ENGINEERING
TOMORROW

Programming Guide

VLT® AutomationDrive EZ FC 321

Software Version 9.44



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1 Introduction

1.1 Purpose of the Programming Guide

This programming guide provides information required for setting up parameters in a drive. The guide contains the following main areas:

- How to use the local control panel (LCP)
- Detailed descriptions of all parameters
- Troubleshooting

1.2 Supported Software Version

Supported software versions: 9.44

The software version number can be read from parameter ***15-43 Software Version***.

1.3 Document Version

This guide is regularly reviewed and updated. All suggestions for improvement are welcome.

The original language of this guide is in English.

Version	Remarks	Software Version
AU37332718195, version 02	Update to new software version	9.44

1.4 Type Approvals and Certifications

The following table shows possible type approvals and certifications for VLT® AutomationDrive EZ FC 321 drives.

NOTICE

Drives of enclosure size T7 (525–690 V) are not UL listed.

Table 1: Type Approvals and Certifications

CE	ErP READY	
c UL us	EAC	

NOTICE

The specific approvals and certification for the drive are on the nameplate of the drive. For more information, contact the local Danfoss office or partner.

For more information on UL 508C thermal memory retention requirements, refer to the section Motor Thermal Protection in the product-specific design guide.

For more information on compliance with the European Agreement concerning International Carriage of Dangerous Goods by Inland Waterways (AND), refer to the section AND-compliant Installation in the product-specific design guide.

2 Safety

2.1 Safety Symbols

The following symbols are used in Danfoss documentation.

⚠ DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates information considered important, but not hazard-related (for example, messages relating to property damage).

The guide also includes ISO warning symbols related to hot surfaces and burn hazard, high voltage and electric shock, and referring to the instructions.

	ISO warning symbol for hot surfaces and burn hazard
	ISO warning symbol for high voltage and electric shock
	ISO action symbol for referring to the instructions

2.2 Safety Precautions

⚠ WARNING

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.

⚠ WARNING



HAZARDOUS VOLTAGE

AC drives contain hazardous voltage when connected to the 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.

⚠ WARNING

UNINTENDED START

When the drive is connected to AC mains, DC supply, or load sharing, the motor may start at any time. Unintended start during programming, service, or repair work can result in death, serious injury, or property damage. Start the motor with an external switch, a fieldbus command, an input reference signal from the local control panel (LCP), via remote operation using MCT 10 software, or after a cleared fault condition.

- Disconnect the drive from the mains.
- Press *[Off/Reset]* on the LCP before programming parameters.
- Ensure that the drive is fully wired and assembled when it is connected to AC mains, DC supply, or load sharing.

⚠ WARNING



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 could result in death or serious injury.

- Stop the motor.
- Disconnect AC mains, permanent magnet type motors, and remote DC-link supplies, including battery backups, UPS, and DC-link connections to other drives.
- Wait for the capacitors to discharge fully before performing any service or repair work. The discharge time is specified on the drive nameplate.
- Use a measuring device to make sure that there is no voltage before opening the drive or performing any work on the cables.

NOTICE

USING THE SAFE TORQUE OFF

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

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.

2.3 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.

The following situations cause the drive to enter protection mode:

- Undervoltage, the voltage has dropped below the low limit.
- Overvoltage, the voltage has exceeded the upper limit. Protection mode can be avoided by activating overvoltage control in parameter ***2-17 Overvoltage Control***. However, activating overvoltage control extends the ramp times.
- Overcurrent, the current has exceeded the limit defined in parameter ***4-18 Current Limit***.
- Ground fault, a ground fault has appeared.

To remove protection mode, set parameter ***14-26 Trip Delay at Inverter Fault*** to 0.

3 Electrical Wiring

3.1 Wiring Diagram

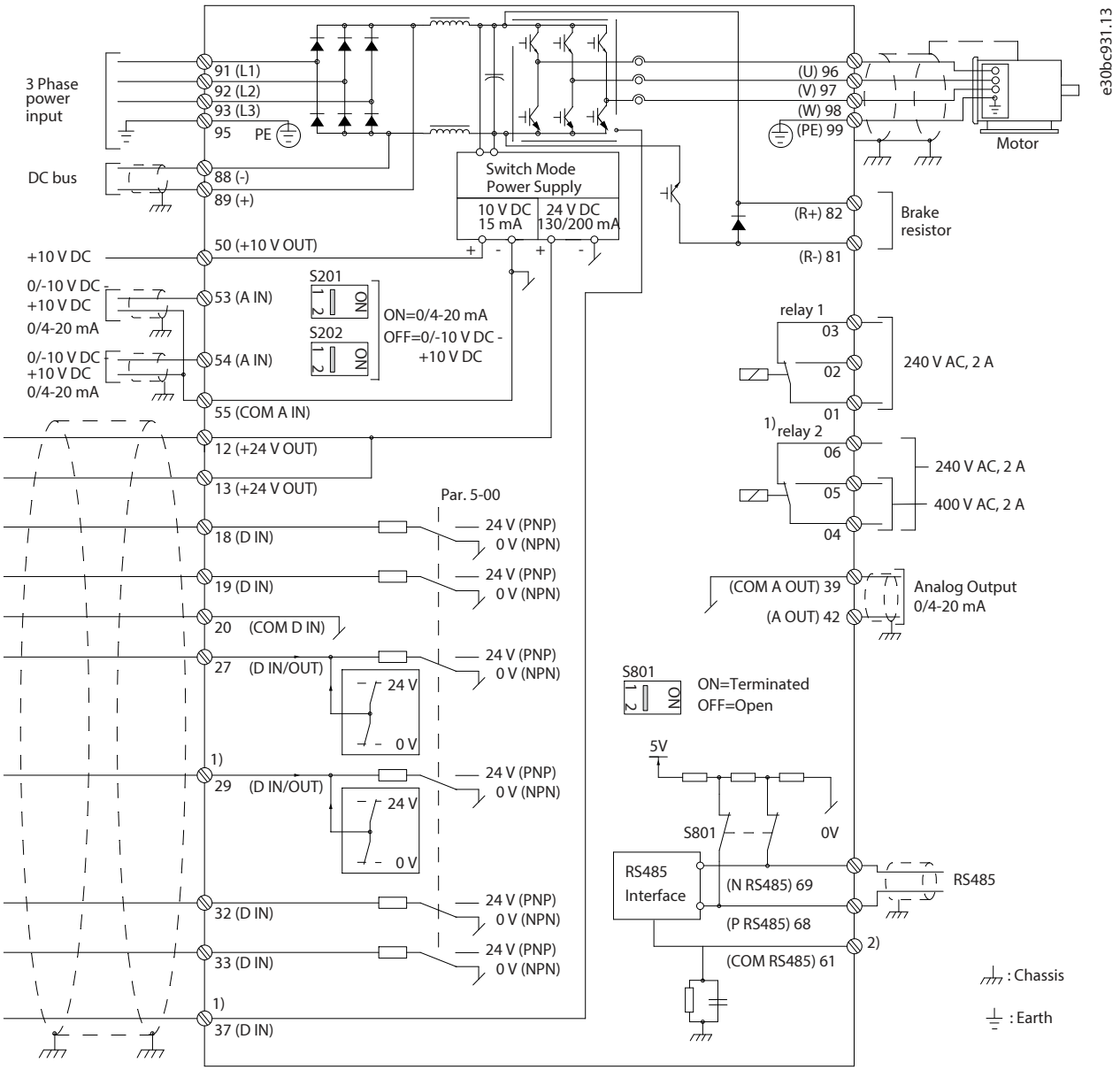


Figure 1: Wiring Diagram

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.

3.2 Input Polarity of Control Terminals

NOTICE

Control cables must be shielded.

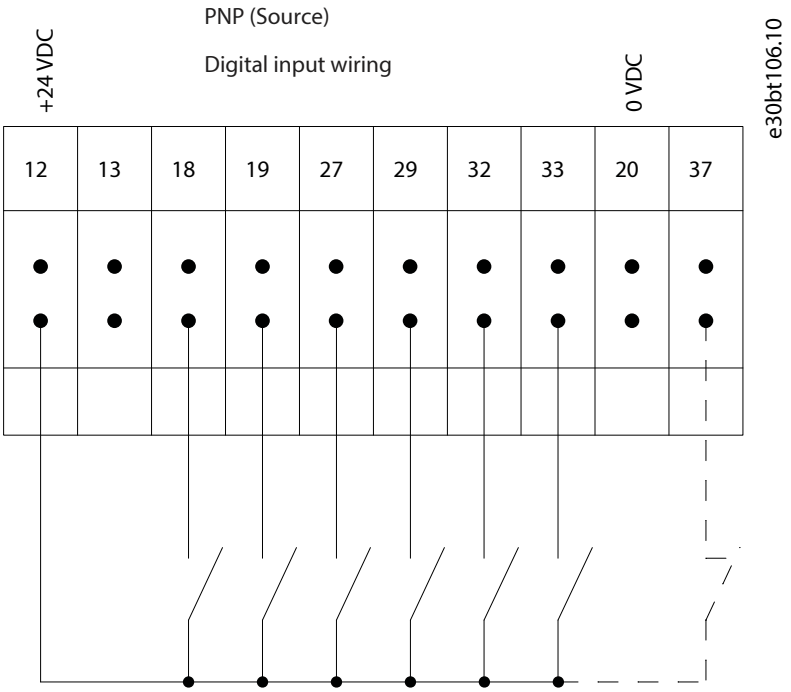


Figure 2: PNP (Source)

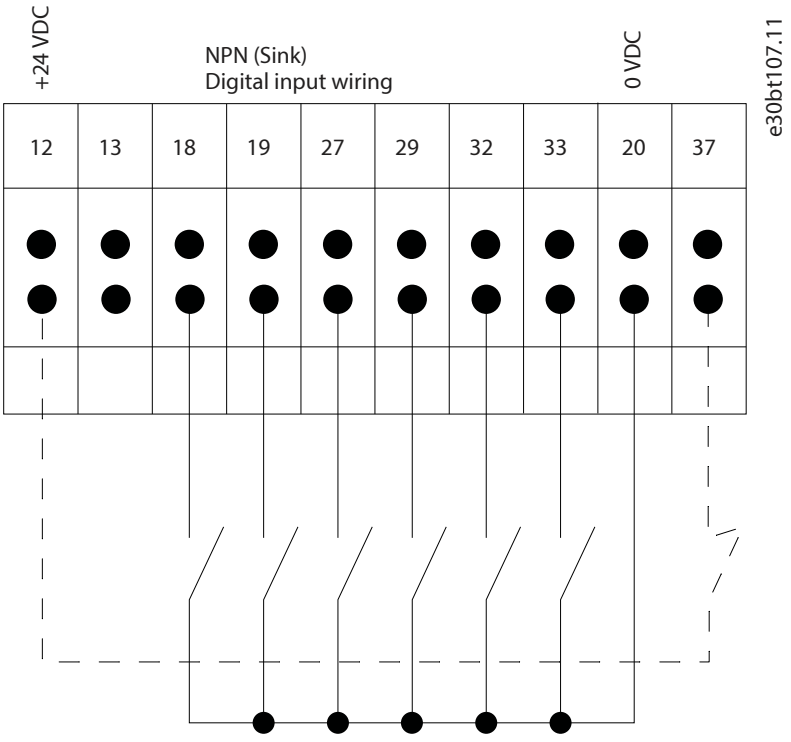


Figure 3: NPN (Sink)

3.3 Grounding of Shielded/Armored Cables

See the section *Grounding* in the design guide for the correct termination of control cables.

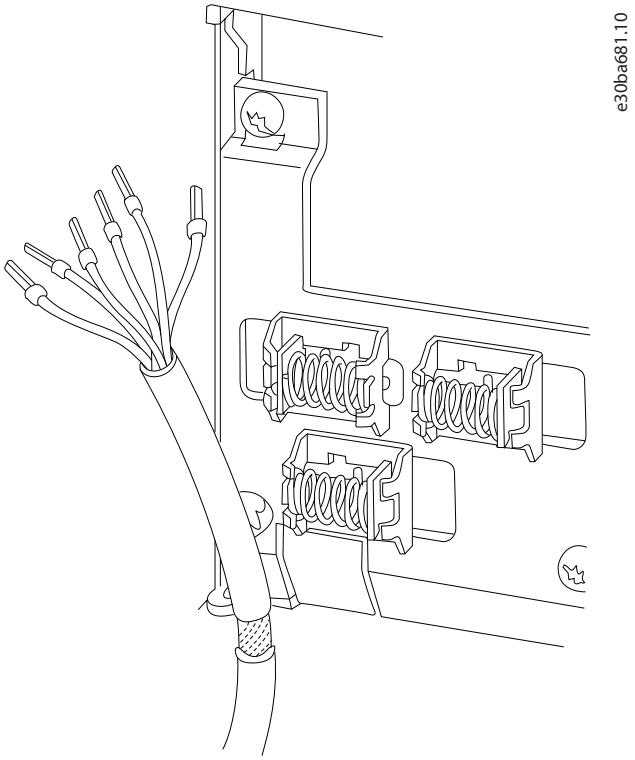


Figure 4: Grounding of Shielded/Armored Cables

4 Other Wiring Examples

4.1 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 (where available).

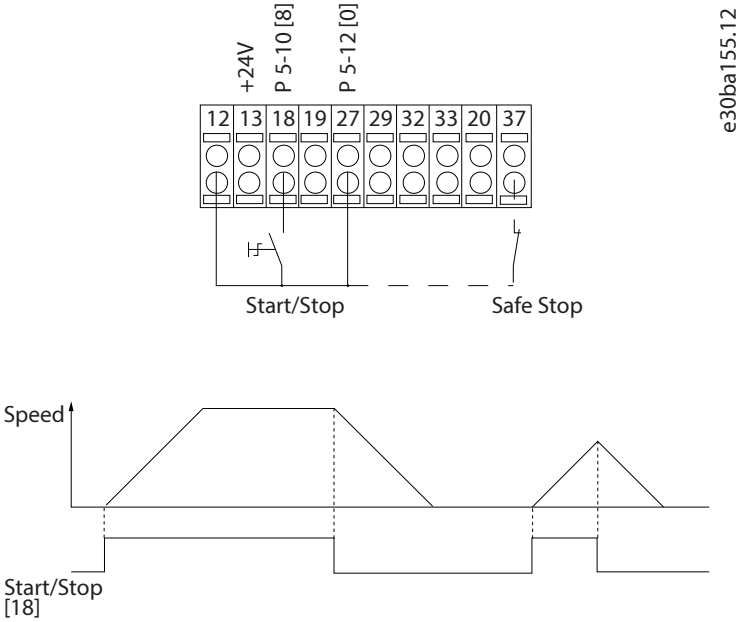


Figure 5: Start/Stop

4.2 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 (where available).

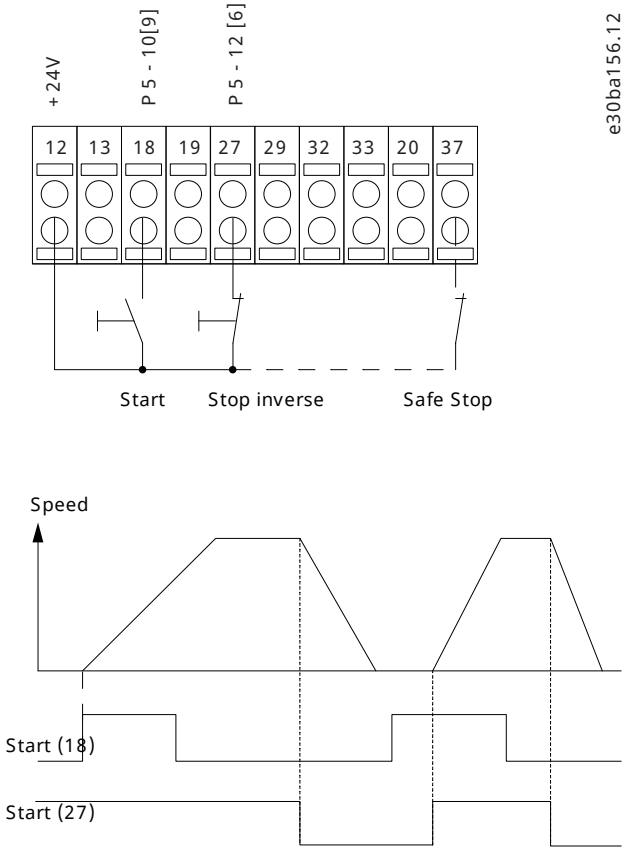


Figure 6: Pulse Start/Stop

4.3 Speed Up/Down

Terminals 29/32 = Speed up/down

Terminal 18 = Parameter ***5-10 Terminal 18 Digital Input***, ***[9] Start*** (default).

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

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

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

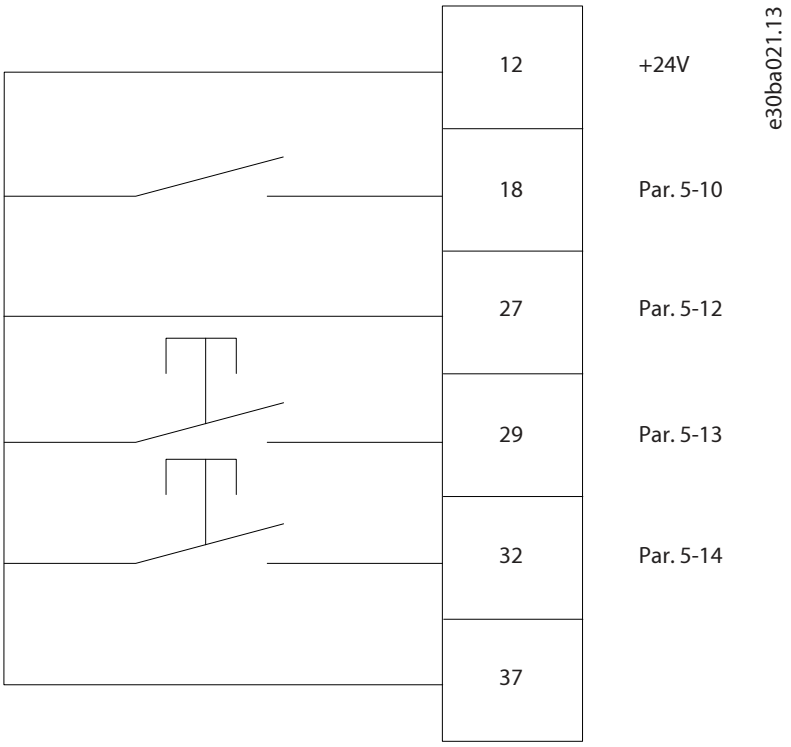


Figure 7: Speed Up/Down

4.4 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 Ref./Feedback = 0 RPM.

Terminal 53, High Ref./Feedback = 1500 RPM.

Switch S201 = OFF (U).

