the alarm word sent via the serial communication port in hex code.

Parameter 16-91 Alarm Word 2

Table 904: Parameter 16-91 Alarm Word 2

16-91 Alarm Word 2		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Show the alarm word sent via the serial communication port in hex code.

Parameter 16-92 Warning Word

Table 905: Parameter 16-92 Warning Word

16-92 Warning Word		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Show the warning word sent via the serial communication port in hex code.

Parameter 16-93 Warning Word 2

Table 906: Parameter 16-93 Warning Word 2

16-93 Warning Word 2		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Show the warning word sent via the serial communication port in hex code.

Parameter 16-94 Ext. Status Word

Table 907: Parameter 16-94 Ext. Status Word

16-94 Ext. Status Word		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Returns the extended status word sent via the serial communication port in hex code.

Parameter 16-95 Ext. Status Word 2

Table 908: Parameter 16-95 Ext. Status Word 2

16-95 Ext. Status Word 2		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Returns the extended warning word sent via the serial communication port in hex code.

Parameter 16-96 Maintenance Word

Table 909: Parameter 16-96 Maintenane Word

16-96 Maintenane Word		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Readout of the preventive maintenance word. The bits reflect the status for the programmed preventive maintenance events in *parameter group 23-1* Maintenance*. 13 bits show combinations of all the possible items:

- Bit 0: Motor bearings
- Bit 1: Pump bearings
- Bit 2: Fan bearings
- Bit 3: Valve
- Bit 4: Pressure transmitter
- Bit 5: Flow transmitter
- Bit 6: Temperature transmitter
- Bit 7: Pump seals
- Bit 8: Fan belt
- Bit 9: Filter
- Bit 10: Drive cooling fan
- Bit 11: Drive system health check
- Bit 12: Warranty
- Bit 13: Maintenance text 0
- Bit 14: Maintenance text 1
- Bit 15: Maintenance text 2
- Bit 16: Maintenance text 3
- Bit 17: Maintenance text 4

The following table details the display of the maintenance word.

Table 910: Maintenance Word

Position 4⇒	**Valve**	**Fan bearings**	**Pump bearings**	**Motor bearings**
Position 3⇒	**Pump seals**	**Temperature transmitter**	**Flow transmitter**	**Pressure transmitter**
Position 2⇒	**Drive system health check**	**Drive cooling fan**	**Filter**	**Fan belt**
Position 1⇒	–	–	–	**Warranty**
0_{hex}	–	–	–	–
1_{hex}	–	–	–	+
2_{hex}	–	–	+	–
3_{hex}	–	–	+	+
4_{hex}	–	+	–	–
5_{hex}	–	+	–	+
6_{hex}	–	+	+	–
7_{hex}	–	+	+	+

Position 4⇒	Valve	Fan bearings	Pump bearings	Motor bearings
Position 3⇒	**Pump seals**	**Temperature transmitter**	**Flow transmitter**	**Pressure transmitter**
Position 2⇒	**Drive system health check**	**Drive cooling fan**	**Filter**	**Fan belt**
Position 1⇒	**–**	**–**	**–**	**Warranty**
8_{hex}	+	–	–	–
9_{hex}	+	–	–	+
A_{hex}	+	–	+	–
B_{hex}	+	–	+	+
C_{hex}	+	+	–	–
D_{hex}	+	+	–	+
E_{hex}	+	+	+	–
F_{hex}	+	+	+	+

Example: The preventive maintenace word shows 040Ahex:

Position	1	2	3	4
Hex value	0	4	0	A

- The 1st digit 0 indicates that no items from the 4th row require maintenance.
- The 2nd digit 4 refers to the 3rd row indicating that the drive cooling fan requires maintenance.
- The 3rd digit 0 indicates that no items for the 2nd row require maintenance.
- The 4th digit A refers to the top row indicating that the valve and the pump bearings require maintenance.

Parameter 16-97 Alarm Word 3

Table 911: Parameter 16-97 Alarm Word 3

16-97 Alarm Word 3		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Shows the alarm word sent via the serial communication port in hex code.

Parameter 16-98 Warning Word 3

Table 912: Parameter 16-98 Warning Word 3

16-98 Warning Word 3		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Shows the warning word sent via the serial communication port in hex code.

5.17 Parameter Group 17-** Feedback

Parameters for configuring the feedback from VLT® Encoder Input MCB 102, VLT® Resolver Input MCB 103m or the drive itself.

5.17.1 17-0* Encoder Interface

Parameter 17-00 Encoders Connected

Table 913: Parameter 17-00 Encoders Connected

17-00 Encoders Connected		
Default value: [0] One encoder	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

N O T I C E

This parameter is only available with VLT® Encoder Option MCB 102 version 4.00 or newer.

Select if 1 or 2 encoders are connected to MCB 102.

Option	Name	Description
[0]*	One encoder	Only 1 encoder is connected. The encoder can be any of the supported encoder types.
[1]	Two encoders	Two encoders are connected. The encoders must be 1 incremental (TTL or SinCos) and 1 absolute (SSI or Endat) without incremental channel.

Parameter 17-01 Standby Encoder

Table 914: Parameter 17-01 Standby Encoder

17-01 Standby Encoder		
Default value: [0] None	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

Select the source for the standby encoder which will be used as feedback if the primary encoder fails.

Option	Name	Description
[0]*	None	No standby encoder.
[1]	Standby encoder to T32/33	Standby encoder connected to terminals 32 and 33.
[2]	Standby encoder to T27/29	Standby encoder connected to terminals 27 and 29.

5.17.2 17-1* Inc. Enc. Interface

N O T I C E

Do not use incremental encoders with PM motors. In a closed-loop control, consider absolute encoders or resolvers.

N O T I C E

These parameters cannot be adjusted while the motor is running.

Parameters in this group configure the incremental interface of the VLT® Encoder Input MCB 102. Both the incremental and absolute interfaces are active at the same time.

Parameter 17-10 Signal Type

Table 915: Parameter 17-10 Signal Type

17-10 Signal Type		
Default value: [1] RS422 (5V TTL)	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

Select this parameter if 1 or 2 encoders are connected to MCB 102.

Option	Name	Description
[0]	None	
[1]*	RS422 (5V TTL)	
[2]	Sinosoidal 1Vpp	

Parameter 17-11 Resolution (PPR)

Table 916: Parameter 17-11 Resolution (PPR)

17-11 Resolution (PPR)		
Default value: 1024	Parameter type: Range, 10 - 16384	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Enter the number of pulses or periods per revolution (the incremental track).

5.17.3 17-2* Abs. Enc. Interface

Parameters in this group configure the absolute interface of the VLT® Encoder Input MCB 102. Both the incremental and absolute interfaces are active at the same time.

Parameter 17-20 Protocol Selection

Table 917: Parameter 17-20 Protocol Selection

17-20 Protocol Selection		
Default value: [0] None	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

Option	Name	Description
[0]*	None	Select *[0] None* if the feedback sensor is an incremental encoder only.
[1]	HIPERFACE	Select *[1] HIPERFACE* if the encoder is absolute only.
[2]	EnDat	
[4]	SSI	
[8]	Z pulse	Select 0 pulse as "absolute" track when using incremental encoder with 0 pulse.

Parameter 17-21 Resolution (Positions/Rev)

Table 918: Parameter 17-21 Resolution (Positions/Rev)

17-21 Resolution (Positions/Rev)		
Default value: Size related	Parameter type: Range, 4 - 1073741824	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Select the resolution of the absolute encoder, that is the number of counts per revolution. The value depends on setting in *parameter 17-20 Protocol Selection*.

Parameter 17-22 Multiturn Revolutions

Table 919: Parameter 17-22 Multiturn Revolutions

17-22 Multiturn Revolutions		
Default value: 1	Parameter type: Range, 1 - 16777216	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Select the number of multi-turn revolutions. Select value 1 for single-turn type encoders.

Parameter 17-24 SSI Data Length

Table 920: Parameter 17-24 SSI Data Length

17-24 SSI Data Length		
Default value: 13	Parameter type: Range, 1 - 32	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

Set the number of bits for the SSI telegram. Select 13 bits for singleturn encoders and 25 bits for multiturn encoders.

Parameter 17-25 Clock Rate

Table 921: Parameter 17-25 Clock Rate

17-25 Clock Rate		
Default value: 260 kHz	Parameter type: Range, 100 - 260 kHz	Setup: All setups
Conversion index: 3	Data type: Uint16	Change during operation: False

Set the SSI clock rate. With long encoder cables, the clock rate must be reduced.

Parameter 17-26 SSI Data Format

Table 922: Parameter 17-26 SSI Data Format

17-26 SSI Data Format		
Default value: [0] Gray code	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

Option	Name	Description
[0]*	Gray code	
[1]	Binary code	Set the data format of the SSI data.

Parameter 17-34 HIPERFACE Baudrate

Table 923: Parameter 17-34 HIPERFACE Baudrate

17-34 HIPERFACE Baudrate		
Default value: [4] 9600	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

Select the baud rate of the attached encoder. The parameter is only accessible when *parameter 17-20 Protocol Selection* is set to *[1] HIPERFACE*.

Option	Name	Description
[0]	600	
[1]	1200	
[2]	2400	
[3]	4800	
[4]*	9600	
[5]	19200	
[6]	38400	

5.17.4 17-4* Fieldbus Reference 2

Parameter 17-40 Fieldbus Sync. Delta

Table 924: Parameter 17-40 Fieldbus Sync. Delta

17-40 Fieldbus Sync. Delta		
Default value: 0	Parameter type: Range, -2147483648 - 2147483647	Setup: 1 setup
Conversion index: 0	Data type: Int32	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX.

Shows the fieldbus synchronizing master position change = master speed when transferred by PCD from fieldbus master.

Parameter 17-41 Fieldbus Profile Velocity

Table 925: Parameter 17-41 Fieldbus Profile Velocity

17-41 Fieldbus Profile Velocity		
Default value: 0	Parameter type: Range, 0 - 2147483647 pu/s	Setup: 1 setup
Conversion index: 0	Data type: Int32	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX.

Velocity reference for the profile generator in positioning mode or when using Mode of operation and Profile ositioning mode.

Parameter 17-42 Fieldbus Velocity FF.

Table 926: Parameter 17-42 Fieldbus Velocity FF.

17-42 Fieldbus Velocity FF.		
Default value: 0	Parameter type: Range, -2147483648 - 2147483647 pu/s	Setup: 1 setup
Conversion index: 0	Data type: Int32	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Velocity feedforward when running in cyclic sync. position mode.

Parameter 17-43 Fieldbus Acceleration FF.

Table 927: Parameter 17-43 Fieldbus Acceleration FF.

17-43 Fieldbus Acceleration FF.		
Default value: 0	Parameter type: Range, -2147483648 - 2147483647 pu/s^2	Setup: 1 setup
Conversion index: 0	Data type: Int32	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Acceleration feedforward when running cyclic sync. position or cyclic sync. velocity mode.

Parameter 17-44 Fieldbus Target Velocity

Table 928: Parameter 17-44 Fieldbus Target Velocity

17-44 Fieldbus Target Velocity		
Default value: 0	Parameter type: Range, -2147483648 - 2147483647 pu/s	Setup: 1 setup
Conversion index: 0	Data type: Int32	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Velocity reference when running cyclic sync. velocity mode.

5.17.5 17-5* Resolver Interface

This parameter group is used for setting parameters for the VLT® Resolver Input MCB 103. Usually, the resolver feedback is used as motor feedback from permanent magnet motors with *parameter 1-01 Motor Control Principle* set to *[3] Flux w/motor feedback*. Resolver parameters cannot be adjusted while the motor is running.

Parameter 17-50 Poles

Table 929: Parameter 17-50 Poles

17-50 Poles		
Default value: 2	Parameter type: Range, 2 - 8	Setup: 1 setup
Conversion index: 0	Data type: Uint8	Change during operation: False

Set the pole number on the resolver. The value is stated in the datasheet for resolvers.

Parameter 17-51 Input Voltage

Table 930: Parameter 17-51 Input Voltage

17-51 Input Voltage		
Default value: 7 V	Parameter type: Range, 2 - 8 V	Setup: 1 setup
Conversion index: -1	Data type: Uint8	Change during operation: False

Set the input voltage to the resolver. The voltage is stated as RMS value. The value is stated in the datasheet for resolvers.

Parameter 17-52 Input Frequency

Table 931: Parameter 17-52 Input Frequency

17-52 Input Frequency		
Default value: 10 kHz	Parameter type: Range, 2 - 15 kHz	Setup: 1 setup
Conversion index: 2	Data type: Uint8	Change during operation: False

Set the input frequency to the resolver. The value is stated in the datasheet for resolvers.

Parameter 17-53 Transformation Ratio

Table 932: Parameter 17-53 Transformation Ratio

17-53 Transformation Ratio		
Default value: 0.5	Parameter type: Range, 0.1 - 1.1	Setup: 1 setup
Conversion index: -1	Data type: Uint8	Change during operation: False

Set the transformation ratio for the resolver. The transformation ratio is:

$$T_{\text{ratio}} = \frac{V_{\text{out}}}{V_{\text{in}}}$$

The value is stated in the datasheet for resolvers.

Parameter 17-56 Encoder Sim. Resolution

Table 933: Parameter 17-56 Encoder Sim. Resolution

17-56 Encoder Sim. Resolution		
Default Value: [0] Disabled	Parameter Type: Option	Setup: All setups
Conversion Index: -	Data Type: Uint8	Change during operation: False

Set the resolution and activate the encoder emulation function (generation of encoder signals from the measured position from a resolver). Use this function to transfer the speed or position information from 1 drive to another. To disable the function, select *[0] Disabled*.

Option	Name	Description
[0]*	Disabled	
[1]	512	
[2]	1024	
[3]	2048	
[4]	4096	
[5]	Enable encoder sim. adv.	Set the encoder simulation resolution via *parameter 17-58 Encoder Sim. Resolution Adv.*

Parameter 17-58 Encoder Sim. Resolution Adv.

Table 934: Parameter 17-58 Encoder Sim. Resolution Adv.

17-58 Encoder Sim. Resolution Adv.		
Default value: 0	Parameter type: Range, 0 - 16384	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: False

Set the encoder simulation resolution as a continuous value in steps of 1. This parameter is only active when *[5] Enable encoder sim. adv.* is selected in *parameter 17-56 Encoder Sim. Resolution*.

Parameter 17-59 Resolver Interface

Table 935: Parameter 17-59 Resolver Interface

17-59 Resolver Interface		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

Activate the VLT® Resolver Input MCB 103 when the resolver parameters are selected. To avoid damage to resolvers, adjust *parameter 17-50 Poles* and *parameter 17-53 Transformation Ratio* before enabling this parameter.

Option	Name	Description
[0]*	Disabled	
[1]	512	

5.17.6 17-6* Monitoring and Application

N O T I C E

The following parameters are only available in FC 302:

- *Parameter 17-67 Raw Inc. Quad Counter*
- *Parameter 17-68 Raw Abs. Pos. Low*
- *Parameter 17-69 Raw Abs. Pos. High*

This parameter group is for selecting extra functions when VLT® Encoder MCB 102 or VLT® Resolver Input MCB 103 is fitted into option slot B as speed feedback. Monitoring and application parameters cannot be adjusted while the motor is running.

Parameter 17-60 Feedback Direction

Table 936: Parameter 17-60 Feedback Direction

17-60 Feedback Direction		
Default value: [0] Clockwise	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

Change the detected encoder rotation direction without changing the wiring to the encoder.

Option	Name	Description
[0]*	Clockwise	
[1]	Counter clockwise	

Parameter 17-61 Feedback Signal Monitoring

Table 937: Parameter 17-61 Feedback Signal Monitoring

17-61 Feedback Signal Monitoring		
Default value: [1] Warning	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

Select which action the drive should take if a faulty encoder signal is detected. The encoder function in *parameter 17-61 Feedback Signal Monitoring* is an electrical check of the hardware circuit in the encoder system.

Option	Name	Description
[0]	Disabled	
[1]*	Warning	
[2]	Trip	
[3]	Jog	
[4]	Freeze output	
[5]	Max speed	
[6]	Switch to open loop	
[7]	Select setup 1	
[8]	Select setup 2	
[9]	Select setup 3	
[10]	Select setup 4	
[11]	Stop & trip	
[12]	Trip/warning	
[13]	Trip/catch	

Parameter 17-67 Raw Inc. Quad Counter

Table 938: Parameter 17-67 Raw Inc. Quad Counter

17-67 Raw Inc. Quad Counter		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

N O T I C E

This parameter is only available with software version 48.9X.

Shows the raw incremental counter value in quad counts (4 times pulse count) of an encoder connected to VLT® Encoder Input MCB 102. It can be an incremental encoder or the incremental part of a dual-channel absolute encoder. MCB 102 must be selected as

feedback source in *parameter 1-02 Flux Motor Feedback Source*, *parameter 7-00 Speed PID Feedback Source*, or *parameter 7-90 Position PI Feedback Source*.

Parameter 17-68 Raw Abs. Pos. Low

Table 939: Parameter 17-68 Raw Abs. Pos. Low

17-68 Raw Abs. Pos. Low		
Default value: 0	Parameter type: Range, 0 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

N O T I C E

This parameter is only available with software version 48.9X.

Shows the least significant 32 bits of the position value read from an absolute encoder connected to VLT® Encoder Input MCB 102. MCB 102 must be selected as feedback source in *parameter 1-02 Flux Motor Feedback Source*, *parameter 7-00 Speed PID Feedback Source*, or *parameter 7-90 Position PI Feedback Source*.

Parameter 17-69 Raw Abs. Pos. High

Table 940: Parameter 17-69 Raw Abs. Pos. High

17-69 Raw Abs. Pos. High		
Default value: 0	Parameter type: Range, 0 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

N O T I C E

This parameter is only available with software version 48.9X.

Shows the most significant 32 bits of the position value read from an absolute encoder connected to VLT® Encoder Input MCB 102. MCB 102 must be selected as feedback source in *parameter 1-02 Flux Motor Feedback Source*, *parameter 7-00 Speed PID Feedback Source*, or *parameter 7-90 Position PI Feedback Source*.

5.17.7 17-7* Position Scaling

Parameters in this group define how the drive scales and handles the position values.

Parameter 17-70 Position Unit

Table 941: Parameter 17-70 Position Unit

17-70 Position Unit		
Default value: [0] pu	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

Select the physical unit for showing the position values on the LCP.

Option	Name	Description
[0]*	pu	Position unit.
[1]	m	Meters.
[2]	mm	Millimeters
[3]	inc	Increments.
[4]	°	Degrees.

Option	Name	Description
[5]	rad	Radian.
[6]	%	Percent.
[7]	qc	Quad count, which is ¼ of an encoder pulse when using quadrature encoder signal.

Parameter 17-71 Position Unit Scale

Table 942: Parameter 17-71 Position Unit Scale

17-71 Position Unit Scale		
Default value: 0	Parameter type: Range, -3 - 3, Array [2]	Setup: All setups
Conversion index: 0	Data type: Int8	Change during operation: False

Enter the scaling factor for the position values. The scaling function multiplies the readout values by 10^x, where x is the value of this parameter. For example, if x = 2, the value 5 is shown as 500. The elements of the array are:

- Index 0 is the scaling factor for readout and settings of position values in parameters or in a fieldbus. Index 1 contains exceptions.
- Index 1 is the scaling factor for readout of position error (*parameter 16-08 Position Error*) and for the value of *parameter 3-08 On Target Window*.

Parameter 17-72 Position Unit Numerator

Table 943: Parameter 17-72 Position Unit Numerator

17-72 Position Unit Numerator		
Default value: 1024	Parameter type: Range, -2147483648 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: False

This parameter is the numerator in the equation which defines the relation between 1 motor revolution and physical movement of machine.

$$\text{Position unit} = \frac{\text{Par. } 17-72}{\text{Par. } 17-73} \times \text{Motor revolutions}$$

Example: Consider a turn table application. The motor makes 10 revolutions when the table makes 1 revolution. The position unit is a degree. For this setup, enter the following values:

- *Parameter 17-72 Position Unit Numerator* = 360
- *Parameter 17-73 Position Unit Denominator* = 10

Set the physical unit for position values in *parameter 17-70 Position Unit*.

Parameter 17-73 Position Unit Denominator

Table 944: Parameter 17-73 Position Unit Denominator

17-73 Position Unit Denominator		
Default value: 1	Parameter type: Range, -2147483648 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: False

See *parameter 17-72 Position Unit Numerator*.

Parameter 17-74 Position Offset

Table 945: Parameter 17-74 Position Offset

17-74 Position Offset		
Default value: 0	Parameter type: Range, -2147483648 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: False

Enter the absolute encoder position offset. Use this parameter to adjust the 0 position of the encoder without physically moving the encoder. Set the physical unit for position values in *parameter 17-70 Position Unit*.

Parameter 17-75 Position Recovery at Power-up

Table 946: Parameter 17-75 Position Recovery at Power-up

17-75 Position Recovery at Power-up		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

NOTICE

This parameter is only available with software version 48.XX.

Select the actual position after power-up when using open loop or incremental encoders.

Option	Name	Description
[0]*	Off	The actual position is 0 after power-up.
[1]	On	This drive stores the actual position at power-down and uses it as the actual position when powered up.

Parameter 17-76 Position Axis Mode

Table 947: Parameter 17-76 Position Axis Mode

17-76 Position Axis Mode		
Default value: [0] Linear axis	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

NOTICE

This parameter is only available with software version 48.XX.

Select the axis type for position counting.

Option	Name	Description
[0]*	Linear axis	The motion is within a position range defined by *parameter 3-06 Minimum Position* and *parameter 3-07 Maximum Position*.
[1]	Rotary 0 - Max	Continuous motion, where the position changes between 0 and *parameter 3-07 Maximum Position*. When passing the maximum position, the reading restarts from 0.
[2]	Rotary min - max	**NOTICE** This option is available only with software version 48.20 and newer.

Option	Name	Description
		Continuous motion, where the position changes between *parameter 3-06 Minimum Position* and *parameter 3-07 Maximum Position*. When passing the maximum position, the reading restarts from the minimum position.

Parameter 17-77 Position Feedback Mode

Table 948: Parameter 17-77 Position Feedback Mode

17-77 Position Feedback Mode		
Default value: [0] Relative	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

NOTICE

This parameter is only available with software version 48.20.

Select the mode for handling absolute encoders. Select *[0] Relative* if the application requires tracking the position when the position value exceeds the measuring range of the encoder, for example, when using single-turn encoders for linear motion. Select *[1] Absolute* if the position values are always within the measuring range of the encoder, for example, when using a laser distance-measuring device.

Option	Name	Description
[0]*	Relative	The actual position is set to the absolute position read from the encoder at power-up, and then the drive uses only the position changes for calculating the actual position. In this mode, the actual position values are between -2147483648 and 2147483647 even when the values exceed the measuring range of the encoder. To save and use the absolute position values outside the measuring range of the encoder after power-down, set *parameter 17-75 Position Recovery at Power-up* to *[1] On*. The position value is accurate if the encoder does not move by more than half of the encoder measuring range when the drive is powered down.
[1]	Absolute	The drive uses the absolute position from the encoder as actual position continuously. In this mode, the actual position values are between 0 and the maximum position of the encoder. The maximum position is determined by the number of bits, for example, the SSI encoder has 25 bits and its maximum value is 2^{25} = 33554432. Set *parameter 3-07 Maximum Position* to the maximum value of the encoder scaled according to *parameter 7-94 Position PI Feedback Scale Numerator*, *parameter 7-95 Position PI Feedback Scale Denominator*, *parameter 17-72 Position Unit Numerator*, and *parameter 17-73 Position Unit Denominator*. If the position exceeds the measuring range of the encoder, the absolute position reference is lost. For example, use this option if there is a laser distance-measuring device and there is a risk that some external objects may occasionally interfere with the laser beam. In this case, the absolute positioning will work correctly when the external disturbance disappears.

Parameter 17-78 Active Position Counter

Table 949: Parameter 17-78 Active Position Counter

17-78 Active Position Counter		
Default value: [0] Counter 0	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

The drive has 4 individual position counters. Only the selected counter is updated. Allows tracking position of up to 4 motors controlled by 1 drive, 1 motor at a time. The active counter can be selected by this parameter in the same setup or by setup change when selecting between motors.

Option	Name	Description
[0]*	Counter 0	
[1]	Counter 1	
[2]	Counter 2	
[3]	Counter 3	

5.17.8 17-8* Position Homing

Parameters for configuring the homing function. The homing function creates a position reference in the physical machine.

Parameter 17-80 Homing Function

Table 950: Parameter 17-80 Homing Function

17-80 Homing Function		
Default value: [0] No homing	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

N O T I C E

This parameter is only available with software version 48.XX.

Select the homing function. The homing function creates a position reference in the physical machine. The selected homing function can be activated with a digital input or a fieldbus bit. Homing is not required when using absolute encoders. All homing functions except *[2] Home Sync Function* require a start homing signal.

Option	Name	Description
[0]*	No homing	No homing function. The actual position is 0 after power-up, independent of the physical machine position.
[1]	Home position	Actual position is set to the value of *parameter 17-82 Home Position*, index 0.
[2]	Home sync function	Homing position is synchronized with the homing sensor according to the setting in *parameter 17-81 Home Sync Function*.
[3]	Analog input 53	Use the value of analog input 53 as the actual position. The value is scaled according to *parameter 3-06 Minimum Position* and *parameter 3-07 Maximum Position*.
[4]	Analog input 54	Same as *[3] Analog input 53*, but for analog input 54.
[5]	Home latch function	Only latching of the actual position every time the home sensor is detected without executing any homing function. The result is updated in *parameter 18-25 latched Actual Pos*.
[9]	Direction with sensor	Perform a search for the homing sensor in the direction defined by the forward/reverse signal on a digital input or fieldbus, using the settings in *parameter 17-83 Homing Speed* and *parameter 17-84 Homing Torque Limit*. When the drive detects the homing sensor input (configured in *parameter group 5-1* Digital Inputs*), it sets the actual position to the value of *parameter 17-82 Home Position*, index 0. The drive then switches to the positioning mode with a target defined in *parameter 17-82 Home Position*, index 0 + index 1. If reversing is required for going to the target position, set *parameter 4-10 Motor Speed Direction* to *[2] Both directions*.
[10]	Forward with sensor	Perform a search for the homing sensor in forward direction using the settings in *parameter 17-83 Homing Speed* and *parameter 17-84 Homing Torque Limit*. When the drive detects the homing sensor input (configured in *parameter group 5-1* Digital Inputs*), it sets the actual position to the value of *parameter 17-82 Home Position*, index 0. The drive then switches to the positioning mode with a target defined in

Option	Name	Description
		parameter 17-82 Home Position, index 0 + index 1. If reversing is required for going to the target position, set *parameter 4-10 Motor Speed Direction* to *[2] Both directions*.
[11]	Reverse with sensor	Same as *[10] Forward with sensor*, but with the search in the reverse direction. Set *parameter 4-10 Motor Speed Direction* to *[1] Counter clockwise* or *[2] Both directions*.
[12]	Forward torque limit	With this option selected, the drive does the following: • Runs forward with the set homing speed (*parameter 17-83 Homing Speed*). • When the torque reaches the limit set in *parameter 17-84 Homing Torque Limit*, and the speed is lower than the value in *parameter 3-05 On Reference Window*, the actual position is set to the value of *parameter 17-82 Home Position*, index 0. • The drive positions to the target defined in *parameter 17-82 Home Position*, index 0 + index 1. Only available in flux closed loop. See also *parameter 17-85 Homing Timeout*.
[13]	Reverse torque limit	Same as *[12] Forward Torque Limit* but in reverse direction. Set *parameter 4-10 Motor Speed Direction* to *[1] Counter clockwise* or *[2] Both directions*. Only available in flux closed loop.
[14]	Direction with Z pulse	Same as *[9] Direction with Sensor* but with encoder zero pulse as home sensor.
[15]	Forward with Z pulse	Same as *[10] Forward with Sensor* but with encoder zero pulse as home sensor.
[16]	Reverse with Z pulse	Same as *[11] Reverse with Sensor* but with encoder zero pulse as home sensor.
[17]	Direction with S & Z	Same as *[9] Direction with Sensor* but moving to encoder zero pulse after finding the home sensor.
[18]	Forward with S & Z	Same as *[10] Forward with Sensor* but moving to encoder zero pulse after finding the home sensor.
[19]	Reverse with S & Z	Same as *[11] Reverse with Sensor* but moving to encoder zero pulse after finding the home sensor.
[20]	Fwd. II with sensor	When on the correct side of the home sensor, performs a search for home sensor in forward direction using the settings in *parameter 17-83 Homing Speed*, and then reverses with 10% of Homing Speed when home sensor is detected. The falling edge of home sensor signal is set to the value defined in *parameter 17-82 Home Position*, index 0. When on the wrong side of the home sensor, the positive end limit switch is reached without detecting the home sensor, the drive reverses until home sensor is passed. After the home sensor is detected, the search for home sensor is performed in forward direction, as described.
[21]	Rev. II with sensor	When on the correct side of the home sensor, performs a search for home sensor in the reverse direction using the settings in *parameter 17-83 Homing Speed*, and then moves forward with 10% of Homing Speed when home sensor is detected. The falling edge of home sensor signal is set to the value defined in *parameter 17-82 Home Position*, index 0. When on the wrong side of the home sensor, a negative end limit switch is reached without detecting the home sensor, the drive operates in forward direction until home sensor is passed. After the home sensor is detected, the search for home sensor is performed in reverse, as described.

Parameter 17-81 Home Sync Function

Table 951: Parameter 17-81 Home Sync Function

17-81 Home Sync Function		
Default value: [0] 1st time after power	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

NOTICE

This parameter is only available with software version 48.XX.

Select the trigger for the homing synchronization function. Only active when *[2] Home Sync Function* is selected in *parameter 17-80 Homing Function*. The homing synchronization function sets the actual position to the value of *parameter 17-82 Home Position*:

- Index 0 if the homing sensor is approached in the forward direction.
- Index 1if the homing sensor is approached in the reverse direction.

Option	Name	Description
[0]*	1st time after power	After power-up, the 1st detection of the homing sensor triggers the function.
[1]	1st t. aft.pow. forward	After power-up, the 1st detection of the homing sensor in the forward direction triggers the function.
[2]	1st t. aft.pow. reverse	After power-up, the 1st detection of the homing sensor in the reverse direction triggers the function.
[3]	1st time after start	After start, the 1st detection of the homing sensor triggers the function.
[4]	1st t. aft.str. forward	After start, the 1st detection of the homing sensor in the forward direction triggers the function.
[5]	1st t. aft.str. reverse	After start, the 1st detection of the homing sensor in the reverse direction triggers the function.
[6]	Every time	Every detection of the homing sensor triggers the function.
[7]	Every time forward	Every detection of the homing sensor in the forward direction triggers the function.
[8]	Every time reverse	Every detection of the homing sensor in the reverse direction triggers the function.

Parameter 17-82 Home Position

Table 952: Parameter 17-82 Home Position

17-82 Home Position		
Default value: 0 Custom- ReadoutUnit2	Parameter type: Range, -2147483648 - 2147483647 CustomReadoutUnit2, Array [2]	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Set the homing position in position units defined in *parameter group 17-7* Position Scaling*. This is an array parameter with 2 elements. Indices in this parameter have a different meaning in the following situations:

- If *parameter 17-80 Homing Function* is set to options [10]–[13], index 0 of this parameter defines the actual home position and index 1 is used as the homing offset, which defines where to stop.
- If *parameter 17-80 Homing Function* is set to *[2] Home Sync Function*, and *parameter 17-81 Home Sync Function* is set to *[0] 1st time after power*, *[3] 1st time after start*, or *[6] Every time*, then indices have the following meaning:
  - Index 0 is the homing position when the homing sensor is approached in the forward direction.
  - Index 1 is the homing position when the homing sensor is approached in the reverse direction.

Parameter 17-83 Homing Speed

Table 953: Parameter 17-83 Homing Speed

17-83 Homing Speed		
Default value: 150 RPM	Parameter type: Range, -32000 - 32000 RPM	Setup: All setups
Conversion index: 67	Data type: Int16	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Enter the speed for the homing functions (*parameter 17-80 Homing Function*, options [10]–[13]).

Parameter 17-84 Homing Torque Limit

Table 954: Parameter 17-84 Homing Torque Limit

17-84 Homing Torque Limit		
Default value: 160%	Parameter type: Range, -0 - 500%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Enter the torque limit for the homing functions (*parameter 17-80 Homing Function*, options [10]–[13]).

Parameter 17-85 Homing Timeout

Table 955: Parameter 17-85 Homing Timeout

17-85 Homing Timeout		
Default value: 60.0 s	Parameter type: Range, -0.1 - 6000.0 s	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Enter the timeout for the homing functions (*parameter 17-80 Homing Function*, options [10]–[13]). If the drive does not detect the homing sensor or does not reach the torque limit within the timeout time, it aborts the homing process and trips.

Parameter 17-86 Homing Flag Behavior

Table 956: Parameter 17-86 Homing Flag Behavior

17-86 Homing Flag Behavior		
Default value: [0] Clear at power-up	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

NOTICE

This parameter is only available with software version 48.XX.

Select when the Homing OK signal is cleared.

Option	Name	Description
[0]*	Clear at power-up	*Homing Ok* is cleared at power-up and a new homing is needed for subsequent positioning operations. The option is a typical selection when using incremental encoder and the position tracking is lost at power-down only.
[1]	Clear at coast	*Homing Ok* is cleared at every motor coast and a new homing is needed. The option is a typical selection for sensorless control as position tracking is lost when motor is coasted.
[2]	Clear at coast running	*Homing Ok* is cleared at motor coast only while motor is running and a new homing is needed. The option is a typical selection for sensorless control with a mechanical brake holding the position at stand still.
[3]	Clear at homing only	*Homing Ok* is only cleared at new start of the selected homing function. The option is a typical selection for absolute encoders. After completing the selected homing function *parameter 17-74 Position Offset* is automatically set to the offset calculated by: *Parameter 17-74 Position Offset* = (*Parameter 17-82.0 Home Position*) - (Position value read from encoder). Start a new homing to re-calculate *Parameter 17-74 Position Offset*, for example, after replacing the encoder.

Parameter 17-87 Homing Activation

Table 957: Parameter 17-87 Homing Activation

17-87 Homing Activation		
Default value: [0] Manual	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

N O T I C E

This parameter is only available with software version 48.XX.

Activation manner of drive homing and master homing. Master homing can be activated by a *Set Master Home* signal or the *Start Homing* signal by selecting options *[2] Manual and Master* and *[3] Auto and Master*.

Option	Name	Description
[0]*	Manual	Activates homing function selected in *parameter 17-80 Homing Function* using the *Start Homing* signal.
[1]	Auto	Homing function selected in *parameter 17-80 Homing Function* is activated automatically when the *Homing OK* signal is low and start signal is applied.
[2]	Manual and master	Activates homing function selected in *parameter 17-80 Homing Function* and sets the actual master position as defined in *parameter 17-88 Master Home Position*, using *Start Homing* signal.
[3]	Auto and master	Homing function selected in *parameter 17-80 Homing Function* is activated automatically when the *Homing OK* signal is low and start signal is applied. The actual master position is set as defined in *parameter 17-88 Master Home Position*.

Parameter 17-88 Master Home Position

Table 958: Parameter 17-88 Master Home Position

17-88 Master Home Position		
Default value: 0 Custom- ReadoutUnit2	Parameter type: Range, -2147483648 - 2147483647 CustomReadoutUnit2	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

NOTICE

This parameter is only available with software version 48.XX.

Set the master home position in position units which are used by master homing function.

5.17.9 17-9* Position Configuration

Parameter 17-90 Absolute Position Mode

Table 959: Parameter 17-90 Absolute Position Mode

17-90 Absolute Position Mode		
Default value: [0] Standard	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

NOTICE

This parameter is only available with software version 48.XX.

Select the behavior when executing consecutive absolute positioning commands.

Option	Name	Description
[0]*	Standard	When the drive receives a new absolute positioning command while the previous command is still in progress, it executes the new positioning command immediately without completing the previous positioning.
[1]	Buffered	When the drive receives a new absolute positioning command while the previous positioning command is still in progress, it completes the previous command and then executes the new positioning command. Only 1 positioning command can be buffered at a time.

Parameter 17-91 Relative Position Mode

Table 960: Parameter 17-91 Relative Position Mode

17-91 Relative Position Mode		
Default value: [0] Target position	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

NOTICE

This parameter is only available with software version 48.XX.

Select which reference to use for relative positioning commands.

Option	Name	Description
[0]*	Target position	The drive uses the latest target position as reference for the new positioning command. The drive executes the new positioning command immediately without completing the previous positioning. The new target is calculated with the formula: New target = previous target + position reference.
[1]	Buffered target pos.	The drive uses the latest target position as reference for the new positioning command. The drive executes the new positioning command when it completes the previous command. Only 1 positioning command can be buffered at a time.
[2]	Commanded position	The drive uses the commanded position as reference for the new positioning command. The drive executes the new positioning command immediately without completing the previous positioning. The new target is calculated with the formula: New target = commanded position + position reference.
[3]	Actual position	The drive uses the actual position as reference for the new positioning command. The drive executes the new positioning command immediately without completing the previous positioning. The new target is calculated with the formula: New target = actual position + position reference.

Parameter 17-92 Position Control Selection

Table 961: Parameter 17-92 Position Control Selection

17-92 Position Control Selection		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

NOTICE

This parameter is only available with software version 48.XX.

This parameter allows to select the position control mode without using a digital input signal or a fieldbus bit.

Option	Name	Description
[0]*	No operation	Use a digital input signal or a fieldbus bit to activate the enable-reference mode and the relative position mode.
[1]	Relative position	This option selects the relative position mode permanently. All positioning commands are considered to be relative. Toggling option *[113] Enable Reference* on a digital input or the enable reference fieldbus bit triggers relative positioning.
[2]	Enable reference	This option selects the enable-reference mode permanently. Any new position reference triggers an absolute positioning command with the selected position reference as target. This option cannot be used with relative positioning.

Parameter 17-93 Master Offset Selection

Table 962: Parameter 17-93 Master Offset Selection

17-93 Master Offset Selection		
Default value: [0] Absolute enabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

NOTICE

This parameter is only available with software version 48.XX.

Select the behavior of the master offset in synchronization mode.

Option	Name	Description
[0]*	Absolute enabled	The drive adds the master offset (*parameter 3-26 Master Offset*) to the position at synchronization start. The offset command is executed at every new synchronization start.
[1]	Absolute	The drive adds the master offset (*parameter 3-26 Master Offset*) to the position at synchronization start. The offset command is executed with every enable master offset signal.
[2]	Relative	The drive adds the master offset (*parameter 3-26 Master Offset*) to the actual synchronization position with every enable master offset signal.
[3]	Selection	The master offset (*parameter 3-26 Master Offset*) is relative or absolute depending on the relative position signal on a digital input or the fieldbus bit.
[4]	Relative home sensor	The master offset (*parameter 3-26 Master Offset*) is relative to the home sensor signal. The offset command is executed with the next home sensor signal when the enable master offset signal is active.
[5]	Relative touch sensor	The master offset (*parameter 3-26 Master Offset*) is relative to the touch sensor signal. The offset command is executed with the next touch sensor signal when the enable master offset signal is active.

Parameter 17-94 Rotary Absolute Direction

Table 963: Parameter 17-94 Rotary Absolute Direction

17-94 Rotary Absolute Direction		
Default value: [0] Shortest	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

NOTICE

This parameter is only available with software version 48.XX.

Select the rotation direction for the absolute position mode when *parameter 17-76 Position Axis Mode* is set to *[1] Rotary Axis*. To use this parameter, set *parameter 4-10 Motor Speed Direction* to *[2] Both directions*.

Option	Name	Description
[0]*	Shortest	The drive selects the rotation direction that provides the shortest route to the target position.
[1]	Forward	Move to the target position in the forward direction.
[2]	Reverse	Move to the target position in the reverse direction.
[3]	Direction	The forward/reverse signal on a digital input or fieldbus determines the rotation direction.

Parameter 17-95 Offset Execution Distance

Table 964: Parameter 17-95 Offset Execution Distance

17-95 Offset Execution Distance		
Default value: 0	Parameter type: Range, 0 - 2147483647 [pu]	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

NOTICE

This parameter is only available with software version 48.9X.

With the dynamic offset feature, it is possible to distribute execution of relative master offset and marker correction while synchronizing over a specific distance instead of using Ramp 1 (*parameter group 3-4* Ramp 1*) and *parameter 3-28 Master Offset Speed Ref*. With this feature, an offset execution profile is calculated based on:

- Offset execution distance
- *Parameter 4-24 Max Speed*
- Actual master speed
- *Parameter 7-99 Min Ramp Time*

The offset execution distance can be related to the distance traveled by the master or the follower, selected in *parameter 17-96 Execution Distance Relation*. The execution distance relation is automatically extended if required due to speed/ramp limitation. This situation can be signaled in the fieldbus status word by selecting *[22] Execution distance extended* in *parameter 8-13 Configurable Status Word STW*.

Parameter 17-96 Execution Distance Relation

Table 965: Parameter 17-96 Execution Distance Relation

17-96 Execution Distance Relation		
Default value: [0] Master related	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

N O T I C E

This parameter is only available with software version 48.9X.

Select whether the value set in *parameter 17-95 Offset Execution Distance* is related to the distance traveled by the master or by the follower.

Option	Name	Description
[0]*	Master related	Offset execution is distributed over the offset execution distance traveled by the master.
[1]	Follower related	Offset execution is distributed over the offset execution distance traveled by the follower.

5.18 Parameter Group 18-** Data Readouts 2

5.18.1 18-0* Maintenance Log

N O T I C E

The following parameters are only available in FC 302:

- *Parameter 18-00 Maintenance Log: Item*
- *Parameter 18-01 Maintenance Log: Action*
- *Parameter 18-02 Maintenance Log: Time*
- *Parameter 18-03 Maintenance Log: Date and Time*

This group contains the last 10 preventive maintenance events. Maintenance log 0 is the latest and maintenance log 9 is the oldest. By selecting 1 of the logs and pressing [OK], the maintenance item, action, and time of the occurrence are shown in *parameter 18-00 Maintenance Log: Item – parameter 18-03 Maintenance Log: Date and Time*.

The alarm log key allows access to both alarm log and maintenance log.

Parameter 18-00 Maintenance Log: Item

Table 966: Parameter 18-00 Maintenance Log: Item

18-00 Maintenance Log: Item		
Default value: 0	Parameter type: Range, 0 - 255, Array [10]	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

Shows the fault code. See the different maintenance items in *parameter 23-10 Maintenance Item*.

Parameter 18-01 Maintenance Log: Action

Table 967: Parameter 18-01 Maintenance Log: Action

18-01 Maintenance Log: Action		
Default value: 0	Parameter type: Range, 0 - 255, Array [10]	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

Shows the fault code. See the different maintenance actions in *parameter 23-11 Maintenance Action*.

Parameter 18-02 Maintenance Log: Time

Table 968: Parameter 18-02 Maintenance Log: Time

18-02 Maintenance Log: Time		
Default value: 0 s	Parameter type: Range, 0 - 2147483647 s, Array [10]	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Shows when the logged event occurred. Time is measured in s since last power-up.

Parameter 18-03 Maintenance Log: Date and Time

Table 969: Parameter 18-03 Maintenance Log: Date and Time

18-03 Maintenance Log: Date and Time		
Default value: Size related	Parameter type: Range, 0 - 0, Array [10]	Setup: All setups
Conversion index: 0	Data type: TimeOfDay	Change during operation: False

Shows when the logged event occurred.

N O T I C E

This requires that the date and time is programmed in *parameter 0-70 Date and Time*.

Date format depends on the setting in *parameter 0-71 Date Format*, while the time format depends on the setting in *parameter 0-72 Time Format*.