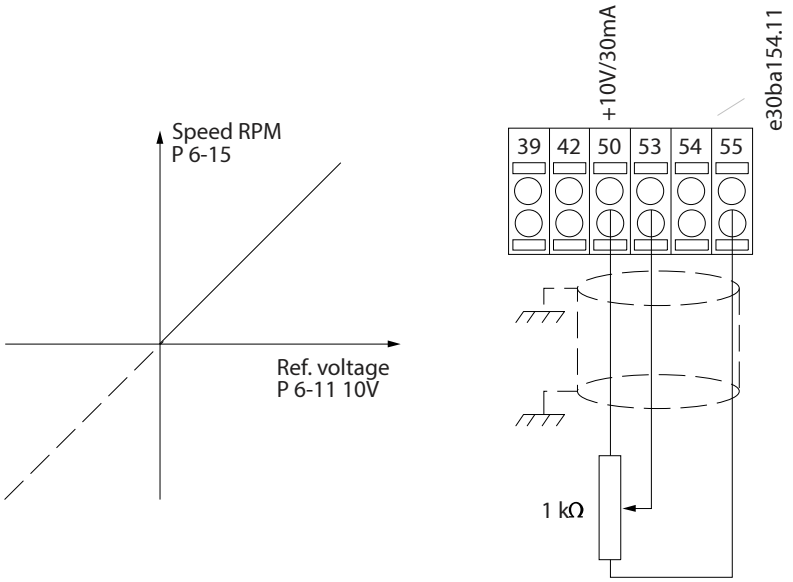


Figure 8: Potentiometer Reference

5 How to Program

5.1 The Graphical Local Control Panel

5.1.1 Overview of the LCP

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

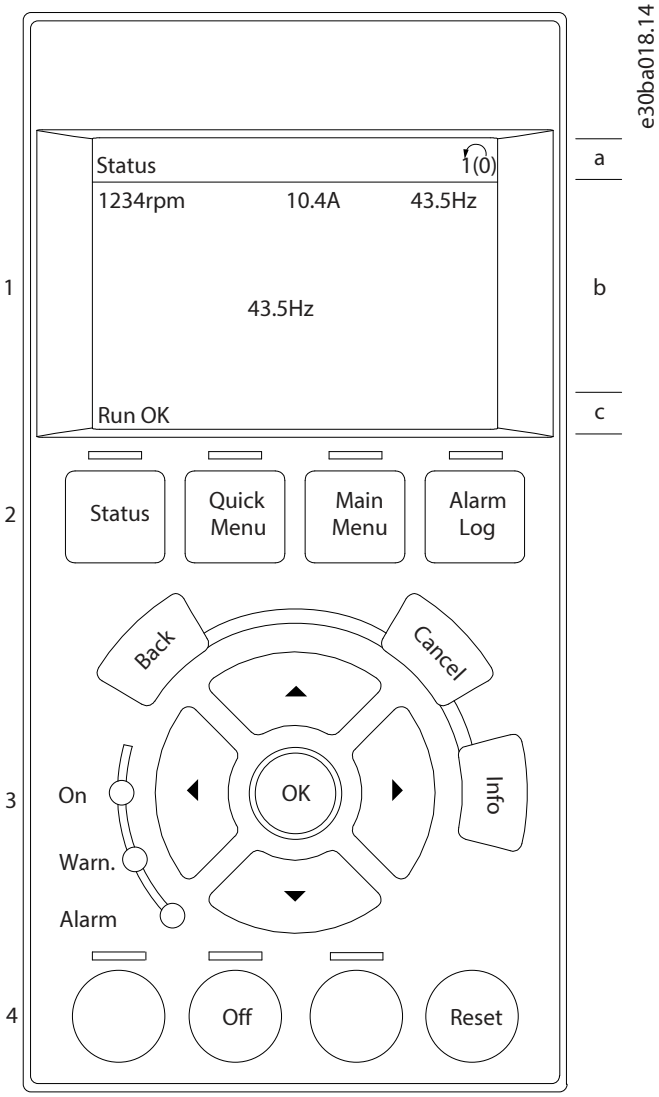


Figure 9: The LCP

1	Graphical display with status lines.	**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.
a	Status line: Status message showing icons and graphics.	**b**	Line 1–2: Operator data lines showing data defined or selected. Add up to 1 extra line by pressing [Status].
c	Status line: Status messages showing text.		

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

NOTICE

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

5.1.2 LCD Display

The display has backlight and a total of 6 alpha-numeric lines. The display lines show the direction of rotation (arrow), the selected setup, and the programming setup. The display is divided into 3 sections.

Top section

The top section shows up to 2 measurements in normal operating status.

NOTE: The EM-x number in the middle of the top line indicates the active setup in parameter groups *24-0x Emergency Mode* and *24-4x Emergency Mode 2*. The active emergency mode setup can also be read in parameter ***0-17 Active Emergency Setup***.

Middle section

The top line shows up to 5 measurements with related unit, regardless of status (except in the case of alarm/warning).

Bottom section

The bottom section always shows the state of the drive in *Status* mode.

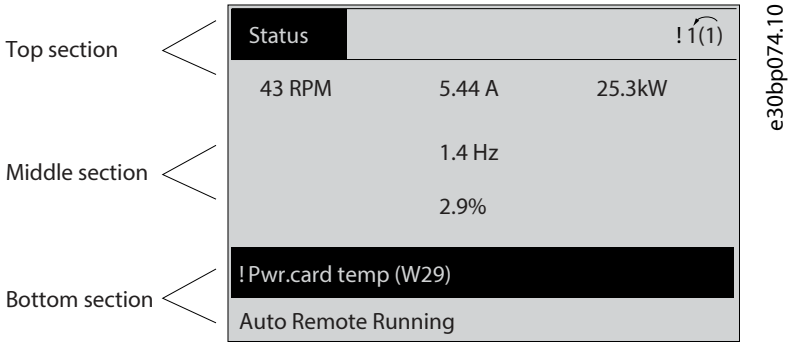


Figure 10: Overview of the Display

The active setup (selected as the active setup in parameter ***0-10 Active Set-up***) is shown. When programming another setup than the active setup, the number of the programmed setup appears to the right.

Display contrast adjustment

Press [Status] and [▲] for darker display.

Press [Status] and [▼] for brighter display.

Most parameter setups can be changed immediately via the LCP, unless a password has been created via parameter ***0-60 Main Menu Password*** or via parameter ***0-65 Quick Menu Password***.

Indicator lights

If certain threshold values are exceeded, the alarm and/or warning indicator lights up, A status and alarm text appear on the LCP. The ON indicator light is activated when the drive receives mains voltage, via a DC bus terminal, or 24 V external supply. At the same time, the back indicator light is on.

- Green LED/On: Control section is working.
- Yellow LED/Warn.: Indicates a warning.

- Flashing Red LED/Alarm: Indicates an alarm.

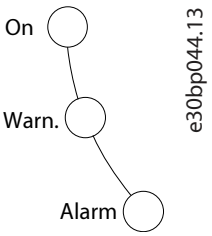


Figure 11: Indicator Lights

5.1.3 LCP Keys

Control 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 2: LCP Keys and Description

LCP keys	Description
[*Status*]	Indicates the status of the drive and/or the motor. Select between 3 different readouts by pressing [*Status*]: 5 line readouts, 4 line readouts, or smart logic control. Press [*Status*] for selecting the mode of display or for changing back to display mode from either the quick menu mode, the main menu mode, or the alarm mode. Also use [*Status*] to toggle single or double readout mode.
[*Quick Menu*]	Allows quick access to different quick menus such as: • My personal menu • Quick set-up • SmartStart • Changes made • Loggings Press [*Quick Menu*] to program the parameters belonging to the Quick Menu. It is possible to switch directly between quick menu mode and main menu mode.
[*Main Menu*]	Use the main menu for programming all parameters. It is possible to switch directly between main menu mode and quick menu mode. Parameter shortcut can be carried out by pressing down [*Main Menu*] for 3 s. The parameter shortcut allows direct access to any parameter.
[*Alarm Log*]	Shows and alarm list of the 5 latest alarms (numbered A1–A5). To obtain more details about an alarm, press the navigation keys to maneuver to the alarm number and press [*OK*]. Information about the condition of the drive before it enters the alarm mode is shown.
[*Back*]	Returns to the previous step or layer in the navigation structure.
[*Cancel*]	Last change or command is canceled as long as the display has not been changed.
[*Info*]	Supplies information about a command, parameter, or function in any display window. [*Info*] provides detailed information whenever help is needed. Exit info mode by pressing either [*Info*], [*Back*], or [*Cancel*].

Table 2: LCP Keys and Description (continued)

LCP keys	Description
Navigation keys	The 4 navigation keys are used to navigate between the different options available in Quick Menu, Main Menu, and Alarm Log. 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 3: 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 • Setup select bit 0 - Setup select bit 1 • 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 installed communication ports. 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***. **NOTE:** An active HAND-OFF-AUTO signal via the digital inputs has higher priority than the control keys [*Hand On*] – [*Auto On*].
[*Reset*]	Use [Reset] 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***. The parameter shortcut can be carried out be pressing down the [*Main Menu*] key for 3 s. The parameter shortcut provides direct access to any parameter.

5.1.4 Quick Transfer of Parameter Settings between Multiple Drives

When 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.

5.1.5 Transferring Data

5.1.5.1 Transferring Data from the Drive to the LCP

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

5.1.5.2 Transferring Data from the LCP to the Drive

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

5.1.6 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.

5.1.7 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, and status view III).

Refer to Table 4 to see the measurements that can be linked to each of the operating variables. When options are mounted, more measurements are available.

Define the links:

- 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 parameter is, the fewer digits are shown after the decimal point.

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

Table 4: 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***	

Table 4: Units (continued)

Operating variable	Unit
Parameter ***16-10 Power [kW]***	[kW]
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***	
Parameter ***16-51 Pulse Reference***	
Parameter ***16-52 Feedback[Unit]***	[Unit]

Table 4: Units (continued)

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

5.1.8 Status Views

5.1.8.1 Status View I

The 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 in the following illustration.

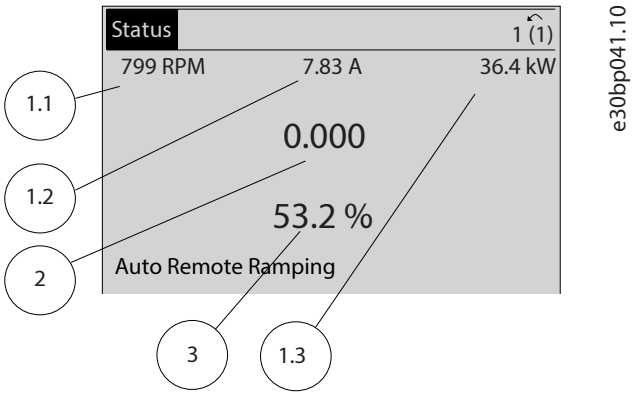


Figure 12: Status View I

5.1.8.2 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 in the 1st and 2nd lines.

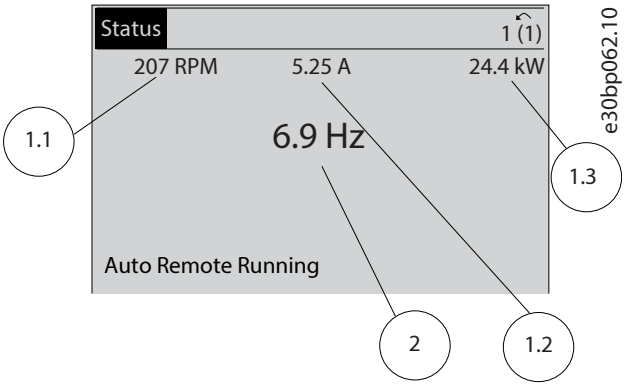


Figure 13: Status View II

5.1.8.3 Status View III

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

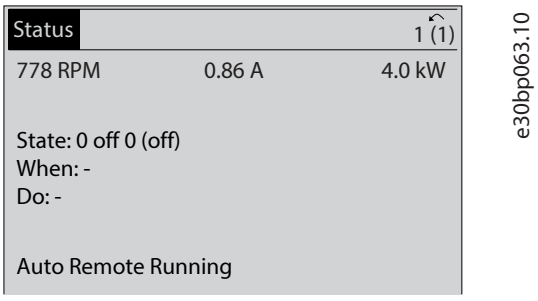


Figure 14: Status View III

5.1.9 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 mode provides access to all parameters.

Quick menu mode enables operation of the drive by setting only a few basic parameters.

Parameters can be changed in either main menu mode or quick menu mode.

5.1.10 Quick Menu Key Functions

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

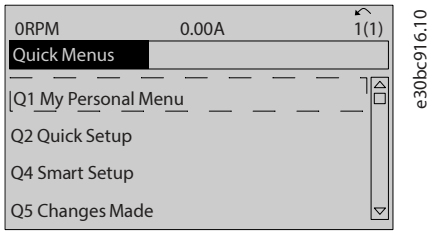


Figure 15: Quick Menus

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).

Parameters are selected via the navigation keys. The parameters in Table 5 are accessible.

Table 5: 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***
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 the 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.

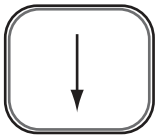
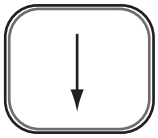
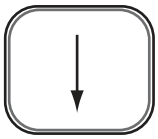
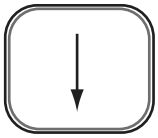
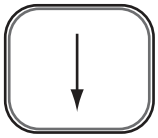
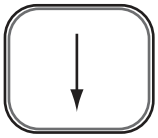
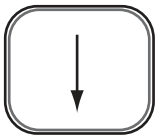
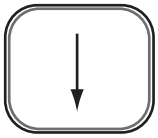
5.1.11 Initial Commissioning

The easiest way of carrying out the initial commissioning is be pressing [*Quick Menu*] and following the quick setup procedure using LCP 102. Read the procedure from left to right. The example applies to an open-loop application.

Table 6: 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.	↓	

Table 6: Quick Setup Procedure (continued)

Press				
Parameter ***5-12 Terminal 27 Digital Input***		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)***		Set the desired AMA function. Enabling complete AMA is recommended.		
Parameter ***3-02 Minimum Reference***		Set the minimum speed of the motor shaft.		
Parameter ***3-03 Maximum Reference***		Set the maximum speed of the motor shaft.		
Parameter ***3-41 Ramp 1 Ramp Up Time***		Set the ramp-up time with reference to synchronous motor speed, n_s.		
Parameter ***3-42 Ramp 1 Ramp Down Time***		Set the ramp-down time with reference to synchronous motor speed, n_s.		
Parameter ***3-13 Reference Site***		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 fieldbuses can be selected:

- PROFIBUS.
- PROFINET.
- DeviceNet.

- EtherNet/IP.

NOTE: The drive ignores any start conditions when SAS is active.

NOTE: The smart setup runs automatically on the 1st 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.

5.1.12 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.

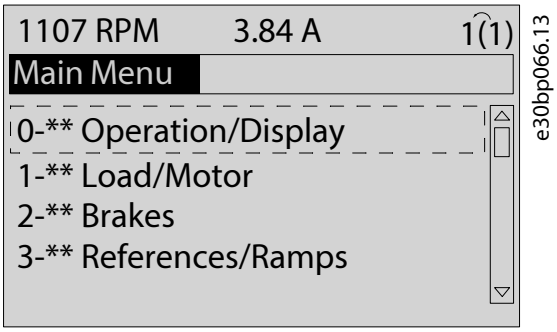


Figure 16: Main Menu Mode

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 1st 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.

5.1.13 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.

5.1.14 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*].

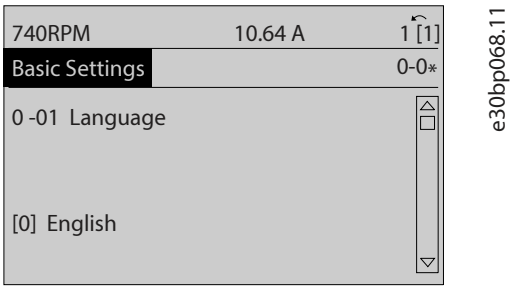


Figure 17: Changing a Text Value

5.1.15 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.

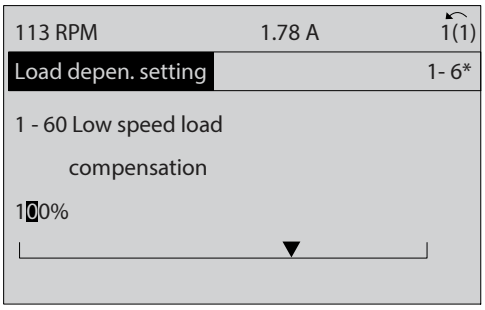


Figure 18: Changing a Data Value

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*].

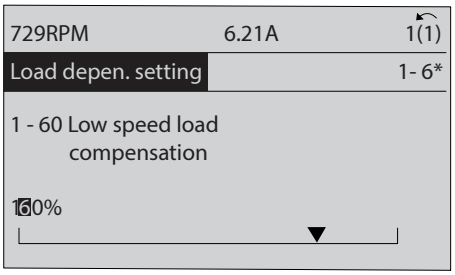


Figure 19: Saving a Data Value

5.1.16 Infinitely Variable Change of Numeric Data Value

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

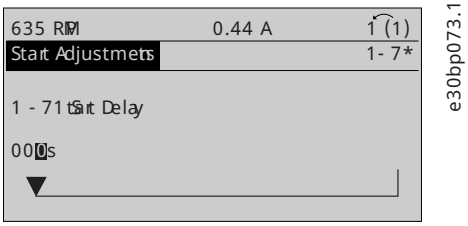


Figure 20: Selecting a Digit

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

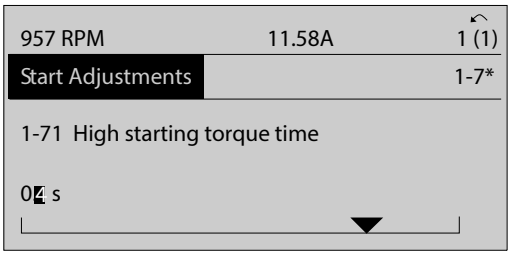


Figure 21: Saving

5.1.17 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.

5.1.18 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.

5.1.19 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.

5.2 Restoring Factory Default Settings

5.2.1 Restoring Factory Default Settings Using the Recommended Initialization

NOTICE

LOSS OF DATA

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

- To create a backup, 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*].

5.2.2 Restoring Factory Default Settings Using Manual Initialization

NOTICE

LOSS OF DATA

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

- To create a backup, upload data to the LCP before initialization.

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

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.

6 Parameter Descriptions

6.1 Selecting Parameters

The parameters are grouped into various parameter groups for easy selection of the correct parameter for optimal operation of the drive.

Parameter descriptions and selections are shown in the LCP. Access the parameters by pressing [*Quick Menu*] or [*Main Menu*] on the LCP. The Quick Menu is used mainly for commissioning the unit at start-up by providing parameters necessary to start operation. The Main Menu provides access to all parameters for detailed application programming.

All digital input/output and analog input/output terminals are multifunctional. All terminals have factory setting functions suitable for a wide range of relevant applications. If other special functions are required, they must be programmed in *parameter groups 5-** Digital In/Out* or *6-** Analog In/Out*.

An asterisk (*) following an option number in a parameter indicates a default setting.

6.2 Parameter Group 0-** Operation and Display

6.2.1 Introduction to Parameter Group 0-** Operation and Display

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

6.2.2 0-0* Basic Settings

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	

Option	Name	Description
[41]	Turkish	
[42]	Trad.Chinese	
[43]	Bulgarian	
[44]	Srpski	
[45]	Romanian	
[46]	Magyar	
[47]	Czech	
[48]	Polski	
[49]	Russian	
[50]	Thai	
[51]	Bahasa Indonesia	
[52]	Hrvatski	

0-02 Motor Speed Unit

Default value:	–	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	False

NOTE: This parameter cannot be adjusted while the motor is running.

NOTE: 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).

0-03 Regional Settings

Default value:	–	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	False

NOTE: 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 kW and set the default value of parameter ***1-23 Motor Frequency*** to 60 Hz.

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 state when reconnecting the drive to mains voltage after it has been powered 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.

6.2.3 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 in OEM machine building to identically program all 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 is the setup in which the drive is currently operating. The active setup 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 the drive 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. If similar parameter settings are required in different setups, it is possible to copy parameter settings between the setups to enable quicker commissioning by using parameter ***0-51 LCP Copy***.

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 FALSE in the *Change during operation*field 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.

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 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	
[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.

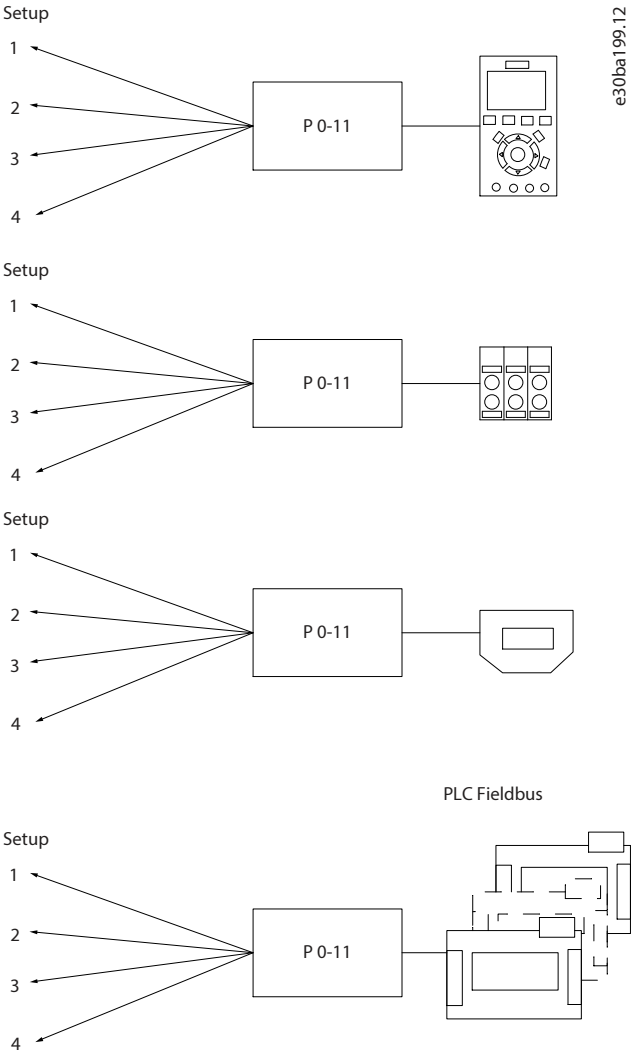


Figure 22: Edit Setup

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

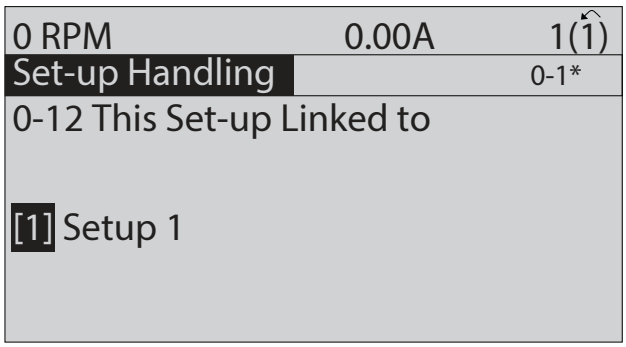
To enable conflict-free changes from 1 setup to another during operation, link setups containing parameters which are not changeable during operation. The link ensures synchronizing of the not changeable during operation-parameter values when moving from 1 setup to another during operation. Not changeable 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	
[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:

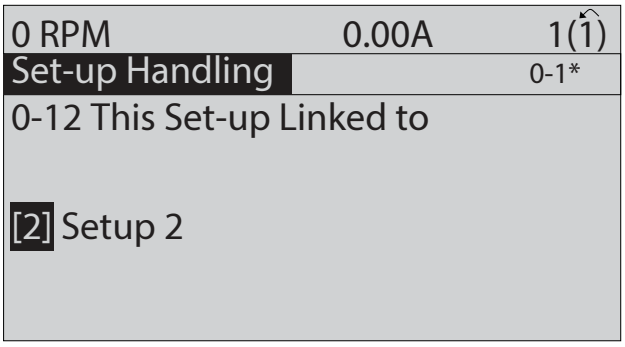
- Select the following options:
  - ***[2] Set-up 2*** in parameter ***0-11 Edit Set-up***
  - Set parameter 0-12 ***This Set-up Linked to*** to ***[1] Set-up 1***.



e75bp075.12

Figure 23: 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***.



e30bp076.11

Figure 24: Setup 2

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 7: Setup Link Example

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

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.

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***.

6.2.4 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***.

0-20 Display Line 1.1 Small

Default value:	–	**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	Shows the EtherNet/IP-specific status word.
[1397]	Alert alarm word	View the alert alarm word in hex code.
[1398]	Alert warning word	View the alert warning word in hex code.
[1399]	Alert status word	View the alert status word in hex code.
[1472]	Legacy alarm word	Shows the compatibility alarm word as a hexadecimal value
[1473]	Legacy warning word	Shows the compatibility warning word as a hexadecimal value.
[1474]	Leg. ext. status word	Shows the compatibility extended status word as a hexadecimal value.
[1500]	Operating hours	View how many hours the drive has run. The value is saved when the drive is turned off.
[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	View how many hours the external fan has run. The value is saved when the drive is turned off.
[1583]	Motor Ud	

Option	Name	Description
[1584]	Motor Uq	
[1585]	Motor Id	
[1586]	Motor Iq	
[1587]	kWh counter hires	View the motor power consumption in kWh as an average value over 1 hour. Reset the counter in parameter ***15-06 Reset kWh Counter***. Decimal places are reset at power-up.
[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.
[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***.
[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 measured in kW.
[1611]	Power [hp]	Actual power consumed by the motor measured 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 current 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	Returning the actual temperature on a KTY/Pt1000 thermistor sensor built in the motor.
[1620]	Motor angle	View the current encoder/resolver angle offset relative to the index position. The value range of 0–65535 corresponds to 0–2 x pi (radians).
[1621]	Torque [%] high res.	The value shown is the torque in percent of nominal torque with sign and 0.1% resolution applied to the motor shaft.
[1622]	Torque [%]	Present motor load as a percentage of the rated motor torque.

Option	Name	Description
[1623]	Motor shaft power [kW]	View the power applied to the motor shaft. This is an estimate based on the motor shaft torque and motor speed. The motor speed is estimated unless operating in a speed-closed-loop mode.
[1624]	Calibrated stator resistance	Shows the calibrated stator resistance.
[1625]	Torque [Nm] high	View the torque value with signal 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 and the motor used. This specific readout has been adapted to the able to show higher values than the standard readout in parameter ***16-16 Torque [Nm]***.
[1628]	Angle error	The angle error between the estimated angle and feedback angle.
[1630]	DC Link voltage	DC-link voltage in the drive.
[1631]	System temp.	View the combined (highest) internal system temperature measurement.
[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 average 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.
[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	Shows the number of logs stored in the Service Log file.
[1643]	Timed actions status	See parameter group *23-0* Timed Actions*.
[1644]	Speed error [RPM]	Shows the speed error RPM.
[1645]	Motor phase U current	Shows the motor phase U current.
[1646]	Motor phase V current	Shows the motor phase V current.
[1647]	Motor phase W current	Shows the motor phase W current.
[1648]	Speed. ref. after ramp [RPM]	This parameter shows the reference given to the drive after the speed ramp in 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 reference feedback.

Option	Name	Description
[1657]	Feedback [RPM]	Read the actual motor RPM from the feedback source in both closed loop and open loop. Select the feedback source in parameter ***7-00 Speed PID Feedback Source***.
[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.
[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]	Returns the output value on the terminal.
[1679]	Analog out X45/3 [mA]	Returns the output value on the terminal.
[1680]	Fieldbus CTW 1	Control word (CTW) received from the bus master.
[1682]	Fieldbus REF 1	Mains reference value sent with control word from the bus master.
[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	View the human-readable alarm and warning numbers in hex as shown in the alarm log.

Option	Name	Description
[1688]	Fieldbus torque FF	Shows the fieldbus torque feed forward.
[1689]	Configurable alarm/warning word	Shows the configurable alarm and 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 preventive maintenance events in parameter group *23-1* Maintenance*.
[1697]	Alarm word 3	Shows alarm word 3 as a hexadecimal value.
[1698]	Warning word 3	Shows warning word 3 as a hexadecimal value.
[1767]	Raw inc. quad counter	
[1768]	Raw abs. pos. low	
[1769]	Raw abs. pos. high	
[1804]	Mech brake count	View the mechanical brake count as a decimal value.
[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 out X49/7	
[1844]	Analog out X49/9	
[1845]	Analog out X49/11	
[1846]	X49 digital output [bin]	
[1847]	Last warning	This parameter shows the last warning.
[1848]	Last warning count	This parameter shows how many times the last warning has been active.
[1860]	Digital input 2	
[1861]	Temp. input X48 max	
[1870]	Mains voltage	View the mains voltage measurement.
[1871]	Mains frequency	View the mains frequency measurement.

Option	Name	Description
[1872]	Mains imbalance	View the maximum measured imbalance for the 3 mains line-to-line measurements.
[1873]	Worst inrush	Identifies which active inrush is producing 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.
[1874]	Inrush mode	The reported mode of each inrush board. Values: 0 = unknown, 1 = inrush, 2 = running. Indexes: 0 = inrush 1, 1 = inrush 2, and so on.
[1875]	Rectifier DC volt.	View the DC voltage measurement from the rectifier module.
[1876]	Mains voltage2	View the mains voltage measurement. Indexes: 0 = inrush1 average, 1 = inrush2 average, 4 = inrush1 L1, 5 = inrush2 L1, 8 = inrush1 L2, and so on.
[1877]	Mains frequency2	View the mains frequency measurement. Indexes: 0 = inrush1 average, 1 = inrush2 average, 4 = inrush1 L1, 5 = inrush2 L1, 8 = inrush1 L2, and so on.
[1878]	Mains imbalance2	View the maximum measured imbalance for the 3 mains line-to-line measurements. Indexes: 0 = inrush1 average, 1 = inrush2 average, 4 = inrush1 L1, 5 = inrush2 L1, 8 = inrush1 L2, and so on.
[1879]	Rectifier DC volt.2	View the DC voltage measurement from the rectifier module. Indexes: 0 = inrush1 average, 1 = inrush2 average, 4 = inrush1 L1, 5 = inrush2 L1, 8 = inrush1 L2, and so on.
[1890]	Process PID error	Shows the error value in the Process PID Controller.
[1891]	Process PID output	Shows the raw output value from the process PID controller.
[1892]	Process PID clamped output	Shows the output value from the process PID controller after reaching a clamp limit.
[1893]	Process PID gain scaled output	Shows the output value from the process PID controller after reaching a clamp limit and scaling the resulting value with considerations to the gain.
[1899]	Speed PID torque FF. [Nm]	Readout of the total commanded torque feed forward.
[2316]	Maintenance text	Showing customized messages for maintenance item and action.
[3019]	Wobble delta freq. scaled	
[3110]	Bypass status word	View the status of the bypass as a hexadecimal value.
[3111]	Bypass running hours	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.
[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	

Option	Name	Description
[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	Read out the status of the digital inputs.
[3441]	Digital outputs	Read out the status of the digital outputs.
[3450]	Actual position	View the actual position.
[3451]	Commanded position	Set the follower position in UU. Corresponds to the CPOS command.
[3452]	Actual master position	Current master position in qc. Corresponds to MAPOS command.
[3453]	Slave index position	Last follower index position in UU. Corresponds to IPOS command.
[3454]	Master index position	Last master index position in qc. Corresponds to MIPOS command.
[3455]	Curve position	Retrieve the follower position that corresponds to the current master position of the curve. Corresponds to CURVEPOS command.
[3456]	Track error	Queries the actual position error of the axis in UU (in consideration of the signs). Corresponds to TRACKER command.
[3457]	Synchronizing error	Queries the actual synchronization error of the follower. This is the distance between the actual master position (converted with drive factor and offset) and the actual position of the follower. The result is shown in UU.
[3458]	Actual velocity	The actual velocity in UU/s. Corresponds to AVEL command.
[3459]	Actual master velocity	The actual velocity master in qc/s. Corresponds to MAVEL command.
[3460]	Synchronizing status	Flag to query synchronization status. Corresponds to SYNCSTAT command.
[3461]	Axis status	
[3462]	Program status	

Option	Name	Description
[3464]	MCO 302 status	
[3465]	MCO 302 control	
[3466]	SPI error counter	
[3470]	MCO alarm word 1	
[3471]	MCO alarm word 2	
[4027]	Back EMF voltage	
[4029]	B-EMF protection log readout	To log events when B-EMF protection is disabled. This is a readout parameter to retrieve the data at a later point.
[4285]	Active safe func.	
[4286]	Safe option info	
[4427]	Estimated D-axis inductance (Ld)	When ***[5] 1st start check motor*** or ***[6] Every st. check motor*** is selected in parameter ***1-47 Torque Calibration***, the last estimated Ld is shown.
[4429]	Estimated Back EMF at 1000 RPM	When ***[5] 1st start check motor*** or ***[6] Every st. check motor*** is selected in parameter ***1-47 Torque Calibration***, the last estimated Back EMF at 1000 RPM is shown.
[4521]	Status	
[4522]	Progress	
[4523]	Baseline result info	
[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]	

0-21 Display Line 1.2 Small

The options are the same as those listed for parameter ***0-20 Display Line 1.1 Small***. Select a variable to show in line 1, center position.

0-22 Display Line 1.3 Small

The options are the same as those listed for parameter ***0-20 Display Line 1.1 Small***. Select a variable to show in line 1, right position.

0-23 Display Line 2 Large

The options are the same as those listed for parameter ***0-20 Display Line 1.1 Small***. Select a variable to show in line 2.

0-24 Display Line 3 Large

The options are the same as those listed for parameter ***0-20 Display Line 1.1 Small***. Select a variable to show in line 3.

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.

6.2.5 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 readout

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.

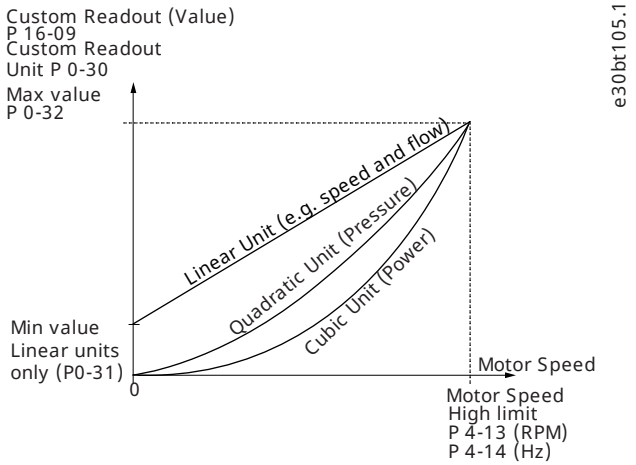


Figure 25: Custom Readout

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

Table 8: Speed Relations for Different Unit Types

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

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	

Option	Name	Description
[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	
[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	

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). It is 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.

0-32 Max Value of User-defined Readout

Default value:	100 CustomReadoutUnit	**Parameter type:**	Range, par. 0-31 -999999.99 CustomReadoutUnit
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***).

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

Default value:	Size related	**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***

0-38 Display Text 2

Default value:	Size related	**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***

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***

6.2.6 0-4* LCP Keypad

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

0-40 [Hand On] Key on LCP

Default value:	–	**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	When switching to [*Hand On*], the reference is set to 0.

0-41 [Off] Key on LCP

Default value:	–	**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***.

0-42 [Auto On] Key on LCP

Default value:	–	**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***.

0-43 [Reset] Key on LCP

Default value:	–	**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, 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***).

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

NOTE: This parameter is only available when a VLT® Bypass Option MCB 104 is installed in the drive.

Enable or disable the [*Off/Reset*] key.

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***.

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

NOTE: This parameter is only available when a VLT® Bypass Option MCB 114 is installed in the drive.

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	

6.2.7 0-5* Copy/Save

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

0-50 LCP Copy

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

NOTE: 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.

Option	Name	Description
[4]	File from MCO to LCP	Copy the MCO file to the LCP memory.
[5]	File from LCP to MCO	Copy the MCPO file from the LCP memory 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.

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.

6.2.8 0-6* Password

0-60 Main Menu Password

Default value:	Size related	**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. When a valid password is entered, this unlocks the drive for 30 minutes.

0-61 Access to Main Menu w/o Password

Default value:	–	**Parameter type:**	Option
Setup:	1 setup	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

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.

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.
[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.

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.

0-66 Access to Personal Menu w/o Password

Default value:	–	**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***, 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.

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.

When a valid password is entered, the drives is unlocked for 30 minutes.

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.

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	

6.2.9 0-7* Clock Settings

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.

0-71 Date Format

Default value:	–	**Parameter type:**	Option
Setup:	1 setup	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Select the date format to be used in the LCP.

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

0-72 Time Format

Default value:	–	**Parameter type:**	Option
Setup:	1 setup	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Set the time format to be used in the LCP.

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

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.

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	

0-75 Last Power Off Time

Default value:	Size related	**Parameter type:**	Range, 0 - 0, Array [5]
Setup:	All setups	**Conversion index:**	0
Data type:	TimeOfDay	**Change during operation:**	True

This parameter stores the last 5 drive power-off timestamps. Index [0] is the latest power-off time, and index [4] is the oldest.

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***.

0-77 DST/Summertime End

Default value:	Size related	**Parameter type:**	Range, 0 - 0
Setup:	1 setup	**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***.

0-79 Clock Fault

Default value:	–	**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 backup is installed.

Option	Name	Description
[0]	Disabled	
[1]	Enabled	

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	

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***.

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***.

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.

0-85 Summer Time Start for Fieldbus

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

Shows the summer time start 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.

0-88 Clock Restore at Powerup

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

Option	Name	Description
[0]*	Disabled	Restoring the time at power-up is disabled.
[1]	Enabled	Restoring the time at power-up is enabled. Date and time will be stored at power down. When the drive is powered up, the previous time is used. As the previous time is incorrect, ***warning 98, Clock Fault*** is issued and stays active until date and time are set again.

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***.

6.2.10 0-9* Varia

0-95 Warning LED Blinking

Default value:	[0] Constant on	**Parameter type:**	Option
Setup:	1 setup	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Option	Name	Description
[0]*	Constant on	
[1]	Blinking	Use ***[1] Blinking*** to identify a drive when many drives are mounted together.

6.3 Parameter Group 1-** Load and Motor

6.3.1 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.

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	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.*

1-01 Motor Control Principle

Default value:	–	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	False

Select which motor control principle to employ. The best shaft performance is achieved by using either flux vector control modes ***[2] Flux sensorless*** or ***[3] Flux w/motor feedb***.

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	Flux vector control without encoder feedback, for simple installation and robustness against sudden load changes.
[3]	Flux w/motor feedb	High accuracy speed and torque control, suitable for the most demanding applications.

1-02 Flux Motor Feedback Source

Default value:	[1] 24V encoder 32/33	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	False

NOTE: This parameter cannot be adjusted while the motor is running.

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* Encoder Interface*, *17-1* Inc. Enc. Interface*, and *17-2* Abs. Enc. Interface*.
[3]	MCB 103	This option is only available for VLT® Resolver Option MCB 103. Configure the resolver interface in parameter group *17-5* Resolver Interface*.

Option	Name	Description
[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	

1-03 Torque Characteristics

Default value:	[0] Constant torque	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

NOTE: 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***.

Option	Name	Description
[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.

$$P_{shaft}[W] = \omega_{mech}[rad/s] \times T[Nm]$$

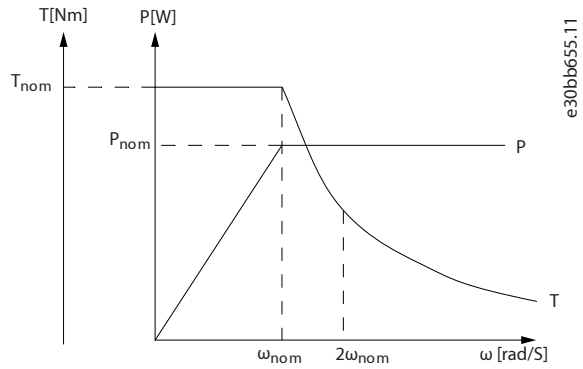


Figure 26: Relationship with Constant Power

1-04 Overload Mode

Default value:	–	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	False

NOTE: 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.

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	
[1]	Speed closed loop	
[2]*	As mode par. 1-00	
[4]	Positioning	

1-06 Clockwise Direction

Default value:	[0] Normal	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	False

NOTE: 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	Inverts motor direction, feedback direction, and angle offset on PM motor.

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

NOTE: This parameter is only valid in the combination of 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.

Option	Name	Description
[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.

6.3.2 Motor Setups

6.3.2.1 Induction 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 mode, or 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 mode 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 9: 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 in the application. Too fast ramp up causes an overcurrent or overtorque. Too fast ramp down causes an overvoltage trip.
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 a smoother motor operation by reducing torque ripple and vibration.
Flux sensorless control principle only	Adjust parameter ***1-53 Model Shift Frquency***. Example 1: If the motor oscillates at 5 Hz, and dynamic performance is required at 15 Hz, set parameter ***1-53 Model Shift Frquency*** 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 oscillations or drive tripping.

6.3.2.2 Permanent Magnet Motor Setup

This section describes how to set up a permanent magnet motor. The following example covers a non-salient permanent magnet motor.