N O T I C E

The drive has no back-up of the clock function. The set date/time resets to default (2000-01-01 00:00) after a power-down unless a real-time clock module with back-up is installed. In *parameter 0-79 Clock Fault*, it is possible to program a warning in case the clock has not been set properly, for example after a power-down. Incorrect setting of the clock affects the time stamps for the maintenance events.

N O T I C E

When mounting a VLT® Analog I/O MCB 109 option card, a battery back-up of date and time is included.

Parameter 18-04 Mech Brake Count

Table 970: Parameter 18-04 Mech Brake Count

18-04 Mech Brake Count		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Number of occurrences the mechanical brake is engaged.

5.18.2 18-1* Emergency Mode Log

The emergency log covers operation of emergency mode with start and stop activities and if critical alarms are suppressed during emergency mode. The log contains the 10 latest activations of emergency mode or the alarm number of the critical alarm that was suppressed as this affects the warranty of the drive. Suppressed alarm numbers are stored and can only be reset by a Danfoss service inspection.

Parameter 18-10 Emergency Mode Log: Event

Table 971: Parameter 18-10 Emergency Mode Log: Event

18-10 Emergency Mode Log: Event		
Default value: 0	Parameter type: Range, 0 - 255, Array [10]	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

This parameter contains an array with 10 elements. The number read represents a fault code, which corresponds to a specific alarm. Refer to 7.1.2 Alarm/Warning Code List.

Parameter 18-11 Emergency Mode Log: Time

Table 972: Parameter 18-11 Emergency Mode Log: Time

18-11 Emergency Mode Log: Time		
Default value: 0 s	Parameter type: Range, 0 - 2147483647 s, Array [10]	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

This parameter shows at which time the logged event occurred. Time is measured in seconds since the drive was started.

Parameter 18-12 Emergency Mode Log: Date and Time

Table 973: Parameter 18-12 Emergency Mode Log: Date and Time

18-12 Emergency Mode Log: Date and Time		
Default value: Size related	Parameter type: Range, Size related, Array [10]	Setup: All setups
Conversion index: 0	Data type: TimeOfDay	Change during operation: False

This parameter shows at which date and time the logged event occurred. The date and time rely on the internal clock in *parameter group 0-7* Clock Settings*.

5.18.3 18-1* Parameter Log

Parameter 18-13 Parameter Number

Table 974: Parameter 18-13 Parameter Number

18-13 Parameter Number		
Default value: 0 N/A	Parameter type: Range, 0 - 0xFFFF N/A, Array [10]	4-setup: All set-ups
Conversion index: 0	Data type: Uint16	Change during operation: False

Shows the parameter which is most recently changed. Index 0 shows the latest change in the parameter.

Parameter 18-14 Parameter Index

Table 975: Parameter 18-14 Parameter Index

18-14 Parameter Index		
Default value: 0 N/A	Parameter type: Range, 0 - 0xFFFF N/A, Array [10]	4-setup: All set-ups
Conversion index: -	Data type: Uint16	Change during operation: False

This parameter shows the index of the parameter which was changed.

Parameter 18-15 Change Time

Table 976: Parameter 18-15 Change Time

18-15 Change Time		
Default value: Size related	Parameter type: Range, 0 - 0, Array [10]	4-setup: All set-ups
Conversion index: 0	Data type: TimeOfDay	Change during operation: False

Shows the date and time stamp when a parameter was most recently changed. It is recommended to set the time and date in the drive to ensure the right time is logged.

Parameter 18-16 Operating Hours

Table 977: Parameter 18-16 Operating Hours

18-16 Operating Hours		
Default value: 0	Parameter type: Range, 0 - 2147483647, Array [10]	4-setup: All set-ups
Conversion index: 0	Data type: Uint32	Change during operation: False

Shows operating hours of the drive at the instance when the parameter was changed.

Parameter 18-17 Running Hours

Table 978: Parameter 18-17 Running Hours

18-17 Running Hours		
Default value: 0	Parameter type: Range, 0 - 2147483647, Array [10]	4-setup: All set-ups
Conversion index: 0	Data type: Uint32	Change during operation: False

Shows running hours of the motor when the parameter is changed.

Parameter 18-18 Value Before Change as Integer

Table 979: Parameter 18-18 Value before change as Integer

18-18 Value before change as Integer		
Default value: 0	Parameter type: Range, -2147483648 - 2147483647, Array [10]	4-setup: All set-ups
Conversion index: 0	Data type: Int32	Change during operation: False

Shows the previous value of the parameter as integer, without scaling or unit conversion. The parameter only shows integer data.

Parameter 18-19 Value Before Change

Table 980: Parameter 18-19 Value Before Change

18-19 Value Before Change		
Default value: Size related	Parameter type: Range, 0-30, Array [10]	4-setup: All set-ups
Conversion index: 0	Data type: VisStr[30]	Change during operation: False

Shows the previous value of the parameter with units. Only applicable for integer values.

5.18.4 18-2* Motor Readouts

This parameter group contains more references and feedback readouts including Safe Option speeds.

Parameter 18-20 Commanded Position

Table 981: Parameter 18-20 Commanded Position

18-20 Commanded Position		
Default value: 0 Custom- ReadoutUnit2	Parameter type: Range, -2147483648 - 2147483647 CustomReadoutUnit2	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

N O T I C E

This parameter is only available in software version 48.XX.

Shows the position reference for the position PI controller which is calculated every millisecond by the profile generator. Commanded position in position units as defined in *parameter group 17-0* Position Scaling*.

Parameter 18-21 Master Position

Table 982: Parameter 18-21 Master Position

18-21 Master Position		
Default value: 0 Custom- ReadoutUnit2	Parameter type: Range, -2147483648 - 2147483647 CustomReadoutUnit2	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

N O T I C E

This parameter is only available in software version 48.XX.

Shows the actual master position based on the source selected in *parameter 3-16 Reference Resource 2*. Master position is converted to follower position units by the master scale set in *parameter 3-22 Master Scale Numerator* and *parameter 3-23 Master Scale Denominator*.

Parameter 18-23 Virtual Master Pos.

Table 983: Parameter 18-23 Virtual Master Pos.

18-23 Virtual Master Pos.		
Default value: 0 Custom- ReadoutUnit2	Parameter type: Range, -2147483648 - 2147483647 CustomReadoutUnit2	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

N O T I C E

This parameter is only available in software version 48.XX.

Shows the current virtual master position which is calculated by the virtual master profile generator. Virtual master position in position units as defined in *parameter group 17-0* Position Scaling*. Virtual master position is converted to follower position units by the master scale set in *parameter 3-22 Master Scale Numerator* and *parameter 3-23 Master Scale Denominator*.

Parameter 18-24 Marker Pos. Offset

Table 984: Parameter 18-24 Marker Pos. Offset

18-24 Marker Pos. Offset		
Default Value: 0	Parameter Type: Range, -2147483648 - 2147483647 [pu]	Setup: All setups
Conversion Index: 0	Data Type: Int32	Change during operation: True

NOTICE

This parameter is only available in software version 48.8X.

Shows the position difference between master marker and follower marker in position units as defined in *parameter group 17-0* Position Scaling*. The value is calculated by: Marker Pos. Offset = Master marker position – Follower marker position.

Parameter 18-25 Latched Actual Pos.

Table 985: Parameter 18-25 Latched Actual Pos.

18-25 Latched Actual Pos.		
Default value: 0	Parameter type: Range, -2147483648 - 2147483647 [pu]	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

NOTICE

This parameter is only available in software version 48.8X.

Shows the actual position latched by the latest detected sensor, that is home sensor, touch sensor, or follower marker.

Parameter 18-26 Actual Velocity [pu/s]

Table 986: Parameter 18-26 Actual Velocity [pu/s]

18-26 Actual Velocity [pu/s]		
Default value: 0	Parameter type: Range, -2147483648 - 2147483647 [pu]	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

NOTICE

This parameter is only available in software version 48.8X.

Shows the actual speed in position units per second.

Parameter 18-27 Safe Opt. Speed

Table 987: Parameter 18-27 Safe Opt. Speed

18-27 Safe Opt. Speed		
Default value: 0 RPM	Parameter type: Range, -30000 - 30000 RPM	Setup: All setups
Conversion index: 67	Data type: Int32	Change during operation: True

Shows the speed that the drive estimates and sends to the VLT® Safety Option MCB 15X.

Parameter 18-28 Safe Opt. Meas. Speed

Table 988: Parameter 18-28 Safe Opt. Meas. Speed

18-28 Safe Opt. Meas. Speed		
Default value: 0 RPM	Parameter type: Range, -30000 - 30000 RPM	Setup: All setups
Conversion index: 67	Data type: Int32	Change during operation: True

Shows the speed measured by the VLT® Safety Option MCB 15X.

Parameter 18-29 Safe Opt. Speed Error

Table 989: Parameter 18-29 Safe Opt. Speed Error

18-29 Safe Opt. Speed Error		
Default value: 0 RPM	Parameter type: Range, -30000 - 30000 RPM	Setup: All setups
Conversion index: 67	Data type: Int32	Change during operation: True

Shows the difference between the speed measured by the VLT® Safety Option MCB 15X and the speed estimated by the drive.

5.18.5 18-3* Analog Input

Parameters in this group show data related to analog inputs.

Parameter 18-36 Analog Input X48/2 [mA]

Table 990: Parameter 18-36 Analog Input X48/2 [mA]

18-36 Analog Input X48/2 [mA]		
Default value: 0	Parameter type: Range, -20 - 20	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

View the actual current measured at input X48/2.

Parameter 18-37 Temp. Input X48/4

Table 991: Parameter 18-37 Temp. Input X48/4

18-37 Temp. Input X48/4		
Default value: 0	Parameter type: Range, -500 - 500	Setup: All set-ups
Conversion index: 0	Data type: Int16	Change during operation: True

View the actual temperature measured at input X48/4. The temperature unit is based on the selection in *parameter 35-00 Term. X48/4 Temperature Unit*.

Parameter 18-38 Temp. Input X48/7

Table 992: Parameter 18-38 Temp. Input X48/7

18-38 Temp. Input X48/7		
Default value: 0	Parameter type: Range, -500 - 500	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

View the actual temperature measured at input X48/7. The temperature unit is based on the selection in *parameter 35-02 Term. X48/7 Temperature Unit*.

Parameter 18-39 Temp. Input X48/10

Table 993: Parameter 18-39 Temp. Input X48/10

18-39 Temp. Input X48/10		
Default value: 0	Parameter type: Range, -500 - 500	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

View the actual temperature measured at input X48/10. The temperature unit is based on the selection in *parameter 35-04 Term. X48/10 Temperature Unit*.

5.18.6 18-4* PGIO Data Readouts

N O T I C E

The following parameters are only available in FC 302

- *Parameter 18-40 Analog Input X49/1*
- *Parameter 18-41 Analog Input X49/3*
- *Parameter 18-42 Analog Input X49/5*
- *Parameter 18-46 X49 Digital Output [bin]*

Parameters for configuring the readout of VLT® Programmable I/O MCB 115.

Parameter 18-40 Analog Input X49/1

Table 994: Parameter 18-40 Analog Input X49/1

18-40 Analog Input X49/1		
Default value: 0	Parameter type: Range, -20 - 20	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

View the actual value at input X49/1 either as a voltage, current or a temperature value.

Parameter 18-41 Analog Input X49/3

Table 995: Parameter 18-41 Analog Input X49/3

18-41 Analog Input X49/3		
Default value: 0	Parameter type: Range, -20 - 20	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

View the actual value at input X49/3 either as a voltage, current, or a temperature value.

Parameter 18-43 Analog Input X49/7

Table 996: Parameter 18-43 Analog Input X49/7

18-43 Analog Input X49/7		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: False

Shows the actual value at output of terminal X49/7 in V or mA. The value reflects the selection in *parameter 36-40 Terminal X49/7 Analog Output*.

Parameter 18-44 Analog Input X49/9

Table 997: Parameter 18-44 Analog Input X49/9

18-44 Analog Input X49/9		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: False

Shows the actual value at output of terminal X49/9 in V or mA. The value reflects the selection in *parameter 36-50 Terminal X49/9 Analog Output*.

Parameter 18-45 Analog Input X49/11

Table 998: Parameter 18-45 Analog Input X49/11

18-45 Analog Input X49/11		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: False

Shows the actual value at output of terminal X49/11 in V or mA. The value reflects the selection in *parameter 36-60 Terminal X49/11 Analog Output*.

Parameter 18-46 X49 Digital Output [bin]

Table 999: Parameter 18-46 X49 Digital Output [bin]

18-46 X49 Digital Output [bin]		
Default value: 0	Parameter type: Range, 0 - 15	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: False

Shows the binary value of all programmable I/O digital outputs.

5.18.7 18-5* Active Alarms/Warnings

The parameters in this group show the numbers of currently active alarms or warnings.

Parameter 18-55 Active Alarm Numbers

Table 1000: Parameter 18-55 Active Alarm Numbers

18-55 Active Alarm Numbers		
Default value: 0	Parameter type: Range, 0 - 65535, Array [20]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter contains an array of up to 20 alarms that are currently active. The value 0 means no alarm.

Parameter 18-56 Active Warning Numbers

Table 1001: Parameter 18-56 Active Warning Numbers

18-56 Active Warning Numbers		
Default value: 0	Parameter type: Range, 0 - 65535, Array [20]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter contains an array of up to 20 warnings that are currently active. The value 0 means no warning.

5.18.8 18-6* Inputs & Outputs 2

Parameter 18-60 Digital Input 2

Table 1002: Parameter 18-60 Digital Input 2

18-60 Digital Input 2		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Shows the signal states from the active digital inputs.

- 0 = No signal
- 1 = Connected signal

5.18.9 18-7* Rectifier Status

N O T I C E
This parameter group is only available in FC 302.

Parameter 18-70 Mains Voltage

Table 1003: Parameter 18-70 Mains Voltage

18-70 Mains Voltage		
Default value: 0 V	Parameter type: Range, 0 - 1000 V	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the mains line-to-line voltage.

Parameter 18-71 Mains Frequency

Table 1004: Parameter 18-71 Mains Frequency

18-71 Mains Frequency		
Default value: 0 Hz	Parameter type: Range, -100 - 100 Hz	Setup: All setups
Conversion index: -1	Data type: Int16	Change during operation: True

Shows the mains frequency.

Parameter 18-72 Mains Imbalance

Table 1005: Parameter 18-72 Mains Imbalance

18-72 Mains Imbalance		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Shows the maximum imbalance for the 3 mains line-to-line measurements.

Parameter 18-73 Worst Inrush

Table 1006: Parameter 18-73 Worst Inrush

18-73 Worst Inrush		
Default value: 0	Parameter type: Range, 0 - 10000	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter identifies which active inrush produces the data shown in *parameter 18-70 Mains Voltage*, *parameter 18-71 Mains Frequency*, *parameter 18-72 Mains Imbalance*, and *parameter 18-75 Rectifier DC Volt*. 1 = inrush 1, 2 = inrush 2, and so on.

Parameter 18-74 Inrush Mode

Table 1007: Parameter 18-74 Inrush Mode

18-74 Inrush Mode		
Default value: 0	Parameter type: Range, 0 - 1000, Array [4]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter shows the reported mode of each inrush board. The values are:

- 0 = unknown
- 1 = inrush
- 2 = running

The indices are as follows:

- 0 = inrush1
- 1 = inrush2
- 2 = inrush3
- 3 = inrush4

Parameter 18-75 Rectifier DC Volt

Table 1008: Parameter 18-75 Rectifier DC Volt

18-75 Rectifier DC Volt		
Default value: 0 V	Parameter type: Range, 0 - 10000 V	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the DC voltage measured on the rectifier module.

Parameter 18-76 Mains Voltage 2

Table 1009: Parameter 18-76 Mains Voltage 2

18-76 Mains Voltage 2		
Default value: 0 V	Parameter type: Range, 0 - 1000 V, Array [16]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

View the mains line-to-line measurements. The values are RMS. The indices are as follows:

- 0 = inrush1 average
- 1 = inrush2 average
- 4 = inrush1 L1
- 5 = inrush2 L1
- 8 = inrush1 L2
- 9 = inrush2 L2
- = inrush1 L3
- = inrush2 L3

Parameter 18-77 Mains Frequency 2

Table 1010: Parameter 18-77 Mains Frequency 2

18-77 Mains Frequency 2		
Default value: 0 Hz	Parameter type: Range, -100 - 100 Hz, Array [4]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

View the mains frequency measurement. The indices are as follows:

- 0 = inrush1
- 1 = inrush2

Parameter 18-78 Mains Imbalance 2

Table 1011: Parameter 18-78 Mains Imbalance 2

18-78 Mains Imbalance 2		
Default value: 0%	Parameter type: Range, 0 - 100%, Array [4]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

View the maximum measured imbalance for the 3 mains line-to-line measurements. The indices are as follows:

- 0 = inrush1
- 1 = inrush2

Parameter 18-79 Rectifier DC Volt. 2

Table 1012: Parameter 18-79 Rectifier DC Volt. 2

18-79 Rectifier DC Volt. 2		
Default value: 0 V	Parameter type: Range, 0 - 1000 V	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

View the DC voltage measurement from the rectifier module. The indices are as follows:

- 0 = inrush1
- 1 = inrush2
- Parameter 18-89 Mode of Operation Display
- **Table 1013: Parameter 18-89 Mode of Operation Display**

18-89 Mode of Operation Display		
Default value: [0] No mode change	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

N O T I C E

This parameter is only available with software version 48.XX.

Shows the active mode of operation which is selected in *parameter 1-09 Mode of Operation*.

Option	Name	Description
[0]*	No mode change	
[1]	Profile position mode	
[2]	Velocity mode (vl)	

Option	Name	Description
[6]	Homing mode	
[8]	Cyclic sync position mode	
[9]	Cyclic sync velocity mode	
[249]	Gear mode	
[250]	Cam mode	

5.18.10 18-9* PID Readouts

Parameter 18-90 Process PID Error

Table 1014: Parameter 18-90 Process PID Error

18-90 Process PID Error		
Default value: 0%	Parameter type: Range, -200 - 200%	Setup: All setups
Conversion index: -1	Data type: Int16	Change during operation: False

Gives the present error value used by the process PID controller.

Parameter 18-91 Process PID Output

Table 1015: Parameter 18-91 Process PID Output

18-91 Process PID Output		
Default value: 0%	Parameter type: Range, -200 - 200%	Setup: All setups
Conversion index: -1	Data type: Int16	Change during operation: False

Gives the present raw output value from the process PID controller.

Parameter 18-92 Process PID Clamped Output

Table 1016: Parameter 18-92 Process PID Clamped Output

18-92 Process PID Clamped Output		
Default value: 0%	Parameter type: Range, -200 - 200%	Setup: All setups
Conversion index: -1	Data type: Int16	Change during operation: False

Gives the present output value from the process PID controller after the clamp limits have been observed.

Parameter 18-93 Process PID Gain Scaled Output

Table 1017: Parameter 18-93 Process PID Gain Scaled Output

18-93 Process PID Gain Scaled Output		
Default value: 0%	Parameter type: Range, -200 - 200%	Setup: All setups
Conversion index: -1	Data type: Int16	Change during operation: False

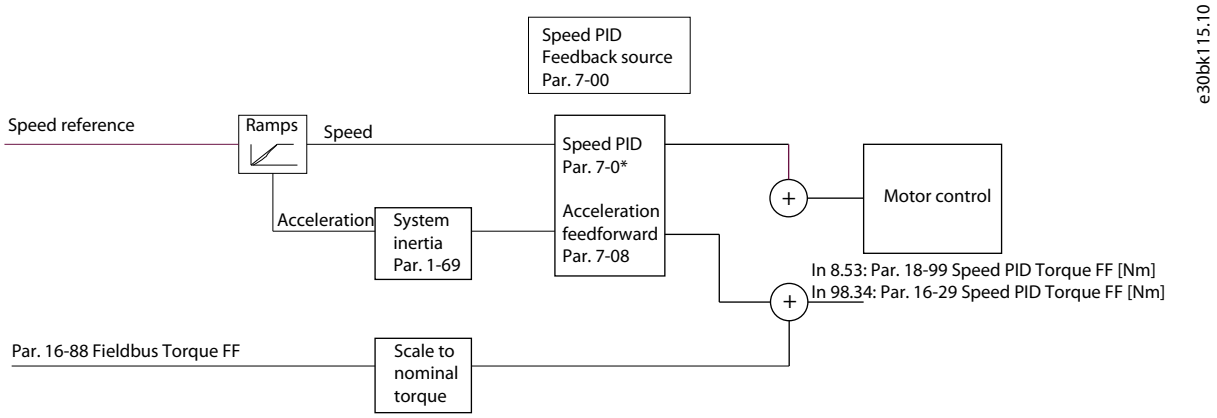
Gives the present output value from the process PID controller after the clamp limits have been observed, and the resulting value has been gain scaled.

Parameter 18-99 Speed Torque FF. [Nm]

Table 1018: Parameter 18-99 Speed Torque FF. [Nm]

18-99 Speed Torque FF. [Nm]		
Default value: 0 Nm	Parameter type: Range, -200000000 - 200000000 Nm	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Readout of the total command torque feed forward [Nm]. The parameter shows the sum of *parameter 16-88 Fieldbus Torque FF* and *parameter 1-69 Maximum Inertia* x *parameter 7-08 Speed PID Feed Forward Factor*.



5.19 Parameter Group 19-** Application Parameters

Parameters in this group are available when VLT® Motion Control Option MCO 305 is installed in the drive. For more information about the option, see the VLT® Motion Control Option MCO 305 Operating Instructions.

5.20 Parameter Group 22-** Appl. Functions

Parameter group for application monitoring functions.

5.20.1 22-0* Miscellaneous

Parameter 22-00 External Interlock Delay

Table 1019: Parameter 22-00 External Interlock Delay

22-00 External Interlock Delay		
Default value: 0 s	Parameter type: Range, 0 - 600 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Set the delay time for the external interlock command.

Parameter 22-03 Start Command Delay

Table 1020: Parameter 22-03 Start Command Delay

22-03 Start Command Delay		
Default value: 0 ms	Parameter type: Range, 0 -100 ms	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter is suited for lift applications and can be set to suppress contact bounce or delay the start command. Start will only be activated when the signal has been stable for the time set in this parameter. The function is active on digital input, FC port, and fieldbus options.

5.21 Parameter Group 23-** Time-based Functions

5.21.1 23-0* Timed Actions

N O T I C E

This parameter group is only available in FC 302.

Use timed actions for actions performed on a daily or weekly basis, for example different references for working hours/non-working hours. Up to 10 timed actions can be programmed in the drive. Select the timed action number from the list when entering *parameter group 23-** Time-based Functions* from the LCP. *Parameter 23-00 ON Time* and *parameter 23-04 Occurrence* then refer to the selected timed action number. Each timed action is divided into an ON time and an OFF time, in which 2 different actions may be performed.

Display lines 2 and 3 in the LCP show the status for timed actions mode (*parameter 0-23 Display Line 2 Large* and *parameter 0-24 Display Line 3 Large*, setting *[1643] Timed Actions Status*).

N O T I C E

A change in mode via the digital inputs can only take place if *parameter 23-08 Timed Actions Mode* is set to *[0] Times Actions Auto*. If commands are applied simultaneously to the digital inputs for constant OFF and constant ON, the timed actions mode changes to timed actions auto and the 2 commands are disregarded. If *parameter 0-70 Date and Time* is not set or the drive is set to hand-on mode or OFF mode (for example via the LCP), the timed actions mode is changed to *[0] Disabled*. The timed actions have a higher priority than the same actions/commands activated by the digital inputs or the smart logic controller.

The actions programmed in timed actions are merged with corresponding actions from digital inputs, control word via bus, and smart logic controller, according to merge rules set up in *parameter group 8-5* Digital/Bus*.

N O T I C E

Program the clock (*parameter group 0-7* Clock Settings*) correctly for timed actions to function.

N O T I C E

The PC-based configuration tool VLT® Motion Control Tool MCT 10 comprises a special guide for easy programming of timed actions.

Parameter 23-00 ON Time

Table 1021: Parameter 23-00 ON Time

23-00 ON Time		
Default value: Size related	Parameter type: Range, 0 - 0, Array [10]	Setup: 2 setups
Conversion index: 0	Data type: TimeOfDayWoDate	Change during operation: True

Sets the ON time for the desired action.

N O T I C E

The drive has no back-up of the clock function. The set date/time resets to default (2000-01-01 00:00) after a power-down unless a real-time clockmodule with back-up is installed. In *parameter 0-79 Clock Fault*, it is possible to program a warning if the clock has not been set properly, for example after a power-down.

Parameter 23-01 ON Action

Table 1022: Parameter 23-01 ON Action

23-01 ON Action		
Default value: [0] Disabled	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

N O T I C E

For options *[32] Set digital out A low–[43] Set digital out F high*, see also *parameter group 5-3* Digital Outputs* and *parameter group 5-4* Relays*.

Select the action during ON time. See *parameter 13-52 SL Controller Action* for descriptions of the options.

Option	Name	Description
[0]*	Disabled	
[1]	No action	
[2]	Select set-up 1	
[3]	Select set-up 2	
[4]	Select set-up 3	
[5]	Select set-up 4	
[10]	Select preset ref 0	
[11]	Select preset ref 1	
[12]	Select preset ref 2	
[13]	Select preset ref 3	
[14]	Select preset ref 4	
[15]	Select preset ref 5	
[16]	Select preset ref 6	
[17]	Select preset ref 7	
[18]	Select ramp 1	
[19]	Select ramp 2	
[20]	Select ramp 3	
[21]	Select ramp 4	
[22]	Run	
[23]	Run reverse	
[24]	Stop	
[25]	Qstop	
[26]	Dcstop	
[27]	Coast	

Option	Name	Description
[32]	Set digital out A low	
[33]	Set digital out B low	
[34]	Set digital out C low	
[35]	Set digital out D low	
[36]	Set digital out E low	
[37]	Set digital out F low	
[38]	Set digital out A high	
[39]	Set digital out B high	
[40]	Set digital out C high	
[41]	Set digital out D high	
[42]	Set digital out E high	
[43]	Set digital out F high	
[60]	Reset counter A	
[61]	Reset counter B	
[62]	Counter A (up)	
[63]	Counter A (down)	
[64]	Counter B (up)	
[65]	Counter B (down)	

Parameter 23-02 OFF Time

Table 1023: Parameter 23-02 OFF Time

23-02 OFF Time		
Default value: Size related	Parameter type: Range, 0 - 0, Array [10]	Setup: 2 setups
Conversion index: 0	Data type: TimeOfDayWoDate	Change during operation: True

Sets the OFF time for the desired action.

N O T I C E

The drive has no back-up of the clock function. The set date/time resets to default (2000-01-01 00:00) after a power-down unless a real-time clockmodule with back-up is installed. In *parameter 0-79 Clock Fault*, it is possible to program a warning if the clock has not been set properly, for example after a power-down.

Parameter 23-03 OFF Action

Table 1024: Parameter 23-03 OFF Action

23-03 OFF Action		
Default value: [1] No action	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the action during OFF time. See *parameter 13-52 SL Controller Action* for descriptions of the options.

Option	Name	Description
[1]*	No action	
[2]	Select set-up 1	
[3]	Select set-up 2	
[4]	Select set-up 3	
[5]	Select set-up 4	
[10]	Select preset ref 0	
[11]	Select preset ref 1	
[12]	Select preset ref 2	
[13]	Select preset ref 3	
[14]	Select preset ref 4	
[15]	Select preset ref 5	
[16]	Select preset ref 6	
[17]	Select preset ref 7	
[18]	Select ramp 1	
[19]	Select ramp 2	
[20]	Select ramp 3	
[21]	Select ramp 4	
[22]	Run	
[23]	Run reverse	
[24]	Stop	
[25]	Qstop	
[26]	Dcstop	
[27]	Coast	
[32]	Set digital out A low	
[33]	Set digital out B low	
[34]	Set digital out C low	
[35]	Set digital out D low	
[36]	Set digital out E low	
[37]	Set digital out F low	
[38]	Set digital out A high	
[39]	Set digital out B high	
[40]	Set digital out C high	

Option	Name	Description
[41]	Set digital out D high	
[42]	Set digital out E high	
[43]	Set digital out F high	
[60]	Reset counter A	
[61]	Reset counter B	
[62]	Counter A (up)	
[63]	Counter A (down)	
[64]	Counter B (up)	
[65]	Counter B (down)	

Parameter 23-04 Occurrence

Table 1025: Parameter 23-04 Occurrence

23-04 Occurrence		
Default value: [0] All days	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select which days the timed action applies to. Specify working/nonworking days in:

- *Parameter 0-81 Working Days.*
- *Parameter 0-82 Additional Working Days.*
- *Parameter 0-83 Additional Non-Working Days.*

Option	Name	Description
[0]*	All days	
[1]	Working days	
[2]	Non-working days	
[3]	Monday	
[4]	Tuesday	
[5]	Wednesday	
[6]	Thursday	
[7]	Friday	
[8]	Saturday	
[9]	Sunday	
[10]	Day 1 of month	
[11]	Day 2 of month	
[12]	Day 3 of month	
[13]	Day 4 of month	

Option	Name	Description
[14]	Day 5 of month	
[15]	Day 6 of month	
[16]	Day 7 of month	
[17]	Day 8 of month	
[18]	Day 9 of month	
[19]	Day 10 of month	
[20]	Day 11 of month	
[21]	Day 12 of month	
[22]	Day 13 of month	
[23]	Day 14 of month	
[24]	Day 15 of month	
[25]	Day 16 of month	
[26]	Day 17 of month	
[27]	Day 18 of month	
[28]	Day 19 of month	
[29]	Day 20 of month	
[30]	Day 21 of month	
[31]	Day 22 of month	
[32]	Day 23 of month	
[33]	Day 24 of month	
[34]	Day 25 of month	
[35]	Day 26 of month	
[36]	Day 27 of month	
[37]	Day 28 of month	
[38]	Day 29 of month	
[39]	Day 30 of month	
[40]	Day 31 of month	

Parameter 23-08 Timed Actions Mode

Table 1026: Parameter 23-08 Timed Actions Mode

23-08 Timed Actions Mode		
Default value: [0] Timed actions auto	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Enable and disable automatic timed actions.

Option	Name	Description
[0]*	Timed actions auto	Enable timed actions.
[1]	Timed actions disabled	Disable timed actions, normal operation according to control commands.
[2]	Constant on actions	Disable timed actions. Constant on actions are activated.
[3]	Constant off actions	Disable timed actions. Constant off actions are activated.

Parameter 23-09 Timed Actions Reactivation

Table 1027: Parameter 23-09 Timed Actions Reactivation

23-09 Timed Actions Reactivation		
Default value: [1] Enabled	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	Disabled	After an update of: • power cycling • setting date • time • change of summertime • change of Hand Auto mode • change of Constant On and Off • setup change where all activated ON actions are overridden to OFF actions until passing the next time for an ON action. Any OFF actions remain unchanged.
[1]*	Enabled	After an update of time/condition On and OFF actions are immediately set to the actual time programming of ON and OFF actions.

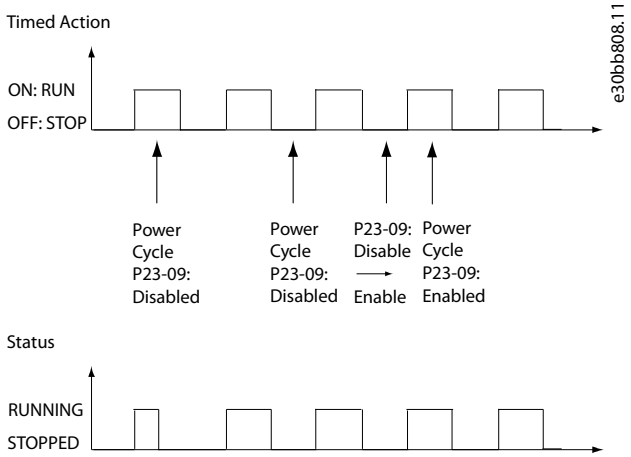


Illustration 94: Example of Reactivation Test

5.21.2 23-1* Maintenance

Wear and tear calls for periodic inspection and service of elements in the application, for example motor bearings, feedback sensors, seals, and filters. With preventive maintenance, the service intervals may be programmed into the drive. The drive gives a message when maintenance is required. 20 preventive maintenance events can be programmed into the drive.

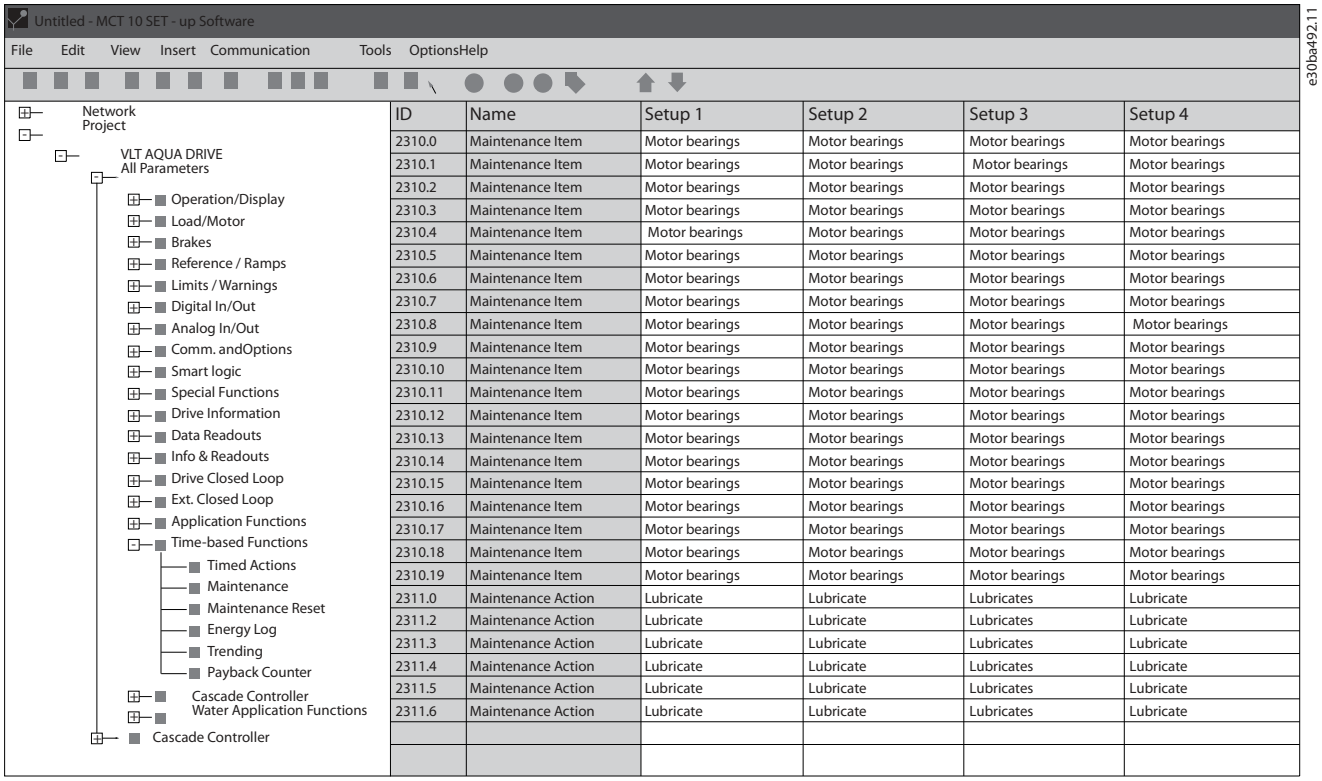
Specify the following for each event:

- Maintenance item (for example, motor bearings).
- Maintenance action (for example, replacement).
- Maintenance time base (for example, running hours, or a specific date and time).
- Maintenance time interval or the date and time of next maintenance.

N O T I C E

To disable a preventive maintenance event, set the associated *parameter 23-12 Maintenance Base* to *[0] Disabled*.

Preventive maintenance can be programmed from the LCP, but use of the PC-based VLT® Motion Control Tool MCT 10 is recommended.



ID	Name	Setup 1	Setup 2	Setup 3	Setup 4
2310.0	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.1	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.2	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.3	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.4	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.5	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.6	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.7	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.8	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.9	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.10	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.11	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.12	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.13	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.14	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.15	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.16	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.17	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.18	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.19	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2311.0	Maintenance Action	Lubricate	Lubricate	Lubricates	Lubricate
2311.2	Maintenance Action	Lubricate	Lubricate	Lubricates	Lubricate
2311.3	Maintenance Action	Lubricate	Lubricate	Lubricates	Lubricate
2311.4	Maintenance Action	Lubricate	Lubricate	Lubricates	Lubricate
2311.5	Maintenance Action	Lubricate	Lubricate	Lubricates	Lubricate
2311.6	Maintenance Action	Lubricate	Lubricate	Lubricates	Lubricate

Illustration 95: Maintenance Menu, MCT 10

The LCP indicates (with a wrench icon and letter M) when it is time for a preventive maintenance action and can be programmed to be indicated on a digital output in *parameter group 5-3* Digital Outputs*. The preventive maintenance status is shown in *parameter 16-96 Maintenance Word*. A preventive maintenance indication can be reset from a digital input, the FC bus, or manually from the LCP through *parameter 23-15 Reset Maintenance Word*.

N O T I C E

The preventive maintenance events are defined in a 20-element array. Hence, each preventive maintenance event must use the same array element index in *parameter 23-10 Maintenance Item* to *parameter 23-14 Maintenance Date and Time*.

Parameter 23-10 Maintenance Item

Table 1028: Parameter 23-10 Maintenance Item

23-10 Maintenance Item		
Default value: [1] Motor Bearings	Parameter type: Option, Array [6]	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

Array with 20 elements shown below the parameter number in the display. Press [OK] and step between elements with [◁], [▷], [△], and [▽]. Select the item to be associated with the preventive maintenance event.

Option	Name	Description
[1]*	Motor bearings	
[11]	Drive cooling fan	
[12]	System health check	
[13]	Warranty	
[14]	Mech brake	
[20]	Maintenance text 0	
[21]	Maintenance text 1	
[22]	Maintenance text 2	
[23]	Maintenance text 3	
[24]	Maintenance text 4	
[25]	Maintenance text 5	
[26]	Service log full	

Parameter 23-11 Maintenance Action

Table 1029: Parameter 23-11 Maintenance Action

23-11 Maintenance Action		
Default value: [1] Lubricate	Parameter type: Option, Array [6]	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

Select the action to be associated with the preventive maintenance event.

Option	Name	Description
[1]*	Lubricate	
[2]	Clean	
[3]	Replace	
[4]	Inspect/check	
[5]	Overhaul	
[6]	Renew	
[7]	Check	
[20]	Maintenance text 0	
[21]	Maintenance text 1	
[22]	Maintenance text 2	
[23]	Maintenance text 3	

Option	Name	Description
[24]	Maintenance text 4	
[25]	Maintenance text 5	
[28]	Clear logs	

Parameter 23-12 Maintenance Base

Table 1030: Parameter 23-12 Maintenance Base

23-12 Maintenance Base		
Default value: Size related	Parameter type: Option, Array [6]	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

Select the time base to be associated with the preventive maintenance event.

Option	Name	Description
[0]	Disabled	Disables the preventive maintenance event.
[1]	Running hours	The number of hours the motor has run. Running hours are not reset at power-on. Specify the maintenance time interval in *parameter 23-13 Maintenance Interval*.
[2]	Operating hours	The number of hours the drive has run. Operating hours are not reset at power-on. Specify the maintenance time interval in *parameter 23-13 Maintenance Interval*.
[3]	Date & time	Uses the internal clock. Specify the date and time of the next maintenance occurrence in *parameter 23-14 Maintenance Date and Time*.
[4]	No of counts	

Parameter 23-13 Maintenance Interval

Table 1031: Parameter 23-13 Maintenance Interval

23-13 Maintenance Interval		
Default value: 1	Parameter type: Range, 1 - 2147483647, Array [6]	Setup: 1 setup
Conversion index: 0	Data type: Uint32	Change during operation: True

Set the interval associated with the current preventive maintenance event. This parameter is only used if *[1] Running Hours* or *[2] Operating Hours* is selected in *parameter 23-12 Maintenance Base*. The timer is reset in *parameter 23-15 Reset Maintenance Word*.

Example

A preventive maintenance event is set up Monday at 8:00. *Parameter 23-12 Maintenance Base* is *[2] Operating hours* and *parameter 23-13 Maintenance Interval* is 7 x 24 hours=168 hours. Next maintenance event is indicated the following Monday at 8:00. If this maintenance event is not reset until Tuesday at 9:00, the next occurrence is the following Tuesday at 9:00.

Parameter 23-14 Maintenance Data and Time

Table 1032: Parameter 23-14 Maintenance Data and Time

23-14 Maintenance Data and Time		
Default value: Size related	Parameter type: Range, 0 - 0, Array [6]	Setup: 1 setup
Conversion index: 0	Data type: TimeOfDay	Change during operation: True

Set the date and time for the next maintenance occurrence if the preventive maintenance event is based on date/time. Date format depends on the setting in *parameter 0-71 Date Format* while the time format depends on the setting in *parameter 0-72 Time Format*.

N O T I C E

The drive has no back-up of the clock function. The set date/time is reset to default (2000-01-01 00:00) after a power-down. In *parameter 0-79 Clock Fault*, it is possible to program a warning if the clock has not been set properly, for example after a power-down. Set the time at least 1 hour later than actual time.

N O T I C E

When mounting a VLT® Analog I/O option MCB 109 option card, a battery back-up of the date and time is included.

Parameter 23-15 Reset Maintenance Word

Table 1033: Parameter 23-15 Reset Maintenance Word

23-15 Reset Maintenance Word		
Default value: [0] Do not reset	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

N O T I C E

When messages are reset, maintenance item, action, and maintenance date/time are not canceled. *Parameter 23-12 Maintenance Time Base* is set to *[0] Disabled*.

Set this parameter to *[1] Do reset* to reset the maintenance word in *parameter 16-96 Maintenance Word* and reset the message shown in the LCP. This parameter changes back to *[0] Do not reset* when pressing [OK].

Option	Name	Description
[0]*	Do not reset	
[1]	Do reset	

Parameter 23-16 Maintenance Text

Table 1034: Parameter 23-16 Maintenance Text

23-16 Maintenance Text		
Default value: 0	Parameter type: Range, 0 - 20, Array [6]	Setup: 1 setup
Conversion index: 0	Data type: VisStr[20]	Change during operation: True

6 individual texts (Maintenance Text 0...Maintenance Text 5) can be written for use in either *parameter 23-10 Maintenance Item* or *parameter 23-11 Maintenance Action*. The text is written according to the guidelines in *parameter 0-37 Display Text 1*.

Parameter 23-18 Reset Mechanical Brake Counter

Table 1035: Parameter 23-18 Reset Mechanical Brake Counter

23-18 Reset Mechanical Brake Counter		
Default value: [0] Do not reset	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Do not reset	Select this option to disable the reset of the mechanical brake counter.
[1]	Do reset	Select this option to enable the reset of the mechanical brake counter. After resetting the mechanical brake counter, the parameter is set to *[0] Do not reset*, which is the default option.

5.22 Parameter Group 24-** Application Functions 2

5.22.1 24-0* Emergency Mode

⚠ C A U T I O N ⚠

The drive is only 1 component of an entire application system. Correct function of emergency mode depends on the correct design and selection of system components. Non-interruption of the drive due to emergency-mode operation could cause overpressure and damage the system and components. The drive itself could be damaged, or may cause damage or fire. Danfoss accepts no responsibility for errors, malfunctions, personal injury, or any damage to the drive itself or the components herein, application systems and components herein, or other property when the drive has been programmed for emergency mode. In no event shall Danfoss be liable to the end user or any other party for any direct or indirect, special, or consequential damage, or loss suffered by such party, which has occurred due to the drive being programmed and operated in emergency mode. Danfoss warranty is only affected or reduced if a critical alarm occurs during emergency-mode operation, and the drive is programmed to continue even though the application system would be damaged eventually.