6.3.2.3 Programming of Permanent Magnet Motors

6.3.2.3.1 Initial Programming Steps

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

6.3.2.3.2 Programming Motor Data

After selecting a permanent magnet motor, the permanent magnet 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.

1. Set parameter ***1-24 Motor Current***.
2. Set parameter ***1-25 Motor Nominal Speed***.
3. Set parameter ***1-26 Motor Cont. Rated Torque***.
4. Set parameter ***1-39 Motor Poles***.
5. Run a complete AMA by setting parameter ***1-29 Automatic Motor Adaptation (AMA)*** to ***[1] Enable complete AMA***.
6. If a complete AMA is NOT performed, configure the following parameters manually:
   a. Parameter ***1-30 Stator Resistance (Rs)***: Enter the line-to-common stator winding resistance (Rs). If only line-to-line data is available, divide the line-to-line value by 2 to get the line-to-common value.
   b. Parameter ***1-37 d-axis Inductance (Ld)***: Enter the line-to-common direct axis inductance of the permanent magnet motor. If only line-to-line data is available, divide the line-to-line value by 2 to get the line-to-common value.

c. Parameter ***1-40 Back EMF at 1000 RPM***: Enter the line-to-line back EMF of the permanent magnet motor at 1000 RPM (RMS value). Back EMF is the voltage generated by a permanent magnet 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.

7. For IPM motors, configure the inductance values in the following parameters:
   a. Parameter ***1-38 q-axis Inductance (Lq)***.
   b. Parameter ***1-44 d-axis Inductance Sat. (LdSat).***
   c. Parameter ***1-45 q-axis Inductance Sat (LqSat).***
   d. Parameter ***1-49 q-axis Inductance Sat. Point***.

> **NOTE:** IPM motors may be missing some inductance values on the product label or in the datasheets. Perform an AMA to get the valid values.

6.3.2.3.3 Testing 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.

6.3.2.3.4 Activating Permanent Magnet 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.

1. Select ***[0] Rotor detection*** in parameter ***1-70 Start Mode***.

Rotor detection is now activated.

6.3.2.3.5 Activating Permanent Magnet 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.

1. Select ***[1] Parking*** in parameter ***1-70 Start Mode***.

Parking is now activated.

6.3.2.3.6 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.

Start the motor at nominal speed. If the application does not run well, check the VVC+ permanent magnet motor settings. See recommendations for various applications in Table 10.

Table 10: 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

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

6.3.2.4 SynRM Motor Setup with VVC+

The SmartStart wizard covers the basic configuration of SynRM motors.

6.3.2.5 Programming of SynRM Motors

6.3.2.5.1 Initial Programming

1. Select ***[5] Sync. Reluctance*** in parameter ***1-10 Motor Construction***.

   SynRM motor operation is activated.

6.3.2.5.2 Programming SynRM 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 data on the motor nameplate and in the motor datasheet.

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***.

6.3.2.5.3 Application-specific Adjustment when Running VVC+ with SynRM 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+ SynRM settings. See recommendations for various applications in Table 11.

Table 11: 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.

6.3.3 1-1* Special Settings

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

1-10 Motor Construction

Default value:	–	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	False

Select the motor design type.

Option	Name	Description
[0]	Asynchron	Use for ASM/IM motors.
[1]	PM, non salient SPM	Use for SPM motors, surface-mounted magnet. Permanent magnet motors are divided into 2 groups, with either surface-mounted (SPM)/non-salient magnets or interior-mounted (IPM)/ salient magnets.
[2]	PM, salient IPM	Use for IPM motors, interior-mounted magnet. Permanent magnet 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.

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***.

NOTE: 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 1.5–3.0 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 0.75–3.0 kW. Settings are loaded automatically for this specific motor.

1-14 Damping Gain

Default value:	Size related	**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.

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.

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.

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.

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.

6.3.4 1-2* Motor Data

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



NOTE: Changing the value of these parameters affects the settings of other parameters.

NOTE: The following parameters have no effect when parameter ***1-10 Motor Construction*** is set to ***[1] PM, non-salient***, ***[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***

1-20 Motor Power [kW]

Default value:	Size related	**Parameter type:**	Range, 0.09 - 3000.00 kW
Setup:	All setups	**Conversion index:**	1
Data type:	Uint32	**Change during operation:**	False

NOTE: 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***.

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***.

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

NOTE: 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.

1-23 Motor Frequency

Default value:	–	**Parameter type:**	Range, 20 - 1000 Hz
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	False

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

NOTE: 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***.

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

NOTE: This parameter cannot be adjusted while the motor is running.

NOTE: 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.

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

NOTE: This parameter cannot be adjusted while the motor is running.

NOTE: 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.

$$nm, n = ns - n\text{slip}$$

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

NOTE: 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***, ***[2] PM, salient IPM***, ***[5] SynRM***, and ***[6] PMaSynRM***.

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

NOTE: This parameter cannot be adjusted 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.

NOTE: 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 • 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 (X_h) on induction motors. Ensure that the motor poles specified in parameter ***1-39 Motor Poles*** are correct for accurate back EMF measurement.

Option	Name	Description
[6]	Enable 360° turn OL	**Sensorless:** Performs a 360° test run in sensorless mode to verify the number of motor poles specified in parameter ***1-39 Motor Poles***. **Closed loop:** Performs a 360° 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° 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%.

NOTE:

For the best adaptation of the drive, run AMA on a cold motor.

Option ***[5] Enable rotating AMA II*** runs the motor while measuring motor data.

Perform a reduced AMA if a sine-wave filter is connected.

NOTE: It is important to set parameter group *1-2* Motor Data* correctly, since these parameters 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.

NOTE: Avoid generating external torque during AMA.

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

NOTE: AMA works problem-free on 1 motor size down, it typically works on 2 motor sizes down, it rarely works on 3 motor sizes down, at it never works on 4 motor sizes down. Remember that the accuracy of the measured motor data is poorer when operating on motors than the nominal drive size.

6.3.5 1-3* Adv. Motor Data

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.

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

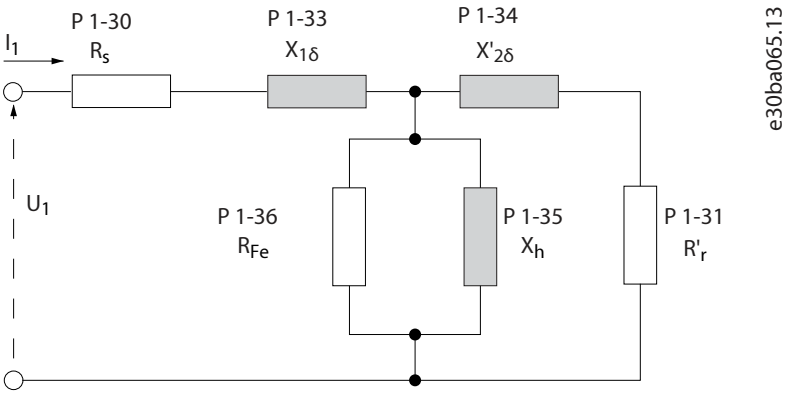


Figure 27: Motor Equivalent Diagram of an Induction Motor

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

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

NOTE: This parameter cannot be adjusted while the motor is running.

NOTE: 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***.

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

NOTE: Parameter ***1-31 Rotor Resistance (Rr)*** has no effect when parameter ***1-10 Motor Construction*** is set to ***[1] PM, non-salient SPM***, ***[2] PM, salient IPM***, ***[5] SynRM***, and ***[6] PMaSynRM***.

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.

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

NOTE: 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.

NOTE: 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***.

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

NOTE: This parameter is only relevant for induction 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.

NOTE: 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***.

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

NOTE: This parameter cannot be adjusted while the motor is running.

NOTE: Parameter ***1-35 Main Reactance (Xh)*** has no 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.

NOTE: 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***.

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

NOTE: 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.

1-37 d-axis Inductance (Ld)

Default value:	0.1 mH	**Parameter type:**	Range, 0 - 1000.0 mH
Setup:	All setups	**Conversion index:**	-3
Data type:	Int32	**Change during operation:**	False

NOTE: This parameter is only active when parameter ***1-10 Motor Construction*** is set to ***[1] PM, non-salient SPM***.

Enter line-to-common direct axis inductance of the permanent magnet motor. Obtain the value from the permanent magnet motor datasheet.

For induction motors, stator resistance and d-axis inductance values are normally described in technical specifications as between line and common (star point). For permanent magnet motors, they are typically described in technical specifications as between line to line. Permanent magnet motors are typically built for star connection.

Table 12: Parameters Related to Permanent Magnet Motors

Parameter	Function
Parameter ***1-30 Stator Resistance (Rs)*** (line to common)	This parameter gives stator winding resistance (R_s) similar to induction motor stator resistance. The stator resistance is defined for line-to-common measurement. For line-to-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 permanent magnet motor. The d-axis inductance is defined for phase-to-common measurement. For line-to-line 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 the stator terminal of the permanent magnet motor at 1000 RPM mechanical speed specifically. It is defined between line-to-line and expressed in RMS value.

NOTE: 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 (star point) or line between line. There is no general standard. The different setups of stator winding resistance and induction are shown in Figure 28. Danfoss AC drives always require the line-to-common value. The back EMF of a permanent magnet 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 Figure 29.

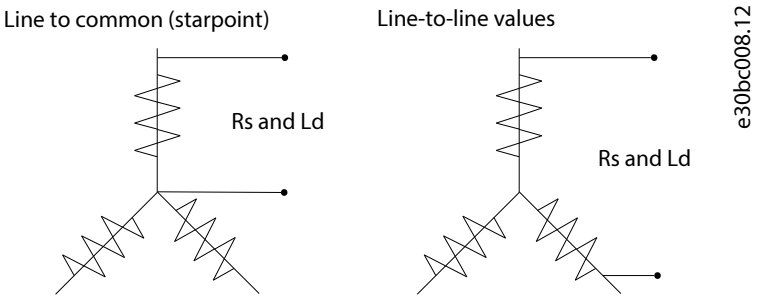


Figure 28: Stator Winding Setups

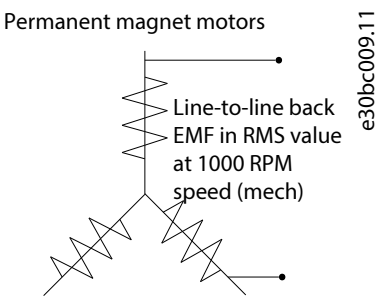


Figure 29: Machine Parameter Definitions of Back EMF of PM Motors

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.

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

NOTE: 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 13: 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

Table 13 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, nor pairs of poles. The drive created the initial setting of parameter ***1-39 Motor Poles***based on parameter ***1-23 Motor Frequency*** and parameter ***1-25 Motor Nominal Speed***.

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	**Conversion index:**	False

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

Set the nominal back EMF for the motor when running at 1000 RPM. Back EMF is the voltage generated by a permanent magnet 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:

$$BackEMF = (Voltage \div RPM) \times 1000$$

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

$$(320 \div 1800) \times 1000 = 178$$

1-41 Motor Angle Offset

Default value:	0	**Parameter type:**	Range, -32768 - 32767
Setup:	All setups	**Conversion index:**	0
Data type:	Int16	**Change during operation:**	True

NOTE: This parameter is only active when parameter ***1-10 Motor Construction*** is set to ***[1] PM, non-salient SPM*** (permanent magnet motor).

Enter the correct offset angle between the PM motor and the index position (single-turn) of the attached encoder or resolver. The value range of 0-32768 corresponds to 0–2 x pi (radians). To obtain the offset angle value: After drive start-up, apply DC hold and enter the value of parameter ***16-20 Motor Angle*** into this parameter.

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.

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

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 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.

1-46 Position Detection Gain

Default value:	Size related	**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.

1-47 Torque Calibration

Default value:	–	**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).***
[5]	1st start check motor	
[6]	Every st. check motor	

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

NOTE: 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.

1-49 q-axis Inductance Sat. Point

Default value:	Size related	**Parameter type:**	Range, 1 - 500%
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	False

NOTE: 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.

6.3.6 1-5* Load Indep. Setting

This parameter group contains parameters related to:

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

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

NOTE: 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.

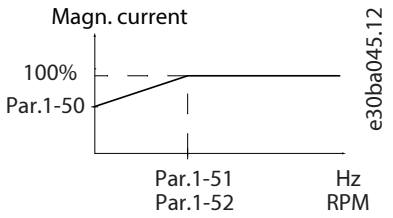


Figure 30: Motor Magnetization

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

NOTE: 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***.

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

NOTE: 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***.

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

NOTE: 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.

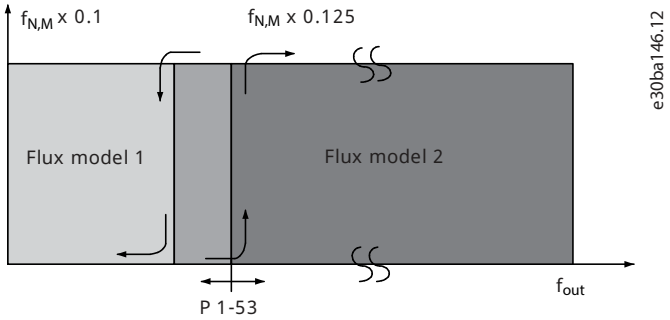


Figure 31: Example of Parameter 1-00 Configuration Mode = [1] Speed closed loop or [2] Torque and parameter 1-01 Motor Control Principle = [3] Flux w/motor feedback

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.

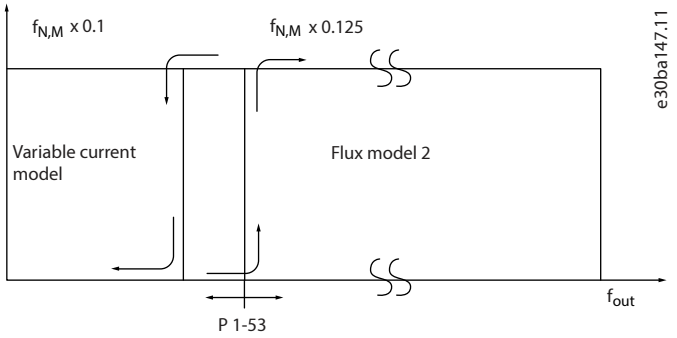


Figure 32: Parameter 1-00 Configuration Mode = [0] Speed open loop, parameter 1-01 Motor Control Principle = [2] Flux sensorless

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".

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***.

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***.

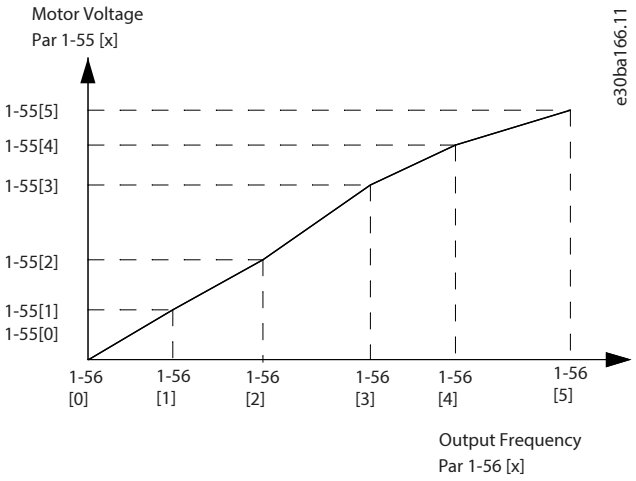


Figure 33: U/f Characteristic

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

NOTE: This parameter is only available in VVC+.

NOTE: This parameter is active when parameter ***1-73 Flying Start*** is enabled.

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. For permanent magnet motors, the default may vary, but a general setting of 20% is recommended. For adjusting permanent magnet motors, the value tunes for back EMF and d-axis inductance of the motor.

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

Induction motor: Set the frequency of the flying start test pulses that are used to detect the motor direction. For induction 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***.

6.3.7 1-6* Load Depend. Setting

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

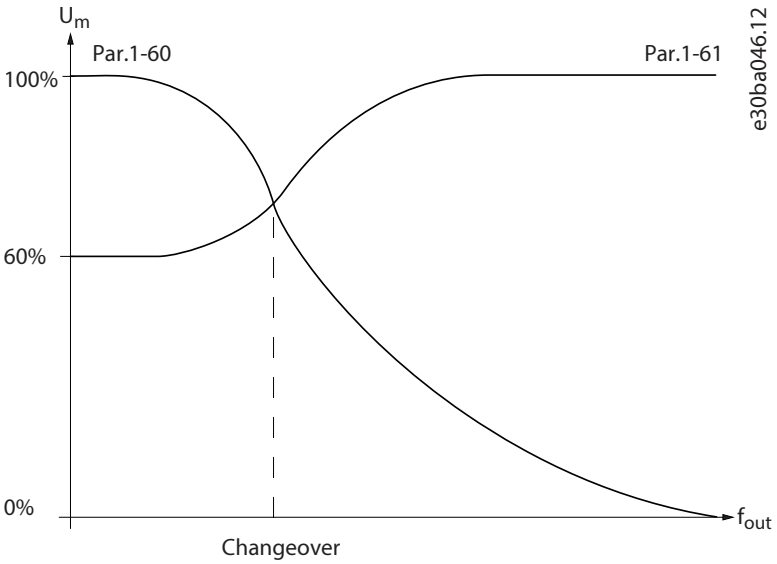


Figure 34: Changeover

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

NOTE: Parameter ***1-61 High Speed Load Compensation*** only has effect when parameter ***1-10 Motor Construction*** = ***[0] Asynchron***.

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 powerHz size kW	>3–4

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***.

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

NOTE: Parameter ***1-63 Slip Compensation Time Constant*** only has effect when parameter ***1-10 Motor Construction*** = ***[0] Asynchron***.

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.

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

NOTE: 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***.

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

NOTE: Parameter ***1-65 Resonance Damping Time Constant*** only has effect when parameter ***1-10 Motor Construction*** = ***[0] Asynchron***.

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.

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

NOTE: 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.

1-67 Load Type

Default setting:	[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.

1-68 Motor Inertia

Default value:	0 kgm	**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.

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

NOTE: 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.

6.3.8 1-7* Start Adjustments

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.
[4]	Rotor Detection II	Estimates the electrical angle of the rotor by sending out test pulses. If the motor is restarted in less than 1.0 s, this function does a second measurement. If movement is detected, the start will be delayed for maximum 10 s.

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.

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.

Option	Name	Description
[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 applications. ***[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 2, option ***[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.

1-73 Flying Start

Default value:	–	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	False

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

NOTE: 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.
[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.

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***.

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***.

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).

6.3.9 1-8* Stop Adjustments

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 14: Options Depending on Control

		ASM	SPM	IPM	SynRM
VVC+	Speed OL	All options	[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 options	[0],[1],[5],[8]	[0],[1],[5],[8]	–

Option	Name	Description
[0]*	Coast	Leaves the 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***.

Option	Name	Description
[3]	Premagnetizing	Builds up a magnetic field while the motor is stopped. This magnetic field allows the motor to produce torque quickly at subsequent start commands (induction motors only). This premagnetizing function does not help the 1st start command. Two different solutions are available to premagnetize the device 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 $I_{pre\text{-}mag} = U_{nom}/(1.73 \times Xh)$. Sample rotor time constants = $(Xh+X2)/(6.3 \times Freq_{nom} \times Rr)$ • 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	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***.

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***.

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***.

1-83 Precise Stop Function

Default value:	[0] Precise ramp stop	**Parameter type:**	Option
Setup:	All seutps	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	False

NOTE: This parameter cannot be adjusted while the motor is running.

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 dependency 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 when the stop signal is given until the ramp down starts. Run a test to find this delay as it is a sum of sensor, PLC, and mechanical parts.

To ensure optimum accuracy, there should be at least 10 cycles during ramp 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 a digital input on terminal 29 or terminal 33.

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***). 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.

Option	Name	Description
[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.

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.

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

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.

NOTE: 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***.

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]***.

6.3.10 1-9* Motor Temperature

1-90 Motor Thermal Protection

Default value:	–	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

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

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 Ω. 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.
[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	

1-91 Motor External Fan

Default value:	–	**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 the illustration below (f_{out} = 1 x $f_{M,N}$) 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.