If critical alarms have been activated during emergency mode operation, the drive informs the user that its performance and expected lifetime may be affected (*W280*), where an inspection of the drive may be needed to secure maximum operation in a new critical situation.

Background

Emergency mode is for use in critical situations where it is imperative for the motor to keep running, regardless of the normal protective functions of the drive. These situations could be ventilation fans in tunnels or stairwells, for instance, where continued operation of fan facilitates safe evacuation of personnel and protection of inventory if a fire occurs. Some selections of the emergency-mode function cause alarms and trip conditions to be disregarded, enabling the motor to run without interruption.

Activation

Emergency mode can be activated via digital input and/or over the fieldbus network. In digital activation, normal or inverse signals levels can be selected as continual fixed signals or as trigger pulse activation to fit the overall fire control system. It can operate in open loop with up to 8 different preset speeds or in closed loop with an external signal reference and feedback source. See *parameter group 5-1* Digital Inputs* and *parameter 24-43 Emergency Mode Signal Operation*.

Messages in display

When emergency mode is activated, the display shows a status message *Emergency Mode* and a warning *Emergency Mode*. Once the emergency mode is deactivated, the status messages disappears and the warning is replaced by the warning *Emergency M Was Active*.

Digital and relay outputs can be configured for the status emergency mode messages, see *parameter group 5-3* Digital Outputs* and *parameter group 5-4* Relays*. Emergency mode messages can also be accessed in the warning word via serial communication (see relevant documentation). Access the status messages *Emergency Mode* via the extended status word.

Table 1036: Messages in Display

Messages	Type	LCP	Messages in display	Alarm word 1–3	Warning word 2	Warning word 3	Ext. status word 2
W200 Emergency Mode	Warning	+	+	–	–	+ (bit 7)	+ (bit 25)
W201 Emerg. M Was Active	Warning	+	+	–	+ (bit 3)	–	–
W202 Emerg. M Limits Exceeded	Alarm (log)	+	+	–	–	+ (bit 9)	+ (bit 27)
W280 Emcy M Service Warning	Alarm (log)	+	+	–	–	+ (bit 10)	–
W281 Emcy OPR unexpected	Warning	+	+	–	–	+ (bit 11)	–

Log

To see an overview of the emergency mode-related events, view the emergency mode log, *parameter group 18-1* Emergency Mode Log*, or press [Alarm Log] on the LCP. The log includes up to 10 of the latest events. Warranty-affecting alarms have a higher priority than the other 2 types of events.

The emergency mode alarm log can only be reset by a Danfoss authorized service partner. To secure the emergency mode operation documentation, the 1st critical alarms can never be removed.

The following events are logged:

- W200 - Emergency mode.
- W201 - Emerg. M mode was act. (deactivated).
- W202 - Emerg. M limits exceeded covered by the activated critical alarm number.
- (W280) - Emcy M service warning - service is needed.
- (W281) - Emcy OPR unexpected - emergency mode does not work as expected.

All alarms are logged as usual, and critical emergency mode alarms are logged in the emergency mode log in *parameter group 18-1* Emergency Mode Log*.

NOTICE

During emergency-mode operation, all stop commands to the drive are ignored, including coast/coast inverse and external interlock. The keypad is also locked during emergency mode to prevent user interference during operation of the safety system. However, if Safe Torque Off is available in the drive, this function is still active.

NOTICE

Emergency mode has a special live zero function for handling lost analog signal inputs used for emergency mode setpoint/feedback, for example, for handling a burnt cable. How emergency mode should continue in these live zero situations is configured in *parameter 6-02 Emergency Mode Live Zero Timeout Function*. If live zero is activated, *Emergency mode not working as expected* is activated so that a redundant system can take over or a setup change can be activated. A warning for live zero has a higher priority than the warning *Emergency mode* and will replace that information in the display.

NOTICE

If setting the command *[11] Start Reversing* on a digital input terminal in *parameter 5-10 Terminal 18 Digital Input*, the drive understands this as a reversing command.

Parameter 24-00 Emergency Mode Function

Table 1037: Parameter 24-00 Emergency Mode Function

24-00 Emergency Mode Function		
Default value: [0] Disabled	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

NOTICE

Alarms are produced or ignored in accordance with the selection in *parameter 24-09 Emergency Mode Alarm Handling*.

Option	Name	Description
[0]*	Disabled	The emergency-mode function is not active.
[1]	Enabled-run forward	In this mode, the motor continues to operate in a clockwise direction. Works only in open loop. Set *parameter 24-01 Emergency Mode Configuration* to *[0] Open Loop*.
[2]	Enable-run reverse	In this mode, the motor continues to operate in a counterclockwise direction. Works only in open loop. Set *parameter 24-01 Emergency Mode Configuration* to *[0] Open Loop*.
[3]	Enabled-coast	In this mode, the output is disabled, and the motor is allowed to coast to stop.
[4]	Enable-run Fwd/Rev	
[8]	Alarm suppression	In this mode, the drive continues operation as normal, meaning on standard parameters and control operation, but where the alarms are suppressed as in normal emergency mode. The emcy LCP

Option	Name	Description
		information and status word is updated as the emergency mode operation is logged in the emergency mode log.

Parameter 24-01 Emergency Mode Configuration

Table 1038: Parameter 24-01 Emergency Mode Configuration

24-01 Emergency Mode Configuration		
Default value: [0] Open loop	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

NOTICE

Before adjusting the PID controller, set *parameter 24-09 Emergency Mode Alarm Handling* to *[9] Trip, all alarms/test*.

NOTICE

If *[2] Enable-run reverse* is selected in *parameter 24-00 Emergency Mode Function*, *[3] Closed loop* cannot be selected in *parameter 24-01 Emergency Mode Configuration*.

The emergency mode can be controlled in open loop with up to 8 different preset values (zones), or in closed loop by a reference and feedback signal. The reference and feedback signal can come via drive input signals or over the fieldbus.

Option	Name	Description
[0]*	Speed open loop	When emergency mode is active, the motor runs with a fixed speed based on a reference set. The unit is the same as selected in *parameter 0-02 Motor Speed Unit*.
[1]	Speed closed loop	When emergency mode is active, the built-in PID controller controls the speed based on the setpoint and a feedback signal selected in *parameter 24-07 Emergency Mode Feedback Source*. Select the unit in *parameter 24-02 Emergency Mode Unit*. For PID controller settings, use *parameter group 20-** FC Closed Loop* as for normal operation. The same PID configuration can be selected for both normal and emergency mode, and the operation can be continued as setup 1–4.
[3]	Process	

Parameter 24-02 Emergency Mode Unit

Table 1039: Parameter 24-02 Emergency Mode Unit

24-02 Emergency Mode Unit		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

By default, emergency mode is configured for open-loop control where only the motor unit is selected in *parameter 0-02 Motor Speed Unit*. For closed-loop operation, select any of the following options.

Option	Name	Description
[0]	None	
[1]	%	
[2]	RPM	
[3]	Hz	

Option	Name	Description
[4]	Nm	
[5]	PPM	
[10]	1/min	
[11]	RPM	
[12]	Pulse/s	
[20]	l/s	
[21]	l/min	
[22]	l/h	
[23]	m^3/s	
[24]	m^3/min	
[25]	m^3/h	
[30]	kg/s	
[31]	kg/min	
[32]	kg/h	
[33]	t/min	
[34]	t/h	
[40]	m/s	
[41]	m/min	
[45]	m	
[60]	°C	
[70]	mbar	
[71]	bar	
[72]	Pa	
[73]	kPa	
[74]	m WG	
[80]	kW	
[120]	GPM	
[121]	gal/s	
[122]	gal/min	
[123]	gal/h	
[124]	CFM	
[125]	ft^3/s	

Option	Name	Description
[126]	ft^3/min	
[127]	ft^3/h	
[130]	lb/s	
[131]	lb/min	
[132]	lb/h	
[140]	ft/s	
[141]	ft/min	
[145]	ft	
[150]	lb ft	
[160]	°F	
[170]	psi	
[171]	lb/in^2	
[172]	in WG	
[173]	ft WG	
[176]	kpsi	
[177]	MPa	
[178]	kBar	
[180]	HP	

Parameter 24-03 Emergency Mode Min Reference

Table 1040: Parameter 24-03 Emergency Mode Min Reference

24-03 Emergency Mode Min Reference		
Default value: Size related	Parameter type: Range, -999999.999 - par. 24-04 EmergencyMode-MaxReference	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Minimum value to the reference/setpoint (limiting the sum of values in *parameter 24-05 Emergency Mode Preset Reference* and value of signal on input selected in *parameter 24-06 Emergency Mode Reference Source*). If running in open loop when emergency mode is active, the unit is selected by the setting *parameter 0-02 Motor Speed Unit*. For closed loop, select the unit in *parameter 24-02 Emergency Mode Unit*.

Parameter 24-04 Emergency Mode Max Reference

Table 1041: Parameter 24-04 Emergency Mode Max Reference

24-04 Emergency Mode Max Reference		
Default value: Size related	Parameter type: Range, par. 24-03 - 999999.999 EmergencyMode-MinReference	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

This parameter defines the maximum speed reference which the emergency mode can operate to, although the motor limits in *parameter 4-10 Motor Speed Direction* have the highest priority. This maximum value is also used as reference value for the 8 preset values calculations in %. If running in open loop when emergency mode is active, the unit is selected by setting *parameter 0-02 Motor Speed Unit*. For closed loop, select the unit in *parameter 24-02 Emergency Mode Unit*.

Parameter 24-05 Emergency Mode Preset Reference

Table 1042: Parameter 24-05 Emergency Mode Preset Reference

24-05 Emergency Mode Preset Reference		
Default value: 0%	Parameter type: Range, -100 - 100%, Array [8]	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

A parameter array with 8 elements (0–7). The 8 present values (zones) are for open-loop control. Index [0] is used for basic emergency mode control. Indexes 1–7 are used to enhance emergency mode control, which also overwrites the basic control. More reference value can be added via *parameter group 24-** Application Functions 2*.

Parameter 24-06 Emergency Mode Reference Source

Table 1043: Parameter 24-06 Emergency Mode Reference Source

24-06 Emergency Mode Reference Source		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the external reference input to be used for emergency mode. In open-loop mode, this signal value is added to the preset values in *parameter 24-05 Emergency Mode Preset Reference*. There may be a different units scaling between preset and external values.

Option	Name	Description
[0]*	No function	
[1]	Analog input 53	
[2]	Analog input 54	
[7]	Pulse input 29	**NOTICE** This option is only available in FC 302.
[8]	Pulse input 33	
[11]	Local bus reference	Serial inputs from internal COM interfaces.
[20]	Digital pot.meter	
[21]	Analog input X30/11	
[22]	Analog input X30/12	
[24]	Analog input X42/3	
[25]	Analog input X42/5	
[37]	Analog input X49/1	
[38]	Analog input X49/3	
[39]	Analog input X49/5	
[133]	Fieldbus REF 1	A reference value can also come via selected fieldbus.

Parameter 24-07 Emergency Mode Feedback Source

Table 1044: Parameter 24-07 Emergency Mode Feedback Source

24-07 Emergency Mode Feedback Source		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

In emergency mode closed-loop operation, feedback is requested for the internal PID controller. Select the feedback input to be used for the feedback signal.

Option	Name	Description
[0]*	No function	
[1]	Analog input 53	
[2]	Analog input 54	
[3]	Frequency input 29	**NOTICE** This option is only available in FC 302.
[4]	Frequency input 33	
[7]	Analog input X30/11	
[8]	Analog input X30/12	
[16]	Analog input X49/1	
[17]	Analog input X49/3	
[18]	Analog input X49/5	
[99]	Normal feedback	

Parameter 24-09 Emergency Mode Alarm Handling

Table 1045: Parameter 24-09 Emergency Mode Alarm Handling

24-09 Emergency Mode Alarm Handling		
Default value: [1] Trip, critical alarms	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: False

NOTICE

Warranty-affecting alarms. Certain alarms can affect the lifetime of the drive. Should 1 of these ignored alarms occur while in emergency mode, the alarms are logged and stored in the emergency-mode log.

NOTICE

The setting in *parameter 14-20 Reset Mode* is disregarded if emergency mode is active (see *parameter group 24-0* Emergency Mode*).

Select an option to define the response to alarms when emergency mode is active and an alarm is issued.

Option	Name	Description
[0]	Trip+reset, critical alarms	Alarms are ignored even though damage may be caused, except for the critical alarms mentioned in the following table. When these alarms occur, the drive trips immediately, followed by an automatic reset and restarts even if the operation leads to an infinite loop of trip and restart.
[1]*	Trip, critical alarms	Alarms are ignored even though damage may be caused, except for the critical alarms mentioned in the following table. For the critical alarms, a trip is caused. A manual reset is required before restart. A manual restart requires disabling emergency mode and enabling emergency mode again.
[2]	Trip, all alarms/test	Option for testing emergency mode operation without compromising the normal handling of warnings and alarms. All alarms are handled as normally defined in 7.1.2 Alarm/Warning Code List

Table 1046: Emergency Mode Alarm Handling

Alarm number	Description	Emergency mode alarm handling selected in *parameter 24-09 Emergency Mode Alarm Handling*. Critical alarms cause a trip.			Warranty-affecting alarms in emergency mode
		[0] Trip+reset	[1] Trip	[2] Test	
4	Mains phase loss	Ignore	Ignore	(Warning/trip)	X
7	DC voltage high	Trip+reset	Trip	Warning/trip	
8	DC voltage low	Trip+reset	Trip	Warning/trip	
9	Inverter overld.	Ignore	Ignore	(Warning/trip)	X
13	Over current	Trip+reset	Trip	(Warning/trip/trip lock)	
14	Ground fault	Trip+reset	Trip	(Warning/trip/trip lock)	
16	Short circuit	Trip+reset	Trip	(Trip/trip lock)	
29	Power module temp	Ignore	Ignore	(Warning/trip/trip lock	X
33	Inrush fault	Ignore	Ignore	Trip/trip lock	X
38	Internal fault	Ignore	Ignore	Trip/trip lock	X
39	Heatsink sensor	Ignore	Ignore	(Trip/trip lock)	X
45	Ground fault 2	Ignore	Ignore		
65	Ctrl. card temp	Ignore	Ignore	Warning/trip/(trip lock)	X
68	Safe stop	Trip	Trip	Trip	
69	Pwr card temp.	Ignore	Ignore	Trip/(trip lock)	X
79	Illegal PS config	Ignore	Ignore		
101	Speed monitor (FC 302)	Ignore	Ignore		
200	Emergency mode	Ignore	Ignore		
201	Emerg. M was active	Ignore	Ignore		
202	Emerg. M limits exceeded	Ignore	Ignore		
244	Heatsink temp	Ignore	Ignore	(Trip/trip lock)	X

Alarm number	Description	Emergency mode alarm handling selected in *parameter 24-09 Emergency Mode Alarm Handling*. Critical alarms cause a trip.			Warranty-affecting alarms in emergency mode
245	Heatsink sensor	Ignore	Ignore	(Trip/trip lock)	X
247	Pwr.card temp	Ignore	Ignore	(Trip/trip lock)	X
280	Emergency m service warn-ing	Ignore	Ignore		
281	Emcy OPR unexpected	Ignore	Ignore		

5.22.2 24-1* Drive Bypass

The drive includes a feature which can be used to automatically activate an external electro-mechanical bypass if the drive trips or if there is an emergency-mode coast (see *parameter 24-00 Emergency Mode Function*).

The bypass switches the motor top operation direct on line. The external bypass is activated by 1 of the digital outputs or relays in the drive when programmed in *parameter group 5-3* Digital Outputs* or *parameter group 5-4* Relays*.

N O T I C E

After enabling the drive bypass function, the drive is no longer safety certified (for using the Safe Torque Off in versions, where included).

To deactivate the drive bypass at normal operation (emergency mode not activated), carry out 1 of the following actions:

- Press [Off] on the LCP, or program 2 of the digital inputs for Hand On-Off-Auto.
- Activate external interlock via digital input.
- Carry out a power cycle.

N O T I C E

The drive bypass cannot be deactivated if in emergency mode. It can be deactivated only by either removing the emergency mode command signal or the power supply to the drive.

When the drive bypass function is activated, the display on the LCP shows the status message *Drive Bypass*. This message has a higher priority than the emergency mode status messages. When the automatic drive bypass function is enabled, it cuts in the external bypass according to the sequence shown in Illustration 96.

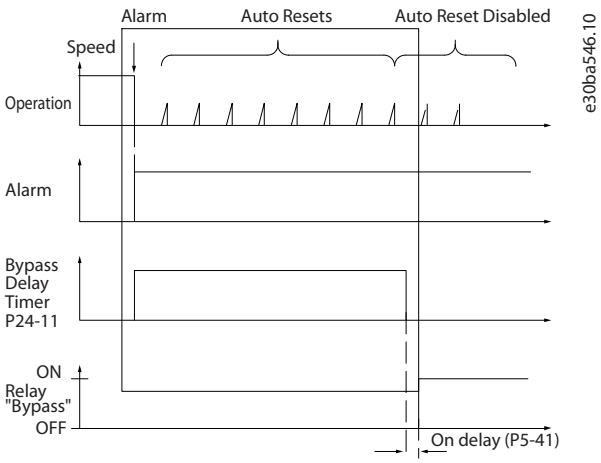


Illustration 96: Drive Bypass

The status can be read in the extended status word 2, bit number 24.

Parameter 24-10 Drive Bypass Function

Table 1047: Parameter 24-10 Drive Bypass Function

24-10 Drive Bypass Function		
Default value: [0] Disabled	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

N O T I C E

After enabling the drive bypass function, the Safe Torque Off function (where included) does not comply with standard EN 954-1, Cat. 3 installations.

This parameter determines the circumstances that activate the drive bypass function.

Option	Name	Description
[0]*	Disabled	
[1]	Enabled	If in normal operation, the drive bypass function is activated under the following conditions: • If there is a trip lock or a trip. • After the number of reset attempts programmed in *parameter 14-20 Reset Mode*. • If the bypass delay timer (*parameter 24-11 Drive Bypass Delay Time*) expires before reset attempts have been completed.
[2]	Enabled (Fire M Only)	

Parameter 24-11 Drive Bypass Delay Time

Table 1048: Parameter 24-11 Drive Bypass Delay Time

24-11 Drive Bypass Delay Time		
Default value: 0 s	Parameter type: Range, 0 - 600 s	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Programmable in 1 s increments. Once the bypass function is activated in accordance with the setting in *parameter 24-10 Drive Bypass Function*, the bypass delay timer begins to operate. If the drive has been set for several restart attempts, the timer continues to run while the drive tries to restart. Should the motor have restarted within the time period of the bypass delay timer, the timer is reset. Should the motor fail to restart at the end of the bypass delay time, the drive bypass relay programmed for bypass in *parameter 5-40 Function Relay* is activated. If a relay delay has also been programmed in *parameter 5-41 On Delay, Relay*, [Relay] or *parameter 5-42 Off Delay, Relay* [Relay], this time must also elapse before the relay action is performed. Where no restart attempts are programmed, the timer runs for the delay period set in this parameter and activates the drive bypass relay, which has been programmed for bypass in *parameter 5-40 Function Relay*. If a relay delay has also been programmed in *parameter 5-41 On Delay, Relay* or *parameter 5-42 Off Delay, Relay* [Relay], this time must also elapse before the relay action is performed.

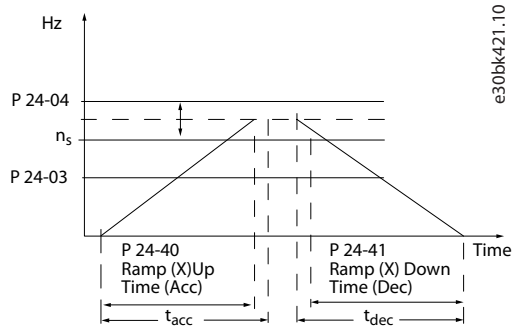
5.22.3 24-4* Emergency Mode 2

Configure the ramp parameters for emergency mode:

- Ramp type
- Ramping times (duration of acceleration and deceleration)
- Level of jerk compensation for S-ramps

Start by setting the linear ramping times corresponding to Illustration 97 and Illustration 98.

Illustration 97: Linear Ramping Times



If S-ramps are selected, set the level of non-linear jerk compensation required. Set jerk compensation by defining the proportion of ramp-up and ramp-down times where acceleration and deceleration are variable (that is, increasing or decreasing). The S-ramp acceleration and deceleration settings are defined as a percentage of the actual ramp time.

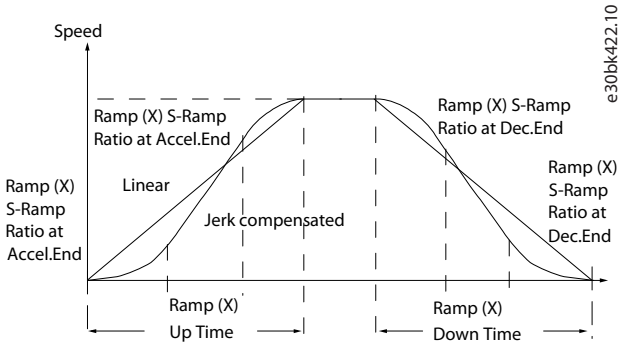


Illustration 98: Non-linear Ramping Times

Parameter 24-40 Emergency Mode Ramp Up Time

Table 1049: Parameter 24-40 Emergency Mode Ramp Up Time

24-40 Emergency Mode Ramp Up Time		
Default value: 3 s	Parameter type: Range, 1.0 - 3600 s, Array [8]	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

This ramp time is used for acceleration while emergency mode is active.

Parameter 24-41 Emergency Mode Ramp Down Time

Table 1050: Parameter 24-41 Emergency Mode Ramp Down Time

24-41 Emergency Mode Ramp Down Time		
Default value: 3 s	Parameter type: Range, 1.0 - 3600 s, Array [8]	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

This ramp time is used for deceleration while emergency mode is active.

Parameter 24-42 Timeout for Emergency Mode Test

Table 1051: Parameter 24-42 Timeout for Emergency Mode Test

24-42 Timeout for Emergency Mode Test		
Default value: 10 min	Parameter type: Range, 1 - 60 min	Setup: All setups
Conversion index: 70	Data type: Uint8	Change during operation: True

A digital impulse triggers the emergency mode operation with stop on all alarms as option *[2] Trip, all alarms/test* in *parameter 24-09 Emergency Mode Alarms Handling*. This test impulse signal can only activate 1 test time period and the normal emergency mode operation takes over as soon as the test time ends, or it stops the test period if the emergency mode signal disappears. Only "normal

high impulse" signals can trigger the test timer and test information is included in the LCP and status word, as emergency mode output "not operating as expected" is activated.

Parameter 24-43 Emergency Mode Signal Operation

Table 1052: Parameter 24-43 Emergency Mode Signal Operation

24-43 Emergency Mode Signal Operation		
Default value: [0] Standard, active-high	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

N O T I C E

Ensure that the correct input selections and connections are in place as it is not possible to operation the LCP while emergency mode is activated.

N O T I C E

If signal handling is set to inverse, a low *[196] EM active* and a low *[197] EM was active* indicate that the drive is off or power cycling, which can be used to activate a redundant system.

Select how emergency mode input and output signals are handled. Before changing this parameter, disable *parameter 24-00 Emergency Mode Function*.

Option	Name	Description
[0]*	Standard, active-high	Normal high input and output signals operate the emergency mode function as long as they are active (high).
[1]	Inverse, active-low	This option adds safety rules to ensure that emergency mode still operates if a signal is lost.
[2]	Impulse, set-reset	This option activates and stops the emergency mode operation on high signal impulse. Operation mode is defined and activated by selected input signals and is frozen 2 s after the 1st signal activation. Reset signal has the highest priority and is required to stop operation or switch to a new operation configuration. A valid signal impulse has to be active for minimum 2 s. **N O T I C E** LCP copy and software download only accept parameter changes if *parameter 24-00 Emergency Mode* is set to *[0] Disabled*.

5.22.4 24-9* Multi-Motor Funct.

Parameter 24-90 Missing Motor Function

Table 1053: Parameter 24-90 Missing Motor Function

24-90 Missing Motor Function		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the action to be taken if the motor current is below the limit calculated as a function of the output frequency. The function is used for detecting, for example, a missing motor in multi-motor applications.

Option	Name	Description
[0]*	Off	
[1]	Warning	

Parameter 24-91 Missing Motor Coefficient 1

Table 1054: Parameter 24-91 Missing Motor Coefficient 1

24-91 Missing Motor Coefficient 1		
Default value: 0	Parameter type: Range, -10 - 10	Setup: All setups
Conversion index: -4	Data type: Int32	Change during operation: True

Enter the cubic coefficient of the missing motor detection-function multiplied by 1000.

Parameter 24-92 Missing Motor Coefficient 2

Table 1055: Parameter 24-92 Missing Motor Coefficient 2

24-92 Missing Motor Coefficient 2		
Default value: 0	Parameter type: Range, -100 - 100	Setup: All setups
Conversion index: -4	Data type: Int32	Change during operation: True

Enter the quadratic coefficient of the missing motor detection-function multiplied by 1000.

Parameter 24-93 Missing Motor Coefficient 3

Table 1056: Parameter 24-93 Missing Motor Coefficient 3

24-93 Missing Motor Coefficient 3		
Default value: 0	Parameter type: Range, -100 - 100	Setup: All setups
Conversion index: -4	Data type: Int32	Change during operation: True

Enter the linear coefficient of the missing motor detection-function multiplied by 1000.

Parameter 24-94 Missing Motor Coefficient 4

Table 1057: Parameter 24-94 Missing Motor Coefficient 4

24-94 Missing Motor Coefficient 4		
Default value: 0	Parameter type: Range, -500 - 500	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the constant coefficient of the missing motor detection-function multiplied by 1000.

Parameter 24-95 Locked Rotor Function

Table 1058: Parameter 24-95 Locked Rotor Function

24-95 Locked Rotor Function		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the action to be taken if the motor current is above the limit calculated as a function of the output frequency. The function is used for detecting, for example, a locked rotor in multi-motor applications.

Option	Name	Description
[0]*	Off	
[1]	Warning	

Parameter 24-96 Locked Rotor Coefficient 1

Table 1059: Parameter 24-96 Locked Rotor Coefficient 1

24-96 Locked Rotor Coefficient 1		
Default value: 0	Parameter type: Range, -10 - 10	Setup: All setups
Conversion index: -4	Data type: Int32	Change during operation: True

Enter the cubic coefficient of the locked-rotor detection function multiplied by 1000.

Parameter 24-97 Locked Rotor Coefficient 2

Table 1060: Parameter 24-97 Locked Rotor Coefficient 2

24-97 Locked Rotor Coefficient 2		
Default value: 0	Parameter type: Range, -100 - 100	Setup: All setups
Conversion index: -4	Data type: Int32	Change during operation: True

Enter the quadratic coefficient of the locked-rotor detection function multiplied by 1000.

Parameter 24-98 Locked Rotor Coefficient 3

Table 1061: Parameter 24-98 Locked Rotor Coefficient 3

24-98 Locked Rotor Coefficient 3		
Default value: 0	Parameter type: Range, -100 - 100	Setup: All setups
Conversion index: -4	Data type: Int32	Change during operation: True

Enter the linear coefficient of the locked-rotor detection function multiplied by 1000.

Parameter 24-99 Locked Rotor Coefficient 4

Table 1062: Parameter 24-99 Locked Rotor Coefficient 4

24-99 Locked Rotor Coefficient 4		
Default value: 0	Parameter type: Range, -500 - 500	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the constant coefficient of the locked-rotor detection function multiplied by 1000.

5.23 Parameter Group 30-** Special Features

5.23.1 30-0* Wobble Function

The wobble function is primarily used for synthetic yarn winding applications. The wobble option is installed in the drive controlling the traverse drive. The yarn moves back and forth in a diamond pattern across the surface of the yarn package. To prevent a build-up of yarn at the same points at the surface, this pattern must be altered. The wobble option can accomplish this by continuously varying the traverse velocity in a programmable cycle. The wobble function is created by superimposing a delta frequency around a center frequency. To compensate for the inertia in the system, a quick frequency jump can be included. Suitable for elastic yarn applications, the option features a randomized wobble ratio.

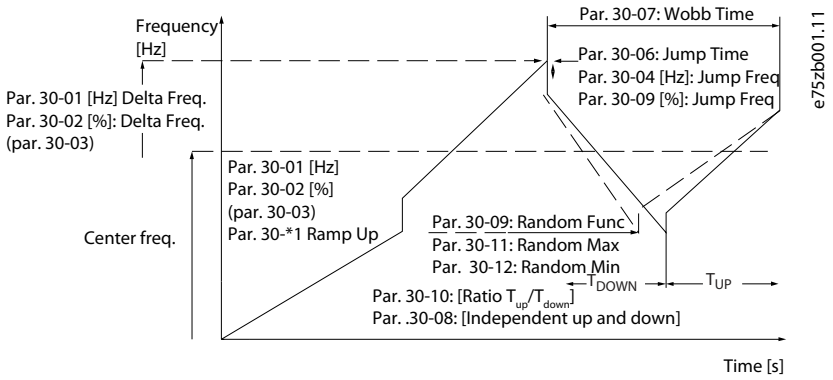


Illustration 99: Wobble Function

Parameter 30-00 Wobble Mode

Table 1063: Parameter 30-00 Wobble Mode

30-00 Wobble Mode		
Default value: [0] Abs. freq., abs. time	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

N O T I C E

This parameter cannot be changed while the motor is running.

The standard speed open-loop mode in *parameter 1-00 Configuration Mode* is extended with a wobble function. In this parameter, it is possible to select which method to be used for the wobbler. Set the parameters as absolute values (direct frequencies) or as relative values (percentage of other parameter). Set the wobble cycle time as an absolute value or as independent up and down times. When using an absolute cycle time, the up and down times are configured through the wobble ratio.

Option	Name	Description
[0]*	Abs. freq., abs. time	
[1]	Abs. freq., up/down time	
[2]	Rel. freq., abs. time	
[3]	Rel. freq., up/down time	

Parameter 30-01 Wobble Delta Frequency [Hz]

Table 1064: Parameter 30-01 Wobble Delta Frequency [Hz]

30-01 Wobble Delta Frequency [Hz]		
Default value: 5 Hz	Parameter type: Range, 0 - 25 Hz	Setup: All setups
Conversion index: -1	Data type: Uint8	Change during operation: True

The delta frequency determines the magnitude of the wobble frequency. The delta frequency is superimposed on the center frequency. *Parameter 30-01 Wobble Delta Frequency [Hz]* contains both the positive and negative delta frequency. The setting of *parameter 30-01 Wobble Delta Frequency [Hz]* must thus not exceed the setting of the center frequency. The initial ramp-up time from standstill until the wobble sequence runs is determined in *parameter group 3-1* References*.

Parameter 30-02 Wobble Delta Freqeuncy [%]

Table 1065: Parameter 30-02 Wobble Delta Freqeuncy [%]

30-02 Wobble Delta Freqeuncy [%]		
Default value: 25%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

The delta frequency can also be expressed as a percentage of the center frequency and can thus be maximum 100%. The function is the same as for *parameter 30-01 Wobble Delta Frequency [Hz]*.

Parameter 30-03 Wobble Delta Freq. Scaling Resource

Table 1066: Parameter 30-03 Wobble Delta Freq. Scaling Resource

30-03 Wobble Delta Freq. Scaling Resource		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the drive input to be used for scaling the delta frequency setting.

Option	Name	Description
[0]*	No function	
[1]	Analog input 53	
[2]	Analog input 54	
[3]	Frequency input 29	**NOTICE** This option is only available in FC 302.
[4]	Frequency input 33	
[7]	Analog input X30/11	
[8]	Analog input X30/12	
[15]	Analog input X48/2	
[16]	Analog input X49/1	
[17]	Analog input X49/3	
[18]	Analog input X49/5	

Parameter 30-04 Wobble Jump Frequency [Hz]

Table 1067: Parameter 30-04 Wobble Jump Frequency [Hz]

30-04 Wobble Jump Frequency [Hz]		
Default value: 0 Hz	Parameter type: Range, 0 - 20.0 Hz	Setup: All setups
Conversion index: -1	Data type: Uint8	Change during operation: True

The jump frequency is used to compensate for the inertia in the traverse system. If a jump in the output frequency is required at the boundaries of the wobble sequence, the frequency jump is set in this parameter. If the traverse system has a very high inertia, a high jump frequency may create a torque limit warning or trip or an overvoltage warning or trip. This parameter can only be changed in stop mode.

Parameter 30-05 Wobble Jump Frequency [%]

Table 1068: Parameter 30-05 Wobble Jump Frequency [%]

30-05 Wobble Jump Frequency [%]		
Default value: 0%	Parameter type: Range, 0 - 100 %	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

The jump frequency can also be expressed as a percentage of the center frequency. The function is the same as for *parameter 30-04 Wobble Jump Frequency [Hz]*.

Parameter 30-06 Wobble Jump Time

Table 1069: Parameter 30-06 Wobble Jump Time

30-06 Wobble Jump Time		
Default value: Size related	Parameter type: Range, 0.005 - 5.000 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

This parameter determines the slope of the jump ramp at the maximum and minimum wobble frequency.

Parameter 30-07 Wobble Sequence Time

Table 1070: Parameter 30-07 Wobble Sequence Time

30-07 Wobble Sequence Time		
Default value: 10 s	Parameter type: Range, 1 - 1000 s	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

This parameter determines the wobble sequence period. This parameter can only be changed in stop mode.

Wobble time $= t_{up} + t_{down}$

Parameter 30-08 Wobble Up/Down Time

Table 1071: Parameter 30-08 Wobble Up/Down Time

30-08 Wobble Up/Down Time		
Default value: 5 s	Parameter type: Range, 0.1 - 1000 s, Array [2]	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Defines the individual up and down times for each wobble cycle.

Parameter 30-09 Wobble Random Function

Table 1072: Parameter 30-09 Wobble Random Function

30-09 Wobble Random Function		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Off	
[1]	On	

Parameter 30-10 Wobble Ratio

Table 1073: Parameter 30-10 Wobble Ratio

30-10 Wobble Ratio		
Default value: 1	Parameter type: Range, 0.1 - 10	Setup: All setups
Conversion index: -1	Data type: Uint8	Change during operation: True

If the ratio 0.1 is selected: t_{down} is 10 times greater than t_{up}. If the ratio 10 is selected: t_{up} is 10 times greater than t_{down}.

Center frequency

Use *parameter group 3-1* References* to set the center frequency.

Parameter 30-11 Wobble Random Ratio Max.

Table 1074: Parameter 30-11 Wobble Random Ratio Max.

30-11 Wobble Random Ratio Max.		
Default value: 10	Parameter type: Range, par. 17-53 - 10	Setup: All setups
Conversion index: -1	Data type: Uint8	Change during operation: True

Enter the maximum allowed wobble ratio.

Parameter 30-12 Wobble Random Ratio Min.

Table 1075: Parameter 30-12 Wobble Random Ratio Min.

30-12 Wobble Random Ratio Min.		
Default value: 0.1	Parameter type: Range, 0.1 - par. 30-11	Setup: All setups
Conversion index: -1	Data type: Uint8	Change during operation: True

Enter the minimum allowed wobble ratio.

Parameter 30-19 Wobble Delta Freq. Scaled

Table 1076: Parameter 30-19 Wobble Delta Freq. Scaled

30-19 Wobble Delta Freq. Scaled		
Default value: 0 Hz	Parameter type: Range, 0 - 1000 Hz	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: False

Readout parameter. View the actual wobble delta frequency after scaling has been applied.

5.23.2 30-2* Adv. Start Adjust

N O T I C E

This parameter group is only available in FC 302.

Parameter 30-20 High Starting Torque Time [s]

Table 1077: Parameter 30-20 High Starting Torque Time [s]

30-20 High Starting Torque Time [s]		
Default value: Size related	Parameter type: Range, 0 - 60 s	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

Define for how long the increased high starting torque current defined in *parameter 30-21 High Starting Torque Current* should be applied.

Parameter 30-21 High Starting Torque Current [%]

Table 1078: Parameter 30-21 High Starting Torque Current [%]

30-21 High Starting Torque Current [%]		
Default value: Size related	Parameter type: Range, 0 - 200.0%	Setup: All setups
Conversion index: -1	Data type: Uint32	Change during operation: True

Set the high starting current that should be applied for the time specified in *parameter 30-20 High Starting Torque Time*. The increased current will improve the starting torque and starting performance in demanding applications. The high starting torque current is valid for VVC+ and flux in speed open loop. The parameter can be used with the following motors:

- SPM
- IPM
- SynRM
- PMaSynRM

Parameter 30-22 Locked Rotor Protection

Table 1079: Parameter 30-22 Locked Rotor Protection

30-22 Locked Rotor Protection		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Available for PM motors only, in flux sensorless mode and VVC$^+$ open-loop mode.

Option	Name	Description
[0]	Off	
[1]	On	Protects the motor from the locked rotor condition. The control algorithm detects a possible locked rotor condition in the motor and trips the drive to protect the motor.

Parameter 30-23 Locked Rotor Detection Time [s]

Table 1080: Parameter 30-23 Locked Rotor Detection Time [s]

30-23 Locked Rotor Detection Time [s]		
Default value: Size related	Parameter type: Range, 0.05 - 1 s	Setup: All setups
Conversion index: -2	Data type: Uint8	Change during operation: True

Time period for detecting the locked rotor condition. A low parameter value leads to faster detection.

Parameter 30-24 Locked Rotor Detection Speed Error [%]

Table 1081: Parameter 30-24 Locked Rotor Detection Speed Error [%]

30-24 Locked Rotor Detection Speed Error [%]		
Default value: 25%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -1	Data type: Uint32	Change during operation: True

Detects locked rotor condition for SPMSM at high speed.

Light-load detection

Light-load detection is a feature for lift application to ensure lift evacuation in a direction which requires the least energy (UPS capacity) during an emergency. When a light-load detection and start signal is received, the drive starts in the selected direction. After the delay in seconds specified in *parameter 30-26 Delay Before Measurements*, the drive integrates the current consumption within the time defined in *parameter 30-25 Measurement Duration*. After completing current integration for 1 direction, the drive starts in

the other direction and repeats the current integration. On comparing the 2 integrated currents, the lift evacuates in the direction which requires the least current.

Parameter 30-25 Measurement Duration

Table 1082: Parameter 30-25 Measurement Duration

30-25 Measurement Duration		
Default value: 0.000 s	Parameter type: Range, 0.000 - 10.000 s	Setup: All setups
Conversion index: -3	Data type: Uint32	Change during operation: True

Duration of current integration measurement. The measurement is done in both directions. The direction with the lowest measurement value is selected by the drive.

Parameter 30-26 Delay Before Measurements

Table 1083: Parameter 30-26 Delay Before Measurements

30-26 Delay Before Measurements		
Default value: 0.000 s	Parameter type: Range, 0.000 - 10.000 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Delay before current measurement. Allows to avoid mismatch in measurements caused by mechanical friction during opening of mechanical brakes.

Parameter 30-27 Light Load Speed [%]

Table 1084: Parameter 30-27 Light Load Speed [%]

30-27 Light Load Speed [%]		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Use this parameter when the light-load detection is active to define the speed during current measurement. Enter the reference speed during the light-load detection. The value is a percentage of nominal motor speed in *parameter 1-25 Motor Nominal Speed*. For standard asynchronous motors, the synchronous speed is used instead of *parameter 1-25 Motor Nominal Speed* due to slip.

Parameter 30-28 Evacuation Speed [%]

Table 1085: Parameter 30-28 Evacuation Speed [%]

30-28 Evacuation Speed [%]		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Speed for evacuation after detection of light-load direction.

Parameter 30-29 Ramp Time

Table 1086: Parameter 30-29 Ramp Time

30-29 Ramp Time		
Default value: Size related	Parameter type: Range, 0.01 - 3600 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Ramp times during evacuation and measurement sequences.

5.23.3 30-5* Unit Configuration

N O T I C E

The following parameter is only available in FC 302:

- *Parameter 30-50 Heat Sink Fan Mode*

Parameters in this group allow to configure the operation of internal units that communicate with the drive. The settings affect the behavior of hardware components inside the drive.

Parameter 30-50 Heat Sink Fan Mode

Table 1087: Parameter 30-50 Heat Sink Fan Mode

30-50 Heat Sink Fan Mode		
Default value: Size related	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select how the heat sink fan responds to operating conditions. Use *parameter 14-52 Fan Control* to control the minimum fan speed.

Option	Name	Description
[0]	Simple profile	The simple profile is a passive fan control based on the current temperature state of the drive. This option represents the classic operating behavior of fans.
[1]	Reduced acoustics	
[2]	Standard	
[3]	Cooler operation	

5.23.4 30-7* Power Low Monitor Protection

Parameter 30-70 Power Low Monitoring

Table 1088: Parameter 30-70 Power Low Monitoring

30-70 Power Low Monitoring		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Disabled	Disables the power-low monitoring feature.
[1]	Enabled	Enables the power-low monitoring feature.

Parameter 30-71 PLM Detection Time

Table 1089: Parameter 30-71 PLM Detection Time

30-71 PLM Detection Time		
Default value: 10 s	Parameter type: Range, 4 - 100 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Set the detection time window for power integration.

Parameter 30-72 PLM Min. Speed

Table 1090: Parameter 30-72 PLM Min. Speed

30-72 PLM Min. Speed		
Default value: 25%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter shows the minimum detection speed above which the PLM algorithm is allowed to act. The speed is given in [%] relative to *parameter 1-25 Motor Nominal Speed*.

Parameter 30-73 PLM Detection Factor

Table 1091: Parameter 30-73 PLM Detection Factor

30-73 PLM Detection Factor		
Default value: 5	Parameter type: Range, 2 - 100	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter gives a detection sensitivity factor for the PLM feature - a copper loss multiplier. The PLM flags a blocked motor when the monitored energy throughout the time window is lower than the copper loss energy multiplied by this sensitivity parameter.

5.23.5 30-8* Compatibility (I)

N O T I C E

The following parameter is only available in FC 302:

- *Parameter 30-80 d-axis Inductance*

Parameter 30-80 d-axis Inductance (Ld)

Table 1092: Parameter 30-80 d-axis Inductance (Ld)

30-80 d-axis Inductance (Ld)		
Default value: Size related	Parameter type: Range, 0.000 - 1000.000 mH	Setup: All setups
Conversion index: -6	Data type: Int32	Change during operation: False

Enter the value of the d-axis inductance. Obtain the value from the permanent magnet motor datasheet. The d-axis inductance cannot be found by performing an AMA.

Parameter 30-81 Brake Resistor (ohm)

Table 1093: Parameter 30-81 Brake Resistor (ohm)

30-81 Brake Resistor (ohm)		
Default value: Size related	Parameter type: Range, 0.01 - 65535.00 ohm	Setup: 1 setup
Conversion index: -2	Data type: Uint32	Change during operation: True

Set the brake resistor value in Ω. This value is used for monitoring the power to the brake resistor in *parameter 2-13 Brake Power Monitoring*. This parameter is only active in drives with an integral dynamic brake.

Parameter 30-83 Speed PID Proportional Gain

Table 1094: Parameter 30-83 Speed PID Proportional Gain

30-83 Speed PID Proportional Gain		
Default value: Size related	Parameter type: Range, 0 - 1	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: True

Enter the speed controller proportional gain. Quick control is obtained at high amplification. However, if amplification is too great, the process may become unstable.

Parameter 30-84 Process PID Proportional Gain

Table 1095: Parameter 30-84 Process PID Proportional Gain

30-84 Process PID Proportional Gain		
Default value: Size related	Parameter type: Range, 0 - 10	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

Enter the process controller proportional gain. Quick control is obtained at high amplification. However, if amplification is too great, the process may become unstable.

Parameter 30-85 Motor Frequency

Table 1096: Parameter 30-85 Motor Frequency

30-85 Motor Frequency		
Default value: Size related	Parameter type: Range, 20.0 - 1000.0 Hz	Setup: All setups
Conversion index: -1	Data type: Uint32	Change during operation: False

NOTICE

Changing this parameter affects the settings of other parameters.

Select the motor frequency from the motor nameplate data.

Parameter 30-88 System Inertia

Table 1097: Parameter 30-88 System Inertia

Parameter 30-88 System Inertia		
Default value: Size related	Parameter type: Range, 0.000000 - 2000.000000 [kgm^2]	Setup: All setups
Conversion index: -6	Data type: Uint32	Change during operation: False

NOTICE

This parameter is only available with software version 48.82 and newer.

Enables setting the system inertia with 6 decimals for small motors (*parameter 1-69 System Inertia* only has 4 decimals).

5.23.6 30-9* Wifi LCP

Parameters for configuring the wireless LCP 103.

Parameter 30-90 SSID

Table 1098: Parameter 30-90 SSID

30-90 SSID		
Default value: Size related	Parameter type: Range, 20.0 - 1000.0 Hz	Setup: 1 setup
Conversion index: 0	Data type: VisStr[32]	Change during operation: True

Enter the wireless network name (SSID). The default value is: Danfoss_<Serial number of the drive>. The serial number is in *parameter 15-51 Frequency Converter Serial Number*.

Parameter 30-91 Channel

Table 1099: Parameter 30-91 Channel

30-91 Channel		
Default value: 5	Parameter type: Range, 1 - 11	Setup: 1 setup
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the wireless channel number. The default channel number is 5. Change the channel number, if there is an interference from other wireless networks. Recommended channels: USA territory: 1, 6, 11. Europe: 1, 7, 13.

Parameter 30-92 Password

Table 1100: Parameter 30-92 Password

30-92 Password		
Default value: Size related	Parameter type: Range, 8 - 48	Setup: 1 setup
Conversion index: 0	Data type: VisStr[48]	Change during operation: True

Enter the wireless network password. Password length: 8–48 characters.

Parameter 30-97 Wifi Timeout Action

Table 1101: Parameter 30-97 Wifi Timeout Action

30-97 Wifi Timeout Action		
Default value: [0] Do nothing	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

Select which action to execute if a local reference (hand-on mode) or a remote reference (auto-on mode) is set via the wireless connection and the connection is lost.

Option	Name	Description
[0]*	Do nothing	The drive does not do any extra actions.
[1]	Stop motor	The drive stops the motor (if the motor was started via a wireless connection).

Parameter 30-98 Remote SSID

Table 1102: Parameter 30-98 Remote SSID

30-98 Remote SSID		
Default value: Size related	Parameter type: Range, 1 - 32	Setup: 1 setup
Conversion index: 0	Data type: VisStr[32]	Change during operation: True

Parameter 30-99 Wifi Network Mode

Table 1103: Parameter 30-99 Wifi Network Mode

30-99 Wifi Network Mode		
Default value: [1] Access point	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	None	
[1]*	Access point	
[2]	Client	

5.24 Parameter Group 31-** Bypass Option

N O T I C E

This parameter group is only available in FC 302.

Parameter 31-00 Bypass Mode

Table 1104: Parameter 31-00 Bypass Mode

31-00 Bypass Mode		
Default value: [0] Drive	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the bypass operating mode.

Option	Name	Description
[0]*	Drive	The drive operates the motor.
[1]	Bypass	The motor is operated at full speed during bypass mode.

Parameter 31-01 Bypass Start Time Delay

Table 1105: Parameter 31-01 Bypass Start Time Delay

31-01 Bypass Start Time Delay		
Default Value: 30 s	Parameter Type: Range, 0 - 60 s	Setup: All setups
Conversion Index: 0	Data Type: Uint16	Change during operation: True

Setting the time delay to pass from the bypass receives a run command until it starts the motor at full speed. A countdown timer shows the remaining time.

Parameter 31-02 Bypass Trip Time Delay

Table 1106: Parameter 31-02 Bypass Trip Time Delay

31-02 Bypass Trip Time Delay		
Default value: 0 s	Parameter type: Range, 0 - 300 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Setting the time delay to pass from the drive experiences an alarm that stops it and until the motor is automatically switched to bypass control. If the delay is set to 0, a drive alarm does not automatically switch the motor to bypass control.

Parameter 31-03 Test Mode Activation

Table 1107: Parameter 31-03 Test Mode Activation

31-03 Test Mode Activation		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Disabled	Test mode is disabled.
[1]	Enabled	The motor runs in bypass while the drive can be tested into an open circuit. In this mode, keypad does not control start/stop of bypass.

Parameter 31-10 Bypass Status Word

Table 1108: Parameter 31-10 Bypass Status Word

31-10 Bypass Status Word		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 74	Data type: V2	Change during operation: False

View the status of the bypass as a hexadecimal value.

Parameter 31-11 Bypass Running Hours

Table 1109: Parameter 31-11 Bypass Running Hours

31-11 Bypass Running Hours		
Default value: 0 h	Parameter type: Range, 0 - 2147483647 h	Setup: All setups
Conversion index: 74	Data type: Uint32	Change during operation: False

View the number of hours in which the motor has run in bypass mode. The counter can be reset in *parameter 15-07 Reset Running Hours Counter*. The value is saved when the drive is turned off.

Parameter 31-19 Remote Bypass Activation

Table 1110: Parameter 31-19 Remote Bypass Activation

31-19 Remote Bypass Activation		
Default value: [0] Disabled	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Disabled	
[1]	Enabled	

5.25 Parameter Group 32-** MCO Basic Settings

Parameters in this group are available when VLT® Motion Control Option MCO 305 is installed in the drive. For information about the option, see the VLT® MCO Control Option MCO 305 Operating Guide.

5.25.1 32-0* Encoder 2

Parameter 32-00 Incremental Signal Type

Table 1111: Parameter 32-00 Incremental Signal Type

32-00 Incremental Signal Type		
Default value: [1] RS422 (5V TTL)	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	None	
[1]*	RS422 (5V TTL)	
[2]	Sinusoidal 1Vpp	
[3]	CAN encoder	

Parameter 32-01 Incremental Resolution

Table 1112: Parameter 32-01 Incremental Resolution

32-01 Incremental Resolution		
Default value: 1024	Parameter type: Range, 1 - 1073741823	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Set the resolution of the incremental encoder connected to terminal X55. The maximum frequency must not exceed 410 kHz.

Parameter 32-02 Absolute Protocol

Table 1113: Parameter 32-02 Absolute Protocol

32-02 Absolute Protocol		
Default Value: [0] None	Parameter Type: Option	Setup: 2 setups
Conversion Index: -	Data Type: Uint8	Change during operation: True

Option	Name	Description
[0]*	None	
[1]	HIPERFACE	
[2]	EnDat	
[4]	SSI	
[5]	SSI with filter	
[6]	BiSS-C	
[7]	BiSS-B	

Parameter 32-03 Absolute Resolution

Table 1114: Parameter 32-03 Absolute Resolution

32-03 Absolute Resolution		
Default value: 8192	Parameter type: Range, 0 - 1073741823	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

The encoder resolution is used for calculating velocity in RPM. Set the resolution of the absolute encoder connected to terminal X55 in positions per revolution. Find the encoder resolution on the encoder nameplate.

Parameter 32-04 Absolute Encoder Baudrate X55

Table 1115: Parameter 32-04 Absolute Encoder Baudrate X55

32-04 Absolute Encoder Baudrate X55		
Default Value: [4] 9600	Parameter Type: Option	Setup: 2 setups
Conversion Index: -	Data Type: Uint8	Change during operation: True

Select the baud rate of the attached encoder.

Option	Name	Description
[0]	600	
[1]	1200	
[2]	2400	
[3]	4800	
[4]*	9600	
[5]	19200	
[6]	38400	

32-05 Absolute Encoder Data Length

Table 1116: 32-05 Absolute Encoder Data Length

32-05 Absolute Encoder Data Length		
Default value: 25	Parameter type: Range, 8 - 37	Setup: 2 setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Specify the number of data bits for the connected absolute encoder, see encoder datasheet. This specification is required for VLT® Motion Control Option MCO 305 and VLT® Motion Control Option MCO 302 to generate the correct number of clock bits.

Parameter 32-06 Absolute Encoder Clock Frequency

Table 1117: Parameter 32-06 Absolute Encoder Clock Frequency

32-06 Absolute Encoder Clock Frequency		
Default value: 262	Parameter type: Range, 78.125 - 2000 kHz	Setup: 2 setups
Conversion index: 3	Data type: Uint32	Change during operation: True

Specifies the frequency of the absolute encoder clock signal generated by VLT® Motion Control Option MCO 305 and VLT® Motion Control Option MCO 302. Set a frequency appropriate for the connected encoder.

Parameter 32-07 Absolute Encoder Clock Generation

Table 1118: Parameter 32-07 Absolute Encoder Clock Generation

32-07 Absolute Encoder Clock Generation		
Default value: [1] On	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data trype: Uint8	Change during operation: True

Option	Name	Description
[0]	Off	Select *[0] Off* when more MCOs are connected to the same absolute encoder. Only 1 MCO is allowed to generate the clock signal when multiple MCOs are interconnected.
[1]*	On	Select *[1] On* when 1 MCO is connected to 1 absolute encoder.

Parameter 32-08 Absolute Encoder Cable Length

Table 1119: Parameter 32-08 Absolute Encoder Cable Length

32-08 Absolute Encoder Cable Length		
Default value: 0	Parameter type: Range, 0 - 300 m	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Set the total cable length (in meters) to avoid that the absolute encoder (SSI) signals come out of synchronization due to signal delays caused by long encoder cables. VLT® Motion Control Option MCO 305 and VLT® Motion Control Option MCO 302 compensate for the cable delay when the cable length is known.

Parameter 32-09 Encoder Monitoring

Table 1120: Parameter 32-09 Encoder Monitoring

32-09 Encoder Monitoring		
Default value: [0] Off	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Off	
[1]	3 channels	
[2]	2 channels	
[3]	Warning	
[4]	Alarm	

Parameter 32-10 Rotational Direction

Table 1121: Parameter 32-10 Rotational Direction

32-10 Rotational Direction		
Default value: [1] No action	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Normally, a positive reference value brings about a positive change of the position. If this is not the case, the reference value can be reversed internally.

Option	Name	Description
[1]*	No action	
[2]	Reference reversed	
[3]	User units reserved	
[4]	Uu and ref reversed	

Parameter 32-11 User Unit Denominator

Table 1122: Parameter 32-11 User Unit Denominator

32-11 User Unit Denominator		
Default value: 1	Parameter type: Range, 1 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

All target positions are made in user units and are converted to quad-counts internally. By selecting scaling units, it is possible to work with any measurement unit (for example mm). This factor consists of a numerator and denominator.

Parameter 32-12 User Units Numerator

Table 1123: Parameter 32-12 User Units Numerator

32-12 User Units Numerator		
Default value: 1	Parameter type: Range, 1 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

All target positions are made in user units and are converted to quad-counts internally. By selecting scaling units, it is possible to work with any measurement unit (for example mm). This factor consists of a numerator and denominator.

Parameter 32-13 Enc.2 Control

Table 1124: Parameter 32-13 Enc.2 Control

32-13 Enc.2 Control		
Default value: [0] No soft changing	Parameter type: Option	Setup: 2 setups
Conversion Index: -	Data Type: Uint8	Change during operation: True

Enables bump-less changing of feedback encoder in software while running and setting position to 0 without loosing the actual position.

Option	Name	Description
[0]*	No soft changing	
[1]	Encoder soft changing enable	
[2]	Soft zero setting enable	
[3]	Encoder soft changing and soft zero enable	

Parameter 32-14 Enc.2 Node ID

Table 1125: Parameter 32-14 Enc.2 Node ID

32-14 Enc.2 Node ID		
Default value: 127	Parameter type: Range, 1 - 127	Setup: 2 setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the node ID for the feedback CAN encoder.

Parameter 32-15 Enc.2 CAN Guard

Table 1126: Parameter 32-15 Enc.2 CAN Guard

32-15 Enc.2 CAN Guard		
Default value: [0] Off	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select if the feedback CAN encoder guardians should be off or on.

Option	Name	Description
[0]*	Off	
[1]	On	

5.25.2 32-3* Encoder 1

Parameter 32-30 Incremental Signal Type

Table 1127: Parameter 32-30 Incremental Signal Type

32-30 Incremental Signal Type		
Default value: [1] RS422 (5V TTL)	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	None	
[1]*	RS422 (5V TTL)	
[3]	CAN encoder	

Parameter 32-31 Incremental Resolution

Table 1128: Parameter 32-31 Incremental Resolution

32-31 Incremental Resolution		
Default value: 1024	Parameter type: Range, 1 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Set the resolution of the incremental encoder connected to terminal X56. The maximum frequency must not exceed 410 kHz.

Parameter 32-32 Absolute Protocol

Table 1129: Parameter 32-32 Absolute Protocol

32-32 Absolute Protocol		
Default value: [0] None	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	None	
[1]	HIPERFACE	
[2]	EnDat	

Option	Name	Description
[4]	SSI	
[5]	SSI with filter	
[6]	BiSS-C	
[7]	BiSS-B	

Parameter 32-33 Absolute Resolution

Table 1130: Parameter 32-33 Absolute Resolution

32-33 Absolute Resolution		
Default value: 8192	Parameter type: Range, 0 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

The encoder resolution is used for calculating velocity in RPM. Set the resolution of the absolute encoder connected to terminal X56 in positions per revolution. Find the encoder resolution on the encoder nameplate.

Parameter 32-35 Absolute Encoder Data Length

Table 1131: Parameter 32-35 Absolute Encoder Data Length

32-35 Absolute Encoder Data Length		
Default value: 25	Parameter type: Range, 8 - 37	Setup: 2 setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Specify the number of data bits for the connected absolute encoder, see encoder datasheet. This specification is required for VLT® Motion Control Option MCO 305 and VLT® Motion Control Option MCO 302 to generate the correct number of clock bits.

Parameter 32-36 Absolute Encoder Clock Frequency

Table 1132: Parameter 32-36 Absolute Encoder Clock Frequency

32-36 Absolute Encoder Clock Frequency		
Default value: 262	Parameter type: Range, 78.125 - 2000 kHz	Setup: 2 setups
Conversion index: 3	Data type: Uint32	Change during operation: True

Specifies the frequency of the absolute encoder clock signal generated by VLT® Motion Control Option MCO 305 and VLT® Motion Control Option MCO 302. Set a frequency appropriate for the connected encoder.

Parameter 32-37 Absolute Encoder Clock Generation

Table 1133: Parameter 32-37 Absolute Encoder Clock Generation

32-37 Absolute Encoder Clock Generation		
Default value: [1] On	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	Off	Select *[0] Off* when more MCOs are connected to the same absolute encoder. Only 1 MCO is allowed to generate the clock signal when multiple MCOs are interconnected.
[1]*	On	Select *[1] On* when 1 MCO is connected to 1 absolute encoder.

Parameter 32-38 Absolute Encoder Cable Length

Table 1134: Parameter 32-38 Absolute Encoder Cable Length

32-38 Absolute Encoder Cable Length		
Default Value: 0	Parameter Type: Range, 0 - 300 m	Setup: 2 setups
Conversion Index: 0	Data Type: Uint16	Change during operation: True

Set the total cable length (in meters) to avoid that the absolute encoder (SSI) signals come out of synchronization due to signal delays caused by long encoder cables. VLT® Motion Control Option MCO 305 and VLT® Motion Control Option MCO 302 compensate for the cable delay when the cable length is known.

Parameter 32-39 Encoder Monitoring

Table 1135: Parameter 32-39 Encoder Monitoring

32-39 Encoder Monitoring		
Default value: [0] Off	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Off	
[1]	3 channels	
[2]	2 channels	
[3]	Warning	
[4]	Alarm	

Parameter 32-40 Encoder Termination

Table 1136: Parameter 32-40 Encoder Termination

32-40 Encoder Termination		
Default value: [1] No action	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[1]*	No action	
[2]	Reference reversed	
[3]	User units reserved	
[4]	Uu and ref reversed	

Parameter 32-43 Enc.1 Control

Table 1137: Parameter 32-43 Enc.1 Control

32-43 Enc.1 Control		
Default value: [0] No soft changing	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No soft changing	
[1]	Encoder soft changing enable	
[2]	Soft zero setting enable	
[4]	Encoder soft changing and soft zero enable	

Parameter 32-44 Enc.1 Node ID

Table 1138: Parameter 32-44 Enc.1 Node ID

32-44 Enc.1 Node ID		
Default value: 127	Parameter type: Range, 1 - 127	Setup: 2 setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the node ID for the feedback CAN encoder.

Parameter 32-45 Enc.1 CAN Guard

Table 1139: Parameter 32-45 Enc.1 CAN Guard

32-45 Enc.1 CAN Guard		
Default value: [0] Off	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select if the feedback CAN encoder guardians should be off or on.

Option	Name	Description
[0]*	Off	
[1]	On	

5.25.3 32-5* Feedback Source

Parameter 32-50 Source Slave

Table 1140: Parameter 32-50 Source Slave

32-50 Source Slave		
Default value: [2] Encoder 2 X55	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[1]	Encoder 1 X56	
[2]*	Encoder 2 X55	
[3]	Motor control	

Parameter 32-51 MCO 302 Last Will

Table 1141: Parameter 32-51 MCO 302 Last Will

32-51 MCO 302 Last Will		
Default value: [1] Trip	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	No action	
[1]*	Trip	
[2]	Coming action	

Parameter 32-52 Source Master

Table 1142: Parameter 32-52 Source Master

32-52 Source Master		
Default value: [1] Encoder 1 X56	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[1]*	Encoder 1 X56	
[2]	Encoder 2 X55	
[3]	Motor control	

5.25.4 32-6* PID Controller

Parameter 32-60 Proportional Factor

Table 1143: Parameter 32-60 Proportional Factor

32-60 Proportional Factor		
Default value: 30	Parameter type: Range, 0 - 100000	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

The proportional factor indicates the linear correction factor with which the deviation between the current set and actual position is evaluated. The motor speed is then corrected accordingly.

Parameter 32-61 Derivative Factor

Table 1144: Parameter 32-61 Derivative Factor

32-61 Derivative Factor		
Default value: 0	Parameter type: Range, 0 - 100000	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

The derivative value is the correction factor with which the changing speed of a motor position error is evaluated. The derivative value prevents overswing due to a high P-share and dampens the system.

Parameter 32-62 Integral Factor

Table 1145: Parameter 32-62 Integral Factor

32-62 Integral Factor		
Default value: 0	Parameter type: Range, 0 - 100000	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

The integral factor is the weighting factor with which, at time n, the sum of all motor position errors are evaluated.

Parameter 32-63 Limit Value for Integral Sum

Table 1146: Parameter 32-63 Limit Value for Integral Sum

32-63 Limit Value for Integral Sum		
Default value: 1000	Parameter type: Range, 0 - 1000	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter limits the integral sum to avoid instability and PID wind-up if a feedback error occurs.

Parameter 32-64 PID Bandwidth

Table 1147: Parameter 32-64 PID Bandwidth

32-64 PID Bandwidth		
Default value: 1000	Parameter type: Range, 0 - 1000	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

The value 1000 means that the PID filter can output the full command value. For a Bandwidth of 500 only 50 % of the set value is output.

Parameter 32-65 Velocity Feed-Forward

Table 1148: Parameter 32-65 Velocity Feed-Forward

32-65 Velocity Feed-Forward		
Default value: 0	Parameter type: Range, 0 - 100000	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Velocity Feed-forward is a scaling factor that is multiplied with the derivative of the setpoint position (the velocity of the setpoint). Use this function to get a more dynamic controller.

Parameter 32-66 Acceleration Feed-Forward

Table 1149: Parameter 32-66 Acceleration Feed-Forward

32-66 Acceleration Feed-Forward		
Default value: 0	Parameter type: Range, 0 - 100000	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Acceleration Feed-forward is multiplied with the 2nd derivative of the setpoint position (the acceleration of the setpoint), and the result is added to the control signal. Use this function to give an extra boost during acceleration.

Parameter 32-67 Max. Tolerated Position Error

Table 1150: Parameter 32-67 Max. Tolerated Position Error

32-67 Max. Tolerated Position Error		
Default value: 20000	Parameter type: Range, 1 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter defines the maximum error allowed between the actual position and the calculated command position. If the actual error exceeds the value set in this parameter, the position control fault alarm is triggered.

Parameter 32-68 Reverse Behavior for Slave

Table 1151: Parameter 32-68 Reverse Behavior for Slave

32-68 Reverse Behavior for Slave		
Default value: [0] Reversing allowed	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Reversing allowed	
[1]	Rev. when master	
[2]	Reversing blocked	

Parameter 32-69 Sampling Time for PID Control

Table 1152: Parameter 32-69 Sampling Time for PID Control

32-69 Sampling Time for PID Control		
Default value: 1	Parameter type: Range, 1 - 1000	Setup: 2 setups
Conversion index: -3	Data type: Uint16	Change during operation: True

Sample time of the PID controller. Increase the time if the controller is unstable because of a low-resolution feedback signal or very high load inertia.

Parameter 32-70 Scan Time for Profile Generator

Table 1153: Parameter 32-70 Scan Time for Profile Generator

32-70 Scan Time for Profile Generator		
Default value: 1	Parameter type: Range, 1 - 5 ms	Setup: 2 setups
Conversion index: -3	Data type: Uint8	Change during operation: True

Sample time of the profile generator. Increasing the time speeds up the execution of the application program execution. However, it also reduces control performance so the sample time should not be increased too much if dynamic control is required.

Parameter 32-71 Size of the Control Window (Activation)

Table 1154: Parameter 32-71 Size of the Control Window (Activation)

32-71 Size of the Control Window (Activation)		
Default value: 0	Parameter type: Range, 0 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Parameter 32-72 Size of the Control Window (Deactiv.)

Table 1155: Parameter 32-72 Size of the Control Window (Deactiv.)

32-72 Size of the Control Window (Deactiv.)		
Default value: 0	Parameter type: Range, 0 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Parameter 32-74 Position Error Filter Time

Table 1156: Parameter 32-74 Position Error Filter Time

32-74 Position Error Filter Time		
Default value: 0	Parameter type: Range, 0 - 10000 ms	Setup: 2 setups
Conversion index: -3	Data type: Int16	Change during operation: True

The position error is only activated if the position error value set in *parameter 32-67 Max. Tolerated Position Error* is exceeded for a time longer than the setting in this parameter.

5.25.5 32-8* Velocity & Accel.

Parameter 32-80 Maximum Velocity (Encoder)

Table 1157: Parameter 32-80 Maximum Velocity (Encoder)

32-80 Maximum Velocity (Encoder)		
Default value: 1500	Parameter type: Range, 1 - 100000 RPM	Setup: 2 setups
Conversion index: 67	Data type: Uint32	Change during operation: True

This parameter defines the maximum velocity in RPM during motion control.

Parameter 32-81 Shortest Ramp

Table 1158: Parameter 32-81 Shortest Ramp

32-81 Shortest Ramp		
Default value: 1	Parameter type: Range, 0.001 - 3600 s	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter defines the qiuck-stop ramp time from the maximum allowed velocity to 0 for motion control.

Parameter 32-82 Ramp Type

Table 1159: Parameter 32-82 Ramp Type

32-82 Ramp Type		
Default value: [0] Linear	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Linear	
[1]	S-ramp const jerk	
[2]	S-ramp const time	

Parameter 32-83 Velocity Resolution

Table 1160: Parameter 32-83 Velocity Resolution

32-83 Velocity Resolution		
Default value: 100	Parameter type: Range, 1 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Parameter 32-84 Default Velocity

Table 1161: Parameter 32-84 Default Velocity

32-84 Default Velocity		
Default value: 50	Parameter type: Range, 1 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Parameter 32-85 Default Acceleration

Table 1162: Parameter 32-85 Default Acceleration

32-85 Default Acceleration		
Default value: 50	Parameter type: Range, 1 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Parameter 32-86 Acc. Up for Limited Jerk

Table 1163: Parameter 32-86 Acc. Up for Limited Jerk

32-86 Acc. Up for Limited Jerk		
Default value: 100	Parameter type: Range, 0 - 1073741823 ms	Setup: 2 setups
Conversion index: -3	Data type: Uint32	Change during operation: True

Parameter 32-87 Acc. Down for Limited Jerk

Table 1164: Parameter 32-87 Acc. Down for Limited Jerk

32-87 Acc. Down for Limited Jerk		
Default value: 0	Parameter type: Range, 0 - 1073741823 ms	Setup: 2 setups
Conversion index: -3	Data type: Uint32	Change during operation: True

Parameter 32-88 Dec. Up for Limited Jerk

Table 1165: Parameter 32-88 Dec. Up for Limited Jerk

32-88 Dec. Up for Limited Jerk		
Default value: 0	Parameter type: Range, 0 - 1073741823 ms	Setup: 2 setups
Conversion index: -3	Data type: Uint32	Change during operation: True

Parameter 32-88 Dec. Down for Limited Jerk

Table 1166: Parameter 32-89 Dec. Down for Limited Jerk

32-89 Dec. Down for Limited Jerk		
Default value: 0	Parameter type: Range, 0 - 1073741823 ms	Setup: 2 setups
Conversion index: -3	Data type: Uint32	Change during operation: True

5.25.6 32-9* Development

Parameter 32-90 Debug Source

Table 1167: Parameter 32-90 Debug Source

32-90 Debug Source		
Default value: [0] Controlcard	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Controlcard	
[1]	Option	

5.26 Parameter Group 33-** MCO Adv. Settings

Parameters in this group are available when VLT® Motion Control Option MCO 305 is installed in the drive. For information about the option, see the VLT® Motion Control Option MCO 305 Operating Instructions.

5.26.1 33-0* Home Motion

Parameter 33-00 Force HOME

Table 1168: Parameter 33-00 Force HOME

33-00 Force HOME		
Default value: [0] Home not forced	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Home not forced	
[1]	Home forced	

Parameter 33-01 Zero Point Offset from Home Pos.

Table 1169: Parameter 33-01 Zero Point Offset from Home Pos.

33-01 Zero Point Offset from Home Pos.		
Default value: 0	Parameter type: Range, -1073741824 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Int32	Change during operation: True

Use this parameter to set an offset of 0 (home position) compared to the position after homing.

Parameter 33-02 Ramp for Home Motion

Table 1170: Parameter 33-02 Ramp for Home Motion

33-02 Ramp for Home Motion		
Default value: 10	Parameter type: Range, -1 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter defines the ramp time (in ms) from standstill to the value set in *parameter 32-80 Maximum Allowed Velocity*.

Parameter 33-03 Velocity for Home Motion

Table 1171: Parameter 33-03 Velocity for Home Motion

33-03 Velocity for Home Motion		
Default value: 10	Parameter type: Range, Size related	Setup: 2 setups
Conversion index: 0	Data type: Int32	Change during operation: True

This parameter defines the velocity of homing. It must not exceed *parameter 32-80 Maximum Allowed Velocity*.

Parameter 33-04 Behavior Duirng HomeMotion

Table 1172: Parameter 33-04 Behavior During HomeMotion

33-04 Behavior During HomeMotion		
Default value: [0] Revers and index	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Define the behavior when the home switch is found: Reversing without index (0 pulse) search, or forwarding without index search.

Option	Name	Description
[0]*	Revers and index	
[1]	Revers no index	
[2]	Forward and index	
[3]	Forward no index	

5.26.2 33-1* Synchronization

Parameter 33-10 Sync Factor Master

Table 1173: Parameter 33-10 Sync Factor Master

33-10 Sync Factor Master		
Default value: 1	Parameter type: Range, -1073741824 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 33-11 Sync Factor Slave

Table 1174: Parameter 33-11 Sync Factor Slave

33-11 Sync Factor Slave		
Default value: 1	Parameter type: Range, -1073741824 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 33-12 Position Offset for Synchronization

Table 1175: Parameter 33-12 Position Offset for Synchronization

33-12 Position Offset for Synchronization		
Default value: 0	Parameter type: Range, Size related	Setup: 2 setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 33-13 Accuracy Window for Position Sync.

Table 1176: Parameter 33-13 Accuracy Window for Position Sync.

33-13 Accuracy Window for Position Sync.		
Default value: 1000	Parameter type: Range, -1073741824 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 33-14 Relative Slave Velocity Limit

Table 1177: Parameter 33-14 Relative Slave Velocity Limit

33-14 Relative Slave Velocity Limit		
Default value: 0	Parameter type: Range, 0 - 100%	Setup: 2 setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Parameter 33-15 Marker Number for Master

Table 1178: Parameter 33-15 Marker Number for Master

33-15 Marker Number for Master		
Default value: 1	Parameter type: Range, 1 - 10000	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Parameter 33-16 Marker Number for Slave

Table 1179: Parameter 33-16 Marker Number for Slave

33-16 Marker Number for Slave		
Default value: 1	Parameter type: Range, 1 - 10000	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Parameter 33-17 Master Marker Distance

Table 1180: Parameter 33-17 Master Marker Distance

33-17 Master Marker Distance		
Default value: 4096	Parameter type: Range, 0 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Parameter 33-18 Slave Marker Distance

Table 1181: Parameter 33-18 Slave Marker Distance

33-18 Slave Marker Distance		
Default value: 4096	Parameter type: Range, 0 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Parameter 33-20 Slave Marker Type

Table 1182: Parameter 33-20 Slave Marker Type

33-20 Slave Marker Type		
Default value: [0] Encoder Z positive	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Encoder Z positive	
[1]	Encoder Z negative	
[2]	Ext. marker positive	
[3]	Ext. marker negative	

Parameter 33-21 Master Marker Tolerance Window

Table 1183: Parameter 33-21 Master Marker Tolerance Window

33-21 Master Marker Tolerance Window		
Default value: 0	Parameter type: Range, 0 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Parameter 33-22 Slave Marker Tolerance Window

Table 1184: Parameter 33-22 Slave Marker Tolerance Window

33-22 Slave Marker Tolerance Window		
Default value: 0	Parameter type: Range, 0 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Parameter 33-23 Start Behavior for Marker Sync

Table 1185: Parameter 33-23 Start Behavior for Marker Sync

33-23 Start Behavior for Marker Sync		
Default value: [0] Leading marker	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint16	Change during operation: True

Option	Name	Description
[0]*	Leading marker	
[1]	Following marker	
[2]	Closest marker	
[3]	Master vel/ldg mrk	
[4]	Master vel/flw mrk	
[5]	Master vel/cls mrk	
[6]	Next 2 markers	
[7]	Start with poly5	
[1000]	Ldg mrk late offs	
[1001]	Flw mrk late offs	
[1002]	Cls mark late offs	
[1003]	Mv/ldg mrk/lt off	
[1004]	Mv/flw mrk/lt off	

Option	Name	Description
[1005]	Mv/cls mrk/lt off	
[1006]	Next 2 mrk/lt off	
[1007]	Poly5/late offs	
[2000]	Camstart mast mrk	

Parameter 33-24 Marker Number for Fault

Table 1186: Parameter 33-24 Marker Number for Fault

33-24 Marker Number for Fault		
Default value: 10	Parameter type: Range, 0 - 10000	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Parameter 33-26 Velocity Filter

Table 1187: Parameter 33-26 Velocity Filter

33-26 Velocity Filter		
Default value: 0	Parameter type: Range, -1073741824 - 1073741823 us	Setup: 2 setups
Conversion index: -6	Data type: Int32	Change during operation: True

Parameter 33-27 Offset Filter Time

Table 1188: Parameter 33-27 Offset Filter Time

33-27 Offset Filter Time		
Default value: 0	Parameter type: Range, 0 - 1073741823 ms	Setup: 2 setups
Conversion index: -3	Data type: Uint32	Change during operation: True

Parameter 33-28 Marker Filter Configuration

Table 1189: Parameter 33-28 Marker Filter Configuration

33-28 Marker Filter Configuration		
Default value: [0] Marker filter 1	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Marker filter 1	
[1]	Marker filter 2	
[2]	Correction syncfact	
[4]	Correction time	
[16]	No marker dist. corr	

Parameter 33-29 Filter Time for Marker Filter

Table 1190: Parameter 33-29 Filter Time for Marker Filter

33-29 Filter Time for Marker Filter		
Default value: 0	Parameter type: Range, -1073741824 - 1073741823 ms	Setup: 2 setups
Conversion index: -3	Data type: Int32	Change during operation: True

Parameter 33-30 Maximum Marker Correction

Table 1191: Parameter 33-30 Maximum Marker Correction

33-30 Maximum Marker Correction		
Default value: 0	Parameter type: Range, 0 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Parameter 33-31 Synchronization Type

Table 1192: Parameter 33-31 Synchronization Type

33-31 Synchronization Type		
Default value: [0] Standard	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Standard	
[1]	Look ahead	

Parameter 33-32 Feed Forward Velocity Adaptation

Table 1193: Parameter 33-32 Feed Forward Velocity Adaptation

33-32 Feed Forward Velocity Adaptation		
Default value: 0	Parameter type: Range, 0 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Parameter 33-33 Velocity Filter Window

Table 1194: Parameter 33-33 Velocity Filter Window

33-33 Velocity Filter Window		
Default value: 0	Parameter type: Range, 0 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Parameter 33-34 Slave Marker Filter Time

Table 1195: Parameter 33-34 Slave Marker Filter Time

33-34 Slave Marker Filter Time		
Default value: 0	Parameter type: Range, 0 - 1073741823 ms	Setup: 2 setups
Conversion index: -3	Data type: Uint32	Change during operation: True

5.26.3 33-4* Limit Handling

Parameter 33-40 Behavior atEnd Limit Switch

Table 1196: Parameter 33-40 Behavior atEnd Limit Switch

33-40 Behavior atEnd Limit Switch		
Default value: [0] Call error handler	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Call error handler	
[1]	Controlled stop	

Parameter 33-41 Negative Software End Limit

Table 1197: Parameter 33-41 Negative Software End Limit

33-41 Negative Software End Limit		
Default value: -500000	Parameter type: Range, -1073741824 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Int32	Change during operation: True

This parameter is active only during positioning if *parameter 33-42 Negative Software Limit Active* is set to *[1] Active*. When *parameter 34-50 Actual Position* reaches below the negative software limit set in this parameter, a position control fault alarm is reported.

Parameter 33-42 Positive Software End Limit

Table 1198: Parameter 33-42 Positive Software End Limit

33-42 Positive Software End Limit		
Default value: 500000	Parameter type: Range, -1073741824 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Int32	Change during operation: True

This parameter is active only during positioning if *parameter 33-42 Negative Software Limit Active* is set to *[1] Active*. When *parameter 34-50 Actual Position* reaches below the negative software limit set in this parameter, a position control fault alarm is reported.

Parameter 33-42 Positive Software End Limit

Table 1199: Parameter 33-42 Positive Software End Limit

33-42 Positive Software End Limit		
Default value: 500000	Parameter type: Range, -1073741824 - 1073741823	Setup: 2 setups
Conversion index: 0	Data type: Int32	Change during operation: True

This parameter is active only during positioning if *parameter 33-42 Negative Software Limit Active* is set to *[1] Active*. When *parameter 34-50 Actual Position* reaches below the negative software limit set in this parameter, a position control fault alarm is reported.

Parameter 33-43 Negative Software End Limit Active

Table 1200: Parameter 33-43 Negative Software End Limit Active

33-43 Negative Software End Limit Active		
Default value: [0] Inactive	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Inactive	
[1]	Active	

Parameter 33-44 Positive Software End Limit Active

Table 1201: Parameter 33-44 Positive Software End Limit Active

33-44 Positive Software End Limit Active		
Default value: [0] Inactive	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

When this parameter is set to active, the drive continuously checks whether the target position is above the positive software limit. If the position is outside the limit, an error is issued and the drive control is switched off.

Option	Name	Description
[0]*	Inactive	
[1]	Active	

Parameter 33-45 Time in Target Window

Table 1202: Parameter 33-45 Time in Target Window

33-45 Time in Target Window		
Default value: 0	Parameter type: Range, 0 - 10 ms	Setup: 2 setups
Conversion index: -3	Data type: Uint8	Change during operation: True

Parameter 33-46 Target Window LimitValue

Table 1203: Parameter 33-46 Target Window LimitValue

33-46 Target Window LimitValue		
Default value: 1	Parameter type: Range, 1 - 10000 ms	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Parameter 33-47 Size of Target Window

Table 1204: Parameter 33-47 Size of Target Window

33-47 Size of Target Window		
Default value: 0	Parameter type: Range, 0 - 10000 ms	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Defines the size of the target window with user unit. A position is only viewed as reached when the actual position is within this window.

5.26.4 33-5* I/O Configuration

Parameter 33-50 Terminal X57/1 Digital Input

Table 1205: Parameter 33-50 Terminal X57/1 Digital Input

33-50 Terminal X57/1 Digital Input		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Home switch no	
[2]	Home switch nc	
[3]	Neg. end switch no	
[4]	Neg. end switch nc	
[5]	Posi. end switch no	
[6]	Posi. end switch nc	
[7]	Error clear no	
[8]	Error clear nc	
[9]	Break prog. exe no	
[10]	Break prog. exe nc	
[11]	Cont. prog. exe no	
[12]	Cont. prog. exe nc	
[13]	Start prog. exe no	
[14]	Start prog. exe nc	
[15]	Program select	

Parameter 33-51 Terminal X57/2 Digital Input

Table 1206: Parameter 33-51 Terminal X57/2 Digital Input

33-51 Terminal X57/2 Digital Input		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Home switch no	
[2]	Home switch nc	
[3]	Neg. end switch no	
[4]	Neg. end switch nc	

Option	Name	Description
[5]	Posi. end switch no	
[6]	Posi. end switch nc	
[7]	Error clear no	
[8]	Error clear nc	
[9]	Break prog. exe no	
[10]	Break prog. exe nc	
[11]	Cont. prog. exe no	
[12]	Cont. prog. exe nc	
[13]	Start prog. exe no	
[14]	Start prog. exe nc	
[15]	Program select	

Parameter 33-52 Terminal X57/3 Digital Input

Table 1207: Parameter 33-52 Terminal X57/3 Digital Input

33-52 Terminal X57/3 Digital Input		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Home switch no	
[2]	Home switch nc	
[3]	Neg. end switch no	
[4]	Neg. end switch nc	
[5]	Posi. end switch no	
[6]	Posi. end switch nc	
[7]	Error clear no	
[8]	Error clear nc	
[9]	Break prog. exe no	
[10]	Break prog. exe nc	
[11]	Cont. prog. exe no	
[12]	Cont. prog. exe nc	

Option	Name	Description
[13]	Start prog. exe no	
[14]	Start prog. exe nc	
[15]	Program select	

Parameter 33-53 Terminal X57/4 Digital Input

Table 1208: Parameter 33-53 Terminal X57/4 Digital Input

33-53 Terminal X57/4 Digital Input		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Home switch no	
[2]	Home switch nc	
[3]	Neg. end switch no	
[4]	Neg. end switch nc	
[5]	Posi. end switch no	
[6]	Posi. end switch nc	
[7]	Error clear no	
[8]	Error clear nc	
[9]	Break prog. exe no	
[10]	Break prog. exe nc	
[11]	Cont. prog. exe no	
[12]	Cont. prog. exe nc	
[13]	Start prog. exe no	
[14]	Start prog. exe nc	
[15]	Program select	

Parameter 33-54 Terminal X57/5 Digital Input

Table 1209: Parameter 33-54 Terminal X57/5 Digital Input

33-54 Terminal X57/5 Digital Input		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Home switch no	
[2]	Home switch nc	
[3]	Neg. end switch no	
[4]	Neg. end switch nc	
[5]	Posi. end switch no	
[6]	Posi. end switch nc	
[7]	Error clear no	
[8]	Error clear nc	
[9]	Break prog. exe no	
[10]	Break prog. exe nc	
[11]	Cont. prog. exe no	
[12]	Cont. prog. exe nc	
[13]	Start prog. exe no	
[14]	Start prog. exe nc	
[15]	Program select	

Parameter 33-55 Terminal X57/6 Digital Input

Table 1210: Parameter 33-55 Terminal X57/6 Digital Input

33-55 Terminal X57/6 Digital Input		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Home switch no	
[2]	Home switch nc	
[3]	Neg. end switch no	
[4]	Neg. end switch nc	
[5]	Posi. end switch no	
[6]	Posi. end switch nc	
[7]	Error clear no	
[8]	Error clear nc	
[9]	Break prog. exe no	

Option	Name	Description
[10]	Break prog. exe nc	
[11]	Cont. prog. exe no	
[12]	Cont. prog. exe nc	
[13]	Start prog. exe no	
[14]	Start prog. exe nc	
[15]	Program select	

Parameter 33-56 Terminal X57/7 Digital Input

Table 1211: Parameter 33-56 Terminal X57/7 Digital Input

33-56 Terminal X57/7 Digital Input		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Home switch no	
[2]	Home switch nc	
[3]	Neg. end switch no	
[4]	Neg. end switch nc	
[5]	Posi. end switch no	
[6]	Posi. end switch nc	
[7]	Error clear no	
[8]	Error clear nc	
[9]	Break prog. exe no	
[10]	Break prog. exe nc	
[11]	Cont. prog. exe no	
[12]	Cont. prog. exe nc	
[13]	Start prog. exe no	
[14]	Start prog. exe nc	
[15]	Program select	

Parameter 33-57 Terminal X57/8 Digital Input

Table 1212: Parameter 33-57 Terminal X57/8 Digital Input

33-57 Terminal X57/8 Digital Input		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Home switch no	
[2]	Home switch nc	
[3]	Neg. end switch no	
[4]	Neg. end switch nc	
[5]	Posi. end switch no	
[6]	Posi. end switch nc	
[7]	Error clear no	
[8]	Error clear nc	
[9]	Break prog. exe no	
[10]	Break prog. exe nc	
[11]	Cont. prog. exe no	
[12]	Cont. prog. exe nc	
[13]	Start prog. exe no	
[14]	Start prog. exe nc	
[15]	Program select	

Parameter 33-58 Terminal X57/9 Digital Input

Table 1213: Parameter 33-58 Terminal X57/9 Digital Input

33-58 Terminal X57/9 Digital Input		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Home switch no	
[2]	Home switch nc	
[3]	Neg. end switch no	
[4]	Neg. end switch nc	
[5]	Posi. end switch no	
[6]	Posi. end switch nc	
[7]	Error clear no	
[8]	Error clear nc	
[9]	Break prog. exe no	

Option	Name	Description
[10]	Break prog. exe nc	
[11]	Cont. prog. exe no	
[12]	Cont. prog. exe nc	
[13]	Start prog. exe no	
[14]	Start prog. exe nc	
[15]	Program select	

Parameter 33-59 Terminal X57/10 Digital Input

Table 1214: Parameter 33-59 Terminal X57/10 Digital Input

33-59 Terminal X57/10 Digital Input		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Home switch no	
[2]	Home switch nc	
[3]	Neg. end switch no	
[4]	Neg. end switch nc	
[5]	Posi. end switch no	
[6]	Posi. end switch nc	
[7]	Error clear no	
[8]	Error clear nc	
[9]	Break prog. exe no	
[10]	Break prog. exe nc	
[11]	Cont. prog. exe no	
[12]	Cont. prog. exe nc	
[13]	Start prog. exe no	
[14]	Start prog. exe nc	
[15]	Program select	

Parameter 33-60 Terminal X59/1 and X59/2 Mode

Table 1215: Parameter 33-60 Terminal X59/1 and X59/2 Mode

33-60 Terminal X59/1 and X59/2 Mode		
Default value: [1] Output	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: False

Option	Name	Description
[0]	Input	
[1]*	Output	

Parameter 33-61 Terminal X59/1 Digital Input

Table 1216: Parameter 33-61 Terminal X59/1 Digital Input

33-61 Terminal X59/1 Digital Input		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Home switch no	
[2]	Home switch nc	
[3]	Neg. end switch no	
[4]	Neg. end switch nc	
[5]	Posi. end switch no	
[6]	Posi. end switch nc	
[7]	Error clear no	
[8]	Error clear nc	
[9]	Break prog. exe no	
[10]	Break prog. exe nc	
[11]	Cont. prog. exe no	
[12]	Cont. prog. exe nc	
[13]	Start prog. exe no	
[14]	Start prog. exe nc	
[15]	Program select	

Parameter 33-62 Terminal X59/2 Digital Input

Table 1217: Parameter 33-62 Terminal X59/2 Digital Input

33-62 Terminal X59/2 Digital Input		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Home switch no	

Option	Name	Description
[2]	Home switch nc	
[3]	Neg. end switch no	
[4]	Neg. end switch nc	
[5]	Posi. end switch no	
[6]	Posi. end switch nc	
[7]	Error clear no	
[8]	Error clear nc	
[9]	Break prog. exe no	
[10]	Break prog. exe nc	
[11]	Cont. prog. exe no	
[12]	Cont. prog. exe nc	
[13]	Start prog. exe no	
[14]	Start prog. exe nc	
[15]	Program select	

Parameter 33-63 Terminal X59/2 Digital Output

Table 1218: Parameter 33-63 Terminal X59/1 Digital Output

33-63 Terminal X59/1 Digital Output		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Moving no	
[2]	Moving nc	
[3]	Error no	
[4]	Error nc	
[5]	Brake control no	
[6]	Brake control nc	

Parameter 33-64 Terminal X59/2 Digital Output

Table 1219: Parameter 33-64 Terminal X59/2 Digital Output

33-64 Terminal X59/2 Digital Output		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Moving no	
[2]	Moving nc	
[3]	Error no	
[4]	Error nc	
[5]	Brake control no	
[6]	Brake control nc	

Parameter 33-65 Terminal X59/3 Digital Output

Table 1220: Parameter 33-65 Terminal X59/3 Digital Output

33-65 Terminal X59/3 Digital Output		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Moving no	
[2]	Moving nc	
[3]	Error no	
[4]	Error nc	
[5]	Brake control no	
[6]	Brake control nc	

Parameter 33-66 Terminal X59/4 Digital Output

Table 1221: Parameter 33-66 Terminal X59/4 Digital Output

33-66 Terminal X59/4 Digital Output		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Moving no	
[2]	Moving nc	
[3]	Error no	

Option	Name	Description
[4]	Error nc	
[5]	Brake control no	
[6]	Brake control nc	

Parameter 33-67 Terminal X59/5 Digital Output

Table 1222: Parameter 33-67 Terminal X59/5 Digital Output

33-67 Terminal X59/5 Digital Output		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Moving no	
[2]	Moving nc	
[3]	Error no	
[4]	Error nc	
[5]	Brake control no	
[6]	Brake control nc	

Parameter 33-68 Terminal X59/6 Digital Output

Table 1223: Parameter 33-68 Terminal X59/6 Digital Output

33-68 Terminal X59/6 Digital Output		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Moving no	
[2]	Moving nc	
[3]	Error no	
[4]	Error nc	
[5]	Brake control no	
[6]	Brake control nc	

Parameter 33-69 Terminal X59/7 Digital Output

Table 1224: Parameter 33-69 Terminal X59/7 Digital Output

33-69 Terminal X59/7 Digital Output		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Moving no	
[2]	Moving nc	
[3]	Error no	
[4]	Error nc	
[5]	Brake control no	
[6]	Brake control nc	

Parameter 33-70 Terminal X59/8 Digital Output

Table 1225: Parameter 33-70 Terminal X59/8 Digital Output

33-70 Terminal X59/8 Digital Output		
Default value: [0] No function	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No function	
[1]	Moving no	
[2]	Moving nc	
[3]	Error no	
[4]	Error nc	
[5]	Brake control no	
[6]	Brake control nc	

5.26.5 33-8* Global Parameters

Parameter 33-80 Activated Program Number

Table 1226: Parameter 33-80 Activated Program Number

33-80 Activated Program Number		
Default value: -1	Parameter type: Range, -1 - 127	Setup: 2 setups
Conversion index: 0	Data type: Int8	Change during operation: True

Parameter 33-81 Power-up State

Table 1227: Parameter 33-81 Power-up State

33-81 Power-up State		
Default value: [1] Motor on	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	Motor off	
[1]*	Motor on	

Parameter 33-82 Drive Status Monitoring

Table 1228: Parameter 33-82 Drive Status Monitoring

33-82 Drive Status Monitoring		
Default value: [1] On	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	Off	
[1]*	On	

Parameter 33-83 Behavior afterError

Table 1229: Parameter 33-83 Behavior afterError

33-83 Behavior afterError		
Default value: [0] Coast	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Coast	
[1]	Coast and brake	
[2]	Controlled stop	
[3]	Contr.stop + brake	
[5]	Only errorhandler	

Parameter 33-84 Behavior afterEsc.