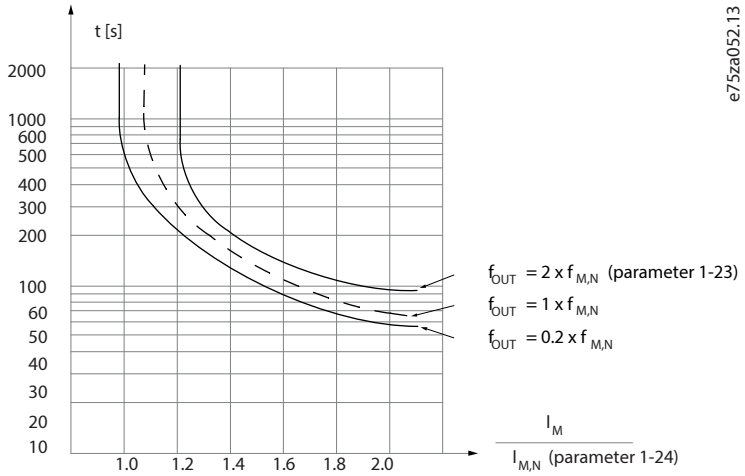


Figure 35: ETR Profile

1-93 Thermistor Resource

Default value:	–	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

NOTE: This parameter cannot be adjusted while the motor is running.

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

NOTE: When using VLT® PTC Thermistor Card MCB 112 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	

Option	Name	Description
[2]	Analog input 54	
[3]	Digital input 18	
[4]	Digital input 19	
[5]	Digital input 32	
[6]	Digital input 33	

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***.

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

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***).

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

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

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.

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.

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

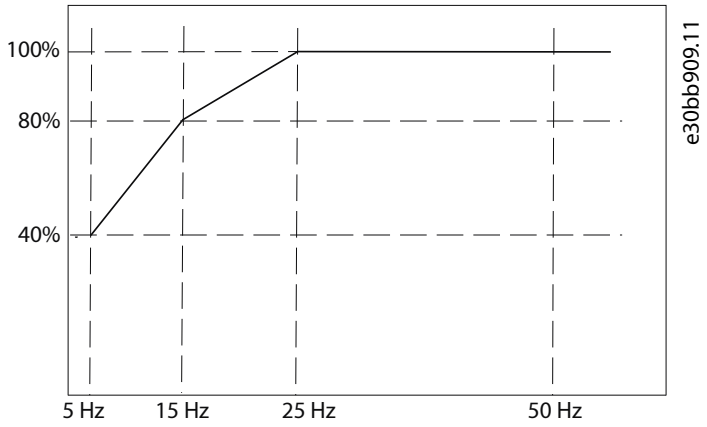


Figure 36: Example of ATEX ETR Thermal Limitation Curve

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***.

Interpolation points

x-axis: f_m [Hz]

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

Table 15: 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%

Use the 4 current points [A] from the motor nameplate. Calculate the values as a percentage of nominal motor current, $I_m/I_{m,n}$ x 100 [%], and enter the values into the array. All operating points underneath the curve are allowed continuously. Above the line, however, these points 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.

NOTE: All frequency/current limit points from the motor nameplate of motor datasheet must be programmed.

6.3.10.1 Connections Related to Motor Temperature Control

6.3.10.1.1 PTC Thermistor Connection

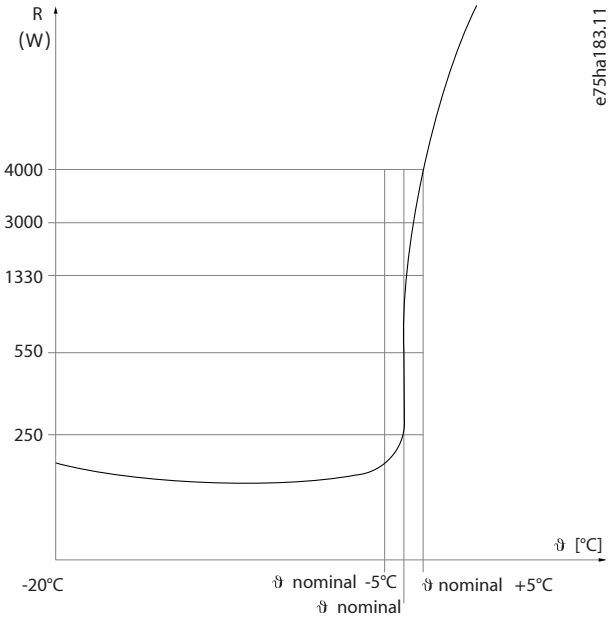


Figure 37: PTC Profile

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***.

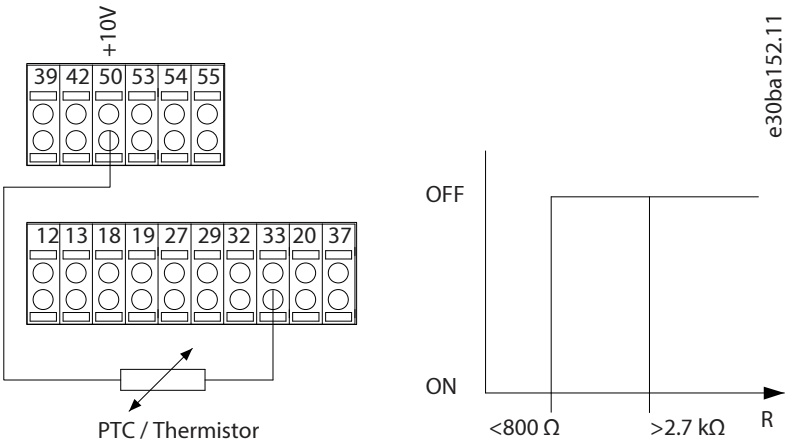


Figure 38: PTC Thermistor Connection - Digital Input

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*.

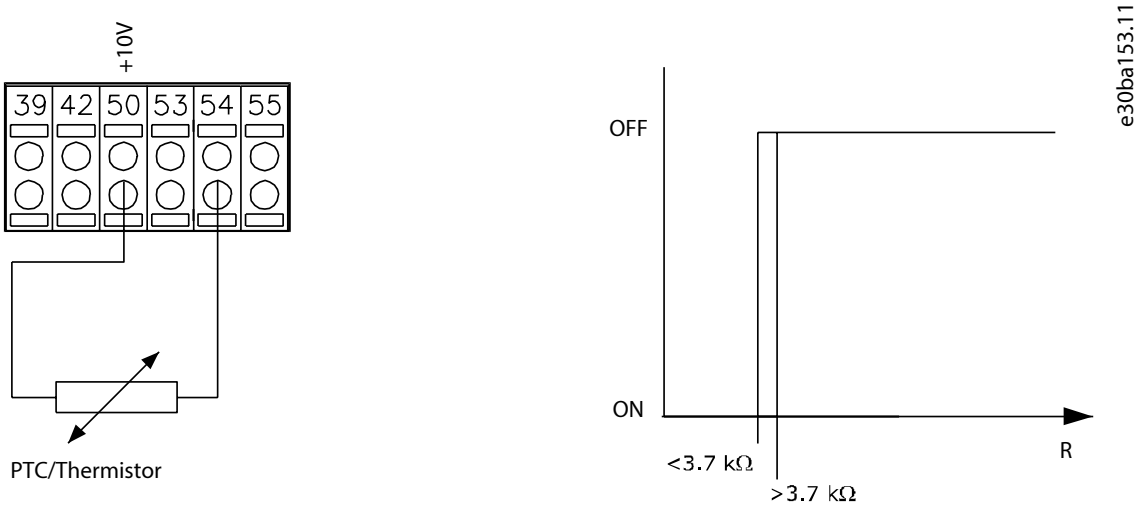


Figure 39: PTC Thermistor Connection - Analog Input

Table 16: 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

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

6.3.10.1.2 KTY Sensor Connection

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

$Rs = Rs_{20\,°C} x(1+\alpha_{cu} x\Delta T)$ where α_{cu}=0.00393.

KTY sensors can be used for motor overload protection (parameter ***1-97 KTY Threshold Level***). FC 321 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***.

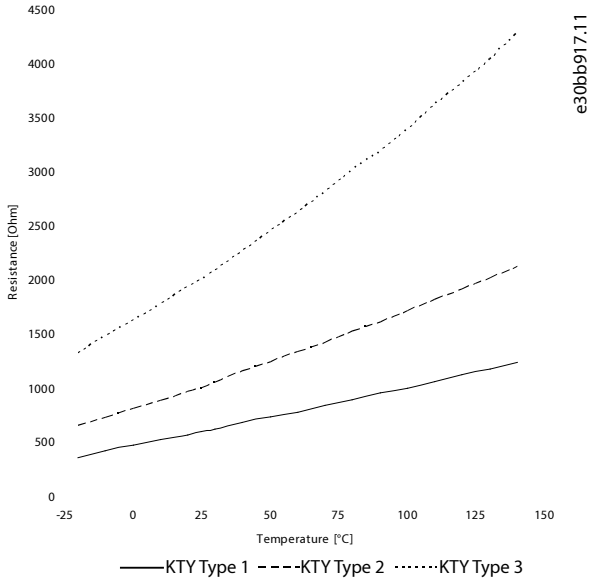


Figure 40: KTY Type Selection

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, Philips KTY-10.

NOTICE

EXTRA ISOLATION REQUIRED

If the temperature of the motor is used through a thermistor or KTY sensor, the PELV is not complied with if there are short circuits between motor windings and the sensor.

- To comply with PELV, put extra isolation on the sensor.

6.3.10.1.3 ETR

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

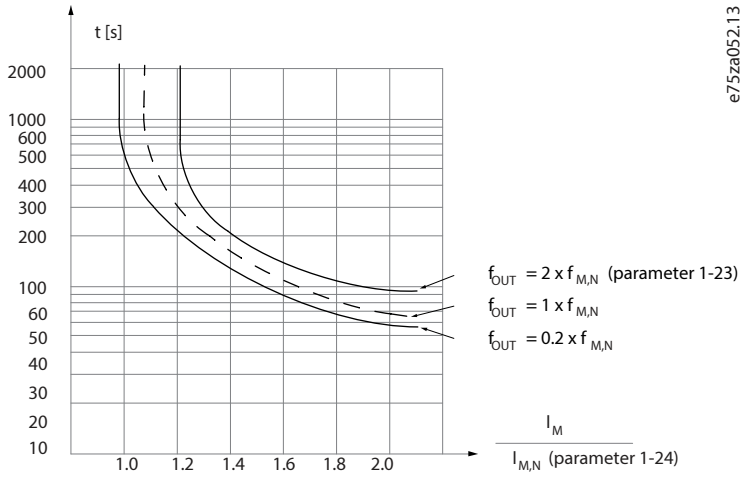


Figure 41: ETR Profile

6.3.10.1.4 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.

NOTE: 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 Table 17.

Table 17: 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

NOTE: 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.

6.3.10.1.5 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***.

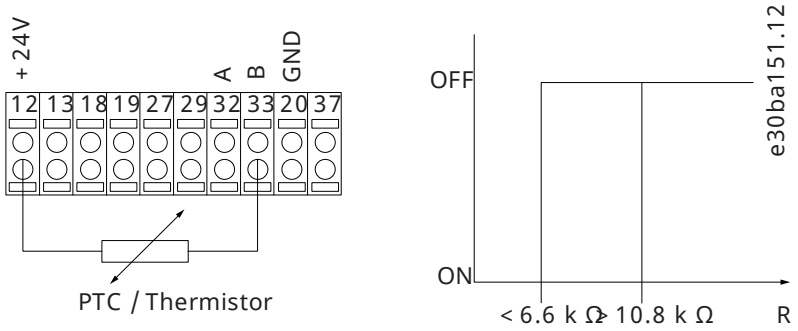


Figure 42: Thermistor Connection

6.4 Parameter Group 2-** Brakes

6.4.1 2-0* DC Brakes

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

2-00 DC Hold Current

Default value:	Size related	**Parameter type:**	Range, 0 - 160%
Setup:	All setups	**Conversion index:**	0
Data type:	Uint8	**Change during operation:**	True

NOTE: 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 the 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]***.

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

NOTE: 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***.

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.

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.

2-04 DC Brake Cut In Speed [Hz]

Default value:	Size	**Parameter type:**	Range, 0 - par. 4-14 RPM
Setup:	All setups	**Conversion index:**	-1
Data type:	Uint16	**Change during operation:**	True

NOTE: 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.

2-05 Maximum Reference

Default value:	Size related	**Parameter type:**	Range, par. 3-02 - 999999.999 ReferenceFeedbackUnit
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***.

2-06 Parking Current

Default value:	50%	**Parameter type:**	Range, 0 - 1000%
Setup:	All setups	**Conversion index:**	0

Data type:	Uint16	**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***.

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.

6.4.2 2-1* Brake Energy Funct.

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

2-10 Brake Function

Default value:	–	**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. **NOTE:** The AC brake is not as efficient as dynamic braking with resistor. AC brake is for VVC+ mode in both open and closed loop.

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)***.

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. $P_{br,avg}$ 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:

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

- T2 units: 390 V
- T4 units: 778 V
- T5 units: 810 V
- T6 units: 943 V/1099 V for D–F enclosures
- T7 units: 1099 V

NOTE: 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)***.

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 and alarm.

Option	Name	Description
[4]	Warning 30s	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.
[5]	Trip 30s	Trips the drive and shows an alarm when the calculated power exceeds 100% of the monitoring limit.
[6]	Warning & trip 30s	Activates both of the above, including warning and alarm.
[7]	Warning 60s	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.
[8]	Trip 60s	Trips the drive and shows an alarm when the calculated power exceeds 100% of the monitoring limit.
[9]	Warning & trip 60s	Activates both of the above, including warning and alarm.
[10]	Warning 300s	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.
[11]	Trip 300s	Trips the drive and shows an alarm when the calculated power exceeds 100% of the monitoring limit.
[12]	Warning & trip 300s	Activates both of the above, including warning and alarm.
[13]	Warning 600s	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.
[14]	Trip 600s	Trips the drive and shows an alarm when the calculated power exceeds 100% of the monitoring limit.
[15]	Warning & trip 600s	Activates both of the above, including warning and alarm.

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)***).

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 the 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.

NOTE: 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*.

NOTE: 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	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	

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.

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

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.

NOTE: 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.

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

Use this parameter for adjusting the overvoltage gain for parameter ***2-17 Over-voltage Control***in the low-speed area.

6.4.3 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.

NOTE: 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.

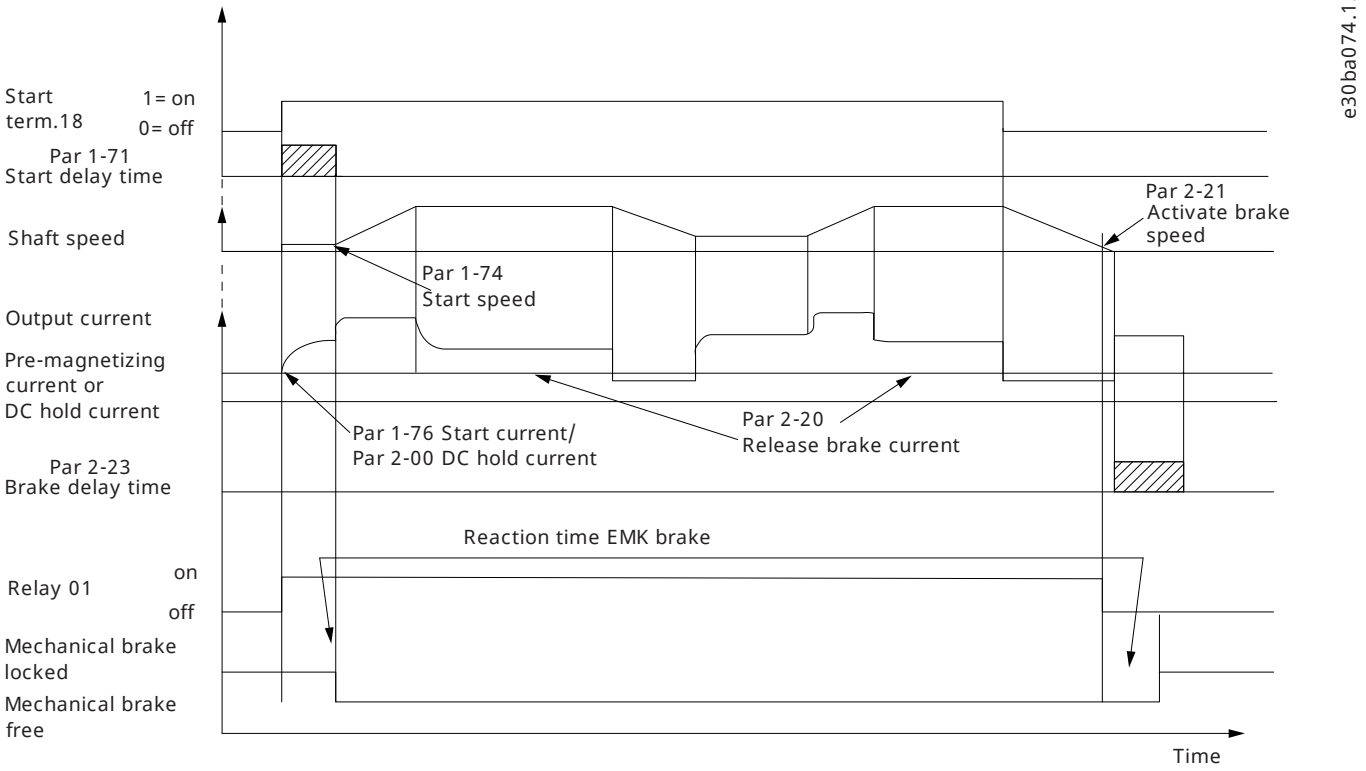


Figure 43: Mechanical Braking

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***.

NOTE: 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.

2-21 Activate Brake Speed [RPM]

Default value:	Size related	**Parameter type:**	Range, 0 - par. 4-13 RPM
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.

2-22 Activate Brake Speed [Hz]

Default value:	Size related	**Parameter type:**	Range, 0 - par. 4-14
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.

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.

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.

2-25 Brake Release Time

Default value:	0.20 s	**Parameter type:**	Range, 0 - 20 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.

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.

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.

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.

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.

6.4.4 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.

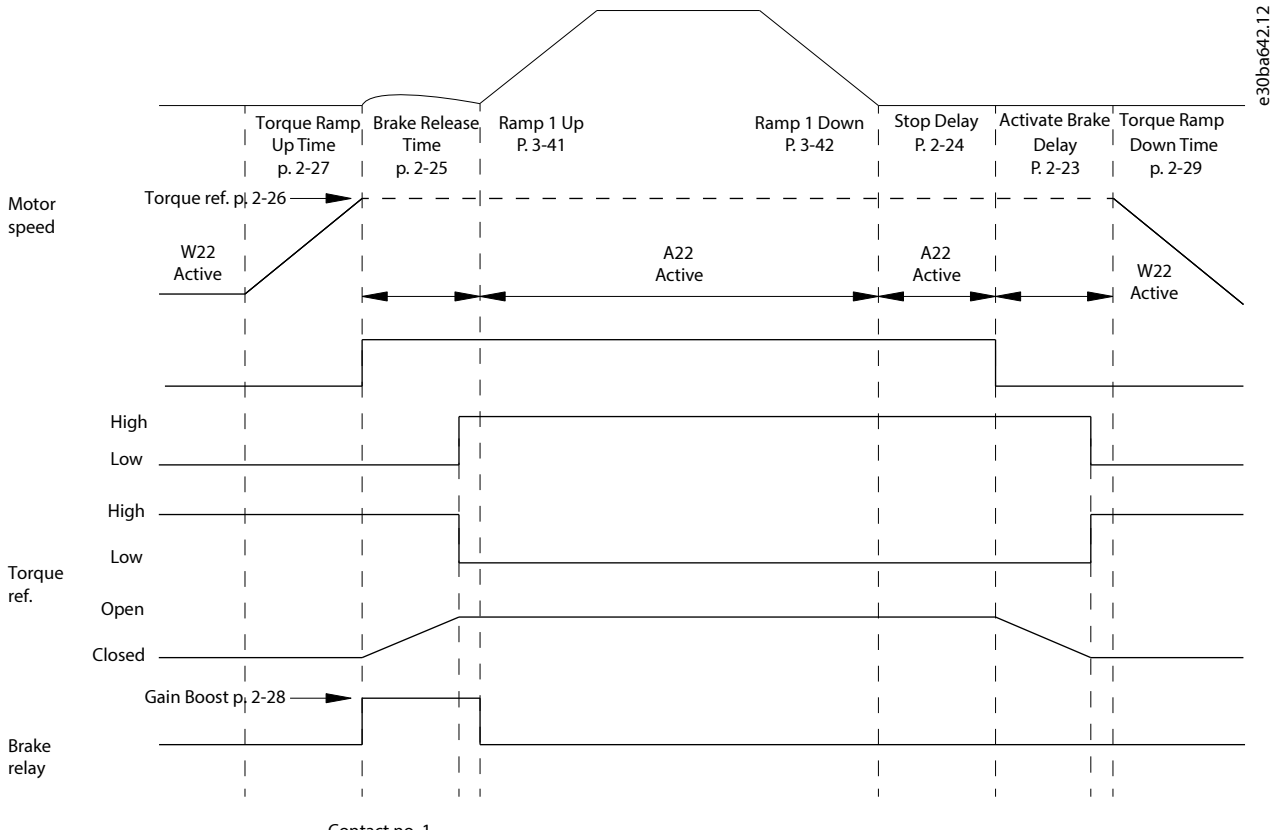


Figure 44: Brake Release Sequence for Hoist Mechanical Brake Control

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).

6.4.5 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.

2-30 Position P Start 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

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.

2-31 Speed PID Start Proportional Gain

Default value:	0.0150	**Parameter type:**	Range, 0.0000 - 1.0000
Seutp:	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.

2-32 Speed PID Start Integral Time

Default value:	200.0 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.

2-33 Speed PID Start Lowpass Filter Time

Default value:	10.0 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.

6.5 Parameter Group 3-** Reference/Ramps

6.5.1 3-0* Reference Limits

3-00 Reference Range

Default value:	–	**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***).

3-01 Reference/Feedback Unit

Default value:	–	**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	
[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	

Option	Name	Description
[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	

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***.

3-03 Maximum Reference

Default value:	Size related	**Parameter type:**	Range, parameter ***3-02 Minimum Reference*** - 999999.999 ReferenceFeedbackUnit
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.

3-05 On Reference Window

Default value:	Size related	**Parameter type:**	Range, 0 - 999999.999 ReferenceFeedbackUnit
Setup:	All setups	**Conversion index:**	-3
Data type:	Int32	**Change during operation:**	True

Enter the tolerance window for on-reference 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.

6.5.2 3-1* References

Select the preset references. Select Preset ref. bit 0/1/2 [16], [17], or [18] for the corresponding digital inputs in parameter group *5-1* Digital Inputs*.

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*.

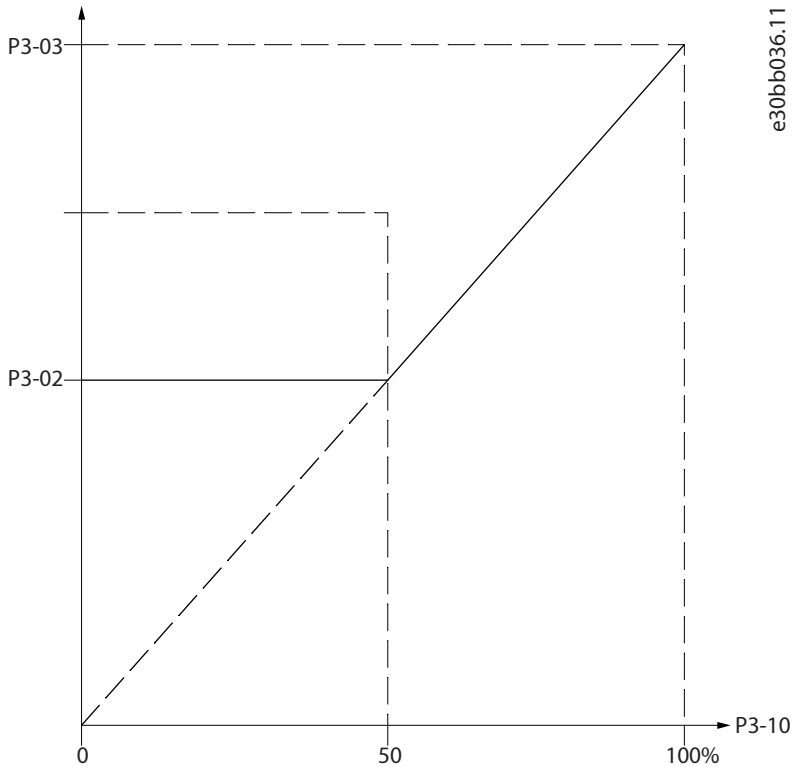


Figure 45: Preset Reference

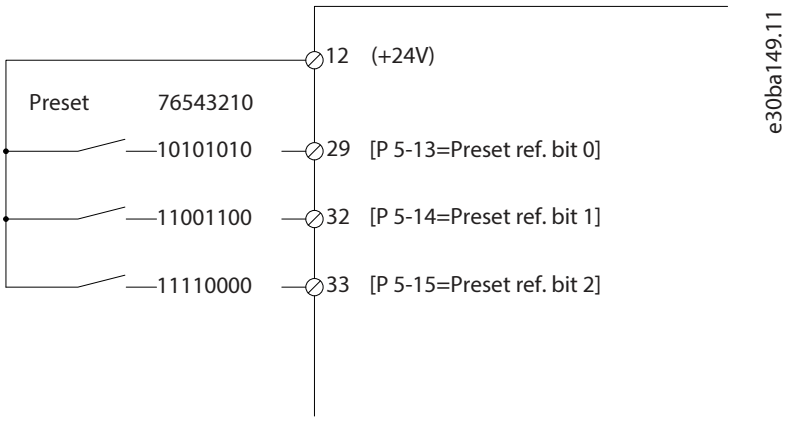


Figure 46: Preset Reference Scheme

Table 18: 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

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***.

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*.

3-13 Reference Site

Default value:	–	**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. **NOTE:** 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.

3-14 Preset Relative Reference

Default value:	0%	**Parameter type:**	Range, -100 - 100%
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***.

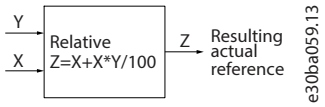


Figure 47: Preset Relative Reference

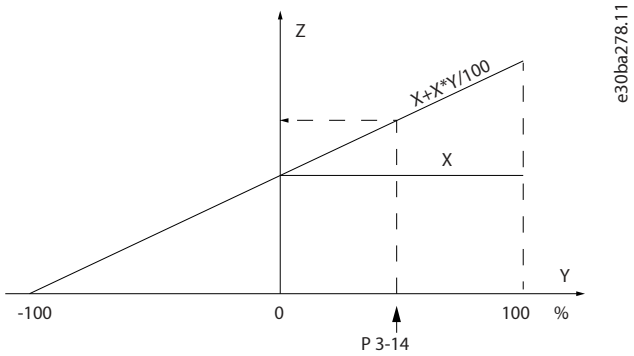


Figure 48: Actual Reference

3-15 Reference Resource 1

Default value:	–	**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***.

Option	Name	Description
[0]	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[7]	Frequency Input 29	
[8]	Frequency Input 33	
[11]	Local Bus Reference	Reference from terminals 68 and 69.
[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

Option	Name	Description
[29]	Analog Input X48/2	
[37]	Analog Input X49/1	
[38]	Analog Input X49/3	
[39]	Analog Input X49/5	

3-16 Reference Resource 2

Default value:	–	**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.

Option	Name	Description
[0]	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[7]	Frequency Input 29	
[8]	Frequency Input 33	
[11]	Local Bus Reference	Reference from terminals 68 and 69.
[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	

3-17 Reference Resource 3

Default value:	–	**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.

Option	Name	Description
[0]	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[7]	Frequency Input 29	
[8]	Frequency Input 33	
[11]	Local Bus Reference	Reference from terminals 68 and 69.
[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	

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

NOTE: This parameter cannot be adjusted while the motor is running.

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 the following drawing) is multiplied by the actual reference (labeled X in the following drawing). This product is then added to the actual reference (X+X*Y/100) to give the resulting actual reference.

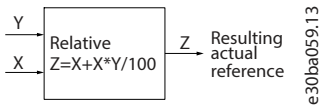


Figure 49: Resulting Actual Reference

Option	Name	Description
[0]*	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[7]	Frequency Input 29	
[8]	Frequency Input 33	
[11]	Local Bus Reference	Reference from terminals 68 and 69.
[20]	Digital Potmeter	
[21]	Analog Input X30/11	
[22]	Analog Input X30/12	

Option	Name	Description
[29]	Analog Input X48/2	
[37]	Analog Input X49/1	
[38]	Analog Input X49/3	
[39]	Analog Input X49/5	

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***.

6.5.3 3-3* Gen Ramp & Sync

3-30 Min. Speed 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

Use this parameter for torque mode. Enter the acceleration time from 0 RPM to the low motor speed limit set in parameter ***4-11 Motor Speed Low Limit***. Ensure that the output current required for achieving the ramp-up time dies not exceed the limit set in parameter ***4-18 Current Limit***.

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

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.

6.5.4 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 Figure 50 and Figure 51.

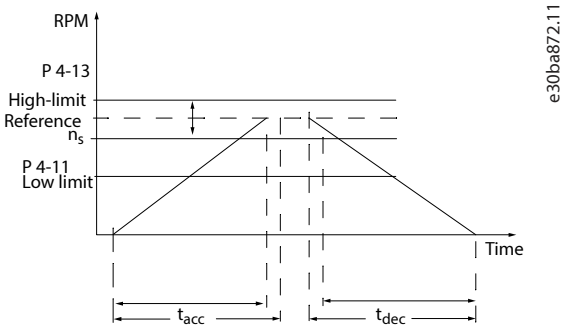


Figure 50: Linear Ramping Times

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.

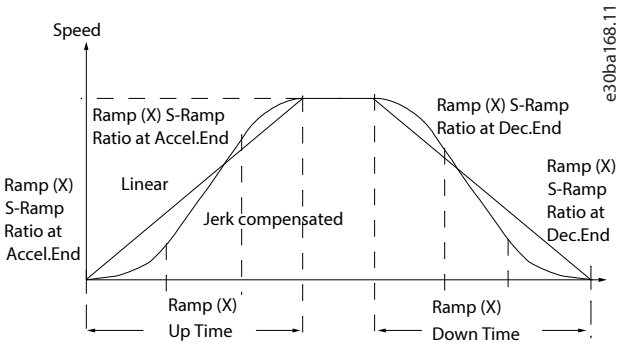


Figure 51: Non-linear Ramping Times

3-40 Ramp 1 Type

Default value:	[1] Linear	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

NOTE: 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***.

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***.

$$\text{Par.}3-41 = \frac{t\text{acc}[s] \times ns[\text{RPM}]}{\text{ref}[\text{RPM}]}$$

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***.$\text{Par.}3-42 = \frac{t\text{dec}[s] \times ns[\text{RPM}]}{\text{ref}[\text{RPM}]}$

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.

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.

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.

3-48 Ramp 1 S-ramp Ratio at Decel. End

Default value:	50%	**Parameter type:**	Rangem 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.

6.5.5 3-5* Ramp 2

3-50 Ramp 2 Type

Default value:	[0] Linear	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

NOTE: 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***.

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***.

$$\text{Par.}3-51 = \frac{t_{acc}[s] \times ns[\text{RPM}]}{\text{ref}[\text{RPM}]}$$

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***.

$$Par.3-52 = \frac{tdec[s] \times ns[RPM]}{ref[RPM]}$$

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.

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.

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.

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.

6.5.6 3-6* Ramp 3

3-60 Ramp 3 Type

Default value:	[0] Linear	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

NOTE: 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***.

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***.

$$\text{Par.}3-61 = \frac{t\text{acc}[s] \times ns[\text{RPM}]}{\text{ref}[\text{RPM}]}$$

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***.

$$\text{Par.}3-62 = \frac{t\text{dec}[s] \times ns[\text{RPM}]}{\text{ref}[\text{RPM}]}$$

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.

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.

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.

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.

6.5.7 3-7* Ramp 4

3-70 Ramp 4 Type

Default value:	[0] Linear	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

NOTE: 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***.

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***.

$$\text{Par.}3-71 = \frac{t\text{acc}[s] \times ns[\text{RPM}]}{\text{ref}[\text{RPM}]}$$

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***.

$$\text{Par.}3-72 = \frac{t\text{dec}[s] \times ns[\text{RPM}]}{\text{ref}[\text{RPM}]}$$

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.

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.

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.

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.

6.5.8 3-8* Other Ramps

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.

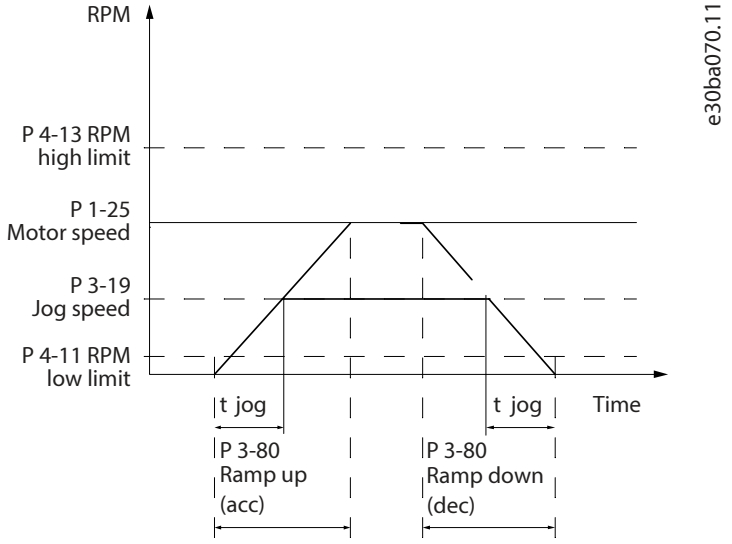


Figure 52: Jog Ramp Time

$$Par.3-80 = \frac{t_{jog}[s] \times n_s[RPM]}{\Delta jogspeed(par.3-19)[RPM]}$$

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.

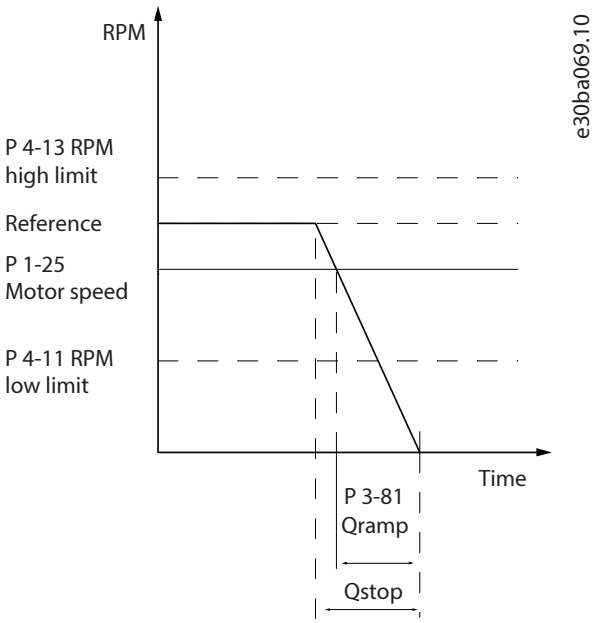


Figure 53: Quick Stop Ramp Time

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	Acceleration with the lowest possible jerk.
[2]	S-ramp Const Time	S-ramp based on the values set in parameter ***3-83 Quick Stop S-ramp Ratio at Decel. Start*** and parameter ***3-84 Quick Stop S-ramp Ratio at Decel. End***.

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.

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.

3-89 Ramp Lowpass Filter Time

Default value:	1 ms	**Parameter type:**	Range, 1 - 200 ms
Setup:	All setups	**Conversion index:**	-4
Data type:	Uint16	**Change during operation:**	True

Use this parameter to set how smoothly the speed changes.

6.5.9 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.

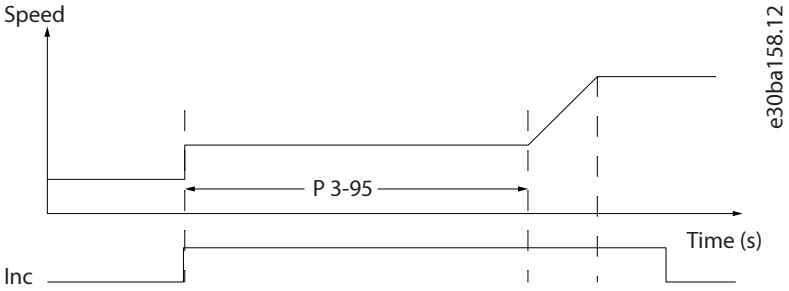


Figure 54: Increase Actual Reference

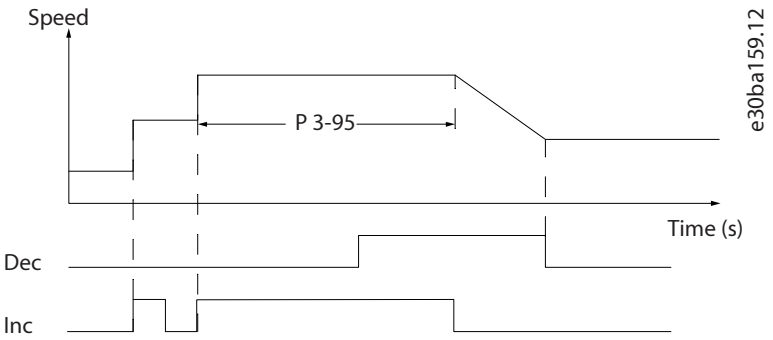


Figure 55: Increase/Decrease Actual Reference

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.

3-91 Ramp Time

Default value:	1 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***.

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.

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.

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.

3-95 Ramp Delay

Default value:	Size related	**Parameter type:**	Range, 0 - 0
Setup:	All setups	**Conversion index:**	-3
Data type:	TimeD	**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***.

6.6 Parameter Group 4-** Limits/Warnings

6.6.1 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 in the fieldbus. A monitoring function may initiate a warning or a trip after which the drive stops and generates an alarm message.

4-10 Motor Speed Direction

Default value:	–	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	False

NOTE: 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.

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]***.

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]***.

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]***.

4-14 Motor Speed High Limit [Hz]

Default value:	Size related	**Parameter type:**	Range, Setting in par. 4-12 - 1000.0 Hz
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***).

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

NOTE: 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.

NOTE: When parameter ***1-00 Configuration Mode*** is set to ***[0] Speed open loop***, parameter ***1-66 Min. Current at Low Speed*** is automatically readjusted.

NOTE: 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.

4-17 Torque Limit Generator Mode

Default value:	Size related	**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.

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

NOTE: 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.

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

NOTE: This parameter cannot be adjusted while the motor is running.

NOTE: 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***).

6.6.2 4-2* Limit Factors

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	

4-21 Speed Limit Factor Source

Default value:	[0] No function	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Parameter 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	

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

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%.

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	

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	

4-29 Speed Low Limit 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 limit set in parameter ***4-11 Motor Speed Low Limit [RPM]*** or parameter ***4-12 Motor Speed Low Limit [Hz]*** 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	

6.6.3 4-3* Motor Feedback Monitoring

This parameter group includes monitoring and handling of motor feedback devices, such as encoders and resolvers.

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	
[8]	Select setup 2	
[9]	Select setup 3	
[10]	Select setup 4	
[11]	Stop & trip	

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).