Table 1230: Parameter 33-84 Behavior afterEsc.

33-84 Behavior afterEsc.		
Default value: [0] Controlled stop	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Controlled stop	
[1]	Contr. stop + outp=0	
[2]	Contr. stop + outp=1	

Parameter 33-85 MCO Supplied by External 24VDC

Table 1231: Parameter 33-85 MCO Supplied by External 24VDC

33-85 MCO Supplied by External 24VDC		
Default value: [0] No	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No	
[1]	Yes	

Parameter 33-86 Terminal at Alarm

Table 1232: Parameter 33-86 Terminal at Alarm

33-86 Terminal at Alarm		
Default value: [0] Relay 1	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Relay 1	
[1]	Relay 2	
[2]	Terminal 27 digital output	
[3]	Terminal 29 digital output	

Parameter 33-87 Terminal State at Alarm

Table 1233: Parameter 33-87 Terminal State at Alarm

33-87 Terminal State at Alarm		
Default value: [0] Do nothing	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Do nothing	
[1]	High	
[2]	Low	

Parameter 33-88 Status Word at Alarm

Table 1234: Parameter 33-88 Status Word at Alarm

33-88 Status Word at Alarm		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

5.26.6 33-9* MCO Port Settings

Parameter 33-90 X62 MCO CAN node ID

Table 1235: Parameter 33-90 X62 MCO CAN node ID

33-90 X62 MCO CAN node ID		
Default value: 127	Parameter type: Range, 0 - 127	Setup: 2 setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Parameter 33-91 X62 MCO CAN Baud Rate

Table 1236: Parameter 33-91 X62 MCO CAN Baud Rate

33-91 X62 MCO CAN Baud Rate		
Default value: [20] 125 Kbps	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[16]	10 Kbps	
[17]	20 Kbps	
[18]	50 Kbps	
[19]	100 Kbps	
[20]*	125 Kbps	
[21]	250 Kbps	
[22]	500 Kbps	
[24]	1000 Kbps	

Parameter 33-94 X60 MCO RS485 Serial Termination

Table 1237: Parameter 33-94 X60 MCO RS485 Serial Termination

33-94 X60 MCO RS485 Serial Termination		
Default value: [0] Off	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Off	
[1]	On	

Parameter 33-95 X60 MCO RS485 Serial Baud Rate

Table 1238: Parameter 33-95 X60 MCO RS485 Serial Baud Rate

33-95 X60 MCO RS485 Serial Baud Rate		
Default value: [2] 9600 Baud	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	2400 Baud	
[1]	4800 Baud	
[2]*	9600 Baud	
[3]	19200 Baud	
[4]	38400 Baud	
[5]	57600 Baud	
[6]	76800 Baud	
[7]	115200 Baud	

5.27 Parameter Group 34-** MCO Data Readouts

Parameters in this group are available when VLT® Motion Control Option MCO 305 is installed in the drive. For information about the option, refer to VLT® Motion Control Option MCO 302 Operating Instructions.

5.27.1 34-0* PCD Write Par.

Parameter 34-01 PCD 1 Write to MCO

Table 1239: Parameter 34-01 PCD 1 Write to MCO

34-01 PCD 1 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD1 of the fieldbus telegram.

Parameter 34-02 PCD 2 Write to MCO

Table 1240: Parameter 34-02 PCD 2 Write to MCO

34-02 PCD 2 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD2 of the fieldbus telegram.

Parameter 34-03 PCD 3 Write to MCO

Table 1241: Parameter 34-03 PCD 3 Write to MCO

34-03 PCD 3 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD3 of the fieldbus telegram.

Parameter 34-04 PCD 4 Write to MCO

Table 1242: Parameter 34-04 PCD 4 Write to MCO

34-04 PCD 4 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD4 of the fieldbus telegram.

Parameter 34-05 PCD 5 Write to MCO

Table 1243: Parameter 34-05 PCD 5 Write to MCO

34-05 PCD 5 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD5 of the fieldbus telegram.

Parameter 34-06 PCD 6 Write to MCO

Table 1244: Parameter 34-06 PCD 6 Write to MCO

34-06 PCD 6 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD6 of the fieldbus telegram.

Parameter 34-07 PCD 7 Write to MCO

Table 1245: Parameter 34-07 PCD 7 Write to MCO

34-07 PCD 7 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD7 of the fieldbus telegram.

Parameter 34-08 PCD 8 Write to MCO

Table 1246: Parameter 34-08 PCD 8 Write to MCO

34-08 PCD 8 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD8 of the fieldbus telegram.

Parameter 34-09 PCD 9 Write to MCO

Table 1247: Parameter 34-09 PCD 9 Write to MCO

34-09 PCD 9 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD9 of the fieldbus telegram.

Parameter 34-10 PCD 10 Write to MCO

Table 1248: Parameter 34-10 PCD 10 Write to MCO

34-10 PCD 10 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD10 of the fieldbus telegram.

5.27.2 34-2* PCD Read Par.

Parameter 34-21 PCD 1 Read from MCO

Table 1249: Parameter 34-21 PCD 1 Read from MCO

34-21 PCD 1 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD1 of the fieldbus telegram.

Parameter 34-22 PCD 2 Read from MCO

Table 1250: Parameter 34-22 PCD 2 Read from MCO

34-22 PCD 2 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD2 of the fieldbus telegram.

Parameter 34-23 PCD 3 Read from MCO

Table 1251: Parameter 34-23 PCD 3 Read from MCO

34-23 PCD 3 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD3 of the fieldbus telegram.

Parameter 34-24 PCD 4 Read from MCO

Table 1252: Parameter 34-24 PCD 4 Read from MCO

34-24 PCD 4 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD4 of the fieldbus telegram.

Parameter 34-25 PCD 5 Read from MCO

Table 1253: Parameter 34-25 PCD 5 Read from MCO

34-25 PCD 5 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD5 of the fieldbus telegram.

Parameter 34-26 PCD 6 Read from MCO

Table 1254: Parameter 34-26 PCD 6 Read from MCO

34-26 PCD 6 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD6 of the fieldbus telegram.

Parameter 34-27 PCD 7 Read from MCO

Table 1255: Parameter 34-27 PCD 7 Read from MCO

34-27 PCD 7 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD7 of the fieldbus telegram.

Parameter 34-28 PCD 8 Read from MCO

Table 1256: Parameter 34-28 PCD 8 Read from MCO

34-28 PCD 8 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD8 of the fieldbus telegram.

Parameter 34-29 PCD 9 Read from MCO

Table 1257: Parameter 34-29 PCD 9 Read from MCO

34-29 PCD 9 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD9 of the fieldbus telegram.

Parameter 34-30 PCD 10 Read from MCO

Table 1258: Parameter 34-30 PCD 10 Read from MCO

34-30 PCD 10 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD10 of the fieldbus telegram.

5.27.3 34-4* Inputs & Outputs

Parameter 34-40 Digital Inputs

Table 1259: Parameter 34-40 Digital Inputs

34-40 Digital Inputs		
Default value: 0	Parameter type: Range, 0 - 4095	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Parameter 34-41 Digital Outputs

Table 1260: Parameter 34-41 Digital Outputs

34-41 Digital Outputs		
Default value: 0	Parameter type: Range, 0 - 255	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

5.27.4 34-5* Process Data

Parameter 34-50 Actual Position

Table 1261: Parameter 34-50 Actual Position

34-50 Actual Position		
Default value: 0	Parameter type: Range, -1073741824 - 1073741823	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

The actual position in user unit.

Parameter 34-51 Commanded Position

Table 1262: Parameter 34-51 Commanded Position

34-51 Commanded Position		
Default value: 0	Parameter type: Range, -1073741824 - 1073741823	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 34-52 Actual Master Position

Table 1263: Parameter 34-52 Actual Master Position

34-52 Actual Master Position		
Default value: 0	Parameter type: Range, -1073741824 - 1073741823	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 34-53 Slave Index Position

Table 1264: Parameter 34-53 Slave Index Position

34-53 Slave Index Position		
Default value: 0	Parameter type: Range, -1073741824 - 1073741823	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 34-54 Master Index Position

Table 1265: Parameter 34-54 Master Index Position

34-54 Master Index Position		
Default value: 0	Parameter type: Range, -1073741824 - 1073741823	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 34-55 Curve Position

Table 1266: Parameter 34-55 Curve Position

34-55 Curve Position		
Default value: 0	Parameter type: Range, -1073741824 - 1073741823	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 34-56 Track Error

Table 1267: Parameter 34-56 Track Error

34-56 Track Error		
Default value: 0	Parameter type: Range, -1073741828 - 1073741827	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Readout of the error between the calculated command position and the actual position in user unit.

Parameter 34-57 Synchronizing Error

Table 1268: Parameter 34-57 Synchronizing Error

34-57 Synchronizing Error		
Default value: 0	Parameter type: Range, -1073741828 - 1073741827	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 34-58 Actual Velocity

Table 1269: Parameter 34-58 Actual Velocity

34-58 Actual Velocity		
Default value: 0	Parameter type: Range, -1073741828 - 1073741827	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 34-59 Actual Master Velocity

Table 1270: Parameter 34-59 Actual Master Velocity

34-59 Actual Master Velocity		
Default value: 0	Parameter type: Range, -1073741828 - 1073741827	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 34-60 Synchronizing Status

Table 1271: Parameter 34-60 Synchronizing Status

34-60 Synchronizing Status		
Default value: 0	Parameter type: Range, -1073741828 - 1073741827	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 34-61 Axis Status

Table 1272: Parameter 34-61 Axis Status

34-61 Axis Status		
Default value: 0	Parameter type: Range, -1073741828 - 1073741827	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 34-62 Program Status

Table 1273: Parameter 34-62 Program Status

34-62 Program Status		
Default value: 0	Parameter type: Range, -1073741828 - 1073741827	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 34-64 MCO 302 Status

Table 1274: Parameter 34-64 MCO 302 Status

34-64 MCO 302 Status		
Default value: 0	Parameter type: Range, 0 - 16384	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Parameter 34-65 MCO 302 Control

Table 1275: Parameter 34-65 MCO 302 Control

34-65 MCO 302 Control		
Default value: 0	Parameter type: Range, 0 - 16384	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Parameter 34-66 SPI Error Counter

Table 1276: Parameter 34-66 SPI Error Counter

34-66 SPI Error Counter		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

5.27.5 34-7* Diagnosis Readouts

Parameter 34-70 MCO Alarm Word 1

Table 1277: Parameter 34-70 MCO Alarm Word 1

34-70 MCO Alarm Word 1		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Parameter 34-71 MCO Alarm Word 2

Table 1278: Parameter 34-71 MCO Alarm Word 2

34-71 MCO Alarm Word 2		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

5.28 Parameter Group 35-** Sensor Input Option

Parameters for configuring the functionality of VLT® Sensor Input MCB 114.

5.28.1 35-0* Temp. Input Mode

Parameter 35-00 Term. X48/4 Temperature Unit

Table 1279: Parameter 35-00 Term. X48/4 Temperature Unit

35-00 Term. X48/4 Temperature Unit		
Default value: [60] °C	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the unit to be used with temperature input X48/4 settings and readouts.

Option	Name	Description
[60]*	°C	
[160]	°F	

Parameter 35-01 Term. X48/4 Input Type

Table 1280: Parameter 35-01 Term. X48/4 Input Type

35-01 Term. X48/4 Input Type		
Default value: [0] Not connected	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

View the temperature sensor type detected at input X48/4.

Option	Name	Description
[0]*	Not connected	
[1]	PT100 2-wire	
[3]	PT1000 2-wire	
[5]	PT100 3-wire	
[7]	PT1000 3-wire	

Parameter 35-02 Term. X48/7 Temperature Unit

Table 1281: Parameter 35-02 Term. X48/7 Temperature Unit

35-02 Term. X48/7 Temperature Unit		
Default value: [60] °C	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the unit to be used with temperature input X48/7 settings and readouts.

Option	Name	Description
[60]*	°C	
[160]	°F	

Parameter 35-03 Term. X48/7 Input Type

Table 1282: Parameter 35-03 Term. X48/7 Input Type

35-03 Term. X48/7 Input Type		
Default value: [0] Not connected	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

View the temperature sensor type detected at input X48/7.

Option	Name	Description
[0]*	Not connected	
[1]	PT100 2-wire	

Option	Name	Description
[3]	PT1000 2-wire	
[5]	PT100 3-wire	
[7]	PT1000 3-wire	

Parameter 35-04 Term. X48/10 Temperature Unit

Table 1283: Parameter 35-04 Term. X48/10 Temperature Unit

35-04 Term. X48/10 Temperature Unit		
Default value: [60] °C	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the unit to be used with temperature input X48/10 settings and readouts.

Option	Name	Description
[60]*	°C	
[160]	°F	

Parameter 35-05 Term. X48/10 Input Type

Table 1284: Parameter 35-05 Term. X48/10 Input Type

35-05 Term. X48/10 Input Type		
Default value: [0] Not connected	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

View the temperature sensor type detected at input X48/10.

Option	Name	Description
[0]*	Not connected	
[1]	PT100 2-wire	
[3]	PT1000 2-wire	
[5]	PT100 3-wire	
[7]	PT1000 3-wire	

Parameter 35-06 Temperature Sensor Alarm Function

Table 1285: Parameter 35-06 Temperature Sensor Alarm Function

35-06 Temperature Sensor Alarm Function		
Default value: [5] Stop and trip	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Set the alarm function.

Option	Name	Description
[0]	Off	
[2]	Stop	
[5]*	Stop and trip	
[27]	Forced stop and trip	

5.28.2 35-1* Temp. Input X48/4

Parameter 35-14 Term. X48/4 Filter Time Constant

Table 1286: Parameter 35-14 Term. X48/4 Filter Time Constant

35-14 Term. X48/4 Filter Time Constant		
Default value: 0.001 s	Parameter type: Range, 0.001 - 10 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the filter time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal X48/4. A high time constant value improves dampening but also increases the time delay through the filter.

Parameter 35-15 Term. X48/4 Temp. Monitor

Table 1287: Parameter 35-15 Term. X48/4 Temp. Monitor

35-15 Term. X48/4 Temp. Monitor		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

This parameter facilitates the possibility of enabling or disabling the temperature monitor for terminal X48/4. Set the temperature limits in *parameter 35-16 Term. X48/4 Low Temp. Limit* and *parameter 35-17 Term. X48/4 High Temp. Limit*.

Option	Name	Description
[0]*	Disabled	
[1]	Enabled	

Parameter 35-16 Term. X48/4 Low Temp. Limit

Table 1288: Parameter 35-16 Term. X48/4 Low Temp. Limit

35-16 Term. X48/4 Low Temp. Limit		
Default value: Size related	Parameter type: Range, N/A	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Enter the minimum temperature reading that is expected for normal operation of the temperature sensor at terminal X48/4.

Parameter 35-17 Term. X48/4 High Temp. Limit

Table 1289: Parameter 35-17 Term. X48/4 High Temp. Limit

35-17 Term. X48/4 High Temp. Limit		
Default value: Size related	Parameter type: Range, N/A	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Enter the maximum temperature reading that is expected for normal operation of the temperature sensor at terminal X48/4.

5.28.3 35-2* Temp. Input X48/7

Table 1290: Parameter 35-24 Term. X48/7 Filter Time Constant

35-24 Term. X48/7 Filter Time Constant		
Default value: 0.001 s	Parameter type: Range, 0.001 - 10 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the filter time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal X48/7. A high time constant value improves dampening but also increases the time delay through the filter.

Parameter 35-25 Term. X48/7 Temp. Monitor

Table 1291: Parameter 35-25 Term. X48/7 Temp. Monitor

35-25 Term. X48/7 Temp. Monitor		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

This parameter facilitates the possibility of enabling or disabling the temperature monitor for terminal X48/4. Set the temperature limits in *parameter 35-26 Term. X48/7 Low Temp. Limit* and *parameter 35-27 Term. X48/7 High Temp. Limit*.

Option	Name	Description
[0]*	Disabled	
[1]	Enabled	

Parameter 35-26 Term. X48/7 Low Temp. Limit

Table 1292: Parameter 35-26 Term. X48/7 Low Temp. Limit

35-26 Term. X48/7 Low Temp. Limit		
Default value: Size related	Parameter type: Range, N/A	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Enter the minimum temperature reading that is expected for normal operation of the temperature sensor at terminal X48/7.

Parameter 35-27 Term. X48/7 High Temp. Limit

Table 1293: Parameter 35-27 Term. X48/7 High Temp. Limit

35-27 Term. X48/7 High Temp. Limit		
Default value: Size related	Parameter type: Range, N/A	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Enter the maximum temperature reading that is expected for normal operation of the temperature sensor at terminal X48/7.

5.28.4 35-3* Temp. Input X48/10

Parameter 35-34 Term. X48/10 Filter Time Constant

Table 1294: Parameter 35-34 Term. X48/10 Filter Time Constant

35-34 Term. X48/10 Filter Time Constant		
Default value: 0.001 s	Parameter type: Range, 0.001 - 10 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the filter time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal X48/10. A high time constant value improves dampening but also increases the time delay through the filter.

Parameter 35-35 Term. X48/10 Temp. Monitor

Table 1295: Parameter 35-35 Term. X48/10 Temp. Monitor

35-35 Term. X48/10 Temp. Monitor		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

This parameter facilitates the possibility of enabling or disabling the temperature monitor for terminal X48/4. Set the temperature limits in *parameter 35-36 Term. X48/10 Low Temp. Limit* and *parameter 35-37 Term. X48/10 High Temp. Limit*.

Option	Name	Description
[0]*	Disabled	
[1]	Enabled	

Parameter 35-36 Term. X48/10 Low Temp. Limit

Table 1296: Parameter 35-36 Term. X48/10 Low Temp. Limit

35-36 Term. X48/10 Low Temp. Limit		
Default value: Size related	Parameter type: Range, N/A	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Enter the minimum temperature reading that is expected for normal operation of the temperature sensor at terminal X48/10.

Parameter 35-37 Term. X48/10 High Temp. Limit

Table 1297: Parameter 35-37 Term. X48/10 High Temp. Limit

35-37 Term. X48/10 High Temp. Limit		
Default value: Size related	Parameter type: Range, N/A	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Enter the maximum temperature reading that is expected for normal operation of the temperature sensor at terminal X48/10.

5.28.5 35-4* Analog Input X48/2

Parameter 35-42 Term. X48/2 Low Current

Table 1298: Parameter 35-42 Term. X48/2 Low Current

35-42 Term. X48/2 Low Current		
Default value: 4 mA	Parameter type: Range, 0 - 20 mA	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: True

Enter the current (mA) that corresponds to the low reference value set in *parameter 35-44 Term. X48/2 Low Ref./Feedb. Value*. The value must be more than 2 mA to activate the live zero timeout function in *parameter 6-01 Live Zero Timeout Function*.

Parameter 35-43 Term. X48/2 High Current

Table 1299: Parameter 35-43 Term. X48/2 High Current

35-43 Term. X48/2 High Current		
Default value: 20 mA	Parameter type: Range, 0 - 20 mA	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: True

Enter the current (mA) that corresponds to the high reference value set in *parameter 35-45 Term. X48/2 High Ref./Feedb. Value*.

Parameter 35-44 Term. 48/2 Low Ref./Feedb. Value

Table 1300: Parameter 35-44 Term. 48/2 Low Ref./Feedb. Value

35-44 Term. 48/2 Low Ref./Feedb. Value		
Default value: 0 ReferenceFeedbackUnit	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Enter the reference or feedback value (in RPM, Hz, bar, and so on) that corresponds to the voltage or current set in *parameter 35-42 Term. X48/2 Low Current*.

Parameter 35-45 Term. 48/2 High Ref./Feedb. Value

Table 1301: Parameter 35-45 Term. 48/2 High Ref./Feedb. Value

35-45 Term. 48/2 High Ref./Feedb. Value		
Default value: 100 ReferenceFeedbackUnit	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Enter the reference or feedback value (in RPM, Hz, bar, and so on) that corresponds to the voltage or current set in *parameter 35-43 Term. X48/2 High Current*.

Parameter 35-46 Term. X48/2 Filter Time Constant

Table 1302: Parameter 35-46 Term. X48/2 Filter Time Constant

35-46 Term. X48/2 Filter Time Constant		
Default value: 0.001 s	Parameter type: Range, 0.001 - 10 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the filter time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal X48/2. A high time constant value improves dampening but also increases the time delay through the filter.

5.29 Parameter Group 36-** Programmable I/O Option

Parameters for configuring VLT® Programmable I/O MCB 115.

Parameters in this group are only active if VLT® Programmable I/O MCB 115 is installed.

5.29.1 36-0* I/O Mode

N O T I C E

The following parameters are only available in FC 302:

- *Parameter 36-00 Terminal X49/1 Mode*
- *Parameter 36-01 Terminal X49/3 Mode*
- *Parameter 36-02 Terminal X49/5 Mode*

Parameter 36-00 Term. X49/1 Mode

Table 1303: Parameter 36-00 Term. X49/1 Mode

36-00 Term. X49/1 Mode		
Default value: [1] Voltage	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the output mode of analog terminal X49/1.

Option	Name	Description
[0]	Current	
[1]*	Voltage	
[2]	PT1000 [°C]	
[3]	PT1000 [°F]	
[4]	Ni 1000 [°C]	
[5]	Ni 1000 [°F]	

Parameter 36-01 Term. X49/3 Mode

Table 1304: Parameter 36-01 Term. X49/3 Mode

36-01 Term. X49/3 Mode		
Default value: [1] Voltage	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the output mode of analog terminal X49/3.

Option	Name	Description
[0]	Current	
[1]*	Voltage	
[2]	PT1000 [°C]	
[3]	PT1000 [°F]	
[4]	Ni 1000 [°C]	
[5]	Ni 1000 [°F]	

Parameter 36-02 Term. X49/5 Mode

Table 1305: Parameter 36-02 Term. X49/5 Mode

36-02 Term. X49/5 Mode		
Default value: [1] Voltage	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the output mode of analog terminal X49/5.

Option	Name	Description
[0]	Current	
[1]*	Voltage	
[2]	PT1000 [°C]	
[3]	PT1000 [°F]	
[4]	Ni 1000 [°C]	
[5]	Ni 1000 [°F]	

Parameter 36-03 Term. X49/7 Mode

Table 1306: Parameter 36-03 Term. X49/7 Mode

36-03 Term. X49/7 Mode		
Default value: [0] Voltage 0–10V	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the output mode of analog terminal X49/7.

Option	Name	Description
[0]*	Voltage 0–10V	
[1]	Voltage 2–10V	
[2]	Current 0–20mA	
[3]	Current 4–20mA	
[4]	Digital	**NOTICE** This option is only available in FC 302.

Parameter 36-04 Term. X49/9 Mode

Table 1307: Parameter 36-04 Term. X49/9 Mode

36-04 Term. X49/9 Mode		
Default value: [0] Voltage 0–10V	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the output mode of analog terminal X49/9.

Option	Name	Description
[0]*	Voltage 0–10V	
[1]	Voltage 2–10V	
[2]	Current 0–20mA	
[3]	Current 4–20mA	
[4]	Digital	**NOTICE** This option is only available in FC 302.

Parameter 36-05 Term. X49/11 Mode

Table 1308: Parameter 36-05 Term. X49/11 Mode

36-05 Term. X49/11 Mode		
Default value: [0] Voltage 0–10V	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the output mode of analog terminal X49/11.

Option	Name	Description
[0]*	Voltage 0–10V	
[1]	Voltage 2–10V	
[2]	Current 0–20mA	
[3]	Current 4–20mA	
[4]	Digital	**NOTICE** This option is only available in FC 302.

5.29.2 36-1* Analog Input X49/1

NOTICE

This parameter group is only available in FC 301.

Parameter 36-10 Terminal X49/1 Low Voltage

Table 1309: Parameter 36-10 Terminal X49/1 Low Voltage

36-10 Terminal X49/1 Low Voltage		
Default value: 0.07 V	Parameter type: Range, 0 - 10 V	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Parameter 36-11 Terminal X49/1 Low Current

Table 1310: Parameter 36-11 Terminal X49/1 Low Current

36-11 Terminal X49/1 Low Current		
Default value: 4 mA	Parameter type: Range, 0 - 20 mA	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: True

Parameter 36-12 Terminal X49/1 High Voltage

Table 1311: Parameter 36-12 Terminal X49/1 High Voltage

36-12 Terminal X49/1 High Voltage		
Default value: 10 V	Parameter type: Range, 0 - 10 V	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Parameter 36-13 Terminal X49/1 High Current

Table 1312: Parameter 36-13 Terminal X49/1 High Current

36-13 Terminal X49/1 High Current		
Default value: 20 mA	Parameter type: Range, 0 - 20 mA	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: True

Parameter 36-14 Terminal X49/1 Low Ref./Feedb. Value

Table 1313: Parameter 36-14 Terminal X49/1 Low Ref./Feedb. Value

36-14 Terminal X49/1 Low Ref./Feedb. Value		
Default value: 0 ReferenceFeedbackUnit	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 36-15 Terminal X49/1 High Ref./Feedb. Value

Table 1314: Parameter 36-15 Terminal X49/1 High Ref./Feedb. Value

36-15 Terminal X49/1 High Ref./Feedb. Value		
Default value: 100 ReferenceFeedbackUnit	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 36-16 Term. X49/1 Filter Time Constant

Table 1315: Parameter 36-16 Term. X49/1 Filter Time Constant

36-16 Term. X49/1 Filter Time Constant		
Default value: 0.001 s	Parameter type: Range, 0.001 - 10 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the filter time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal X49/1. A high time constant value improves dampening but also increases the time delay through the filter.

5.29.3 36-2* Analog Input X49/3

N O T I C E

This parameter group is only available in FC 302.

Parameter 36-20 Terminal X49/3 Low Voltage

Table 1316: Parameter 36-20 Terminal X49/3 Low Voltage

36-20 Terminal X49/3 Low Voltage		
Default value: 0.07 V	Parameter type: Range, 0 - 10 V	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Parameter 36-21 Terminal X49/3 Low Current

Table 1317: Parameter 36-21 Terminal X49/3 Low Current

36-21 Terminal X49/3 Low Current		
Default value: 4 mA	Parameter type: Range, 0 - 20 mA	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: True

Parameter 36-22 Terminal X49/3 High Voltage

Table 1318: Parameter 36-22 Terminal X49/3 High Voltage

36-22 Terminal X49/3 High Voltage		
Default value: 10 V	Parameter type: Range, 0 - 10 V	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Parameter 36-23 Terminal X49/3 High Current

Table 1319: Parameter 36-23 Terminal X49/3 High Current

36-23 Terminal X49/3 High Current		
Default value: 20 mA	Parameter type: Range, 0 - 20 mA	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: True

Parameter 36-24 Terminal X49/3 Low Ref./Feedb. Value

Table 1320: Parameter 36-24 Terminal X49/3 Low Ref./Feedb. Value

36-24 Terminal X49/3 Low Ref./Feedb. Value		
Default value: 0 ReferenceFeedbackUnit	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter Parameter 36-25 Terminal X49/3 High Ref./Feedb. Value

Table 1321: Parameter 36-25 Terminal X49/3 High Ref./Feedb. Value

36-25 Terminal X49/3 High Ref./Feedb. Value		
Default value: 100 ReferenceFeedbackUnit	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 36-26 Term. X49/3 Filter Time Constant

Table 1322: Parameter 36-26 Term. X49/3 Filter Time Constant

36-26 Term. X49/3 Filter Time Constant		
Default value: 0.001 s	Parameter type: Range, 0.001 - 10 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the filter time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal X49/3. A high time constant value improves dampening but also increases the time delay through the filter.

5.29.4 36-3* Analog Input X49/5

N O T I C E

This parameter group is only available in FC 302.

Parameter 36-30 Terminal X49/5 Low Voltage

Table 1323: Parameter 36-30 Terminal X49/5 Low Voltage

36-30 Terminal X49/5 Low Voltage		
Default value: 0.07 V	Parameter type: Range, 0 - 10 V	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Parameter 36-31 Terminal X49/3 Low Current

Table 1324: Parameter 36-31 Terminal X49/3 Low Current

36-31 Terminal X49/3 Low Current		
Default value: 4 mA	Parameter type: Range, 0 - 20 mA	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: True

Parameter 36-32 Terminal X49/5 High Voltage

Table 1325: Parameter 36-32 Terminal X49/5 High Voltage

36-32 Terminal X49/5 High Voltage		
Default value: 10 V	Parameter type: Range, 0 - 10 V	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Parameter 36-33 Terminal X49/5 High Current

Table 1326: Parameter 36-33 Terminal X49/5 High Current

36-33 Terminal X49/5 High Current		
Default value: 20 mA	Parameter type: Range, 0 - 20 mA	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: True

Parameter 36-34 Terminal X49/5 Low Ref./Feedb. Value

Table 1327: Parameter 36-34 Terminal X49/5 Low Ref./Feedb. Value

36-34 Terminal X49/5 Low Ref./Feedb. Value		
Default value: 0 ReferenceFeedbackUnit	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 36-35 Terminal X49/5 High Ref./Feedb. Value

Table 1328: Parameter 36-35 Terminal X49/5 High Ref./Feedb. Value

36-35 Terminal X49/5 High Ref./Feedb. Value		
Default value: 100 ReferenceFeedbackUnit	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 36-36 Term. X49/5 Filter Time Constant

Table 1329: Parameter 36-36 Term. X49/5 Filter Time Constant

36-36 Term. X49/5 Filter Time Constant		
Default value: 0.001 s	Parameter type: Range, 0.001 - 10 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the filter time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal X49/5. A high time constant value improves dampening but also increases the time delay through the filter.

5.29.5 36-4* Output X49/7

N O T I C E

The following parameter is only available in FC 302:

- *Parameter 36-41 Terminal X49/7 Digital Output*

Use the parameters in this group to configure the mode of inputs and outputs of VLT® Programmable I/O MCB 115.

Parameter 36-40 Terminal X49/7 Analogue Output

Table 1330: Parameter 36-40 Terminal X49/7 Analogue Output

36-40 Terminal X49/7 Analogue Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the functionality of terminal X49/7.

Option	Name	Description
[0]*	No operation	Indicates no signal on the analog output.
[52]	MCO	
[100]	Output frequency	0 Hz = 0 mA; 100 Hz = 20 mA.
[101]	Reference	*Parameter 3-00 Reference Range [Min - Max]* 0% = 0 mA; 100% = 20 mA *Parameter 3-00 Reference Range [-Max - Max]* -100% = 0 mA; 0% = 10 mA; +100% = 20 mA.
[102]	Feedback	
[103]	Motor current	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. **Example:** Inverter normal current (11 kW) is 24 A. 160 %=38.4 A. Motor normal current is 22 A, the readout is 11.46 mA. $\frac{20\text{ mA} \times 22\ A}{38.4\ A} = 11.46\text{ mA}$ When the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{VLT,MAX} \times 100}{I_{Motor,Nom}} = \frac{38.4 \times 100}{22} = 175\,\%$
[104]	Torque rel to limit	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[105]	Torque relate to rated	The torque is related to the motor torque setting.
[106]	Power	Taken from *parameter 1-20 Motor Power [kW]*.
[107]	Speed	Taken from *parameter 3-03 Maximum Reference*. 20 mA equals the value in *parameter 3-03 Maximum Reference*.
[108]	Torque	Torque reference related to 160% torque.
[109]	Max out freq	0 Hz = 0 mA, *parameter 4-19 Max Output Frequency* = 20 mA.

Option	Name	Description
[113]	PID clamped output	
[117]	Shaft power	
[119]	Torque % lim	
[123]	Speed both dir	
[135]	Torq.% nom 4–20mA	The torque setting is related to the motor torque setting.
[139]	Bus ctrl	An output value set from fieldbus process data. The output works independently of internal functions in the drive.
[141]	Bus ctrl t.o.	*Parameter 4-54 Warning Reference Low* defines the behavior of the analog output in case of fieldbus timeout.
[147]	Main act val	
[158]	Motor Volt.	

Parameter 36-41 Terminal X49/7 Digital Output

Table 1331: Parameter 36-41 Terminal X49/7 Digital Output

36-41 Terminal X49/7 Digital Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No operation	
[1]	Control ready	
[2]	Drive ready	
[3]	Drive rdy/rem ctrl	
[4]	Enable/no warning	
[5]	Running	
[6]	Running/no warning	
[7]	Run in range/no warn	
[8]	Run on ref/no warn	
[9]	Alarm	
[10]	Alarm or warning	
[11]	At torque limit	
[12]	Out of current range	
[13]	Below current, low	
[14]	Above current, high	

Option	Name	Description
[15]	Out of speed range	
[16]	Below speed, low	
[17]	Above speed, high	
[18]	Out of feedb. range	
[19]	Below feedback, low	
[20]	Above feedback, high	
[21]	Thermal warning	
[22]	Ready,no thermal W	
[23]	Remote,ready, no TW	
[24]	Ready, Voltage OK	
[25]	Reverse	
[26]	Bus OK	
[27]	Torque limit & stop	
[28]	Brake, no brake war	
[29]	Brake ready, no fault	
[30]	Brake fault (IGBT)	
[31]	Relay 123	
[32]	Mech brake ctrl	
[33]	Safe stop active	
[35]	External interlock	
[38]	Motor feedback error	
[39]	Tracking error	
[40]	Out of ref range	
[41]	Below reference, low	
[42]	Above ref, high	
[43]	Extended PID Limit	
[45]	Bus ctrl.	
[46]	Bus ctrl, 1 if timeout	
[47]	Bus ctrl, 0 if timeout	
[50]	On reference	
[51]	MCO controlled	
[59]	Remote, enable, no TW	

Option	Name	Description
[60]	Comparator 0	
[61]	Comparator 1	
[62]	Comparator 2	
[63]	Comparator 3	
[64]	Comparator 4	
[65]	Comparator 5	
[66]	Comparator 6	
[67]	Comparator 7	
[68]	Comparator 8	
[69]	Comparator 9	
[70]	Logic rule 0	
[71]	Logic rule 1	
[72]	Logic rule 2	
[73]	Logic rule 3	
[74]	Logic rule 4	
[75]	Logic rule 5	
[76]	Logic rule 6	
[77]	Logic rule 7	
[78]	Logic rule 8	
[79]	Logic rule 9	
[80]	SL digital output A	
[81]	SL digital output B	
[82]	SL digital output C	
[83]	SL digital output D	
[84]	SL digital output E	
[85]	SL digital output F	
[90]	kWh counter pulse	
[96]	Reverse after ramp	
[98]	Virtual master dir	
[120]	Local ref active	
[121]	Remote ref active	
[122]	No alarm	

Option	Name	Description
[123]	Start command activ	
[124]	Running reverse	
[125]	Drive in hand mode	
[126]	Drive in auto mode	
[151]	ATEX ETR cur. alarm	
[152]	ATEX ETR freq. alarm	
[153]	ATEX ETR cur. warning	
[154]	ATEX ETR freq. warning	
[173]	10Wh counter pulse	
[180]	Clock fault	
[181]	Prev. Maintenance	
[188]	AHF Capacitor Connect	
[189]	External Fan Control	
[190]	Safe Function active	
[191]	Safe Opt. Reset req.	
[192]	RS Flipflop 0	
[193]	RS Flipflop 1	
[194]	RS Flipflop 2	
[195]	RS Flipflop 3	
[196]	RS Flipflop 4	
[197]	RS Flipflop 5	
[198]	RS Flipflop 6	
[199]	RS Flipflop 7	
[221]	IGBT-cooling	
[222]	Homing OK	
[223]	On target	
[224]	Position limit	
[225]	Position error	
[226]	Touch on target	
[227]	Touch activated	
[231]	In power lim. mot.	
[232]	In power lim. gen.	

Option	Name	Description
[233]	In power limit	
[234]	PE power off	
[246]	Emergency mode was act.	
[247]	Emergency mode	
[249]	Emcy m. OPR unexpected	
[250]	Emcy mode limits	
[254]	Testing emcy mode	

Parameter 36-42 Terminal X49/7 Min Scale

Table 1332: Parameter 36-42 Terminal X49/7 Min Scale

36-42 Terminal X49/7 Min Scale		
Default value: 0%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Match the minimum output of terminal X49/7 with a required value. The required value is defined as a percentage of the value selected in *parameter 36-40 Terminal X49/7 Analogue Output*. To know more about how this parameter works, see *parameter 6-52 Terminal 42 Output Max Scale*. The following example describes how the drive uses this parameter. **Example:**

- *Parameter 36-03 Terminal X49/7 Mode = [0] Voltage 0–10 V*.
- *Parameter 36-40 Terminal X49/7 Analogue Output = [100] Output frequency*.
- *Parameter 4-19 Max Output Frequency* = 200 Hz.

Application requirement: If the output frequency is lower than 20 Hz, the output of terminal X49/7 should be 0 V. To fulfil the example requirement, enter 10% in *parameter 36-42 Terminal X49/7 Min. Scale*.

Parameter 36-43 Terminal X49/7 Max. Scale

Table 1333: Parameter 36-43 Terminal X49/7 Max. Scale

Parameter 36-43 Terminal X49/7 Max. Scale		
Default value: 100%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Scale the maximum output of terminal X49/7. For example, the scaling is done for the following reasons:

- To provide an output value lower than the maximum possible value.
- To provide the full signal range using output values lower than a certain limit.

To know more about how this parameter works, see *parameter 6-52 Terminal 42 Output Max Scale*. **Example:**

- *Parameter 36-03 Terminal X49/7 Mode = [0] Voltage 0–10 V*
- *Parameter 36-40 Terminal X49/7 Analogue Output = [100] Output Frequency*.
- *Parameter 4-19 Max Output Frequency* = 200 Hz.

Example case 1: 5 V maximum output is required when the output frequency is 200 Hz. *Parameter 36-43 Terminal X49/7 Max. Scale* x 100% = 200%. **Example case 2:** 10 V maximum output is required when the output frequency is 150 Hz (75% of the maximum output frequency). *Parameter 36-43 Terminal X49/7 Max. Scale* = 75%.

Parameter 36-44 Terminal X49/7 Bus Ctrl

Table 1334: Parameter 36-44 Terminal X49/7 Bus Ctrl

36-44 Terminal X49/7 Bus Ctrl		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: N2	Change during operation: True

This parameter contains the output level of terminal X49/7 if the terminal is controlled by bus.

Parameter 36-45 Terminal X49/7 Timeout Preset

Table 1335: Parameter 36-45 Terminal X49/7 Timeout Preset

36-45 Terminal X49/7 Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

The drive sends the value of this parameter to the output terminal when the terminal is controlled by a fieldbus and a timeout is detected.

5.29.6 36-5* Output X49/9

Use the parameters in this group to configure the mode of inputs and outputs of VLT® Programmable I/O MCB 115.

N O T I C E

The following parameter is only available in FC 302:

- *Parameter 36-51 Terminal X49/9 Digital Output*.

Parameter 36-50 Terminal X49/9 Analogue Output

Table 1336: Parameter 36-50 Terminal X49/9 Analogue Output

36-50 Terminal X49/9 Analogue Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the functionality of terminal X49/9.