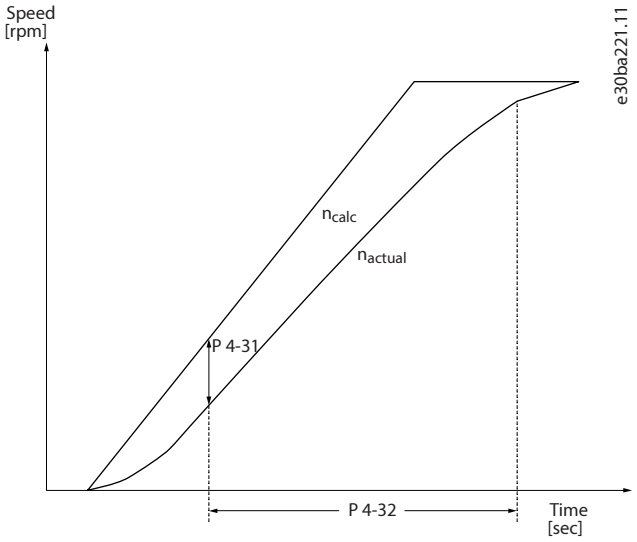


Figure 56: Motor Feedback Speed Error

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***.

4-34 Tracking Error Function

Default value:	–	**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	

Option	Name	Description
[2]	Trip	
[3]	Trip after stop	

4-35 Tracking Error

Default value:	10 RPM	**Parameter type:**	Range, 1 - 600 RPM
Setups:	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.

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.

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.

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.

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.

6.6.4 4-4* Speed Monitor

4-43 Motor Speed Monitor Function

Default value:	–	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

NOTE: 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.

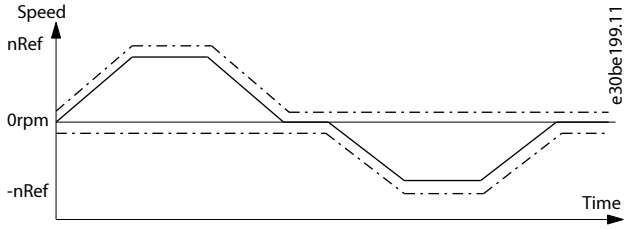


Figure 57: Speed Reference and Maximum Allowed Speed Difference

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	

Option	Name	Description
[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.

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

NOTE: 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]***.

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

NOTE: 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***.

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	

6.6.5 4-5* Adjustable Warnings

Use these parameters for adjustable 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.

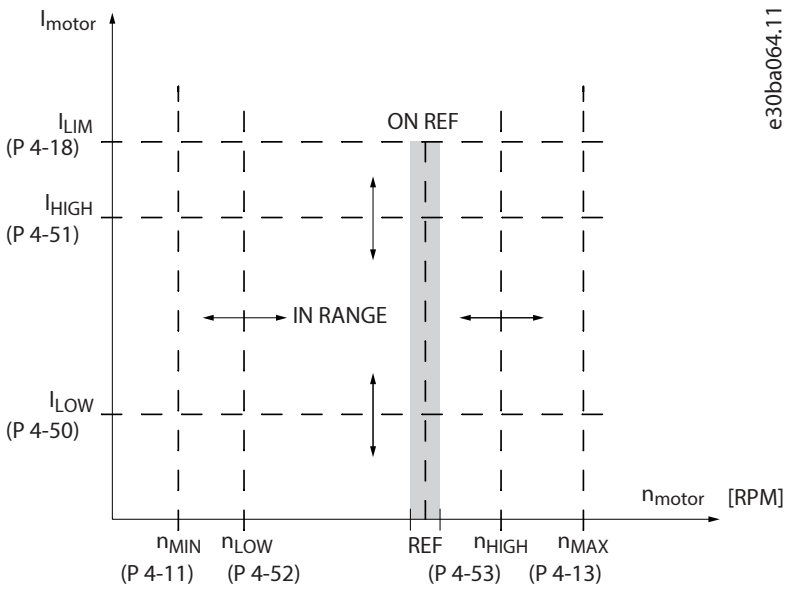


Figure 58: Adjustable Warnings

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. Refer to Figure 58.

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 and on relay output 01 or 02. Refer to Figure 58.

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 and on relay output 01 or 02. Refer to Figure 58.

4-53 Warning Speed High

Default value:	Size related	**Parameter type:**	Range, setting in par. 4-53 - 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 and on relay outputs 01 or 02. Refer to Figure 58.

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 and on relay output 01 or 02.

4-55 Warning Reference High

Default value:	999999.999	**Parameter type:**	Range, setting in par. 4-54 - 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 and on relay output 01 or 02.

4-56 Warning Feedback Low

Default value:	Size related	**Parameter type:**	Range, setting in par. 4-57 - -999999.999
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 and on relay output 01 or 02.

4-57 Warning Feedback High

Default value:	Size related	**Parameter type:**	Range, par. 4-56 - 999999.99
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 and on relay output 01 or 02.

4-58 Missing Motor Phase Function

Default value:	–	**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.	**NOTE:** Only available in flux closed loop. To activate for U/f and VVC+. set parameter ***4-59 Motor Check at Start*** to ***[0] On***. 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	**NOTE:** 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 19: 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 phases.	Detects 1–3 phases.
[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)			
[5]	Motor check (service switch)	Coasts if the 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, 3-phase detection is enabled for U/f and VVC+ motor control.

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

NOTE: 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. • Select ***[1] On*** to make the drive check that all 3 motor phases are present. 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 following table details the motor check at start for different motor control principles:

Table 20: 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.	N/A		
[1]	On				

6.6.6 4-6* Speed Bypass

Some systems require that certain output frequencies of speeds are avoided due to resonance problems in the system. A maximum of 4 frequency or speed ranges can be avoided.

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.

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.

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.

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.

6.6.7 4-8* Power Limit

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.

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.

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]***.

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	**Changing 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]***.

6.6.8 4-9* Directional Limits

The directional limits functionality allows specifying different torque and speed limits for different combinations of torque application direction and rotation direction. In Figure 59, quadrants 1–4 show different combinations of rotation direction and torque application, and the parameters that act in different quadrants.

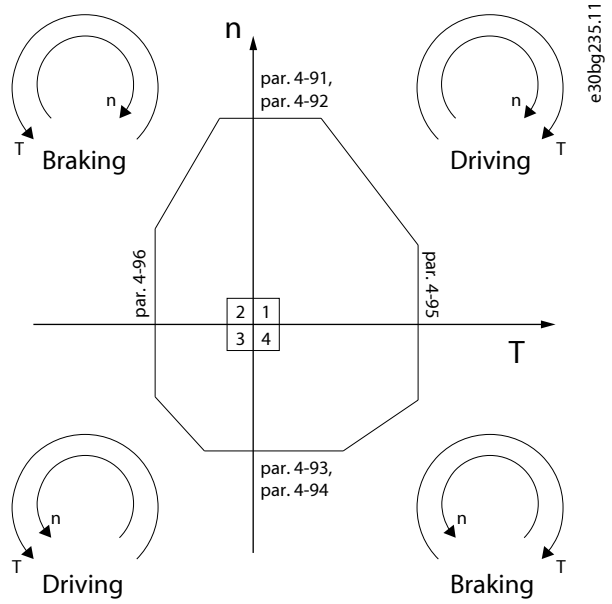


Figure 59: Example of Directional Limits

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***.

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.

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.

4-92 Positive Speed Limit [Hz]

Default value:	Size related	**Parameter type:**	Range, 0.0 - par. 4-14 Hz
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.

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.

4-94 Negative Speed Limit [Hz]

Default value:	Size related	**Parameter type:**	Range, 0.0 - par. 4-14 Hz
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.

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.

4-96 Negative Torque Limit

Default value:	Size related	**Parameter type:**	Range, 0 - 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.

6.7 Parameter Group 5-** Digital In/Out

6.7.1 5-0* Digital I/O Mode

This parameter group contains parameters for configuring the input and output using NPN and PNP.

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

NOTICE

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.

5-01 Terminal 27 Mode

Default value:	–	**Parameter type:**	Option
Setup:	All setups	**Converison index:**	–
Data type:	Uint8	**Change during operation:**	True

Option	Name	Description
[0]	Input	Defines terminal 27 as a digital input.
[1]	Output	Defines terminal 27 as a digital output.

5-02 Terminal 29 Mode

Default value:	–	**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.

6.7.2 5-1* Digital Inputs

The digital inputs are used for selecting various functions in the drive. Refer to Table 22 for functions which can be assigned to digital inputs.

Functions in function group 1 have higher priority than functions in function group 2.

Table 21: 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 22: Digital Input Functions and Terminals

Digital input function	Option number	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

Table 22: Digital Input Functions and Terminals (continued)

Digital input function	Option number	Terminal
Stop inverse	[6]	All
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]	All
External interlock	[51]	–
DigiPot increase	[55]	All
DigitPot decrease	[56]	All
DigiPot clear	[57]	All
DigiPot hoist	[58]	All
Counter A (up)	[60]	Terminal 29, 33

Table 22: Digital Input Functions and Terminals (continued)

Digital input function	Option number	Terminal
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
Timed actions disabled	[68]	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]	All
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]	–
Constant OFF actions	[129]	All
Constant ON actions	[130]	All
Emcy mode ref bit 0	[190]	All
Emcy mode ref bit 1	[191]	All
Emcy mode ref bit 2	[192]	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 EZ FC 321 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. 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 the following functions:

Table 23: 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.
[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***. **NOTE:** 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.

Table 23: Digital Inputs, Function Descriptions - 1 (continued)

Option		Function
[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 24.
[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 24: 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. 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 25: 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***. **NOTE:** 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 26: 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 27: 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***.
[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.

Table 27: Digital Inputs, Function Descriptions - 3 (continued)

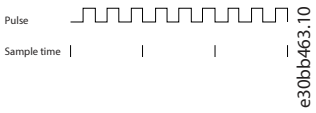
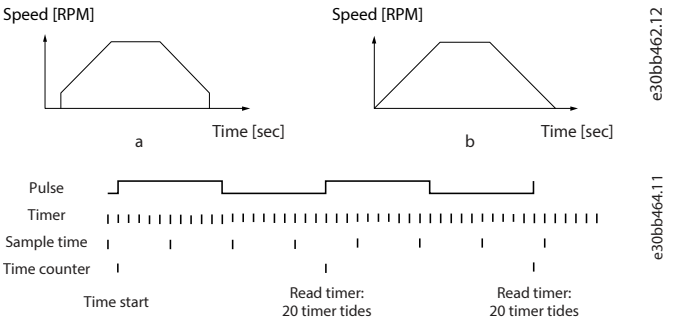
Option		Function
[27]	Precise start, stop	Use when *[0] Precise ramp stop*is selected in parameter ***1-83 Precise Stop Function***. Precise start, stop is available for terminals 18 and 19. Precise start ensures that the rotor turning angle from standing still to reference is the same for each start (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).  **Figure 60: 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.  **Figure 61: Duration Between Pulse Flanks**

Table 27: Digital Inputs, Function Descriptions - 3 (continued)

Option		Function
[34]	Ramp bit 0	Enables a selection between 1 of the 4 ramps available, according to Table 28.
[35]	Ramp bit 1	Same as ***[34] Ramp bit 0***.

Table 28: 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 29: 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 used for parameter ***1-83 Precise Stop Function*** option ***[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.

Table 29: Digital Inputs, Function Descriptions - 4 (continued)

Option		Function
[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.
[68]	Timed actions disabled	Timed actions are disabled (see parameter group *23-0* Timed Actions*).
[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***.
[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. **NOTE:** Flying start overrules light load detection.

Table 29: Digital Inputs, Function Descriptions - 4 (continued)

Option		Function
[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 backup. **NOTE:** 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 backup. For more details, see the description of ***[96] Mains loss***. **NOTE:** 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.
[129]	Constant OFF actions	
[130]	Constant ON actions	
[190]	Emcy mode ref bit 0	Enables a choice between 1 of the 8 preset reference according to Table 24.
[191]	Emcy mode ref bit 1	Enables a choice between 1 of the 8 preset reference according to Table 24.
[192]	Emcy mode ref bit 2	Enables a choice between 1 of the 8 preset reference according to Table 24.
[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.	Serves as input to activate the power limit function in the motor mode. See parameter group *4-8* Power Limit*.
[232]	Power limit gen.	Serves as input to activate the power limit function in the generating mode. See parameter group *4-8* Power Limit*.

Table 29: Digital Inputs, Function Descriptions - 4 (continued)

Option		Function
[233]	Power limit both	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	Use this option to activate both light-load detection and evacuation.

5-10 Terminal 18 Digital Input

Default value:	–	**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 23, Table 25, Table 27, and Table 29.

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	

Option	Name	Description
[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	
[65]	Reset counter B	
[68]	Timed actions disabled	
[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	
[129]	Constant OFF actions	
[130]	Constant ON actions	

Option	Name	Description
[190]	Emcy mode ref bit 0	
[191]	Emcy mode ref bit 1	
[192]	Emcy mode ref bit 2	
[195]	Test emcy mode	
[196]	Reset emcy mode	
[231]	Power limit mot.	
[232]	Power limit gen.	
[233]	Power limit both	
[234]	Light load + evacuation	

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***.

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

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 start	
[10]	Reversing	
[11]	Start reversing	
[12]	Enable start forward	
[13]	Enable start reverse	
[14]	Jog	
[15]	Preset reference on	
[16]	Preset ref bit 0	

Option	Name	Description
[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	
[28]	Catch up	
[29]	Slow down	
[34]	Ramp bit 0	
[35]	Ramp bit 1	
[37]	Emergency mode	
[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	
[68]	Timed actions disabled	
[70]	Mech. brake feedb.	
[71]	Mech. brake feedb. inv.	
[72]	PID error inverse	
[73]	PID reset I 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	

Option	Name	Description
[100]	Safe option reset	
[129]	Constant OFF actions	
[130]	Constant ON actions	
[190]	Emcy mode ref bit 0	
[191]	Emcy mode ref bit 1	
[192]	Emcy mode ref bit 2	
[195]	Test emcy mode	
[196]	Reset emcy mode	
[231]	Power limit mot	
[232]	Power limit gen.	
[233]	Power limit both	
[234]	Light load + evacuation	

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

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 start	
[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	

Option	Name	Description
[19]	Freeze reference	
[20]	Freeze output	
[21]	Speed up	
[22]	Speed down	
[23]	Set-up select bit 0	
[24]	Set-up select bit 1	
[28]	Catch up	
[29]	Slow down	
[30]	Counter input	
[31]	Pulse edge triggered	
[32]	Pulse time based	
[34]	Ramp bit 0	
[35]	Ramp bit 1	
[37]	Emergency mode	
[44]	Restart drive	
[51]	External interlock	
[55]	DigiPot increase	
[56]	DigiPot decrease	
[57]	DigiPot clear	
[58]	DigiPot hoist	
[60]	Counter A (up)	
[61]	Counter A (down)	
[62]	Reset counter A	
[63]	Counter B (up)	
[64]	Counter A (down)	
[65]	Reset counter B	
[68]	Timed actions disabled	
[70]	Mech. brake feedb.	
[71]	Mech. brake feedb. inv.	
[72]	PID error inverse	
[73]	PID reset I part	
[74]	PID enable	
[75]	MCO specific	
[78]	Reset maint. word	
[80]	PTC card 1	
[91]	PROFIdrive OFF2	
[92]	PROFIdrive OFF3	

Option	Name	Description
[94]	Light load detection	
[95]	Evacuation mode	
[96]	Mains loss	
[97]	Mains loss inverse	
[98]	Start edge triggered	
[100]	Safe option reset	
[129]	Constant OFF actions	
[130]	Constant ON actions	
[190]	Emcy mode ref bit 0	
[191]	Emcy mode ref bit 1	
[192]	Emcy mode ref bit 2	
[195]	Test emcy mode	
[196]	Reset emcy mode	
[231]	Power limit mot	
[232]	Power limit gen.	
[233]	Power limit both	
[234]	Light load + evacuation	

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 ***5-12 Terminal 27 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***.

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 ***5-12 Terminal 12 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 ***5-12 Terminal 27 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

Default value:	–	**Parameter type:**	Option
Setup:	1 setup	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

NOTE: 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.

NOTE: 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	The drive coasts the motor when Safe Torque Off is activated. Manual reset from LCP, digital input, or fieldbus.
[3]	Safe stop warning	The drive coasts the motor 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	The drive coasts the motor when Safe Torque Off is activated. Manual reset from LCP, digital input, or fieldbus.
[5]	PTC 1 warning	The drive coasts the motor 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. The drive coasts the motor when Safe Torque Off is activated. Manual reset from LCP, digital input, or fieldbus.

Option	Name	Description
[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. The drive coasts the motor 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 30: Overview of Functions, Alarms, and Warnings

Function	Number	PTC	Relay[1]
No function	[0]	–	–
Safe Torque Off alarm	[1]*	–	Safe Torque Off [A68]
Safe Torque Off warning	[3]	–	Safe Torque Off [W68]
PTC 1 alarm	[4]	PTC 1 Safe Torque Off [A71]	–
PTC 1 warning	[5]	PTC 1 Safe Torque Off [W71]	–
PTC 1 and relay A	[6]	PTC 1 Safe Torque off [A71]	Safe Torque Off [A68]
PTC 1 and relay W	[7]	PTC 1 Safe Torque Off [W71]	Safe Torque Off [W68]
PTC 1 and relay A/W	[8]	PTC 1 Safe Torque Off [A71]	Safe Torque Off [W68]
PTC 1 and relay W/A	[9]	PTC 1 Safe Torque Off [W71]	Safe Torque Off [A68]

1) W means warning and A means alarm.

A dangerous failure related to STO issues *alarm 72, Dangerous Failure*.

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 23, Table 25, Table 27, and Table 29.

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	

Option	Name	Description
[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	
[28]	Catch up	
[29]	Slow down	
[34]	Ramp bit 0	
[35]	Ramp bit 1	
[37]	Emergency mode	
[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	
[68]	Timed actions disabled	
[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	

Option	Name	Description
[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	
[129]	Constant OFF actions	
[130]	Constant ON actions	
[190]	Emcy mode ref bit 0	
[191]	Emcy mode ref bit 1	
[192]	Emcy mode ref bit 2	
[195]	Test emcy mode	
[196]	Reset emcy mode	
[231]	Power limit mot.	
[232]	Power limit gen.	
[233]	Power limit both	
[234]	Light load + evacuation	

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***.

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***.

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 those listed for parameter ***5-20 Terminal X46/1 Digital Input***.

5-24 Terminal X46/9

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***.

5-25 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***.

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***.

6.7.3 5-3* Digital Outputs

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***.

NOTE: These parameters cannot be adjusted while the motor is running.

Table 31: 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.
[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 in range/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.

Table 31: Digital Outputs, Function Descriptions - 1 (continued)

Option		Function
[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.

Table 31: Digital Outputs, Function Descriptions - 1 (continued)

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*** and 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).
[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.
[55]	Pulse output	
[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.
[63]	Comparator 3	See parameter group *13-1* Comparators*. If comparator 3 is evaluated as true, the output goes high. Otherwise, it is low.

Table 31: Digital Outputs, Function Descriptions - 1 (continued)

Option		Function
[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.
[76]	Logic rule 6	See parameter group *13-4* Logic Rules*. If logic rule 6 is evaluated as true, the output goes high. Otherwise, it is low.
[77]	Logic rule 7	See parameter group *13-4* Logic Rules*. If logic rule 7 is evaluated as true, the output goes high. Otherwise, it is low.
[78]	Logic rule 8	See parameter group *13-4* Logic Rules*. If logic rule 8 is evaluated as true, the output goes high. Otherwise, it is low.
[79]	Logic rule 9	See parameter group *13-4* Logic Rules*. If logic rule 9 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.

Table 31: Digital Outputs, Function Descriptions - 1 (continued)

Option		Function
[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.
[90]	kWh counter pulse	Sends a pulse (200 ms pulse width) to output terminal whenever kWh counter changes (parameter ***15-02 kWh Counter***).
[120]	Local ref active	Output is high when parameter ***3-13 Reference Site*** = ***[2] Local***.

Table 32: 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***	1	0
Reference site: Remote parameter ***3-13 Reference Site***	0	1
Reference site: Linked to Hand/ Auto	–	–
Hand	1	0
Hand⇒off	1	0
Auto⇒off	0	0
Auto	0	1

Table 33: 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 32.
[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.

Table 33: 5-30 Digital Outputs - 2 (continued)

Option		Function
[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]).
[150]	CBM warning	
[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	
[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 are 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*.

Table 33: 5-30 Digital Outputs - 2 (continued)

Option		Function
[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.
[231]	In power lim. mot.	
[232]	In power lim. gen.	
[233]	In power limit	
[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 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 life-time before service is required.
[254]	Testing emcy mode	Emergency mode is activated in a special test mode where the drive stops on all alarms.