Option	Name	Description
[0]*	No operation	Indicates no signal on the analog output.
[52]	MCO	
[100]	Output frequency	0 Hz = 0 mA; 100 Hz = 20 mA.
[101]	Reference	*Parameter 3-00 Reference Range [Min - Max]* 0% = 0 mA; 100% = 20 mA *Parameter 3-00 Reference Range [-Max - Max]* -100% = 0 mA; 0% = 10 mA; +100% = 20 mA.
[102]	Feedback	
[103]	Motor current	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. **Example:** Inverter normal current (11 kW) is 24 A. 160 %=38.4 A. Motor normal current is 22 A, the readout is 11.46 mA.

Option	Name	Description
		$\frac{20\ \text{mA} \times 22\ A}{38.4\ A} = 11.46\ \text{mA}$ When the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{VLT,MAX} \times 100}{I_{Motor,Nom}} = \frac{38.4 \times 100}{22} = 175\ \%$
[104]	Torque rel to limit	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[105]	Torque relate to rated	The torque is related to the motor torque setting.
[106]	Power	Taken from *parameter 1-20 Motor Power [kW]*.
[107]	Speed	Taken from *parameter 3-03 Maximum Reference*. 20 mA equals the value in *parameter 3-03 Maximum Reference*.
[108]	Torque	Torque reference related to 160% torque.
[109]	Max out freq	0 Hz = 0 mA, *parameter 4-19 Max Output Frequency* = 20 mA.
[113]	PID clamped output	
[117]	Shaft power	
[119]	Torque % lim	
[123]	Speed both dir	
[135]	Torq.% nom 4–20mA	The torque setting is related to the motor torque setting.
[139]	Bus ctrl	An output value set from fieldbus process data. The output works independently of internal functions in the drive.
[141]	Bus ctrl t.o.	*Parameter 4-54 Warning Reference Low* defines the behavior of the analog output in case of fieldbus timeout.
[147]	Main act val	
[158]	Motor Volt.	

Parameter 36-51 Terminal X49/9 Digital Output

Table 1337: Parameter 36-51 Terminal X49/9 Digital Output

36-51 Terminal X49/9 Digital Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No operation	
[1]	Control ready	
[2]	Drive ready	

Option	Name	Description
[3]	Drive rdy/rem ctrl	
[4]	Enable/no warning	
[5]	Running	
[6]	Running/no warning	
[7]	Run in range/no warn	
[8]	Run on ref/no warn	
[9]	Alarm	
[10]	Alarm or warning	
[11]	At torque limit	
[12]	Out of current range	
[13]	Below current, low	
[14]	Above current, high	
[15]	Out of speed range	
[16]	Below speed, low	
[17]	Above speed, high	
[18]	Out of feedb. range	
[19]	Below feedback, low	
[20]	Above feedback, high	
[21]	Thermal warning	
[22]	Ready,no thermal W	
[23]	Remote,ready, no TW	
[24]	Ready, Voltage OK	
[25]	Reverse	
[26]	Bus OK	
[27]	Torque limit & stop	
[28]	Brake, no brake war	
[29]	Brake ready, no fault	
[30]	Brake fault (IGBT)	
[31]	Relay 123	
[32]	Mech brake ctrl	
[33]	Safe stop active	
[35]	External interlock	

Option	Name	Description
[38]	Motor feedback error	
[39]	Tracking error	
[40]	Out of ref range	
[41]	Below reference, low	
[42]	Above ref, high	
[43]	Extended PID Limit	
[45]	Bus ctrl.	
[46]	Bus ctrl, 1 if timeout	
[47]	Bus ctrl, 0 if timeout	
[50]	On reference	
[51]	MCO controlled	
[59]	Remote, enable, no TW	
[60]	Comparator 0	
[61]	Comparator 1	
[62]	Comparator 2	
[63]	Comparator 3	
[64]	Comparator 4	
[65]	Comparator 5	
[66]	Comparator 6	
[67]	Comparator 7	
[68]	Comparator 8	
[69]	Comparator 9	
[70]	Logic rule 0	
[71]	Logic rule 1	
[72]	Logic rule 2	
[73]	Logic rule 3	
[74]	Logic rule 4	
[75]	Logic rule 5	
[76]	Logic rule 6	
[77]	Logic rule 7	
[78]	Logic rule 8	
[79]	Logic rule 9	

Option	Name	Description
[80]	SL digital output A	
[81]	SL digital output B	
[82]	SL digital output C	
[83]	SL digital output D	
[84]	SL digital output E	
[85]	SL digital output F	
[90]	kWh counter pulse	
[96]	Reverse after ramp	
[98]	Virtual master dir	
[120]	Local ref active	
[121]	Remote ref active	
[122]	No alarm	
[123]	Start command activ	
[124]	Running reverse	
[125]	Drive in hand mode	
[126]	Drive in auto mode	
[151]	ATEX ETR cur. alarm	
[152]	ATEX ETR freq. alarm	
[153]	ATEX ETR cur. warning	
[154]	ATEX ETR freq. warning	
[173]	10Wh counter pulse	
[180]	Clock fault	
[181]	Prev. Maintenance	
[188]	AHF Capacitor Connect	
[189]	External Fan Control	
[190]	Safe Function active	
[191]	Safe Opt. Reset req.	
[192]	RS Flipflop 0	
[193]	RS Flipflop 1	
[194]	RS Flipflop 2	
[195]	RS Flipflop 3	
[196]	RS Flipflop 4	

Option	Name	Description
[197]	RS Flipflop 5	
[198]	RS Flipflop 6	
[199]	RS Flipflop 7	
[221]	IGBT-cooling	
[222]	Homing OK	
[223]	On target	
[224]	Position limit	
[225]	Position error	
[226]	Touch on target	
[227]	Touch activated	
[231]	In power lim. mot.	
[232]	In power lim. gen.	
[233]	In power limit	
[234]	PE power off	
[246]	Emcy mode was act.	
[247]	Emergency mode	
[249]	Emcy m OPR unexpected	
[250]	Emcy mode limits	
[254]	Testing emcy mode	

Parameter 36-52 Terminal X49/9 Min. Scale

Table 1338: Parameter 36-52 Terminal X49/9 Min. Scale

36-52 Terminal X49/9 Min. Scale		
Default value: 0%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Match the minimum output of terminal X49/9 with a required value. The required value is defined as a percentage of the value selected in *parameter 36-50 Terminal X49/9 Analogue Output*. To know more about how this parameter works, see *parameter 6-52 Terminal 42 Output Max Scale*. The following example describes how the drive uses this parameter. **Example:**

- *Parameter 36-04 Terminal X49/9 Mode = [0] Voltage 0–10 V*.
- *Parameter 36-50 Terminal X49/9 Analogue Output = [100] Output frequency*.
- *Parameter 4-19 Max Output Frequency* = 200 Hz.

Application requirement: If the output frequency is lower than 20 Hz, the output of terminal X49/9 should be 0 V. To fulfil the example requirement, enter 10% in *parameter 36-52 Terminal X49/9 Min. Scale*.

Parameter 36-53 Terminal X49/9 Max. Scale

Table 1339: Parameter 36-53 Terminal X49/9 Max. Scale

36-53 Terminal X49/9 Max. Scale		
Default value: 100%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Scale the maximum output of terminal X49/9. For example, the scaling is done for the following reasons:

- To provide an output value lower than the maximum possible value.
- To provide the full signal range using output values lower than a certain limit.

To know more about how this parameter works, see *parameter 6-52 Terminal 42 Output Max Scale*. **Example:**

- *Parameter 36-04 Terminal X49/9 Mode = [0] Voltage 0–10 V*
- *Parameter 36-50 Terminal X49/9 Analogue Output = [100] Output Frequency*.
- *Parameter 4-19 Max Output Frequency* = 200 Hz.

Example case 1: 5 V maximum output is required when the output frequency is 200 Hz. *Parameter 36-53 Terminal X49/9 Max. Scale* x 100% = 200%. **Example case 2:** 10 V maximum output is required when the output frequency is 150 Hz (75% of the maximum output frequency). *Parameter 36-53 Terminal X49/9 Max. Scale* = 75%.

Parameter 36-54 Terminal X49/9 Bus Ctrl

Table 1340: Parameter 36-54 Terminal X49/9 Bus Ctrl

36-54 Terminal X49/9 Bus Ctrl		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: N2	Change during operation: True

This parameter contains the output level of terminal X49/9 if the terminal is controlled by bus.

Parameter 36-55 Terminal X49/9 Timeout Preset

Table 1341: Parameter 36-55 Terminal X49/9 Timeout Preset

36-55 Terminal X49/9 Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

The drive sends the value of this parameter to the output terminal when the terminal is controlled by a fieldbus and a timeout is detected.

5.29.7 36-6* Output X49/11

Use the parameters in this group to configure the mode of inputs and outputs of VLT® Programmable I/O MCB 115.

N O T I C E

The following parameter is only available in FC 302:

– *Parameter 36-61 Terminal X49/11 Digital Output*.

Parameter 36-60 Terminal X49/11 Analogue Output

Table 1342: Parameter 36-60 Terminal X49/11 Analogue Output

36-60 Terminal X49/11 Analogue Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the functionality of terminal X49/11.

Option	Name	Description
[0]*	No operation	Indicates no signal on the analog output.
[52]	MCO	
[100]	Output frequency	0 Hz = 0 mA; 100 Hz = 20 mA.
[101]	Reference	*Parameter 3-00 Reference Range [Min - Max]* 0% = 0 mA; 100% = 20 mA *Parameter 3-00 Reference Range [-Max - Max]* -100% = 0 mA; 0% = 10 mA; +100% = 20 mA.
[102]	Feedback	
[103]	Motor current	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. **Example:** Inverter normal current (11 kW) is 24 A. 160 %=38.4 A. Motor normal current is 22 A, the readout is 11.46 mA. $\frac{20\text{ mA} \times 22\,A}{38.4\,A} = 11.46\text{ mA}$ When the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{VLT,MAX} \times 100}{I_{Motor,Nom}} = \frac{38.4 \times 100}{22} = 175\,\%$
[104]	Torque rel to limit	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[105]	Torque relate to rated	The torque is related to the motor torque setting.
[106]	Power	Taken from *parameter 1-20 Motor Power [kW]*.
[107]	Speed	Taken from *parameter 3-03 Maximum Reference*. 20 mA equals the value in *parameter 3-03 Maximum Reference*.
[108]	Torque	Torque reference related to 160% torque.
[109]	Max out freq	0 Hz = 0 mA, *parameter 4-19 Max Output Frequency* = 20 mA.
[113]	PID clamped output	
[117]	Shaft power	
[119]	Torque % lim	
[123]	Speed both dir	
[139]	Bus ctrl	An output value set from fieldbus process data. The output works independently of internal functions in the drive.
[141]	Bus ctrl t.o.	*Parameter 4-54 Warning Reference Low* defines the behavior of the analog output in case of fieldbus timeout.
[147]	Main act val	
[158]	Motor Volt.	

Parameter 36-61 Terminal X49/11 Digital Output

Table 1343: Parameter 36-61 Terminal X49/11 Digital Output

36-61 Terminal X49/11 Digital Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No operation	
[1]	Control ready	
[2]	Drive ready	
[3]	Drive rdy/rem ctrl	
[4]	Enable/no warning	
[5]	Running	
[6]	Running/no warning	
[7]	Run in range/no warn	
[8]	Run on ref/no warn	
[9]	Alarm	
[10]	Alarm or warning	
[11]	At torque limit	
[12]	Out of current range	
[13]	Below current, low	
[14]	Above current, high	
[15]	Out of speed range	
[16]	Below speed, low	
[17]	Above speed, high	
[18]	Out of feedb. range	
[19]	Below feedback, low	
[20]	Above feedback, high	
[21]	Thermal warning	
[22]	Ready,no thermal W	
[23]	Remote,ready, no TW	
[24]	Ready, Voltage OK	
[25]	Reverse	
[26]	Bus OK	
[27]	Torque limit & stop	

Option	Name	Description
[28]	Brake, no brake war	
[29]	Brake ready, no fault	
[30]	Brake fault (IGBT)	
[31]	Relay 123	
[32]	Mech brake ctrl	
[33]	Safe stop active	
[35]	External interlock	
[38]	Motor feedback error	
[39]	Tracking error	
[40]	Out of ref range	
[41]	Below reference, low	
[42]	Above ref, high	
[43]	Extended PID Limit	
[45]	Bus ctrl.	
[46]	Bus ctrl, 1 if timeout	
[47]	Bus ctrl, 0 if timeout	
[50]	On reference	
[51]	MCO controlled	
[59]	Remote, enable, no TW	
[60]	Comparator 0	
[61]	Comparator 1	
[62]	Comparator 2	
[63]	Comparator 3	
[64]	Comparator 4	
[65]	Comparator 5	
[66]	Comparator 6	
[67]	Comparator 7	
[68]	Comparator 8	
[69]	Comparator 9	
[70]	Logic rule 0	
[71]	Logic rule 1	
[72]	Logic rule 2	

Option	Name	Description
[73]	Logic rule 3	
[74]	Logic rule 4	
[75]	Logic rule 5	
[76]	Logic rule 6	
[77]	Logic rule 7	
[78]	Logic rule 8	
[79]	Logic rule 9	
[80]	SL digital output A	
[81]	SL digital output B	
[82]	SL digital output C	
[83]	SL digital output D	
[84]	SL digital output E	
[85]	SL digital output F	
[90]	kWh counter pulse	
[96]	Reverse after ramp	
[98]	Virtual master dir	
[120]	Local ref active	
[121]	Remote ref active	
[122]	No alarm	
[123]	Start command activ	
[124]	Running reverse	
[125]	Drive in hand mode	
[126]	Drive in auto mode	
[151]	ATEX ETR cur. alarm	
[152]	ATEX ETR freq. alarm	
[153]	ATEX ETR cur. warning	
[154]	ATEX ETR freq. warning	
[173]	10Wh counter pulse	
[180]	Clock fault	
[181]	Prev. Maintenance	
[188]	AHF Capacitor Connect	
[189]	External Fan Control	

Option	Name	Description
[190]	Safe Function active	
[191]	Safe Opt. Reset req.	
[192]	RS Flipflop 0	
[193]	RS Flipflop 1	
[194]	RS Flipflop 2	
[195]	RS Flipflop 3	
[196]	RS Flipflop 4	
[197]	RS Flipflop 5	
[198]	RS Flipflop 6	
[199]	RS Flipflop 7	
[221]	IGBT-cooling	
[222]	Homing OK	
[223]	On target	
[224]	Position limit	
[225]	Position error	
[226]	Touch on target	
[227]	Touch activated	
[231]	In power lim. mot.	
[232]	In power lim. gen.	
[233]	In power limit	
[234]	PE power off	
[246]	Emcy mode was act.	
[247]	Emergency mode	
[249]	Emcy m. OPR unexpected	
[250]	Emcy mode limits	
[254]	Testing emcy mode	

Parameter 36-62 Terminal X49/11 Min. Scale

Table 1344: Parameter 36-62 Terminal X49/11 Min. Scale

36-62 Terminal X49/11 Min. Scale		
Default value: 0%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Match the minimum output of terminal X49/11 with a required value. The required value is defined as a percentage of the value selected in *parameter 36-60 Terminal X49/11 Analogue Output*. To know more about how this parameter works, see *parameter 6-52 Terminal 42 Output Max Scale*. The following example describes how the drive uses this parameter. **Example:**

- *Parameter 36-05 Terminal X49/16 Mode = [0] Voltage 0–10 V*.
- *Parameter 36-50 Terminal X49/11 Analogue Output = [100] Output frequency*.
- *Parameter 4-19 Max Output Frequency* = 200 Hz.

Application requirement: If the output frequency is lower than 20 Hz, the output of terminal X49/9 should be 0 V. To fulfil the example requirement, enter 10% in *parameter 36-62 Terminal X49/11 Min. Scale*.

Parameter 36-63 Terminal X49/11 Max. Scale

Table 1345: Parameter 36-63 Terminal X49/11 Max. Scale

36-63 Terminal X49/11 Max. Scale		
Default value: 100%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Scale the maximum output of terminal X49/11. For example, the scaling is done for the following reasons:

- To provide an output value lower than the maximum possible value.
- To provide the full signal range using output values lower than a certain limit.

To know more about how this parameter works, see *parameter 6-52 Terminal 42 Output Max Scale*. **Example:**

- *Parameter 36-05 Terminal X49/11 Mode = [0] Voltage 0–10 V*
- *Parameter 36-60 Terminal X49/11 Analogue Output = [100] Output Frequency*.
- *Parameter 4-19 Max Output Frequency* = 200 Hz.

Example case 1: 5 V maximum output is required when the output frequency is 200 Hz. *Parameter 36-63 Terminal X49/11 Max. Scale* x 100% = 200%. **Example case 2:** 10 V maximum output is required when the output frequency is 150 Hz (75% of the maximum output frequency). *Parameter 36-63 Terminal X49/11 Max. Scale* = 75%.

Parameter 36-64 Terminal X49/11 Bus Ctrl

Table 1346: Parameter 36-64 Terminal X49/11 Bus Ctrl

36-64 Terminal X49/11 Bus Ctrl		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: N2	Change during operation: True

This parameter contains the output level of terminal X49/11 if the terminal is controlled by bus.

Parameter 36-55 Terminal X49/9 Timeout Preset

Table 1347: Parameter 36-55 Terminal X49/9 Timeout Preset

36-55 Terminal X49/9 Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

The drive sends the value of this parameter to the output terminal when the terminal is controlled by a fieldbus and a timeout is detected.

5.30 Parameter Group 40-** Special Settings

5.30.1 40-1* Aux. Functions Control

Parameter 40-10 Kin. Back-up UdcRef

Table 1348: Parameter 40-10 Kin. Back-up UdcRef

40-10 Kin. Back-up UdcRef		
Default value: Size related	Parameter type: Range, 300 - 1080 V	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Set DC-link voltage for kinetic back-up mode. To set a higher DC-link voltage for riding through an unbalanced fault, set *parameter 14-10 Mains Failure* to *[4] Kinetic back-up* and leave *parameter 40-14 Mains Loss Duration* as set. If ride through is not required, set *parameter 14-10 Mains Failure* to either *[1] Ctrl. ramp-down*, *[2] Ctrl. ramp-down, trip*, or *[5] Kinetic back-up, trip*.

Parameter 40-11 Kin. Back-up Integral Time

Table 1349: Parameter 40-11 Kin. Back-up Integral Time

40-11 Kin. Back-up Integral Time		
Default value: Size related	Parameter type: Range, 0.001 - 1000 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

The kinetic back-up controller integral time value enables optimizing the DC-link voltage response. If there is external capacitance on the DC link, increase the value. To obtain fast control response, decrease the value. However, if the value is too low, the process becomes unstable.

Parameter 40-12 Kin. Back-up Lead Filter Time

Table 1350: Parameter 40-12 Kin. Back-up Lead Filter Time

40-12 Kin. Back-up Lead Filter Time		
Default value: Size related	Parameter type: Range, 0.001 - 1000 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

N O T I C E

This parameter is only valid in VVC+ control.

This parameter specifies the kinetic back-up controller lead filter time. Increase this value to ensure stable DC-link voltage control for high-inertia applications.

Parameter 40-13 Kin. Back-up Min Run Time

Table 1351: Parameter 40-13 Kin. Back-up Min Run Time

40-13 Kin. Back-up Min Run Time		
Default value: Size related	Parameter type: Range, 0.005 - 2 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

Minimum runtime of the kinetic back-up. Kinetic back-up control must run during this time, even mains voltage can come back within this time span. The purpose of this function is to avoid that the drive frequently changes in and out of kinetic back-up mode, if fluctuating mains voltage occurs.

Parameter 40-14 Mains Loss Duration

Table 1352: Parameter 40-14 Mains Loss Duration

40-14 Mains Loss Duration		
Default value: 60.00 s	Parameter type: Range, 0.05 - 60.00 s	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

Enter the maximum value of mains loss duration. When *parameter 14-10 Mains Failure = [4] Kinetic Back-up*, the DC-link voltage boosts to the value set in *Parameter 40-10 Kin. Back-up UdcRef*. Then the drive returns to normal operation. The drive allows 2 successive mains faults. A 3rd mains fault triggers a trip. Setting this parameter to 60 s disables the function.

Parameter 40-15 Kin.Back-up Start Off

Table 1353: Parameter 40-15 Kin.Back-up Start Off

40-15 Kin.Back-up Start Off		
Default value: Size related	Parameter type: Range, -200.0 - 200.0 V	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Set the voltage offset to be added to the kinetic back-up reference to boost the gain when kinetic back-up is activated. This function is used in low-inertia applications.

5.30.2 40-2* PM Motor Specific

NOTICE

The following parameters are only available in FC 302:

- *Parameter 40-28 Back EMF Protection*
- *Parameter 40-29 B-EMF Protection Log Readout*

Parameter 40-28 Back EMF Protection

Table 1354: Parameter 40-28 Back EMF Protection

40-28 Back EMF Protection		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

The drive is protected by default from Back EMF, which can be generated by IPM or SPM motor types due to calculated speed limitation. The actual limitation is based on *parameter 1-40 Back EMF at 1000 RPM* and protects the drive from motor-generated overvoltage.

⚠ CAUTION ⚠

By disabling the speed limitation, a risk of destructive effect on the IGBTs can be encountered when the drive loses the motor. If the function is disabled, ensure to protect the drive by other means to prevent motor-generated overvoltage.

Option	Name	Description
[0]	Disabled	
[1]*	Enabled	

Parameter 40-29 B-EMF Protection Log Readout

Table 1355: Parameter 40-29 B-EMF Protection Log Readout

40-29 B-EMF Protection Log Readout		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Readout parameter to log events if the Back EMF has been enabled or disabled. The range of the readout parameter is between [0x0 -0xFFFF] hex. The value indicates the bit pattern to identify the current state of Back EMF in the drive. Bit 1 is set: When Back EMF is enabled, the bit is set to 1. Once enabled the Back EMF cannot be reversed. Bit 1 and bit 2: Motor frequency exceeded Back EMF limitation. Bit 2 can be reversed. Bit 1, bit 2, and bit 3: The drive has been coasted as motor frequency exceeded the Back EMF limitation. Bit 1, bit 2, bit 3, bit 4: The drive has generated an overvoltage alarm because the drive has coasted as the motor frequency exceeded Back EMF limitation.

5.30.3 40-4* Extend. Fault Log

Parameters in this group are array parameters, where up to 10 alarm logs can be viewed. [0] is the most recently logged data and [9] is the oldest. This parameter group provides details on reference, frequency, motor current, voltage, DC-link voltage, status, and control word values at the time an alarm occurred.

Parameter 40-40 Fault Log: Ext. Reference

Table 1356: Parameter 40-40 Fault Log: Ext. Reference

40-40 Fault Log: Ext. Reference		
Default value: 0%	Parameter type: Range, -200 - 200%, Array [10]	Setup: All setups
Conversion index: -1	Data type: Int16	Change during operation: False

View the present reference value applied on impulse or analog basis when the logged event occurred.

Parameter 40-41 Fault Log: Frequency

Table 1357: Parameter 40-41 Fault Log: Frequency

40-41 Fault Log: Frequency		
Default value: 0 Hz	Parameter type: Range, 0 - 6500 Hz, Array [10]	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: False

View the actual motor frequency value when the logged event occurred.

Parameter 40-42 Fault Log: Current

Table 1358: Parameter 40-42 Fault Log: Current

40-42 Fault Log: Current		
Default value: 0 A	Parameter type: Range, 0 - 10000 A, Array [10]	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: False

View the motor current measured when the logged event occurred.

Parameter 40-43 Fault Log: Voltage

Table 1359: Parameter 40-43 Fault Log: Voltage

40-43 Fault Log: Voltage		
Default value: 0 V	Parameter type: Range, 0 - 6000 V, Array [10]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View the motor voltage when the logged event occurred.

Parameter 40-44 Fault Log: DC Link Voltage

Table 1360: Parameter 40-44 Fault Log: DC Link Voltage

40-44 Fault Log: DC Link Voltage		
Default value: 0 V	Parameter type: Range, 0 - 10000 V, Array [10]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View the DC-link voltage when the logged event occurred.

Parameter 40-45 Fault Log: Control Word

Table 1361: Parameter 40-45 Fault Log: Control Word

40-45 Fault Log: Control Word		
Default value: 0	Parameter type: Range, 0 - 65535, Array [10]	Setup: All setups
Conversion index: 0	Data type: V2	Change during operation: False

View the control word sent from the drive when the logged event occurred.

Parameter 40-46 Fault Log: Status Word

Table 1362: Parameter 40-46 Fault Log: Status Word

40-46 Fault Log: Status Word		
Default value: 0	Parameter type: Range, 0 - 65535, Array [10]	Setup: All setups
Conversion index: 0	Data type: V2	Change during operation: False

View the status word sent from the drive when the logged event occurred.

5.30.4 40-5* Advanced Control Settings

Parameters for configuring the advanced motor control settings.

Parameter 40-50 Flux Sensorless Model Shift

Table 1363: Parameter 40-50 Flux Sensorless Model Shift

40-50 Flux Sensorless Model Shift		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Use this parameter to enable or disable the shifting between flux model 1 and flux model 2 at low speed. See also *parameter 1-66 Min. Current at Low Speed*.

Option	Name	Description
[0]	Off	
[1]	On	

Parameter 40-51 Flux Sensorless Corr. Gain

Table 1364: Parameter 40-51 Flux Sensorless Corr. Gain

40-51 Flux Sensorless Corr. Gain		
Default value: Size related	Parameter type: Range, 0.1 - 200.0	Setup: All setups
Conversion index: -1	Data type: Uint32	Change during operation: True

Adjust the flux correction gain used at low speed.

Parameter 40-52 Speed PID Anti Windup Gain

Table 1365: Parameter 40-52 Speed PID Anti Windup Gain

40-52 Speed PID Anti Windup Gain		
Default value: Size related	Parameter type: Range, 0 - 500%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

This Flux parameter is active in the drive when the following parameters are set to 1 of the values listed here:

- *Parameter 1-00 Configuration Mode*
  - *[0] Speed open loop* or
  - *[1] Speed closed loop* or
  - *[4] Torque open loop*
- *Parameter 1-01 Motor Control Principle*
  - *[2] Flux sensorless* or
  - *[3] Flux w/motor feedback*
- *Parameter 1-10 Motor Construction*
  - *[0] Asynchron* or
  - *[1] PM, non-salient SPM* or
  - *[2] PM, salient IPM*

Parameter 40-53 Current PID Anti Windup Gain

Table 1366: Parameter 40-53 Current PID Anti Windup Gain

40-53 Current PID Anti Windup Gain		
Default value: Size related	Parameter type: Range, 0 - 500%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

This Flux parameter is active in the drive when the following parameters are set to 1 of the values listed here:

- *Parameter 1-00 Configuration Mode*
  - *[0] Speed open loop* or
  - *[1] Speed closed loop* or
  - *[4] Torque open loop*
- *Parameter 1-01 Motor Control Principle*
  - *[2] Flux sensorless* or
  - *[3] Flux w/motor feedback*
- *Parameter 1-10 Motor Construction*
  - *[0] Asynchron* or
  - *[1] PM, non-salient SPM* or
  - *[2] PM, salient IPM*

Parameter 40-54 Flux /w Feedback Dynamic Mode

Table 1367: Parameter 40-54 Flux /w Feedback Dynamic Mode

40-54 Flux /w Feedback Dynamic Mode		
Default value: [0] Off	Parameter type: Option, array [2]	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

The position and speed controllers are executed on the fastest control task (up to 7 kHz depending on the switching frequency) in flux with motor feedback for PM motors and on the 1 ms task for induction motors. In dynamic mode, the position and speed controllers are also executed on the fastest ontrol task for induction motors. This mode significantly improves control performance for induction motors.

Option	Name	Description
[0]*	Off	Dynamic mode is not activated.
[1]	On	Dynamic mode is activated.

Parameter 40-55 Modulation Index

Table 1368: Parameter 40-55 Modulation Index

40-55 Modulation Index		
Default value: 100%	Parameter type: Range, 80 - 106%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

NOTICE

This parameter is for IPM and SPM motors in VVC+ control principle only.

Activate this parameter by setting *parameter 14-03 Overmodulation* to *[2] User Defined*. Use this parameter to set the maximum modulation index and thus trim the application, especially if running with high-power motors without sine-wave filters. Increasing the maximum modulation index increases the motor voltage and improves efficiency and stability. Setting the modulation index too high may lead to torque ripples on the motor shaft.

Parameter 40-58 Control Word Source Internal

Table 1369: Parameter 40-58 Control Word Source Internal

40-58 Control Word Source Internal		
Default value: [1] FC RS485	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: False

Option	Name	Description
[0]	None	
[1]*	FC RS485	
[2]	FC USB	
[3]	Option A	
[4]	Option B	
[5]	Option C0	
[6]	Option C1	

Option	Name	Description
[30]	External Can	
[35]	Option A fast	**NOTICE** This option is only available in FC 302.
[37]	Option C0 fast	**NOTICE** This option is only available in FC 302.

5.31 Parameter Group 42-** Safety Functions

The parameters in this parameter group are available when a safety option is installed in the drive. For information about the safety-related parameters, see the intallation guides for the safety options:

- VLT® Safety Option MCB 150/151 Installation Guide
- VLT® Safety Options MCB 152 Installation Guide

5.31.1 42-0* Speed Performance

Parameter 42-00 Speed Deviation Timer

Table 1370: Parameter 42-00 Speed Deviation Timer

42-00 Speed Deviation Timer		
Default value: 10 ms	Parameter type: Range, 10 - 5000 ms	Setup: 2 setups
Conversion index: -3	Data type: Uint16	Change during operation: False

Enter the time for which a speed deviation above 120 RPM between estimated and measured speed is allowed.

Parameter 42-01 Fast Ramp

Table 1371: Parameter 42-01 Fast Ramp

42-01 Fast Ramp		
Default value: [0] No	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: False

Option	Name	Description
[0]*	No	
[1]	Yes	

5.31.2 42-1* Speed Monitoring

Parameter 42-10 Measured Speed Source

Table 1372: Parameter 42-10 Measured Speed Source

42-10 Measured Speed Source		
Default value: Size related	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: False

Option	Name	Description
[0]	None	
[1]	Safe option	

Parameter 42-11 Encoder Resolution

Table 1373: Parameter 42-11 Encoder Resolution

42-11 Encoder Resolution		
Default value: [1024]	Parameter type: Range, 1 - config. dependent	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: False

Encoder or proximity switch resolution of the encoder connected to the MCB 150 TTL and MCB 151 HTL.

Parameter 42-12 Encoder Direction

Table 1374: Parameter 42-12 Encoder Direction

42-12 Encoder Direction		
Default value: [0] Clockwise	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: False

Option	Name	Description
[0]*	Clockwise	
[1]	Counterclockwise	

Parameter 42-13 Gear Ratio

Table 1375: Parameter 42-13 Gear Ratio

42-13 Gear Ratio		
Default value: 1	Parameter type: Range, 0.0001 - 1000.0000	Setup: 1 setup
Conversion index: 0	Data type: Uint32	Change during operation: False

Ratio between motor speed and encoder speed.

NOTICE

Only use when the drive is gear-mounted.

Parameter 42-14 Feedback Type

Table 1376: Parameter 42-14 Feedback Type

42-14 Feedback Type		
Default value: [0] With direction info	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: False

Option	Name	Description
[0]*	With direction info	
[1]	Without direction info	

Parameter 42-15 Feedback Filter

Table 1377: Parameter 42-15 Feedback Filter

42-15 Feedback Filter		
Default value: 200 Hz	Parameter type: Range, 0.01 - 200 Hz	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Frequency of the feedback filter. The default value is 200 Hz (off) if the encoder resolution is higher than 150 PPR. A filter value of 200 Hz is selected, meaning the filter is off. The use of filters depends on the given encoder resolution, gear ratio, and feedback type.

Parameter 42-16 Mounting Type

Table 1378: Parameter 42-16 Mounting Type

42-16 Mounting Type		
Default value: [0] Motor shaft mounted	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: False

Option	Name	Description
[0]*	Motor shaft mounted	
[1]	Application mounted	
[2]	Sensorless	

Parameter 42-18 Zero Speed Timer

Table 1379: Parameter 42-18 Zero Speed Timer

42-18 Zero Speed Timer		
Default value: 8760 h	Parameter type: Range, 0 - 10000 h	Setup: 1 setup
Conversion index: 74	Data type: Uint16	Change during operation: False

Time period where the option is allowed to be below 120 RPM when SLS is active before STO is activated.

5.31.3 42-2* Safe Input

Parameter 42-20 Safe Function

Table 1380: Parameter 42-20 Safe Function

42-20 Safe Function		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

Enable any of the safety options or disable safety option for the digital safe inputs.

Option	Name	Description
[0]	STO	
[1]	SS1-a	
[2]	SS1-b	
[3]	SLS-a	

Option	Name	Description
[4]	SLS-b	
[5]	Disable	
[8]	SO mon	
[10]	None	
[20]	Internal event OK	
[30]	No function	

Parameter 42-21 Type

Table 1381: Parameter 42-21 Type

42-21 Type		
Default Value: [0] NCNC	Parameter Type: Option	Setup: All setups
Conversion Index: -	Data Type: Uint8	Change during operation: False

Option	Name	Description
[0]*	NCNC	
[1]	Antivalent	
[2]	NC	
[3]	NO	

Parameter 42-22 Discrepancy Time

Table 1382: Parameter 42-22 Discrepancy Time

42-22 Discrepancy Time		
Default Value: 10 ms	Parameter Type: Range, 0 - 5000 ms	Setup: All setups
Conversion Index: -3	Data Type: Uint16	Change during operation: False

An adjustable filter time prevents faults caused by temporary discrepancy.

Parameter 42-23 Stable Signal Time

Table 1383: Parameter 42-23 Stable Signal Time

42-23 Stable Signal Time		
Default Value: 10 ms	Parameter Type: Range, 0 - 5000 ms	Setup: All setups
Conversion Index: -3	Data Type: Uint16	Change during operation: False

An adjustable signal filter in the safety option suppresses temporary signal changes using test pulse pattern.

Parameter 42-24 Restart Behaviour

Table 1384: Parameter 42-24 Restart Behaviour

42-24 Restart Behaviour		
Default value: [0] Manual	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

Option	Name	Description
[0]*	Manual	
[1]	Automatic	

5.31.4 42-3* General

Parameter 42-30 External Failure Reaction

Table 1385: Parameter 42-30 External Failure Reaction

42-30 External Failure Reaction		
Default value: [0] STO	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: False

Option	Name	Description
[0]*	STO	
[1]	SS1-a	
[2]	SS1-b	

Parameter 42-31 Reset Source

Table 1386: Parameter 42-31 Reset Source

42-31 Reset Source		
Default value: [0] Drive reset	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: False

Option	Name	Description
[0]*	Drive reset	
[1]	Drive safe reset	
[2]	Safe option DI2_A	

Parameter 42-33 Parameter Set Name

Table 1387: Parameter 42-33 Parameter Set Name

42-33 Parameter Set Name		
Default value: Size related	Parameter type: Range, 0 - 8	Setup: 1 setup
Conversion index: 0	Data type: VisibleString	Change during operation: False

Name of the safe parameter set. It is recommended to enter text with characters to avoid bad customization data error.

5.31.5 42-4* SS1

Parameter 42-40 Type

Table 1388: Parameter 42-40 Type

42-40 Type		
Default value: [0] Delay	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

Use this parameter to select the type of SS1 safety function.

Option	Name	Description
[0]*	Delay	
[1]	Ramp (slope)	
[2]	Ramp (time)	

Parameter 42-41 Ramp Profile

Table 1389: Parameter 42-41 Ramp Profile

42-41 Ramp Profile		
Default value: [0] Linear	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

Option	Name	Description
[0]*	Linear	
[2]	S-ramp const time	

Parameter 42-42 Delay Time

Table 1390: Parameter 42-42 Delay Time

42-42 Delay Time		
Default value: 1 s	Parameter type: Range, 0.1 - 3600 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Configure the time during which STO must be activated.

Parameter 42-43 Delta T

Table 1391: Parameter 42-43 Delta T

42-43 Delta T		
Default value: 2%	Parameter type: Range, 0 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

T subtracts from the time in *parameter 42-42 Delay Time* to get the motor to stop before the timer expires.

Parameter 42-44 Deceleration Rate

Table 1392: Parameter 42-44 Deceleration Rate

42-44 Deceleration Rate		
Default value: 1500/s	Parameter type: Range, 1 - 30000/s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Deceleration rate for the SS1 slope-based ramp type.

Parameter 42-45 Delta V

Table 1393: Parameter 42-45 Delta V

42-45 Delta V		
Default value: 120 RPM	Parameter type: Range, 1 - 10000 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: False

Tolerance between calculated and actual speed that the safety option allows.

Parameter 42-46 Zero Speed

Table 1394: Parameter 42-46 Zero Speed

42-46 Zero Speed		
Default value: 10 RPM	Parameter type: Range, 1 - 600 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: False

When this speed is reached, the safety option activates the STO.

Parameter 42-47 Ramp Time

Table 1395: Parameter 42-47 Ramp Time

42-47 Ramp Time		
Default value: 1 s	Parameter type: Range, 0.1 - 3600 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

The time it takes to ramp down to 0 RPM.

Parameter 42-48 S-ramp Ratio at Decel. Start

Table 1396: Parameter 42-48 S-ramp Ratio at Decel. Start

42-48 S-ramp Ratio at Decel. Start		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

The proportion of the total ramp-down time (*parameter 42-42 Delay Time*) where the deceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

Parameter 42-49 S-ramp Ratio at Decel. End

Table 1397: Parameter 42-49 S-ramp Ratio at Decel. End

42-49 S-ramp Ratio at Decel. End		
Default value: 50%	Parameter type: Range, 1 - 99%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

The proportion of the total ramp-down time (*parameter 42-42 Delay Time*) where the deceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

5.31.6 42-5* SLS

Parameter 42-50 Cut Off Speed

Table 1398: Parameter 42-50 Cut Off Speed

42-50 Cut Off Speed		
Default value: 270 RPM	Parameter type: Range, 120 - 10000 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: False

Speed at which the fail-safe reaction gets activated. This should be the value of *parameter 42-51 Speed Limits* plus a tolerance.

Parameter 42-51 Speed Limit

Table 1399: Parameter 42-51 Speed Limit

42-51 Speed Limit		
Default value: 150 RPM	Parameter type: Range, 0 - 9999 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: False

Maximum speed allowed when the SLS function is active.

Parameter 42-52 Fail Safe Reaction

Table 1400: Parameter 42-52 Fail Safe Reaction

42-52 Fail Safe Reaction		
Default value: [0] STO	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

Option	Name	Description
[0]*	STO	
[1]	SS1-a	
[2]	SS1-b	

Parameter 42-53 Start Ramp

Table 1401: Parameter 42-53 Start Ramp

42-53 Start Ramp		
Default value: [0] No	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

Option	Name	Description
[0]*	No	
[1]	Yes	

Parameter 42-54 Ramp Down Time

Table 1402: Parameter 42-54 Ramp Down Time

42-54 Ramp Down Time		
Default value: 1 s	Parameter type: Range, 0.1 - 3600 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Ramp-down time for the start ramp.

5.31.7 42-7* SMS

Parameter 42-70 Activation

Table 1403: Parameter 42-70 Activation

42-70 Activation		
Default value: [0] Inactive	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: False

Option	Name	Description
[0]*	Inactive	
[1]	Active	

Parameter 42-71 Cut Off Speed

Table 1404: Parameter 42-71 Cut Off Speed

42-71 Cut Off Speed		
Default value: 1500 RPM	Parameter type: Range, 120 - 20000 RPM	Setup: 2 setups
Conversion index: 67	Data type: Uint16	Change during operation: False

Maximum allowed speed.

5.31.8 42-8* Status

Parameter 42-80 Safe Option Status

Table 1405: Parameter 42-80 Safe Option Status

42-80 Safe Option Status		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Shows the safety option status word as a hexadecimal value.

Parameter 42-81 Safe Option Status 2

Table 1406: Parameter 42-81 Safe Option Status 2

42-81 Safe Option Status 2		
Default value: 0	Parameter type: Range, 0 - 2147483647	Setup: 1 setup
Conversion index: 0	Data type: Uint32	Change during operation: True

Shows the safety option status word 2 as a hexadecimal value. For example, it contains DI1, DI2, and blank initial state status.

Parameter 42-85 Active Safe Func.

Table 1407: Parameter 42-85 Active Safe Func.

42-85 Active Safe Func.		
Default value: [10] None	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	STO	
[1]	SS1-a	
[2]	SS1-b	
[3]	SLS-a	
[4]	SLS-b	
[8]	SO Mon	
[10]*	None	

Parameter 42-86 Safe Option Info

Table 1408: Parameter 42-86 Safe Option Info

42-86 Safe Option Info		
Default value: 0	Parameter type: Range, 0 - 25	Setup: All setups
Conversion index: 0	Data type: VisibleString	Change during operation: True

Shows information about the safety option. Can be used on the LCP.

Parameter 42-89 Customization File Version

Table 1409: Parameter 42-89 Customization File Version

42-89 Customization File Version		
Default value: Size related	Parameter type: Range, 0.00 - 99.99	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

Stores the customization file version.

5.32 Parameter Group 43-** Unit Readouts

The parameters in this group provide readouts for monitoring the operation of drives in enclosure sizes D–F.

5.32.1 43-0* Component Status

N O T I C E

The following parameters are only available in FC 302:

- *Parameter 43-00 Component Temp.*
- *Parameter 43-01 Auxiliary Temp.*

This parameter group contains read-only information on hardware components in the power section. All parameters in this group are arrays:

- [0]: Power card 1 (the master power card in a parallel drive, or the only power card in a drive with a single inverter section).
- [1]: Power card 2 (inverter connection in a parallel drive).
- [2]: Power card 3 (inverter connection in a parallel drive).
- [3]: Power card 4 (inverter connection in a parallel drive).
- [4]: Power card 5 (rectifier connection in a parallel drive).
- [5]: Power card 6 (rectifier connection in a parallel drive).
- [6]: Power card 7 (rectifier connection in a parallel drive).
- [7]: Power card 8 (rectifier connection in a parallel drive).
- [8]: Inrush card (optional).
- [9]: Fan power card 1 (optional).
- [10]: Fan power card 2 (optional).

Parameter 43-00 Component Temp.

Table 1410: Parameter 43-00 Component Temp.

43-00 Component Temp.		
Default value: 0 °C	Parameter type: Range, -128 - 127 °C, Array [18]	Setup: All set-ups
Conversion index: 100	Data type: Int8	Change during operation: True

Shows the temperature of a system component. The elements of the array reference local PCB temperature sensor measurements. *Parameter 16-31 System Temp*. uses all elements in this array to calculate the system temperature.

Parameter 43-01 Auxiliary Temp.

Table 1411: Parameter 43-01 Auxiliary Temp.

43-01 Auxiliary Temp.		
Default value: 0 °C	Parameter type: Range, -128 - 127 °C, Array [18]	Setup: All set-ups
Conversion index: 100	Data type: Int8	Change during operation: True

Shows the temperature of an auxiliary component. The elements of the array reference the temperature measurements from the NTC temperature sensors connected to hardware components in the drive. Refer to the Operating Guide for specifications of temperature sensor placement.

Parameter 43-02 Component SW ID

Table 1412: Parameter 43-02 Component SW ID

43-02 Component SW ID		
Default value: 0	Parameter type: Range, 0 - 20, Array [18]	Setup: All set-ups
Conversion index: 0	Data type: VisStr[18]	Change during operation: True

Shows the software version of the installed option.

5.32.2 43-1* Power Card Status

N O T I C E

This parameter group is only available in FC 302.

This parameter group contains read-only information on the power card status. All parameters in this group are arrays:

- [0]: Power card 1 (the master power card in a parallel drive, or the only power card in a drive with a single inverter section).
- [1]: Power card 2 (inverter connection in a parallel drive).

- [2]: Power card 3 (inverter connection in a parallel drive).
- [3]: Power card 4 (inverter connection in a parallel drive).
- [4]: Power card 5 (rectifier connection in a parallel drive).
- [5]: Power card 6 (rectifier connection in a parallel drive).
- [6]: Power card 7 (rectifier connection in a parallel drive).
- [7]: Power card 8 (rectifier connection in a parallel drive).

Parameter 43-10 HS Temp. ph.U

Table 1413: Parameter 43-10 HS Temp. ph.U

43-10 HS Temp. ph.U		
Default value: 0 °C	Parameter type: Range, -128 - 127, Array [8]	Setup: All set-ups
Conversion index: 100	Data type: Int8	Change during operation: True

Shows the heat sink temperature at the location of the phase U IGBT power module. This measurement is not available in all enclosure sizes. *Parameter 16-34 Heatsink Temp.* uses the value in this parameter.

Parameter 43-11 HS Temp. ph.V

Table 1414: Parameter 43-11 HS Temp. ph.V

43-11 HS Temp. ph.V		
Default value: 0 °C	Parameter type: Range, -128 - 127, Array [8]	Setup: All set-ups
Conversion index: 100	Data type: Int8	Change during operation: True

Shows the heat sink temperature at the location of the phase V IGBT power module. This measurement is not available in all enclosure sizes. *Parameter 16-34 Heatsink Temp.* uses the value in this parameter.

Parameter 43-12 HS Temp. ph.W

Table 1415: Parameter 43-12 HS Temp. ph.W

43-12 HS Temp. ph.W		
Default value: 0 °C	Parameter type: Range, -128 - 127, Array [8]	Setup: All set-ups
Conversion index: 100	Data type: Int8	Change during operation: True

Shows the heat sink temperature at the location of the phase W IGBT power module. This measurement is not available in all enclosure sizes. *Parameter 16-34 Heatsink Temp.* uses the value in this parameter.

Parameter 43-13 PC Fan A Speed

Table 1416: Parameter 43-13 PC Fan A Speed

43-13 PC Fan A Speed		
Default value: 0 RPM	Parameter type: Range, 0 - 65535, Array [8]	Setup: All set-ups
Conversion index: 67	Data type: Uint16	Change during operation: True

Shows the measured speed of fan A on the power card. Each power card has up to 3 fan connections. Place the fan in the drive according to the Operating Guide. A typical placement for fan A is in the backchannel (the external fan). The value of this parameter is:

- The actual fan speed when there is a DC fan in the drive.
- Relative speed when there is an AC fan in the drive.

Parameter 43-14 PC Fan B Speed

Table 1417: Parameter 43-14 PC Fan B Speed

43-14 PC Fan B Speed		
Default value: 0 RPM	Parameter type: Range, 0 - 65535, Array [8]	Setup: All set-ups
Conversion index: 67	Data type: Uint16	Change during operation: True

Shows the measured speed of fan B on the power card. Each power card has up to 3 fan connections. Place the fan in the drive according to the Operating Guide. A typical placement for fan B is on the enclosure door (the internal fan). The value of this parameter is:

- The actual fan speed when there is a DC fan in the drive.
- Relative speed when there is an AC fan in the drive.

Parameter 43-15 PC Fan C Speed

Table 1418: Parameter 43-15 PC Fan C Speed

43-15 PC Fan C Speed		
Default value: 0 RPM	Parameter type: Range, 0 - 65535, Array [8]	Setup: All set-ups
Conversion index: 67	Data type: Uint16	Change during operation: True

Shows the measured speed of fan C on the power card. Each power card has up to 3 fan connections. Place the fan in the drive according to the Operating Guide. A typical placement for fan C is inside the enclosure (the mixing fan). The value of this parameter is:

- The actual fan speed when there is a DC fan in the drive.
- Relative speed when there is an AC fan in the drive.

5.32.3 43-2* Fan Pow.Card Status

N O T I C E

This parameter group is only available in FC 302.

Parameter 43-20 FPC Fan A Speed

Table 1419: Parameter 43-20 FPC Fan A Speed

43-20 FPC Fan A Speed		
Default value: 0 RPM	Parameter type: Range, 0 - 65535, Array [2]	Setup: All set-ups
Conversion index: 67	Data type: Uint16	Change during operation: True

Shows the speed of the power card fan A.

Parameter 43-21 FPC Fan B Speed

Table 1420: Parameter 43-21 FPC Fan B Speed

43-21 FPC Fan B Speed		
Default value: 0 RPM	Parameter type: Range, 0 - 65535, Array [2]	Setup: All set-ups
Conversion index: 67	Data type: Uint16	Change during operation: True

Shows the speed of the power card fan B.

Parameter 43-23 FPC Fan D Speed

Table 1421: Parameter 43-23 FPC Fan D Speed

43-23 FPC Fan D Speed		
Default value: 0 RPM	Parameter type: Range, 0 - 65535, Array [2]	Setup: All set-ups
Conversion index: 67	Data type: Uint16	Change during operation: True

Shows the speed of the power card fan D.

Parameter 43-24 FPC Fan E Speed

Table 1422: Parameter 43-24 FPC Fan E Speed

43-24 FPC Fan E Speed		
Default value: 0 RPM	Parameter type: Range, 0 - 65535, Array [2]	Setup: All set-ups
Conversion index: 67	Data type: Uint16	Change during operation: True

Shows the speed of the power card fan E.

Parameter 43-25 FPC Fan F Speed

Table 1423: Parameter 43-25 FPC Fan F Speed

43-25 FPC Fan F Speed		
Default value: 0 RPM	Parameter type: Range, 0 - 65535, Array [2]	Setup: All set-ups
Conversion index: 67	Data type: Uint16	Change during operation: True

Shows the speed of the power card fan F.

5.33 Parameter Group 50-** License

Parameter 50-00 License Installed

Table 1424: Parameter 50-00 License Installed

50-00 License Installed		
Default value: 0	Parameter type: Range, 0 - 40, Array [3]	Setup: All setups
Conversion index: 0	Data type: VisibleString	Change during operation: False

Shows all licenses activated in the drive.

Parameter 50-01 License Code

Table 1425: Parameter 50-01 License Code

50-01 License Code		
Default value: Size related	Parameter type: Range, 0 - 19	Setup: 1 setup
Conversion index: 0	Data type: VisibleString	Change during operation: True

Enter the license code provided by the Danfoss sales representative to activate licensed features in the drive. The license code comprises 16 alphanumeric characters in the format (XXXX-XXXX-XXXX-XXXX). When the license is accepted by the drive, the parameter is shown as 0000-0000-0000-0000.

N O T I C E

Restart the drive after entering the new license code. Parameters relevant for configuring the new feature(s) are now shown in the drive. The new type code is reflected in *parameter 15-45 Actual Typecode String*. The original type code of the drive can be viewed in *parameter 15-44 Ordered Typecode String*. The activated license is shown in *parameter 50-00 License Installed*.

The license code can also be set from the factory.

5.34 Parameter Group 600-** PROFIsafe

Parameter 600-22 PROFIdrive/safe Tel. Selected

Table 1426: Parameter 600-22 PROFIdrive/safe Tel. Selected

600-22 PROFIdrive/safe Tel. Selected		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Parameter 600-44 Fault Message Counter

Table 1427: Parameter 600-44 Fault Message Counter

600-44 Fault Message Counter		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the number of safety fault buffer changes.

Parameter 600-47 Fault Number

Table 1428: Parameter 600-47 Fault Number

600-47 Fault Number		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the internal fault number for a fault in the safety fault buffer.

Parameter 600-52 Fault Situation Counter

Table 1429: Parameter 600-52 Fault Situation Counter

600-52 Fault Situation Counter		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

Number of fault situations that have occurred since the last reset in the safety fault buffer.

5.35 Parameter Group 601-** PROFIdrive 2

Parameter 601-22 PROFIdrive Safety Channel Tel. No.

Table 1430: Parameter 601-22 PROFIdrive Safety Channel Tel. No.

601-22 PROFIdrive Safety Channel Tel. No.		
Default value: 108	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

6 Integrated Motion Controller

6.1 Introduction

NOTICE

The integrated motion control is only available with special IMC software version 48.XX. To order the drive with the IMC software, use the type code with software release version S067.

The integrated motion controller (IMC) enables position control with all motor control principles and motor types with and without feedback.

To activate the IMC functionality, select *[9] Positioning* or *[10] Synchronization* in *parameter 1-00 Configuration Mode*. IMC enables the following functions:

- Positioning: Absolute, relative, and touch probe.
- Homing.
- Position synchronization.
- Virtual master.

Position control in both positioning and synchronization modes can be either sensorless or with feedback. In the sensorless control principle, the motor angle calculated by the motor controller is used as feedback. In the closed-loop control principle, VLT® AutomationDrive FC 301 supports 24 V encoders as standard. With extra options, the drive supports most standard incremental encoders, absolute encoders, and resolvers. The position controller can handle both linear and rotary systems. The controller can scale positions to any relevant physical unit such as mm or degrees.

6.2 Positioning, Homing, and Synchronization

6.2.1 Positioning

The drive supports relative positioning and absolute positioning. A positioning command requires 3 inputs:

- Target position.
- Speed reference.
- Ramp times.

The 3 inputs can come from various sources, see Illustration 100.

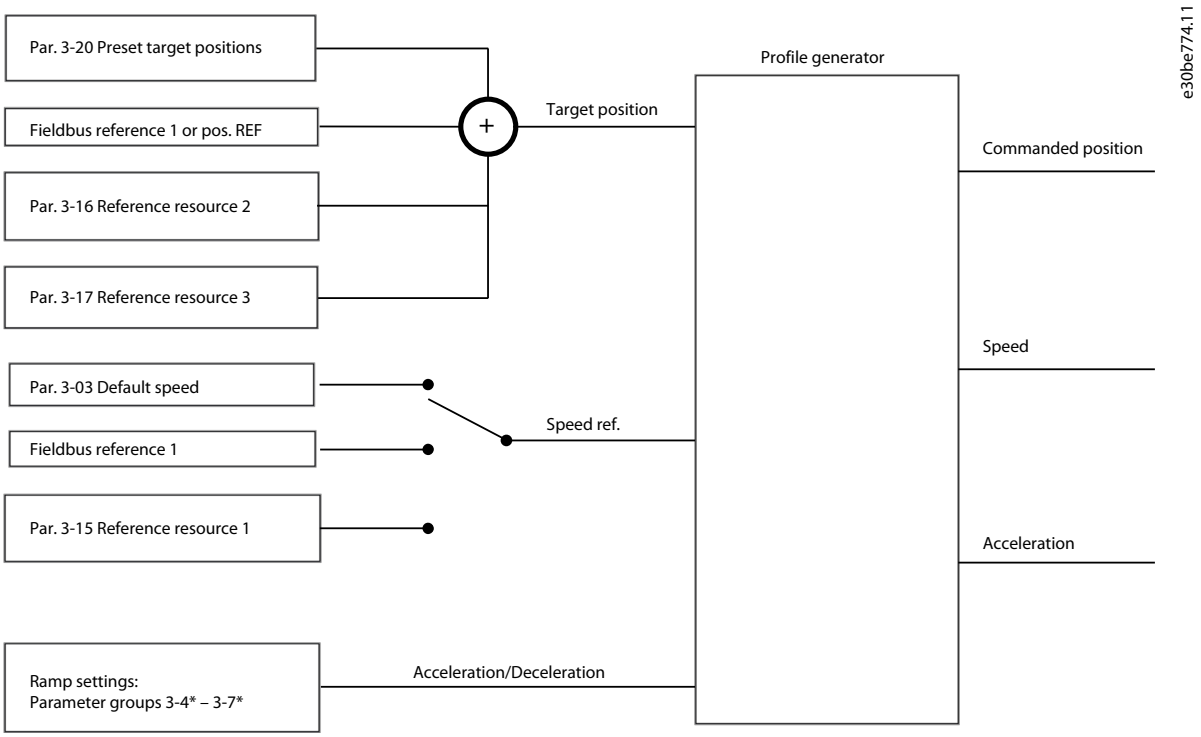


Illustration 100: Positioning References

In each control cycle (1 ms), the profile generator calculates position, speed, and acceleration required to do the specified movement. The outputs from the profile generator are used for the position and speed controller.

6.2.2 Homing

Homing is required for creating a reference to the physical machine position in closed-loop control principle with incremental encoder or in sensorless control principle. IMC supports various homing functions with or without a homing sensor. Select the homing function in *parameter 17-80 Homing Function*. After selecting a homing function, complete homing before executing absolute positioning.

6.2.3 Synchronization

In synchronization mode, the drive follows the position of a master signal. The master signal and the offset between the master and the slave are handled as shown in Illustration 101.

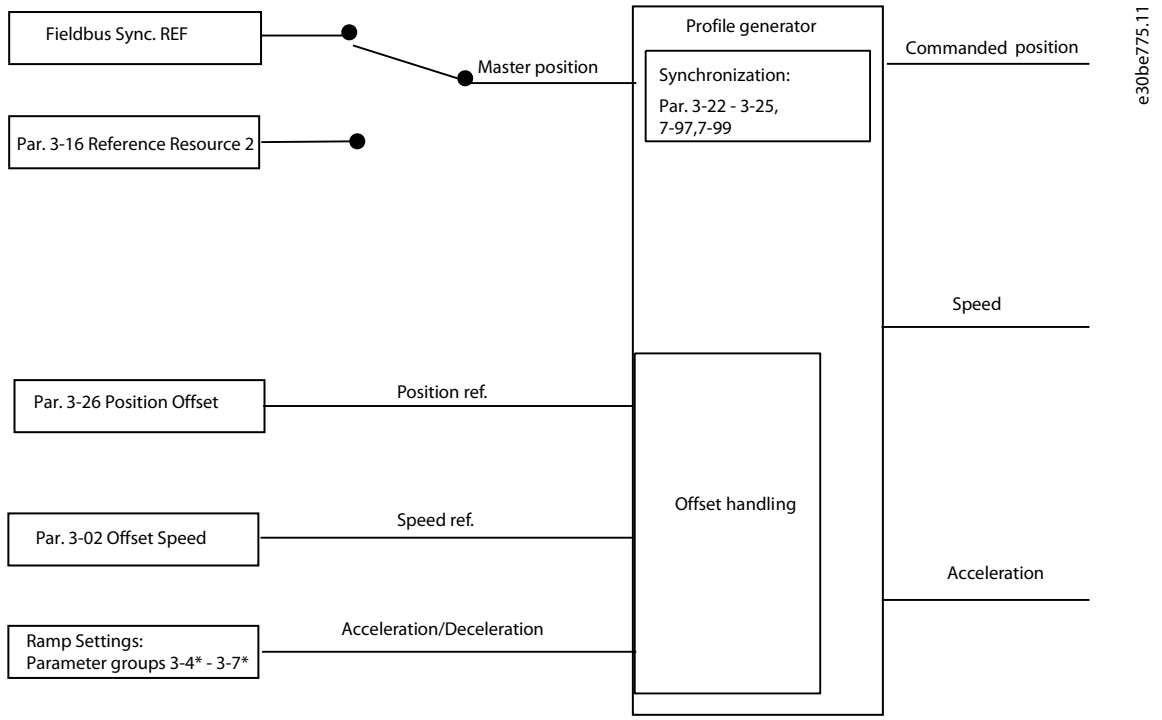


Illustration 101: Synchronization References

In each control cycle (1 ms), the profile generator calculates position, speed, and acceleration required to do the specified movement. The outputs from the profile generator are used as inputs for the position and speed controller.

6.2.4 Fieldbus References

Fieldbus references for speed and position are set via the process data (PCD) configuration as shown in the example:

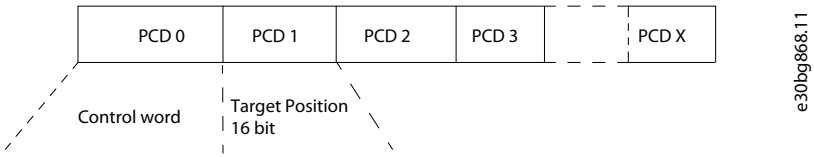


Illustration 102: Positioning: Default settings (PCD 1 = Fieldbus REF 1)

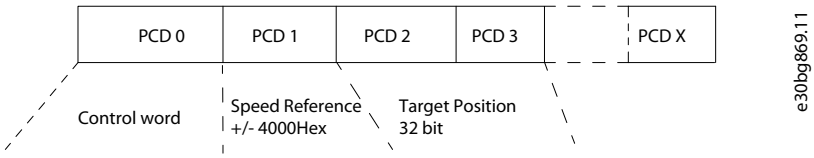


Illustration 103: Positioning: PCD write configuration PCD 1 = Fieldbus REF 1, PCD 2 and 3 = Fieldbus Pos REF

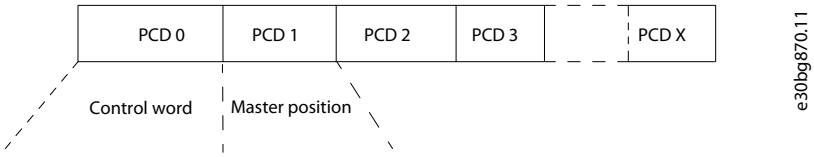


Illustration 104: Synchronizing: PCD write configuration PCD 1 = Fieldbus Sync REF

6.3 Control

6.3.1 Control Loops

In positioning and synchronization mode, 2 extra control loops control the motor in addition to the motor controller running flux control principle, sensorless, or with motor feedback. The position PI controller is the outer loop providing the setpoint for the speed PID, which provides the reference for the motor controller. For a closed loop, feedback source can be selected individually for each of 3 controllers.

For sensorless control principle, select *[0] Motor feedb. P1-02* in the following parameters:

- Speed PID: *Parameter 7-00 Speed PID Feedback Source*.
- Position PI: *Parameter 7-90 Position PI Feedback Source*.

With this set-up, both controllers use the motor angle calculated by the motor controller. See Illustration 105 for control structure and parameters affecting the control behavior.

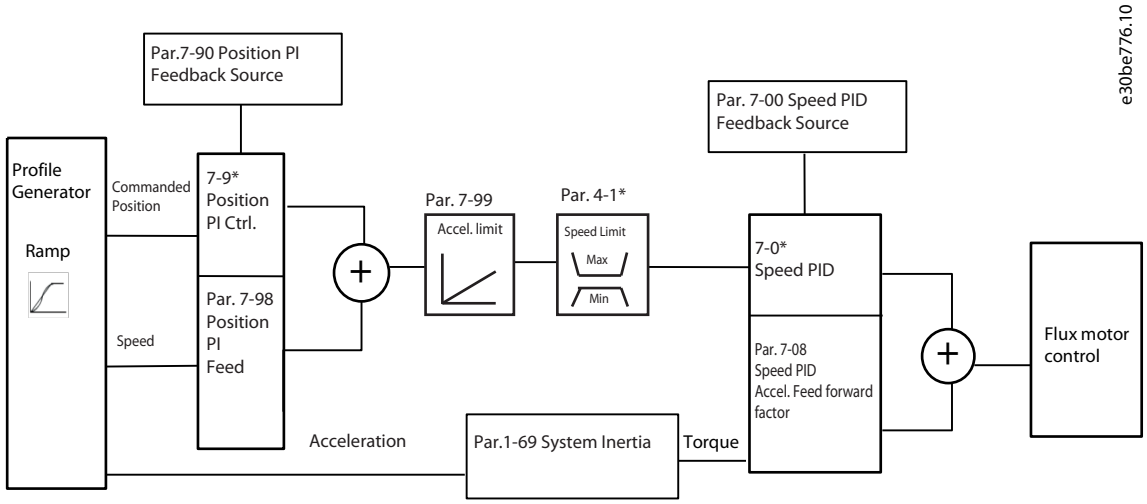


Illustration 105: Positioning and Synchronization Mode

6.3.2 Control and Status Signals

IMC control and status signals are available I/O bits and fieldbus bits.

Table 1431: Control and Status Signals

Name	Function	Digital input[1]	Control word	Digital output	Status word
Control signals					
Enable master offset	Activates the master offset when *parameter 17-93 Master Offset Selection* is set to options *[0]–[5]*.	x	x	–	
Start homing	Starts selected homing function.	x	x	–	–
Start virtual master	Starts the virtual master.	x	x	–	–
Activate touch	Selects touch probe positioning mode.	x	x	–	–
Relative position	Selects between absolute and relative positioning.	x	x	–	–
Enable reference	Starts selected motion.	x	x	–	–
Sync. to position mode	Selects positioning in synchronizing mode.	x	x	–	–

Name	Function	Digital input[1]	Control word	Digital output	Status word
Home sensor	Selects input for home sensor.	x	x	–	–
Home sensor inverse	Selects input for home sensor.	x	–	–	–
Touch sensor	Selects input for touch probe sensor.	x	x	–	–
Touch sensor inverse	Selects input for touch probe sensor.	x	–	–	–
Speed mode	Selects speed mode when *parameter 1-00 Configuration Mode* is set to *[9] Positioning* or *[10] Synchronization*.	x	x	–	–
Target inverse	Changes the sign of the set target position. For example, if the set target is 1000, the activation of this option changes the value to -1000.	x	x	–	–
Position virtual master	Activates position-controlled virtual master	x	x	–	–
Set master home	Master position = *parameter 17-88 Master Home*	x	x	–	–
Set vir. mas. pos. to actual	Virtual master position = *parameter 16-06 Actual Position*	x	x	–	–
Activate CAM table	Activation of new CAM table while running	x	x	–	–
Master marker	Master marker signal for marker synchronization, rising edge	x	–	–	–
Master marker (inverse)	Master marker signal for marker synchronization, falling edge				
Follower marker	Follower marker signal for marker synchronizing, rising edge	x	–	–	–
Follower marker (inverse)	Follower marker signal for marker synchronizing, falling edge	x	–	–	–
Status signals					
Reverse after ramp	Indicates the sign of speed reference after the ramp.	–	–	x	–
Virtual master dir.	Controls the direction of slaves.	–	–	x	–
Homing OK	Homing is completed with the selected homing function.	–	–	X	X
On target	Positioning: Target position reached. Synchronization: Slave position aligned with master position.	–	–	x	x
Position error	Maximum position error exceeded.	–	–	x	x
Position limit	A position limit is reached (*parameter 3-06 Minimum Position* or *parameter 3-07 Maximum Position*).	–	–	x	–
Touch on target	Target position is reached in touch probe position mode.	–	–	x	x
Touch activated	Touch probe positioning active.	–	–	x	x
Touch sensor found	The touch sensor has been detected.	–	–	x	x

Name	Function	Digital input[1]	Control word	Digital output	Status word
Vir. master on ref.	The virtual master is running on the set reference	–	–	x	x
Execution distance extended	The offset execution distance set in *parameter 17-95 Offset Execution Distance* has been extended due to speed/ramp limitation.	–	–	–	x
Pos. set acknowledge	The set target position has been activated.	–	–	x	x

[1] For best accuracy, use fast digital inputs 18, 32, and 33 for home and touch probe sensors.

When *[3] FC Motion Profile* is selected in *parameter 8-10 Control Word Profile*, the bits in the control word and the status word have the following meaning:

Table 1432: Control Word

Bit	0	1
0	Preset reference LSB	–
1	Preset reference MSB	–
2[1]	Preset reference EXB	–
3	Coast stop	No coast stop
4	Quick stop	No quick stop
5[1]	No reference	Enable reference
6	Ramp stop	Start
7	No reset	Reset
8	No jog	Jog
9[1]	Absolute	Relative
10	Data not valid	Data valid
11[1]	No homing	Start homing
12[1]	No touch	Activate touch

Bit	0	1
13	Set-up select LSB	–
14	Set-up select MSB	–
15	No reversing	Reversing

[1] Different from *[0] FC Profile*. Options for bits 0–2, and 12–15 in *parameter 8-14 Configurable Control Word CTW*:

- *[11] Start Homing*
- *[12] Activate Touch Probe*
- *[13] Sync. to Pos. Mode*
- *[14] Ramp 2*
- *[15] Relay 1*
- *[16] Relay 2*
- *[17] Speed Mode*
- *[18] Start Virtual Master*
- *[19] Activate Master Offset*
- *[21] Target Inverse*
- *[26] Home Sensor*
- *[27] Touch Sensor*
- *[28] Position Vir. Master*
- *[29] Set Master Home*
- *[30] Set Vir. Mas. Pos. to Actual*
- *[31] Activate CAM Table*

Table 1433: Status Word

Bit	0	1
0	Control not ready	Control ready
1	Drive not ready	Drive ready
2	Coasting	Enable
3	No error	Trip
4[(1)]	Not homed	Home done
5	Reserved	Reserved
6	No error	Trip lock
7	No warning	Warning
8[(1)]	Not on target position	Target position reached
9	Local operation	Bus control
10	Out of frequency limit	Frequency limit OK
11	No operation	In operation
12	Drive OK	Stopped, auto start

Bit	0	1
13	Voltage OK	Voltage exceeded
14	Torque OK	Torque exceeded
15	Timer OK	Timer exceeded

[1] Different from *[0] FC Profile*. Options for bits 5 and 12–15 in *parameter 8-13 Configurable Status Word STW*:

- *[4] Position Error*
- *[5] Position Limit*
- *[6] Touch on Target*
- *[7] Touch Activated*
- *[8] Touch Sen. Found*
- *[9] Vir. Master on Ref.*
- *[22] Execution Distance Extended*
- *[210] Pos. Set Acknowledge*

7 Troubleshooting

7.1 Status Messages

7.1.1 Warnings and Alarms

A warning or an alarm is signaled by the relevant indicator light on the front of the drive and indicated by a code on the display.

A warning remains active until its cause is no longer present. Under certain circumstances, operation of the motor may still be continued. Warning messages may be critical, but are not necessarily so.

In the event of an alarm, the drive trips. Reset the alarm to resume operation once the cause has been rectified.

3 ways to reset:

- Press [Reset].
- Via a digital input with the reset function.
- Via serial communication/optional fieldbus.

NOTICE

After a manual reset pressing [Reset], press [Auto On] to restart the motor.

If an alarm cannot be reset, the reason may be that its cause has not been rectified, or the alarm is trip locked.

Alarms that are trip locked offer extra protection, meaning that the mains supply must be switched off before the alarm can be reset. After being switched back on, the drive is no longer blocked and can be reset once the cause has been rectified.

Alarms that are not trip locked can also be reset using the automatic reset function in *parameter 14-20 Reset Mode* (Warning: Automatic wake up is possible.)

If a warning or alarm is marked against a code in the alarm/warning code list, this means that either a warning occurs before an alarm, or it is possible to specify whether a warning or an alarm should be shown for a given fault.

This is possible, for instance, in *parameter 1-90 Motor Thermal Protection*. After an alarm or trip, the motor carries on coasting, and the alarm and warning flash. Once the problem has been rectified, only the alarm continues flashing until the drive is reset.

NOTICE

No missing motor phase detection (numbers 30-32) and no stall detection are active when *parameter 1-10 Motor Construction* is set to *[1] PM non-salient SPM*.

7.1.2 Alarm/Warning Code List

Table 1434: Alarm/Warning Code List

Number	Description	Warning	Alarm/trip	Alarm/trip lock	Parameter reference
1	10 volts low	X	–	–	*Paremeter 14-90.0 Fault Level*
2	Live zero error	(X)	(X)	–	*Parameter 6-01 Live Zero Timeout Function*
3	No motor	(X)	–	–	*Parameter 1-80 Function at Stop* and *parameter 4-58 Missing Motor Phase* when set to *[5] Motor check*
4	Mains phase loss	(X)	(X)	(X)	*Parameter 14-12 Response to Mains Imbalance*
5	DC-link voltage high	X	–	–	–
6	DC-link voltage low	X	–	–	–
7	DC overvoltage	X	X	–	–
8	DC undervoltage	X	X	–	–

Number	Description	Warning	Alarm/trip	Alarm/trip lock	Parameter reference
9	Inverter overloaded		X	X	–
10	Motor ETR overtemperature	(X)	(X)	–	*Parameter 1-90 Motor Thermal Protection*
11	Motor thermistor overtemperature	(X)	(X)	–	*Parameter 1-90 Motor Thermal Protection*
12	Torque limit	X	X	–	*Parameter 14-90.6 Fault level* and *parameter 14-25 Trip Delay at Torque Limit*
13	Over current	X	X	X	–
14	Ground fault	–	X	X	*Parameter 14-90.4 Fault Level*
15	Hardware mismatch	–	X	X	–
16	Short circuit	–	X	X	*Parameter 14-90.8 Fault Level* default is Trip Lock
17	Control word timeout	(X)	(X)	–	*Parameter 8-04 Control Word Timeout Function*
20	Temp. input error	–	X	–	–
21	Param error	–	–	X	–
22	Hoist mech. brake	(X)	(X)	–	*Parameter group 2-2* Mechanical Brake*
23	Internal fans	X	–	–	–
24	External fans	X	–	–	–
25	Brake resistor short-circuited	X	–	–	–
26	Brake resistor power limit	(X)	(X)	–	*Parameter 2-13 Brake Power Monitoring*
27	Brake chopper short-circuited	X	X	–	–
28	Brake check	(x)	(X)	–	*Parameter 2-15 Brake Check*
29	Heat sink temp	–	X	X	*Parameter 14-90.9 Fault Level*
30	Motor phase U missing	–	(X)	(X)	*Parameter 4-58 Missing Motor Phase Function* and *parameter 14-90.16 Fault Level*
31	Motor phase V missing	–	(X)	(X)	*Parameter 4-58 Missing Motor Phase Function* and *parameter 14-90.16 Fault Level*
32	Motor phase W missing	–	(X)	(X)	*Parameter 4-58 Missing Motor Phase Function* and *parameter 14-90.16 Fault Level*
33	Inrush fault	–	X	X	–
34	Fieldbus communication fault	X	–	–	*Parameter 14-90.27 Fault Level*
35	Option fault	–	–	X	–
36	Mains failure	X	X	–	–
37	Imbalance of supply voltage	–	X	–	–

Number	Description	Warning	Alarm/trip	Alarm/trip lock	Parameter reference
38	Internal fault	–	X	X	–
39	Heat sink sensor	–	X	X	–
40	Overload of digital output terminal 27	(X)	–	–	*Parameter 5-00 Digital I/O Mode, parameter 5-01 Terminal 27 Mode*
41	Overload of digital output terminal 29	(X)	–	–	*Parameter 5-00 Digital I/O Mode, parameter 5-02 Terminal 29 Mode*
42	Ovrld X30/6-7	(X)	–	–	–
43	Ext. supply (option)	X	–	–	–
45	Ground fault 2	–	X(1)	X	*Parameter 14-90.5 Fault Level*
46	Pwr. card supply	–	X	X	–
47	24 V supply low	X	X	X	–
48	1.8 V supply low	–	X	X	–
50	AMA calibration failed	–	X	–	–
51	AMA check U_{nom} and I_{nom}	–	X	–	–
52	AMA low I_{nom}	–	X	–	–
53	AMA motor too big	–	X	–	–
54	AMA motor too small	–	X	–	–
55	AMA parameter out of range	–	X	–	–
56	AMA interrupted by user	–	X	–	–
57	AMA time-out	–	X	–	–
58	AMA internal fault	X	X	–	–
59	Current limit	X	X	–	*Parameter 14-24 Trip Delay at Current Limit*
60	External interlock	X	X	–	–
61	Feedback error	(X)	(X)	–	*Parameter 4-30 Motor Feedback Loss Function*
62	Output frequency at maximum limit	X	X	–	–
63	Mechanical brake low	–	(X)	–	*Parameter 4-30 Motor Feedback Loss Function*
64	Voltage limit	X	–	–	–
65	Control board overtemperature	–	X	X	*Parameter 14-90.11 Fault Level*
66	Heat sink temperature low	X	–	–	–
67	Option configuration has changed	–	X	–	–
68	Safe stop	(X)	(X)(1)	–	*Parameter 5-19 Terminal 37 Safe Stop*

Number	Description	Warning	Alarm/trip	Alarm/trip lock	Parameter reference
69	Pwr. card temp	–	X	X	–
70	Illegal FC configuration	–	–	X	–
73	Safe stop auto restart	(X)	(X)	–	*Parameter 5-19 Terminal 37 Safe Stop*
76	Power unit setup	X	–	–	–
77	Reduced power mode	X	–	–	*Parameter 14-59 Actual Number of Inverter Units*
78	Tracking error	(X)	(X)	–	*Parameter 4-34 Tracking Error Function*
79	Illegal PS config	–	X	X	–
80	Drive Initialized to default value	–	X	–	–
81	CSIV corrupt	–	X	–	–
82	CSIV parameter error	–	X	–	–
83	Illegal option combination	–	–	X	–
88	Option detection	–	–	X	–
89	Mechanical brake sliding	X	–	–	–
90	Feedback monitor	(X)	(X)	–	*Parameter 17-61 Feedback Signal Monitoring*
91	Analog input 54 wrong settings	–	–	X	S202
99	Locked rotor	–	X	X	–
101	Speed monitor	X	X	–	–
104	Mixing fans	X	X	–	–
122	Mot. rotat. unexp.	–	X	–	–
123	Motor mod. changed	–	X	–	–
157	Power limit mot.	–	X	–	*Parameter 4-80 Power Limit Func. Motor Mode, parameter 4-82 Power Limit Motor Mode*
158	Power limit gen.	–	X	–	*Parameter 4-81 Power Limit Func. Generator Mode, parameter 4-83 Power Limit Generator Mode*
200	Emergency mode	X	–	–	
201	Emerg. m was active	X	–	–	
202	Emerg. m limits exceeded	X	–	–	
210	Position tracking	X	X	–	*Parameter 4-70 Position Error Function, parameter 4-71 Maximum Position Error, parameter 4-72 Position Error Timeout*

Number	Description	Warning	Alarm/trip	Alarm/trip lock	Parameter reference
211	Position limit	X	X	–	*Parameter 3-06 Minimum Position*, *parameter 3-07 Maximum Position*, *parameter 4-73 Position Limit Function*
212	Homing not done	–	X	–	*Parameter 17-80 Homing Function*
213	Homing timeout	–	X	–	*Parameter 17-85 Homing Timeout*
214	No sensor input	–	X	–	–
215	Start fwd/rev	X	X	–	*Parameter 4-74 Start Fwd/Rev Function*
216	Touch timeout	–	X	–	*Parameter 4-75 Touch Timeout*
220	Configuration File Version not supported	X	–	–	–
246	Power card supply	–	–	X	–
250	New spare part	–	–	X	–
251	New type code	–	X	X	–
280	Emcy m service warning	X	–	–	–
281	Emcy OPR unexpected	X	–	–	–
430	PWM disabled	–	X	–	–

[1] Cannot be auto reset via *parameter 14-20 Reset Mode*.

(X) Dependent on parameter.

A trip is the action following an alarm. The trip coasts the motor and is reset by pressing [Reset] or by a digital input (*parameter group 5-1* Digital Inputs*). The original event that caused an alarm cannot damage the drive or cause dangerous conditions.

A trip lock is an action when an alarm occurs, which could damage the drive or connected parts. A trip lock situation can only be reset by cycling power.

7.1.3 Indicator Light

Table 1435: Indicator Light

Warning	Yellow
Alarm	Flashing red
Trip locked	Yellow and red

7.1.4 Alarm Word, Warning Word, and Extended Status Word

Table 1436: Description of Alarm Word

Bit	Hex	Dec	Alarm word	Alarm word 2	Alarm word 3
			Parameter 16-90 Alarm Word	*Parameter 16-91 Alarm Word 2*	*Parameter 16-97 Alarm Word 3*
Alarm Word Extended Status Word					
0	00000001	1	Brake check (A28)	Servicetrip, read/ write	Temp. input error
1	00000002	2	Pwr.card temp (A69)	Servicetrip, (reserved)	Memory module fault

Bit	Hex	Dec	Alarm word	Alarm word 2	Alarm word 3
			Parameter 16-90 Alarm Word	*Parameter 16-91 Alarm Word 2*	*Parameter 16-97 Alarm Word 3*
2	00000004	4	Earth fault (A14)	Servicetrip, typecode/spare part	Internal fan error
3	00000008	8	Ctrl.card temp (A65)	Servicetrip, (reserved)	Sync. fault
4	00000010	16	Ctrl. word TO (A17)	Servicetrip, (reserved)	OPM fault
5	00000020	32	Overcurrent (A13)	Reserved	–
6	00000040	64	Torque limit (A12)	Reserved	Profibus converter invalid
7	00000080	128	Motor th over (A11)	Reserved	–
8	00000100	256	Motor ETR over (A10)	Reserved	–
9	00000200	512	Inverter overld. (A9)	Discharge high	–
10	00000400	1024	DC under volt (A8)	Start failed	–
11	00000800	2048	DC over volt (A7)	Speed limit	–
12	00001000	4096	Short circuit (A16)	External interlock	–
13	00002000	8192	Inrush fault (A33)	Illegal option combi.	–
14	00004000	16384	Mains ph. loss (A4)	No safety option	–
15	00008000	32768	AMA not OK	Reserved	–
16	00010000	65536	Live zero error (A2)	Reserved	–
17	00020000	131072	Internal fault (A38)	KTY error	–
18	00040000	262144	Brake overload (A26)	Fans error	–
19	00080000	524288	U phase loss (A30)	ECB error	–
20	00100000	1048576	V phase loss (A31)	Hoist mechanical brake (A22)	–
21	00200000	2097152	W phase loss (A32)	Reserved	–
22	00400000	4194304	Fieldbus fault (A34)	Reserved	–
23	00800000	8388608	24 V supply low (A47)	Reserved	–
24	01000000	16777216	Mains failure (A36)	Reserved	–
25	02000000	33554432	1.8 V supply low (A48)	Current limit (A59)	Emergency mode
26	04000000	67108864	Brake resistor (A25)	Motor rotating unexpectedly (A122)	Sensor 4
27	08000000	134217728	Brake IGBT (A27)	Reserved	Sensor 3
28	10000000	268435456	Option change (A67)	Reserved	Sensor 2
29	20000000	536870912	Drive initialized (A80)	Encoder loss (A90)	Sensor 1
30	40000000	1073741824	Safe stop (A68)	PTC thermistor (A74)	Load
31	80000000	2147483648	Mech. brake low (A63	Dangerous failure (A72)	Stator

Table 1437: Description of Warning Word

Bit	Hex	Dec	Warning word	Warning word 2	Warning word 3
			Parameter 16-92 Warning Word	*Parameter 16-93 Warning Word 2*	*Parameter 16-98 Warning Word 3*
Warning Word					
0	00000001	1	Brake check (W28)	Start delayed	Temp. input error
1	00000002	2	Pwr.card temp (A69)	Stop delayed	–
2	00000004	4	Earth fault (W14)	Reserved	Internal fan warning
3	00000008	8	Ctrl.card temp (W65)	Reserved	–
4	00000010	16	Ctrl. word TO (W17)	–	–
5	00000020	32	Overcurrent (W13)	Reserved	Test MOC function
6	00000040	64	Torque limit (W12)	Reserved	Profibus converter time warning
7	00000080	128	Motor th over (W11)	Reserved	EmcymodeActive
8	00000100	256	Motor ETR over (W10)	Reserved	EmcymodeHasBeenActive
9	00000200	512	Inverter Overld (W9)	Discharge high	EmcymodeLimits active
10	00000400	1024	DC under volt (W8)	Multi-motor underload	EmcymodeServiceRequest due to limits
11	00000800	2048	DC over volt (W7)	Multi-motor overload	EmcymodeNotRedyToOperate
12	00001000	4096	DC voltage low (W6)	Compressor interlock	CBM Reserved
13	00002000	8192	DC voltage high (W5)	Mechanical brake sliding	CBM Reserved
14	00004000	16384	Mains ph. loss (W4)	Safe option warning	CBM Reserved
15	00008000	32768	No motor (W3)	Auto DC braking	CBM Reserved
16	00010000	65536	Live zero error (W2)		CBM Reserved
17	00020000	131072	10 V low (W1)	KTY warn	CBM Reserved
18	00040000	262144	Brake overload (W26)	Fans warn	Load low S2
19	00080000	524288	Brake resistor (W25)	ECB warn	Load low
20	00100000	1048576	Brake IGBT (W27)	Hoist mechanical brake (W22)	Sensor 4 S2
21	00200000	2097152	Speed limit (W49)	Reserved	Sensor 4
22	00400000	4194304	Fieldbus fault (W34)	Reserved	Sensor 3 S2
23	00800000	8388608	24 V supply low (W47)	Reserved	Sensor 3
24	01000000	16777216	Mains failure (W36)	Reserved	Sensor 2 S2
25	02000000	33554432	Current limit (W59)	Power Limit Motor	Sensor 2
26	04000000	67108864	Low temp (W66)	Power Limit Generator	Sensor 1 S2
27	08000000	134217728	Voltage limit (W64)	Reserved	Sensor 1

Bit	Hex	Dec	Warning word	Warning word 2	Warning word 3
			Parameter 16-92 Warning Word	*Parameter 16-93 Warning Word 2*	*Parameter 16-98 Warning Word 3*
28	10000000	268435456	Encoder loss (W90)	Reserved	Load S2
29	20000000	536870912	Output freq. lim. (W62)	BackEMF too high	Load
30	40000000	1073741824	Safe stop (W68)	PTC thermistor (W74)	Stator S2
31	80000000	2147483648	Extended status word	–	Stator

Table 1438: Description of Extended Status Word

Bit	Hex	Dec	Ext. status word	Ext. status word 2	Ext. status word 3
			Parameter 16-94 Ext. Status Word	*Parameter 16-95 Ext. Status Word 2*	*Parameter 16-99 Ext. Status Word 3*
Extended Status Word					
0	00000001	1	Ramping	Off	High pressure stop
1	00000002	2	AMA running	Hand/auto	Low pressure stop
2	00000004	4	Start CW/CCW start_possible is active, when the DI selections [12] OR [13] are active and the requested direction matches the reference sign	Profibus OFF1 active	Defrost
3	00000008	8	Slow down slow down command active, for example via CTW bit 11 or DI	Profibus OFF2 active	Pre/post lube
4	00000010	16	Catch up catch up command active, for example via CTW bit 12 or DI	Profibus OFF3 active	User-defined alerts
5	00000020	32	Feedback high feedback >*parameter 4-57 Warning Feedback High*	Relay 123 active	–
6	00000040	64	Feedback low feedback <*parameter 4-56 Warning Feedback Low*	Start prevented	–
7	00000080	128	Output current high current >*parameter 4-51 Warning Current High*	Control ready	–
8	00000100	256	Output current low current <*parameter 4-50 Warning Current Low*	Drive ready	–
9	00000200	512	Output freq high speed >*parameter 4-53 Warning Speed High*	Quick stop	–
10	00000400	1024	Output freq low	DC brake	–

Bit	Hex	Dec	Ext. status word	Ext. status word 2	Ext. status word 3
			Parameter 16-94 Ext. Status Word	*Parameter 16-95 Ext. Status Word 2*	*Parameter 16-99 Ext. Status Word 3*
			speed <*parameter 4-52 Warning Speed Low*		
11	00000800	2048	Brake check OK brake test NOT OK	Stop	–
12	00001000	4096	Braking max. BrakePower > Brakepowerlimit (2-12)	Standby	–
13	00002000	8192	Braking	Freeze output request	–
14	00004000	16384	Out of speed range	Freeze output	–
15	00008000	32768	OVC active	Jog request	–
16	00010000	65536	AC brake	Jog	–
17	00020000	131072	Password timelock number of allowed password trials exceeded - timelock active	Start request	–
18	00040000	262144	Password protection 0-61 = ALL_NO_ACCESS OR BUS_NO_ACCESS OR BUS_READONLY	Start	–
19	00080000	524288	Reference high reference >*parameter 4-55 Warning Reference High*	Start applied	–
20	00100000	1048576	Reference low reference <*parameter 4-54 Warning Reference Low*	Start delay	–
21	00200000	2097152	Local reference reference site = REMOTE -> auto on pressed & active	Sleep	–
22	00400000	4194304	Protection mode notification	Sleep boost	–
23	00800000	8388608	Unused	Running/pipe filling	–
24	01000000	16777216	Unused	Drive bypass	–
25	02000000	33554432	Unused	Emergency mode	–
26	04000000	67108864	Unused	External interlock	–
27	08000000	134217728	Unused	Emerg. m limit exceeded	–
28	10000000	268435456	Unused	FlyStart active	–

Bit	Hex	Dec	Ext. status word	Ext. status word 2	Ext. status word 3
			Parameter 16-94 Ext. Status Word	*Parameter 16-95 Ext. Status Word 2*	*Parameter 16-99 Ext. Status Word 3*
29	20000000	536870912	Unused	–	–
30	40000000	1073741824	Unused	–	–
31	80000000	2147483648	Protection mode	No function	–

The alarm words, warning words and extended status words can be read out via a serial bus or optional fieldbus for diagnostics. See also *parameter 16-94 Ext. Status Word*.

7.2 Descriptions of Warnings and Alarms

Depending on settings, FC 301/302 is able to give warnings or trigger alarms. Below, an extract of most common alarms and warnings can be found.

The following warning and alarm information defines each warning or alarm condition, provides the probable cause for the condition, and entails a remedy or troubleshooting procedure.

7.2.1 WARNING 1, 10 Volts Low

Cause

The control card voltage is less than 10 V from terminal 50. Remove some of the load from terminal 50, as the 10 V supply is overloaded. Maximum 15 mA or minimum 590 Ω.

A short circuit in a connected potentiometer or incorrect wiring of the potentiometer can cause this condition.

Troubleshooting

Remove the wiring from terminal 50.

- If the warning clears, the problem is with the wiring.
- If the warning does not clear, replace the control card.

7.2.2 WARNING/ALARM 2, Live Zero Error

Cause

This warning or alarm only appears if programmed in *parameter 6-01 Live Zero Timeout Function*. The signal on 1 of the analog inputs is less than 50% of the minimum value programmed for that input. Broken wiring or a faulty device sending the signal can cause this condition.

Troubleshooting

- Check connections on all analog mains terminals.
  - Control card terminals 53 and 54 for signals, terminal 55 common.
  - VLT® General Purpose I/O MCB 101 terminals 11 and 12 for signals, terminal 10 common.
  - VLT® Analog I/O Option MCB 109 terminals 1, 3, and 5 for signals, terminals 2, 4, and 6 common.
- Check that the drive programming and switch settings match the analog signal type.
- Perform an input terminal signal test.

7.2.3 WARNING/ALARM 3, No Motor

Cause

No motor is connected to the output of the drive.

7.2.4 WARNING/ALARM 4, Mains Phase Loss

Cause

A phase is missing on the supply side, or the mains voltage imbalance is too high. This message also appears for a fault in the input rectifier. Options are programmed in *parameter 14-12 Function at Mains Imbalance*.

Troubleshooting

- Check the supply voltage and supply currents to the drive.

7.2.5 WARNING 5, DC Link Voltage High

Cause

The DC-link voltage (DC) is higher than the high-voltage warning limit. The limit depends on the drive voltage rating. The unit is still active.

7.2.6 WARNING 6, DC Link Voltage Low

Cause

The DC-link voltage (DC) is lower than the low-voltage warning limit. The limit depends on the drive voltage rating. The unit is still active.

7.2.7 WARNING/ALARM 7, DC Overvoltage

Cause

If the DC-link voltage exceeds the limit, the drive trips after a certain time.

Troubleshooting

- Extend the ramp time.
- Change the ramp type.
- Activate the functions in *parameter 2-10 Brake Function*.
- Increase *parameter 14-26 Trip Delay at Inverter Fault*.
- If the alarm/warning occurs during a power sag, use kinetic back-up (*parameter 14-10 Mains Failure*).
- Connect a brake resistor.

7.2.8 WARNING/ALARM 8, DC Undervoltage

Cause

If the DC-link voltage drops below the undervoltage limit, the drive checks for 24 V DC back-up supply. If no 24 V DC back-up supply is connected, the drive trips after a fixed time delay. The time delay varies with unit size.

Troubleshooting

- Check that the supply voltage matches the drive voltage.
- Perform an input voltage test.
- Perform a soft-charge circuit test.

7.2.9 WARNING/ALARM 9, Inverter Overload

Cause

The drive has run with more than 100% overload for too long and is about to cut out. The counter for electronic thermal inverter protection issues a warning at 98% and trips at 100% with an alarm. The drive cannot be reset until the counter is below 90%.

Troubleshooting

- Compare the output current shown on the LCP with the drive rated current.
- Compare the output current shown on the LCP with the measured motor current.
- Show the thermal drive load on the LCP and monitor the value.
  - When running above the drive continuous current rating, the counter increases.
  - When running below the drive continuous current rating, the counter decreases.

7.2.10 WARNING/ALARM 10, Motor Overload Temperature

Cause

According to the electronic thermal protection (ETR), the motor is too hot.

This warning/alarm is controlled by *parameter 1-90 Motor Thermal Protection*:

- If the parameter is set to warning options, the drive issues a warning or an alarm when the counter is >90%.
- If the parameter is set to trip options, the drive trips when the counter reaches 100%.

The fault occurs when the motor runs with more than 100% overload for too long.

Troubleshooting

- Check for motor overheating.
- Check whether the motor is mechanically overloaded.

- Check that the motor current set in *parameter 1-24 Motor Current* is correct.
- Ensure that the motor data in *parameters 1-20* to *1-25* is set correctly.
- If an external fan is in use, check that it is selected in *parameter 1-91 Motor External Fan*.
- Run AMA in *parameter 1-29 Automatic Motor Adaptation (AMA)*. This tunes the drive to the motor more accurately and reduces thermal loading.

7.2.11 WARNING/ALARM 11, Motor Thermistor Overtemp

Cause

The motor thermistor indicates that the motor temperature is too high.

Troubleshooting

- Check for motor overheating.
- Check that the thermistor is securely connected.
- Check whether the motor is mechanically overloaded.
- When using terminal 53 or 54:
  - Check that the thermistor is connected correctly between either terminal 53 or 54 (analog voltage input) and terminal 50 (+10 V supply).
  - Check that the terminal switch for 53 and 54 is set for voltage.
  - Check that *parameter 1-93 Thermistor Resource* selects 53 or 54.
- When using terminal 18, 19, 31, 32, or 33 (digital inputs):
  - Check that the thermistor is connected correctly between the digital input terminal used (digital input PNP only) and terminal 50.
  - Select the terminal to use in *parameter 1-93 Thermistor Resource*.

7.2.12 WARNING/ALARM 12, Torque Limit

Cause

The torque has exceeded the value in *parameter 4-16 Torque Limit Motor Mode* or the value in *parameter 4-17 Torque Limit Generator Mode*. *Parameter 14-25 Trip Delay at Torque Limit* can change this warning from a warning-only condition to a warning followed by an alarm.

Troubleshooting

- If the motor torque limit is exceeded during ramp-up, extend the ramp-up time.
- If the generator torque limit is exceeded during ramp-down time, extend the ramp-down time.
- If torque limit occurs while running, increase the torque limit. Make sure that the system can operate safely at a higher torque.
- Check the application for excessive current draw on the motor.

7.2.13 WARNING/ALARM 13, Overcurrent

Cause

The inverter peak current limit (approximately 200% of the rated current) is exceeded. The warning lasts approximately 1.5 s, then the drive trips and issues an alarm. Shock loading or quick acceleration with high-inertia loads can cause this fault. If the acceleration during ramp-up is quick, the fault can also appear after kinetic back-up. If extended mechanical brake control is selected, a trip can be reset externally.

Troubleshooting

- Remove power and check if the motor shaft can be turned.
- Check that the motor size matches the drive.
- Check that the motor data is correct in *parameters 1-20* to *1-25*.

7.2.14 ALARM 14, Earth (Ground) Fault

Cause

There is current from the output phase to ground, either in the cable between the drive and the motor, or in the motor itself. The current sensors detect the ground fault by measuring current going out from the drive and current going into the drive from the motor. Ground fault is issued if the deviation of the 2 currents is too large. The current going out of the drive must be the same as the current going into the drive.

Troubleshooting

- Remove power to the drive and repair the ground fault.
- Check for ground faults in the motor by measuring the resistance to ground of the motor cables and the motor with a megohmmeter.
- Reset any potential individual offset in the 3 current sensors in the drive. Perform a manual initialization or perform a complete AMA. This method is most relevant after changing the power card.

7.2.15 ALARM 15, Hardware Mismatch

Cause

A fitted option is not operational with the present control card hardware or software.

Troubleshooting

Record the value of the following parameters and contact Danfoss.

- *Parameter 15-40 FC Type*.
- *Parameter 15-41 Power Section*.
- *Parameter 15-42 Voltage*.
- *Parameter 15-43 Software Version*.
- *Parameter 15-45 Actual Typecode String*.
- *Parameter 15-49 SW ID Control Card*.
- *Parameter 15-50 SW ID Power Card*.
- *Parameter 15-60 Option Mounted*.
- *Parameter 15-61 Option SW Version* (for each option slot).

7.2.16 ALARM 16, Short Circuit

Cause

There is short-circuiting in the motor or motor wiring.

Troubleshooting

⚠ W A R N I N G ⚠

HAZARDOUS VOLTAGE

AC drives contain hazardous voltage when connected to AC mains or connected on the DC terminals. Failure to perform installation, start-up, and maintenance by qualified personnel can result in death or serious injury.

– Only qualified personnel must perform installation, start-up, and maintenance.

- Disconnect power before proceeding.
- Remove the power to the drive and repair the short circuit.

7.2.17 WARNING/ALARM 17, Control Word Timeout

Cause

There is no communication to the drive. The warning is only active when *parameter 8-04 Control Word Timeout Function* is NOT set to *[0] Off*.

If *parameter 8-04 Control Word Timeout Function* is set to *[5] Stop and trip*, a warning appears, and the drive ramps down to a stop and shows an alarm.

Troubleshooting

- Check the connections on the serial communication cable.
- Increase *parameter 8-03 Control Word Timeout Time*.
- Check the operation of the communication equipment.
- Verify that proper EMC installation was performed.

7.2.18 WARNING/ALARM 20, Temp. Input Error

Cause

The temperature sensor is not connected.

7.2.19 WARNING/ALARM 21, Parameter Error

Cause

The parameter is out of range. The parameter number is shown in the display.

Troubleshooting

- Set the affected parameter to a valid value.

7.2.20 WARNING/ALARM 22, Hoist Mechanical Brake

Cause

The value of this warning/alarm shows the type of warning/alarm.

0 = The torque reference was not reached before timeout (*parameter 2-27 Torque Ramp Up Time*).

1 = Expected brake feedback was not received before timeout (*parameter 2-23 Activate Brake Delay*, *parameter 2-25 Brake Release Time*).

7.2.21 WARNING 23, Internal Fan Fault

Cause

The fan warning function is a protective function that checks if the fan is running/mounted. The fan warning can be disabled in *parameter 14-53 Fan Monitor* (*[0] Disabled*).

For drives with DC fans, a feedback sensor is mounted in the fan. If the fan is commanded to run and there is no feedback from the sensor, this warning appears. For drives with AC fans, the voltage to the fan is monitored.

Troubleshooting

- Check for proper fan operation.
- Cycle power to the drive and check that the fan operates briefly at start-up.
- Check the sensors on the control card.

7.2.22 WARNING 24, External Fan Fault

Cause

The fan warning function is a protective function that checks if the fan is running/mounted. The fan warning can be disabled in *parameter 14-53 Fan Monitor* (*[0] Disabled*).

For drives with DC fans, a feedback sensor is mounted in the fan. If the fan is commanded to run and there is no feedback from the sensor, this warning appears. For drives with AC fans, the voltage to the fan is monitored.

Troubleshooting

- Check for proper fan operation.
- Cycle power to the drive and check that the fan operates briefly at start-up.
- Check the sensors on the heat sink.

7.2.23 WARNING 25, Brake Resistor Short Circuit

Cause

The brake resistor is monitored during operation. If a short circuit occurs, the brake function is disabled and the warning appears. The drive is still operational, but without the brake function.

Troubleshooting

- Remove the power to the drive and replace the brake resistor (refer to *parameter 2-15 Brake Check*).

7.2.24 WARNING/ALARM 26, Brake Resistor Power Limit

Cause

The power transmitted to the brake resistor is calculated as a mean value over the last 120 s of run time. The calculation is based on the DC-link voltage and the brake resistor value set in *parameter 2-16 AC Brake Max. Current*. The warning is active when the dissipated braking power is higher than 90% of the brake resistor power. If option *[2] Trip* is selected in *parameter 2-13 Brake Power Monitoring*, the drive trips when the dissipated braking power reaches 100%.

7.2.25 WARNING/ALARM 27, Brake Chopper Fault

Cause

The brake transistor is monitored during operation, and if a short circuit occurs, the brake function is disabled, and a warning is issued. The drive is still operational, but since the brake transistor has short-circuited, substantial power is transmitted to the brake resistor, even if it is inactive.

Troubleshooting

- Remove the power to the drive and remove the brake resistor.

7.2.26 WARNING/ALARM 28, Brake Check Failed

Cause

The brake resistor is not connected or not working.

Troubleshooting

- Check *parameter 2-15 Brake Check*.

7.2.27 ALARM 29, Heat Sink Temp

Cause

The maximum temperature of the heat sink is exceeded. The temperature fault is not reset until the temperature drops below a defined heat sink temperature. The trip and reset points are different based on the drive power size.

Troubleshooting

Check for the following conditions:

- The ambient temperature is too high.
- The motor cables are too long.
- Incorrect airflow clearance above and below the drive.
- Blocked airflow around the drive.
- Damaged heat sink fan.
- Dirty heat sink.

7.2.28 ALARM 30, Motor Phase U Missing

Cause

Motor phase U between the drive and the motor is missing.

Troubleshooting

⚠ W A R N I N G ⚠

HAZARDOUS VOLTAGE

AC drives contain hazardous voltage when connected to AC mains or connected on the DC terminals. Failure to perform installation, start-up, and maintenance by qualified personnel can result in death or serious injury.

– Only qualified personnel must perform installation, start-up, and maintenance.

- Disconnect power before proceeding.
- Remove the power from the drive and check motor phase U.

7.2.29 ALARM 31, Motor Phase V Missing

Cause

Motor phase V between the drive and the motor is missing.

Troubleshooting

⚠ W A R N I N G ⚠

HAZARDOUS VOLTAGE

AC drives contain hazardous voltage when connected to AC mains or connected on the DC terminals. Failure to perform installation, start-up, and maintenance by qualified personnel can result in death or serious injury.

– Only qualified personnel must perform installation, start-up, and maintenance.

- Disconnect power before proceeding.
- Remove the power from the drive and check motor phase V.

7.2.30 ALARM 32, Motor Phase W Missing

Cause

Motor phase W between the drive and the motor is missing.

Troubleshooting

⚠ W A R N I N G ⚠

HAZARDOUS VOLTAGE

AC drives contain hazardous voltage when connected to AC mains or connected on the DC terminals. Failure to perform installation, start-up, and maintenance by qualified personnel can result in death or serious injury.

– Only qualified personnel must perform installation, start-up, and maintenance.

- Disconnect power before proceeding.
- Remove the power from the drive and check motor phase W.

7.2.31 ALARM 33, Inrush Fault

Cause

Too many power-ups have occurred within a short time period.

Troubleshooting

- Let the unit cool to operating temperature.
- Check potential DC-link fault to ground.

7.2.32 WARNING/ALARM 34, Fieldbus Communication Fault

Cause

The fieldbus on the communication option card is not working.

7.2.33 WARNING/ALARM 35, Option Fault

Cause

An option alarm is received. The alarm is option-specific. The most likely cause is a power-up or a communication fault.

7.2.34 WARNING/ALARM 36, Mains Failure

Cause

This warning/alarm is only active if the supply voltage to the drive is lost and *parameter 14-10 Mains Failure* is not set to *[0] No Function*.

Troubleshooting

- Check the fuses to the drive and mains supply to the unit.

7.2.35 ALARM 37, Phase Imbalance

Cause

There is a current imbalance between the power units.

7.2.36 ALARM 38, Internal Fault

Cause

When an internal fault occurs, a code number defined in Table 1439 is shown.

Troubleshooting

- Cycle power.
- Check that the option is properly installed.
- Check for loose or missing wiring.

It may be necessary to contact the Danfoss supplier or service department. Note the code number for further troubleshooting guidance.

Table 1439: Internal Fault Codes

Number	Text
0	The serial port cannot be initialized. Contact the Danfoss supplier or Danfoss service department.
256–258	The power EEPROM data is defective or too old. Replace the power card.

Number	Text
512–519	Internal fault. Contact the Danfoss supplier or Danfoss service department.
783	Parameter value outside of minimum/maximum limits.
1024–1284	Internal fault. Contact the Danfoss supplier or Danfoss service department.
1299	The option software in slot A is too old.
1300	The option software in slot B is too old.
1302	The option software in slot C1 is too old.
1315	The option software in slot A is not supported/allowed.
1316	The option software in slot B is not supported/ allowed.
1318	The option software in slot C1 is not supported/ allowed.
1379–2819	Internal fault. Contact the Danfoss supplier or Danfoss service department.
1792	Hardware reset of digital signal processor.
1793	Motor-derived parameters not transferred correctly to the digital signal processor.
1794	Power data not transferred correctly at power-up to the digital signal processor.
1795	The digital signal processor has received too many unknown SPI telegrams. The AC drive also uses this fault code if the MCO does not power up correctly. This situation can occur due to poor EMC protection or improper grounding.
1796	RAM copy error.
2561	Replace the control card.
2820	LCP stack overflow.
2821	Serial port overflow.
2822	USB port overflow.
3072–5122	Parameter value is outside its limits.
5123	Option in slot A: Hardware incompatible with the control board hardware.
5124	Option in slot B: Hardware incompatible with the control board hardware.
5125	Option in slot C0: Hardware incompatible with the control board hardware.
5126	Option in slot C1: Hardware incompatible with the control board hardware.
5376– 6231	Internal fault. Contact the Danfoss supplier or Danfoss service department.

7.2.37 ALARM 39, Heat Sink Sensor

Cause

There is no feedback from the heat sink temperature sensor.

The signal from the IGBT thermal sensor is not available on the power card.

Troubleshooting

- Check the ribbon cable between the power card and the gate drive card.
- Check for a defective power card.
- Check for a defective gate drive card.

7.2.38 WARNING 40, Overload of Digital Output Terminal 27

Troubleshooting

- Check the load connected to terminal 27 or remove the short-circuit connection.
- Check *parameter 5-00 Digital I/O Mode* and *parameter 5-01 Terminal 27 Mode*.

7.2.39 WARNING 41, Overload of Digital Output Terminal 29

Troubleshooting

- Check the load connected to terminal 29 or remove the short-circuit connection.
- Check *parameter 5-00 Digital I/O Mode* and *parameter 5-02 Terminal 29 Mode*.

7.2.40 WARNING 42, Ovrld X30/6-7

Troubleshooting

For terminal X30/6:

- Check the load connected to the terminal, or remove the short-circuit connection.
- Check *parameter 5-32 Term X30/6 Digi out (MCB 101)* (VLT® General Purpose I/O MCB 101).

For terminal X30/7:

- Check the load connected to the terminal, or remove the short-circuit connection.
- Check *parameter 5-33 Term X30/7 Digi Out (MCB 101)* (VLT® General Purpose I/O MCB 101).

7.2.41 ALARM 43, Ext. Supply

Cause

VLT® Extended Relay Option MCB 113 is mounted without 24 V DC.

Troubleshooting

Choose 1 of the following:

- Connect a 24 V DC external supply.
- Specify that no external supply is used via *parameter 14-80 Option Supplied by External 24VDC*, *[0] No*. A change in *parameter 14-80 Option Supplied by External 24VDC* requires a power cycle.

7.2.42 ALARM 45, Earth Fault 2

Cause

Ground fault.

Troubleshooting

- Check for proper grounding and loose connections.
- Check for proper wire size.
- Check the motor cables for short circuits or leakage currents.

7.2.43 ALARM 46, Power Card Supply

Cause

The supply on the power card is out of range. Another reason can be a defective heat sink fan.

There are 3 supplies generated by the switch mode supply (SMPS) on the power card:

- 24 V.
- 5 V.
- ±18 V.

When powered with VLT® 24 V DC Supply MCB 107, only 24 V and 5 V supplies are monitored. When powered with 3-phase mains voltage, all 3 supplies are monitored.

Troubleshooting

- Check for a defective power card.
- Check for a defective control card.
- Check for a defective option card.

- If a 24 V DC supply is used, verify proper supply power.
- Check for a defective heat sink fan.

7.2.44 WARNING 47, 24 V Supply Low

Cause

The supply on the power card is out of range.

There are 3 supplies generated by the switch mode supply (SMPS) on the power card:

- 24 V.
- 5 V.
- ±18 V.

Troubleshooting

- Check for a defective power card.

7.2.45 WARNING 48, 1.8 V Supply Low

Cause

The 1.8 V DC supply used on the control card is outside of the allowed limits. The supply is measured on the control card.

Troubleshooting

- Check for a defective control card.
- If an option card is present, check for overvoltage.

7.2.46 WARNING 49, Speed Limit

Cause

The warning is shown when the speed is outside of the specified range in *parameter 4-11 Motor Speed Low Limit [RPM]* and *parameter 4-13 Motor Speed High Limit [RPM]*. When the speed is below the specified limit in *parameter 1-86 Trip Speed Low [RPM]* (except when starting or stopping), the drive trips.

7.2.47 ALARM 50, AMA Calibration Failed

Cause

A calibration error has occurred.

Troubleshooting

- Contact the Danfoss supplier or Danfoss service department.

7.2.48 ALARM 51, AMA Check Unom and Inom

Cause

The settings for motor voltage, motor current, and motor power are wrong.

Troubleshooting

- Check settings in *parameters 1-20* to *1-25*.

7.2.49 ALARM 52, AMA Low Inom

Cause

The motor current is too low.

Troubleshooting

- Check the settings in *parameter 1-24 Motor Current*.

7.2.50 ALARM 53, AMA Motor Too Big

Cause

The motor is too big for the AMA to operate.

Troubleshooting

- Check the settings in *parameter group 1-2* Motor Data*.

7.2.51 ALARM 54, AMA Motor Too Small

Cause

The motor is too small for the AMA to operate.

Troubleshooting

- Check the settings in *parameter group 1-2* Motor Data*.

7.2.52 ALARM 55, AMA Parameter Out of Range

Cause

The AMA cannot run because the paramenter values of the motor are out of the acceptable range.

Troubleshooting

- Check the settings in *parameter group 1-2* Motor Data*.

7.2.53 ALARM 56, AMA Interrupted by User

Cause

The AMA is manually interrupted.

Troubleshooting

- Re-run the AMA calibration.

7.2.54 ALARM 57, AMA Internal Fault

Cause

Internal fault.

Troubleshooting

Try to restart the AMA. Repeated restarts can overheat the motor.

7.2.55 ALARM 58, AMA Internal Fault

Cause

Internal fault.

Troubleshooting

Contact the Danfoss supplier.

7.2.56 WARNING 59, Current Limit

Cause

The current is higher than the value in *parameter 4-18 Current Limit*.

Troubleshooting

- Ensure that the motor data in *parameters 1-20* to *1-25* is set correctly.
- Increase the current limit if necessary. Ensure that the system can operate safely at a higher limit.

7.2.57 WARNING 60, External Interlock

Cause

A digital input signal indicates a fault condition external to the drive. An external interlock has commanded the drive to trip.

Troubleshooting

- Clear the external fault condition.
- To resume normal operation, apply 24 V DC to the terminal programmed for external interlock.
- Reset the drive.

7.2.58 WARNING/ALARM 61, Feedback Error

Cause

An error between calculated speed and speed measurement from feedback device.

Troubleshooting

- Check the settings for warning/alarm/disabling in *parameter 4-30 Motor Feedback Loss Function*.
- Set the tolerable error in *parameter 4-31 Motor Feedback Speed Error*.
- Set the tolerable feedback loss time in *parameter 4-32 Motor Feedback Loss Timeout*.

7.2.59 WARNING 62, Output Frequency at Maximum Limit

Cause

The output frequency has reached the value set in *parameter 4-19 Max Output Frequency*.

Troubleshooting

- Check the application for possible causes.
- Increase the output frequency limit. Be sure that the system can operate safely at a higher output frequency.

The warning clears when the output drops below the maximum limit.

7.2.60 ALARM 63, Mechanical Brake Low

Cause

The actual motor current has not exceeded the release brake current within the start delay time window.

7.2.61 WARNING 64, Voltage Limit

Cause

The load and speed combination demands a motor voltage higher than the actual DC-link voltage.

7.2.62 WARNING/ALARM 65, Control Card Overtemperature

Cause

The cutout temperature of the control card has exceeded the upper limit.

Troubleshooting

- Check that the ambient operating temperature is within the limits.
- Check for clogged filters.
- Check fan operation.
- Check the control card.

7.2.63 WARNING 66, Heat Sink Temperature Low

Cause

The drive is too cold to operate. This warning is based on the temperature sensor in the IGBT module.

Troubleshooting

- Increase the ambient temperature of the unit.
- Supply a trickle amount of current to the drive whenever the motor is stopped by setting *parameter 2-00 DC Hold/Preheat Current* to 5% and *parameter 1-80 Function at Stop*.

7.2.64 ALARM 67, Option Module Configuration has Changed

Cause

One or more options have either been added or removed since the last power-down.

Troubleshooting

- Check that the configuration change is intentional and reset the unit.

7.2.65 ALARM 68, Safe Stop Activated

Cause

Safe Torque Off (STO) has been activated.

Troubleshooting

- To resume normal operation, apply 24 V DC to terminal 37, then send a reset signal (via bus, digital I/O, or by pressing [Reset]).

7.2.66 ALARM 70, Illegal FC Configuration

Cause

The control card and power card are incompatible.

Troubleshooting

- To check compatibility, contact the Danfoss supplier with the type code from the unit nameplate and the part numbers on the cards.

7.2.67 ALARM 71, PTC 1 Safe Stop

Cause

Because the motor is too warm, the VLT® PTC Thermistor Card MCB 112 activated the Safe Torque Off (STO).

Troubleshooting

- Once the motor temperature reaches an acceptable level and the digital input from MCB 112 is deactivated, perform 1 of the following:
  - Send a reset signal via bus or digital I/O.
  - Press [Reset].

7.2.68 ALARM 72, Dangerous Failure

Cause

Safe Torque Off (STO) with trip lock.

Troubleshooting

An unexpected combination of STO commands has occurred:

- VLT® PTC Thermistor Card MCB 112 enables X44/10, but STO is not enabled.
- MCB 112 is the only device using STO (specified through selection *[4] PTC 1 alarm* or *[5] PTC 12 warning* in *parameter 5-19 Terminal 37 Safe Stop*). STO is activated, but X44/10 is not activated.

7.2.69 WARNING 73, Safe Stop Auto Restart

Cause

STO activated.

Troubleshooting

- With automatic restart enabled, the motor can start when the fault is cleared.

7.2.70 ALARM 74, PTC Thermistor

Cause

The PTC is not working. Alarm is related to VLT® PTC Thermistor Card MCB 112.

7.2.71 ALARM 75, Illegal Profile Sel.

Cause

There was an attempt to write the parameter value while the motor was running.

Troubleshooting

- Stop the motor before writing the MCO profile to *parameter 8-10 Control Word Profile*.

7.2.72 Warning 76, Power Unit Setup

Cause

The required number of power units does not match the detected number of active power units.

Troubleshooting

- When replacing a drive module, this warning can occur if the power-specific data in the module power card does not match the rest of the drive. Confirm that the spare part and its power card are the correct part number.

7.2.73 WARNING 77, Reduced Power Mode

Cause

The drive is operating in reduced power mode (less than allowed number of inverter sections). The warning is generated on power cycle when the drive is set to run with fewer inverters and remains on.

7.2.74 ALARM 78, Tracking Error

Cause

The difference between setpoint value and actual value exceeds the value in *parameter 4-35 Tracking Error*.

Troubleshooting

- Disable the function or select an alarm/warning in *parameter 4-34 Tracking Error Function*.
- Investigate the mechanics around the load and motor. Check feedback connections from motor encoder to drive.
- Select motor feedback function in *parameter 4-30 Motor Feedback Loss Function*.
- Adjust the tracking error band in *parameter 4-35 Tracking Error* and *parameter 4-37 Tracking Error Ramping*.

7.2.75 ALARM 79, Illegal Power Section Configuration

Cause

The scaling card has an incorrect part number or is not installed. The MK102 connector on the power card could not be installed.

7.2.76 ALARM 80, Drive Initialized to Default Value

Cause

Parameter settings are initialized to default settings after a manual reset.

Troubleshooting

- To clear the alarm, reset the unit.

7.2.77 ALARM 81, CSIV Corrupt

Cause

The CSIV file has syntax errors.

7.2.78 ALARM 82, CSIV Parameter Error

Cause

CSIV failed to initialize a parameter.

7.2.79 ALARM 83, Illegal Option Combination

Cause

The mounted options are incompatible.

7.2.80 ALARM 84, No Safety Option

Cause

The safety option was removed without applying a general reset.

Troubleshooting

- Reconnect the safety option.

7.2.81 ALARM 88, Option Detection

Cause

A change in the option layout is detected. *Parameter 14-89 Option Detection* is set to *[0] Frozen configuration* and the option layout has been changed.

Troubleshooting

- To apply the change, enable option layout changes in *parameter 14-89 Option Detection*.
- Alternatively, restore the correct option configuration.

7.2.82 WARNING 89, Mechanical Brake Sliding

Cause

The hoist brake monitor detects a motor speed exceeding 10 RPM.

7.2.83 ALARM 90, Feedback Monitor

Troubleshooting

- Check the connection to the encoder/resolver option and, if necessary, replace the VLT® Encoder Input MCB 102 or VLT® Resolver Input MCB 103.

7.2.84 ALARM 91, Analog Input 54 Wrong Settings

Troubleshooting

- Set switch S202 in position OFF (voltage input) when a KTY sensor is connected to analog input terminal 54.

7.2.85 ALARM 99, Locked Rotor

Cause

The rotor is blocked.

Troubleshooting

- Check if the motor shaft is locked.
- Check if the start current triggers the current limit set in *parameter 4-18 Current Limit*.
- Check if it increases the value in *parameter 30-23 Locked Rotor Detection Time [s]*.

7.2.86 WARNING/ALARM 104, Mixing Fan Fault

Cause

The fan is not operating. The fan monitor checks that the fan is spinning at power-up or whenever the mixing fan is turned on. The mixing fan fault can be configured as a warning or an alarm in *parameter 14-53 Fan Monitor*.

Troubleshooting

- Cycle power to the drive to determine if the warning/alarm returns.

7.2.87 WARNING/ALARM 122, Mot. Rotat. Unexp.

Cause

The drive performs a function that requires the motor to be at standstill, for example DC hold for PM motors.

7.2.88 WARNING 123, Motor Mod. Changed

Cause

The motor selected in *parameter 1-11 Motor Model* is not correct.

Troubleshooting

- Check the motor model.

7.2.89 WARNING/ALARM 157, Power Limit Mot.

Cause

The output power exceeds the value defined in *parameter 4-82 Power Limit Motor Mode*.

7.2.90 WARNING/ALARM 158, Power Limit Gen.

Cause

The generating power exceeds the value defined in *parameter 4-83 Power Limit Generator Mode*.

7.2.91 WARNING 163, ATEX ETR Cur.Lim.Warning

Cause

The drive has run above the characteristic curve for more than 50 s. The warning is activated at 83% and deactivated at 65% of the allowed thermal overload.

7.2.92 ALARM 164, ATEX ETR Cur.Lim.Alarm

Cause

Running above the characteristic curve for more than 60 s within a period of 600 s activates the alarm, and the drive trips.

7.2.93 WARNING 165, ATEX ETR Freq.Lim.Warning

Cause

The drive has run for more than 50 s below the allowed minimum frequency (*parameter 1-98 ATEX ETR Interpol. Points Freq.*).

7.2.94 ALARM 166, ATEX ETR Freq.Lim.Alarm

Cause

The drive has run for more than 60 s (in a period of 600 s) below the allowed minimum frequency (*parameter 1-98 ATEX ETR Interpol. Points. Freq.*).

7.2.95 WARNING/ALARM 210, Position Tracking

Cause

The actual position error exceeds the value in *parameter 4-71 Maximum Position Error*. *Parameter 4-70 Position Error Function* defines whether this is a warning or an alarm.

7.2.96 WARNING/ALARM 211, Position Limit

Cause

The position is outside the limits defined in *parameter 3-06 Minimum Position* and *parameter 3-07 Maximum Position*. *Parameter 4-73 Position Limit Function* defines the function for this warning/alarm.

7.2.97 WARNING/ALARM 212, Homing not Done

Cause

A homing function is selected in *parameter 17-80 Homing Function* and absolute positioning is executed before homing is completed.

7.2.98 ALARM 213, Homing Timeout

Cause

Homing was started but did not finish within the time defined in *parameter 17-85 Homing Timeout*.

7.2.99 ALARM 214, No Sensor Input

Cause

A homing process with a homing function that requires a sensor, or touch probe positioning is started with no input defined for the sensor.

7.2.100 WARNING/ALARM 215, Start Fwd/Rev

Cause

One of the hardware end-limit options, *[12] Enable Start Forward* or *[13] Enable Start Reverse* is active.

7.2.101 WARNING/ALARM 216, Touch Timeout

Cause

A touch probe sensor is not found within the time in *parameter 4-75 Touch Timeout*. The timeout timer is started as soon as the touch probe positioning is activated even if the application is not moving.

7.2.102 WARNING 220, Configuration File Version not Supported

Cause

The drive does not support the current configuration file version. Customization is aborted.

7.2.103 WARNING 250, New Spare Part

Cause

A component in the drive system has been replaced.

Troubleshooting

- Reset the drive system to restore normal operation.

7.2.104 WARNING 251, New Typecode

Cause

The power card or other components have been replaced, and the typecode has changed.

7.2.105 ALARM 430, PWM Disabled

Cause

The PWM on the power card is disabled.

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VLT Drives Glossary

6

60° AVM

60° asynchronous vector modulation (*parameter 14-00 Switching Pattern*).

A

Actual position

The actual position from an encoder, or a value that the motor control calculates in open loop. The drive uses the actual position as feedback for position PI.

Analog reference

A signal transmitted to the analog inputs 53 or 54 (voltage or current).

Analog inputs

The analog inputs are used for controlling various functions of the drive.

There are 2 types of analog inputs:

Current input, 0–20 mA, and 4–20 mA

Voltage input, -10 V DC to +10 V DC.

Analog outputs

The analog outputs can supply a signal of 0–20 mA, 4–20 mA.

Automatic motor adaptation, AMA

AMA algorithm determines the electrical parameters for the connected motor at standstill.

B

BDM

A BDM is a drive module which consists of a power converter module and a control and regulating device for speed, torque, current, or voltage.

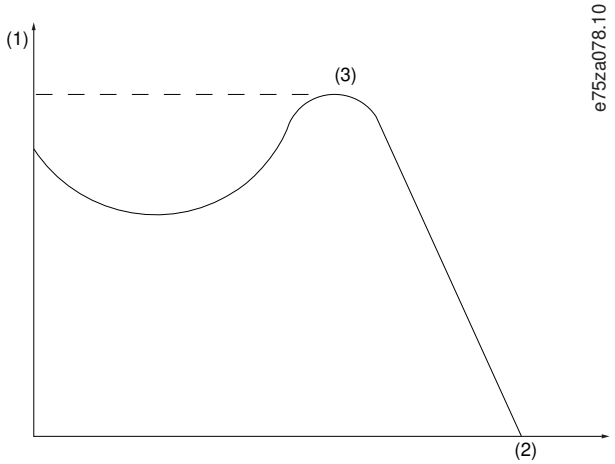
Binary reference

A signal transmitted to the serial communication port.

Brake resistor

The brake resistor is a module capable of absorbing the brake power generated in regenerative braking. This regenerative brake power increases the DC-link voltage and a brake chopper ensures that the power is transmitted to the brake resistor.

Break-away torque



C

CBM

Condition Based Monitoring monitors the machine condition and performance when the drive is in service and detects mechanical, motor, or application failures in advance. Corrective actions can be performed before the process or application is impacted.

CDM

A CDM is a drive system without the motor and without the measuring sensors, which are mechanically connected to the motor shaft. The drive system consists of, but is not restricted to, the BDM and extensions, such as the feed module and auxiliary equipment.

CT characteristics Constant-torque characteristics used for all applications such as conveyor belts, displacement pumps, and cranes.

Commanded position The actual position reference calculated by the profile generator. The drive uses the commanded position as setpoint for position PI.

Control command Start and stop the connected motor with LCP and digital inputs.
Functions are divided into 2 groups.
Functions in group 1 have higher priority than functions in group 2.

Table 1: Function Groups

Group 1	Group 2
Reset, coast stop, reset and coast stop, quick stop, DC brake, stop, the LCP [OFF] key.	Start, pulse start, reversing, start reversing, jog, freeze output.

D

DSP Digital signal processor.

Digital inputs The digital inputs can be used for controlling various functions of the drive.

Digital outputs The drive features 2 solid-state outputs that can supply a 24 V DC (maximum 40 mA) signal.

E

ETR Electronic thermal relay is a thermal load calculation based on present load and time. Its purpose is to estimate the motor temperature.

F

FC standard bus Includes RS485 bus with FC protocol or MC protocol. See *parameter 8-30 Protocol*.

f_M Motor frequency.

$f_{M,N}$ Rated motor frequency (nameplate data).

f_{MAX} Maximum motor frequency.

f_{MIN} Minimum motor frequency.

f_{jog} Motor frequency when the jog function is activated (via digital terminals).

H

Hiperface® Hiperface® is a registered trademark by Stegmann.

I

I_M Motor current (actual).

$I_{M,N}$ Rated motor current (nameplate data).

IMC Integrated Motion Controller (IMC) is a functionality that enables an AC drive to perform high-precision positioning and synchronization operations without the need for additional modules or hardware.

$I_{VLT,MAX}$ Maximum output current.

$I_{VLT,N}$ Rated output current supplied by the drive.

Initializing If initializing is carried out in *parameter 14-22 Operation Mode*, the drive returns to the default setting.

Intermittent duty cycle

An intermittent duty rating refers to a sequence of duty cycles. Each cycle consists of an on-load and an off-load period. The operation can be either periodic duty or non-periodic duty.

L

LCP

The local control panel makes up a complete interface for control and programming of the drive. The control panel is detachable and can be installed up to 3 m (10 ft) from the drive, that is, in a front panel with the installation kit option.

lsb

Least significant bit.

M

MCM

Short for "mille circular mil", an American measuring unit for cable cross-section. 1 MCM=0.5067 mm^2

Motor running

Torque generated on output shaft and speed from 0 RPM to maximum speed on motor.

msb

Most significant bit.

N

NLCP

Numerical local control panel interface for control and programming of the drive. The display is numerical and the panel is used to show process values. The NLCP has no storage and copy functions.

$n_{M,N}$

Nominal motor speed (nameplate data).

n_s

Synchronous motor speed.

$$n_s = \frac{2 \times \text{par. } 1-23 \times 60\, s}{\text{par. } 1-39}$$

n_{slip}

Motor slip.

O

Online/offline parameters

Changes to online parameters are activated immediately after the data value is changed. Press [OK] to activate changes to off-line parameters.

P

PCD

Process-control data.

PDS

The PDS is a speed control system for an electric motor, including the CDM and motor, but without the equipment which it powers.

$P_{M,N}$

Rated motor power (nameplate data in kW or hp).

Position error

Position error is the difference between the actual position and the commanded position. The position error is the input for the position PI controller.

Position unit

The physical unit for position values.

Power cycle

Switch off the mains until the display (LCP) is dark, then turn power on again.

Power factor

The power factor is the relation between I_1 and I_{RMS}.

$$\text{Power factor} = \frac{\sqrt{3 \times U \times I_{1\cos\phi}}}{\sqrt{3 \times U \times I_{RMS}}}$$

The power factor for 3-phase control:

$$\text{Power factor} = \frac{I_1 \times \cos\phi 1}{I_{RMS}} = \frac{I_1}{I_{RMS}} \text{ since } \cos\phi 1 = 1$$

The power factor indicates to which extent the drive imposes a load on the mains supply.

The lower the power factor, the higher the I_{RMS} for the same kW performance.

$$I_{RMS} = \sqrt{I_1^2 + I_5^2 + I_7^2} + .. + I_n^2$$

In addition, a high-power factor indicates that the different harmonic currents are low.

The DC coils in the drive produce a high-power factor, which minimizes the imposed load on the mains supply.

Preset reference

A defined preset reference to be set from -100% to +100% of the reference range. Selection of 8 preset references via the digital terminals.

Process PID

The PID control maintains the required speed, pressure, temperature, and so on, by adjusting the output frequency to match the varying load.

Pulse input/incremental encoder

An external, digital pulse transmitter used for feeding back information on motor speed. The encoder is used in applications where great accuracy in speed control is required.

Pulse reference

A pulse frequency signal transmitted to the digital inputs (terminal 29 or 33).

R

RCD

Residual-current device.

Ref_{MAX}

Determines the relationship between the reference input at 100-% full scale value (typically 10 V, 20 mA) and the resulting reference. The maximum reference value is set in *parameter 3-03 Maximum Reference*.

Ref_{MIN}

Determines the relationship between the reference input at 0-% value (typically 0 V, 0 mA, 4 mA) and the resulting reference. The minimum reference value is set in *parameter 3-02 Minimum Reference*.

S

SFAVM

Switching pattern called stator flux-oriented asynchronous vector modulation (*parameter 14-00 Switching Pattern*).

SLC

The SLC (smart logic control) is a sequence of user-defined actions executed when the associated user-defined events are evaluated as true by the SLC. (See *parameter group 13-** Smart Logic Control*).

STW

Status word.

Safe Torque Off (STO)

The STO function brings the drive safely to a no-torque state.

Setup

Save parameter settings in 4 setups. Change between the 4 parameter setups and edit 1 setup, while another setup is active.

Slip compensation

The drive compensates for the motor slip by giving the frequency a supplement that follows the measured motor load keeping the motor speed almost constant.

Start-disable command

A start command belonging to Group 2 control commands, see the *table Function Groups* under *Control Command*.

Stop command

A stop command belonging to Group 1 control commands, see the *table Function Groups* under *Control Command*.

T

THD	Total harmonic distortion states the total contribution of harmonics.
$T_{M,N}$	Rated torque (motor).
Target position	The final target position specified by positioning commands. The profile generator uses this position to calculate the speed profile.
Thermistor	A temperature-dependent resistor placed on the drive or the motor.
Trip	A state entered in fault situations, for example, if the drive is subject to an overtemperature or when the drive is protecting the motor, process, or mechanism. The drive prevents a restart until the cause of the fault has disappeared. To cancel the trip state, restart the drive. Do not use the trip state for personal safety.
Trip lock	The drive enters this state in fault situations to protect itself. The drive requires physical intervention, for example when there is a short circuit on the output. A trip lock can only be canceled by disconnecting mains, removing the cause of the fault, and reconnecting the drive. Restart is prevented until the trip state is canceled by activating reset or, sometimes, by being programmed to reset automatically. Do not use the trip lock state for personal safety.

U

U_M	Motor voltage.
$U_{M,N}$	Rated motor voltage (nameplate data).
$U_{VLT,MAX}$	Maximum output voltage.

V

VT characteristics	Variable torque characteristics typical for many pumps and fans.
VVC^+	If compared with standard voltage/frequency ratio control, Voltage Vector Control (VVC^+) improves the dynamics and the stability, both when the speed reference is changed and in relation to the load torque.

H

η_{VLT}	The efficiency of the drive is defined as the ratio between the power output and the power input.

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