5-30 Terminal 27 Digital Output

Default value:	–	**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 31 and Table 33.

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	

Option	Name	Description
[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	
[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	
[51]	MCO controlled	
[55]	Pulse output	
[59]	Actual position 4–20mA	

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	
[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	
[150]	CBM warning	
[151]	ATEX ETR cur. alarm	
[152]	ATEX ETR freq. alarm	

Option	Name	Description
[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	
[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	

5-31 Terminal 29 Digital Output

Default value:	–	**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***.

5-32 Term X30/6 Digi Out (MCB 101)

Default value:	–	**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***.

5-33 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

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	
[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	

Option	Name	Description
[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	
[51]	MCO controlled	
[59]	Actual position 4–20mA	
[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	

Option	Name	Description
[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	
[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	
[150]	CBM warning	
[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	

Option	Name	Description
[221]	IGBT-cooling	
[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	

6.7.4 5-4* Relays

This parameter group contains parameters for configuring the timing and the output functions for the relays.

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 parameter ***4-50 Warning Current Low*** and ***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.

Option	Name	Description
[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.
[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*.

Option	Name	Description
[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	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	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).
[47]	Bus ctrl, 0 if timeout	Controls output via bus. The state of the output is set in parameter parameter ***5-90 Digital & Relay Bus Control***. If a bus timeout occurs, the output state is set low (off).
[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.

Option	Name	Description
[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.
[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] Set digital out A high***.
[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] Set digital out B high***.

Option	Name	Description
[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] Set digital out C high***.
[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] Set digital out D high***.
[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] Set digital out E high***.
[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] Set digital out F high***.
[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 34: 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

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*]).
[150]	CBM warning	

Option	Name	Description
[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*.
[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.
[231]	In power lim. mot.	
[232]	In power lim. gen.	
[233]	In power limit	
[234]	PE power off	
[246]	Emcy mode was act.	The drive has been operating in emergency mode.

Option	Name	Description
[247]	Emergency mode	The drive is operating in emergency mode. See parameter group *24-0* Emergency Mode*.
[249]	Emcy m. OPR unexptected	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.

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.

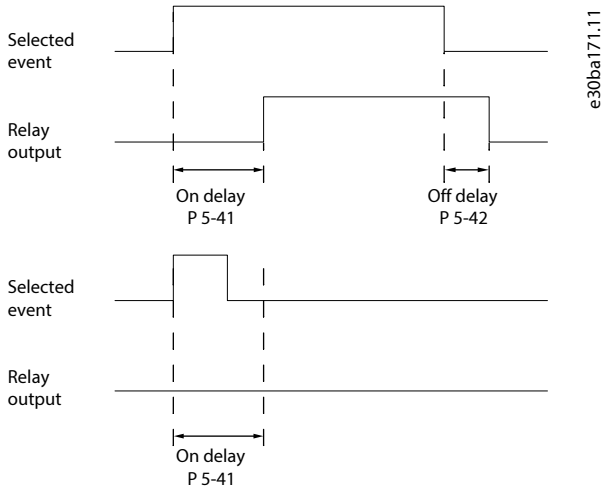


Figure 62: On Delay, Relay

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.

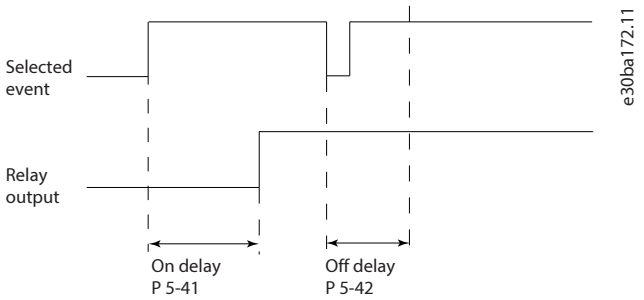


Figure 63: Off Delay, Relay

6.7.5 5-5* Pulse Input

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, set parameter ***5-10 Terminal 27 Mode*** to ***[0] Input***.

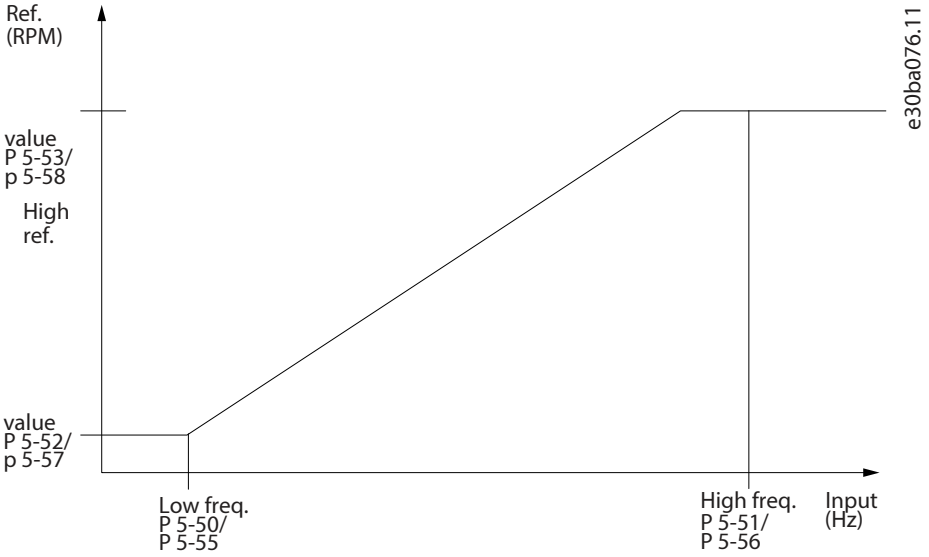


Figure 64: Pulse Input

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 6.7.5 5-5* Pulse Input.

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***.

5-52 Term. 29 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 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).

5-53 Term. 29 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 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).

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 a lot of 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.

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***.

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***.

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***.

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***.

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

NOTE: 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.

6.7.6 5-6* Pulse Outputs

NOTE: These parameters cannot be adjusted while the motor is running.

This parameter group contains parameters for configuring pulse outputs with their functions and scaling. Terminals 27 and 29 area allocated to pulse output via parameter ***5-01 Terminal 27 Mode*** and parameter ***5-02 Terminal 29 Mode***, respectively.

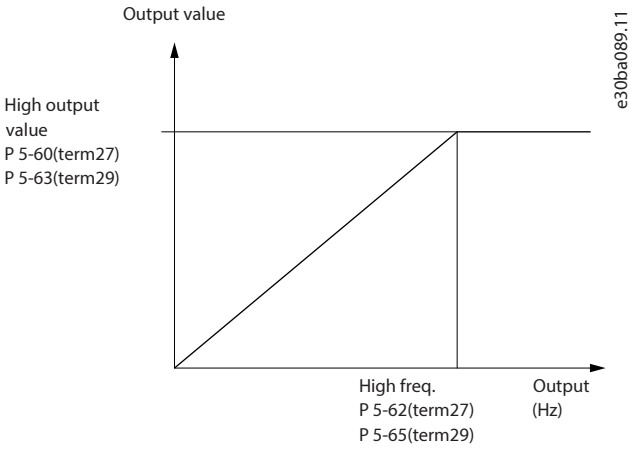


Figure 65: Configuration of Pulse Outputs

Table 35: 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	Control digital output via bus. The state of the output is set in parameter ***5-90 Digital & Relay Bus Control***. The output state is retained if a bus timeout occurs.
[48]	Bus control timeout	
[51]	MCO-controlled	
[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	
[119]	Torque % lim	

5-60 Terminal 27 Pulse Output Variable

Default value:	–	**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	
[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	

5-62 Pulse Output Max Freq #27

Default value:	Size related	**Parameter type:**	Range, 0 - 32000 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***.

5-63 Terminal 29 Pulse Output Variable

Default value:	–	**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 29.
[45]	Bus ctrl.	Control digital output via bus. The state of the output is set in parameter ***5-90 Digital & Relay Bus Control***. The output state is retained if a bus timeout occurs.
[48]	Bus ctrl., timeout	
[51]	MCO controlled	
[100]	Output frequency	
[101]	Reference	
[102]	Feedback	
[103]	Motor current	

Option	Name	Description
[104]	Torque rel to limit	
[105]	Torque related to rated	
[106]	Power	
[107]	Speed	
[108]	Torque	
[109]	Max out freq	
[119]	Torque % lim	

5-65 Pulse Output Max Freq #29

Default value	Size related	**Parameter type:**	Range, 0 - 32000 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***.

5-66 Terminal X30/6 Pulse Output Variable

Default value:	–	**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 X30/6.
[45]	Bus ctrl.	Control digital output via bus. The state of the output is set in parameter ***5-90 Digital & Relay Bus Control***. The output state is retained if a bus timeout occurs.
[48]	Bus ctrl., timeout	
[51]	MCO controlled	
[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	

Option	Name	Description
[109]	Max out freq	
[119]	Torque % lim	

5-68 Pulse Output Max Freq #30/6

Default value:	Size related	**Parameter type:**	Range, 0 - 32000 Hz
Setup:	All setups	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	True

NOTE: 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.

6.7.7 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).

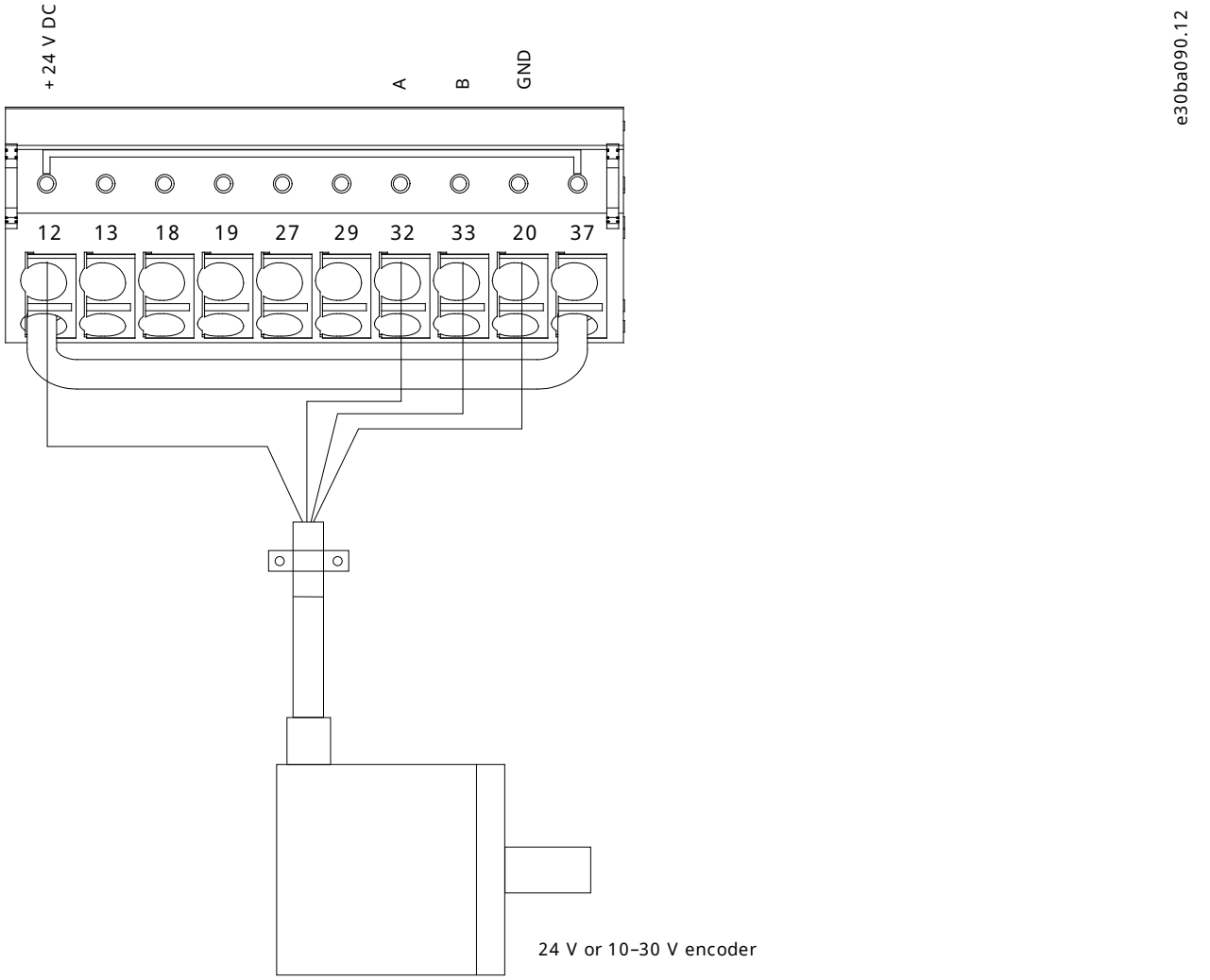


Figure 66: Encoder Connection

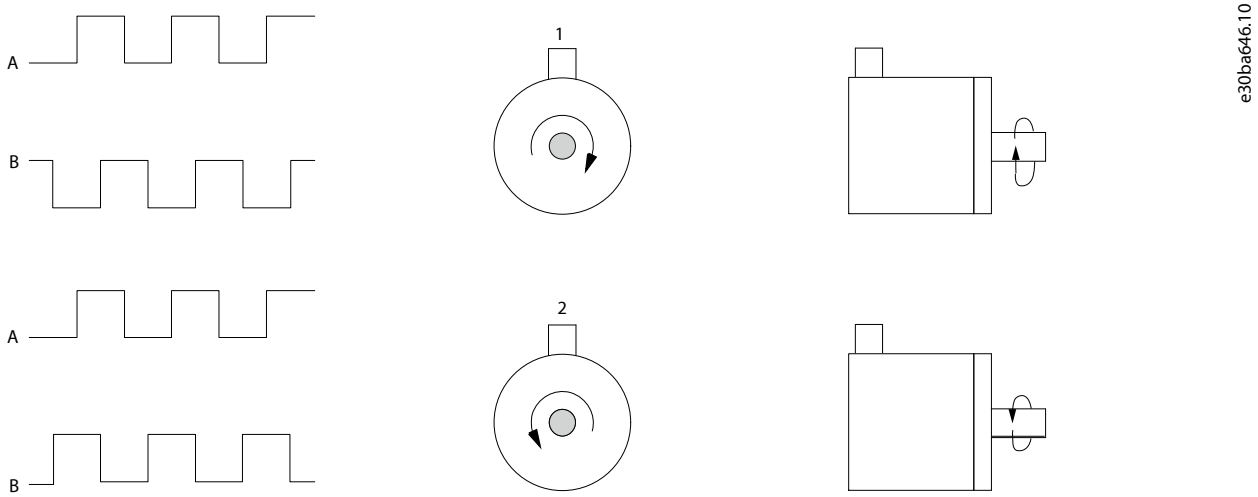


Figure 67: Encoder Rotation Direction

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.

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

NOTE: 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.

6.7.8 5-8* I/O Options

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%.

6.7.9 5-9* Bus-controlled

This parameter group contains parameters for selecting digital and relay outputs via a fieldbus setting.

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 36: Bus-controlled Digital Outputs and Relays

Bit	Output/Relay
0	Digital output terminal 27
1	Digital output terminal 29

Table 36: Bus-controlled Digital Outputs and Relays (continued)

Bit	Output/Relay
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 relay 5 output terminal
21	Option C relay 6 output terminal
22	Option C relay 7 output terminal
23	Option C relay 8 output terminal
21–31	Reserved for future terminals

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***.

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.

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***.

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.

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***.

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	**Changing 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.

6.8 Parameter Group 6-** Analog In/Out

6.8.1 6-0* Analog I/O Mode

The analog inputs an be allocated to be either voltage (0 to ±10 V) or current (0/4–20 mA).

NOTE: Thermistors may be connected to either an analog or a digital input.

6-00 Live Zero Timeout Time

Default value:	10 s	**Parameter type:**	Range, 0 - 99 s
Setup:	All setups	**Conversion index:**	0
Data type:	Uint8	**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.

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	
[30]	Warning only	

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.

Option	Name	Description
[3]	Jogging	Overruled to jog speed.
[4]	Max. speed	Overruled to maximum speed.

6.8.2 6-1* Analog Input 1

Parameters for configuring the scaling and limits for analog input 1 (terminal 53).

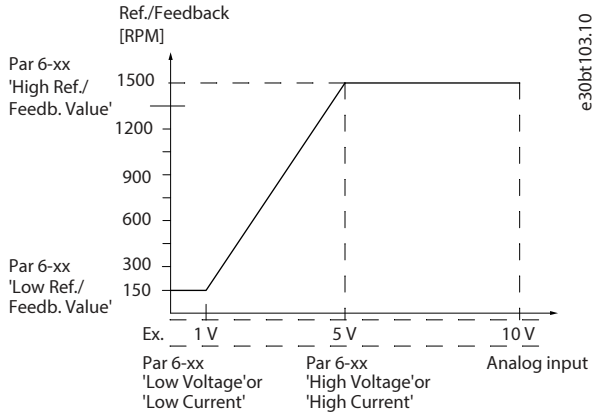


Figure 68: Analog Input 1

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***.

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***.

6-12 Terminal 53 Low Current

Default value:	0.14 mA	**Parameter type:**	Range, 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***.

6-13 Terminal 53 High Current

Default value:	20 mA	**Parameter type:**	Range, 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***.

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***.

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***.

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

NOTE: 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.

6.8.3 6-2* Analog Input 2

This parameter group contains parameters for configuring the scaling and limits for analog input 2 (terminal 54).

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***.

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***.

6-22 Terminal 54 Low Current

Default value:	Size related	**Parameter type:**	Range, 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***.

6-23 Terminal 54 High Current

Default value:	20 mA	**Parameter type:**	Range, 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***.

6-24 Terminal 54 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 minimum reference feedback value set in parameter ***3-02 Minimum Reference***.

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***.

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

NOTE: 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.

6.8.4 6-3* Analog Input 3 General Purpose I/O MCB 101

This parameter group contains parameters for configuring the scale and limits for analog input 3 (X30/11) in VLT® General Purpose I/O MCB 101.

6-30 Terminal X30/11 Low Voltage

Default value:	0.07 V	**Parameter type:**	Range, 0 - setting in 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***).

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***).

6-34 Term. X30/11 Low Ref./Feedb. Value

Default value:	Size related	**Parameter type:**	Range, 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 low voltage value (set in parameter ***6-30 Terminal X30/11 Low Voltage***).

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***).

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

NOTE: 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.

6.8.5 6-4* Analog Input X30/12

This parameter group contains parameters for configuring the scale and limits for analog input 4 (X30/12) in VLT® General Purpose I/O MCB 101.

6-40 Terminal X30/12 Low Voltage

Default value:	0.07 V	**Parameter type:**	Range, 0 - setting in 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***.

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***.

6-44 Term. X30/12 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

Sets the analog output scaling value to correspond to the low voltage value set in parameter ***6-40 Terminal X30/12 Low Voltage***.

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***.

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

NOTE: 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.

6.8.6 6-5* Analog Output 1

This parameter group contains parameters for configuring the scaling and limits for analog output 1 (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 and digital common connection. The resolution on analog output is 12 bit.

6-50 Terminal 42 Output

Default value:	–	**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	The analog value is set by the MCO 305 application program using the command OUTDA.
[53]	MCO 4–20mA	The analog value is set by the MCO 305 application program using the command OUTDA.
[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. $\frac{20\ mA \times 22\ A}{38.4\ A} = 11.46 mA$ When the normal motor current is equal to 20 mA, the output setting of parameter ***6-52 Terminal 42 Output Max Scale*** is: $\frac{I_{VLT,MAX} \times 100}{I_{Motor,Nom}} = \frac{38.4 \times 100}{22} = 175\ \%$

Option	Name	Description
[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 4–20mS	
[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 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. $\frac{16\ mA\ \times\ 22\ A}{38.4\ A} = 13.17 mA$ 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.

Option	Name	Description
[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	An output value based on main actual value from serial communication.
[148]	Main act val 4-20mA	An output value based on main actual value from serial communication.
[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.	An output value based on actual motor voltage.
[159]	Motor Volt. 4-20mA	An output value based on actual motor voltage.
[184]	Mirror AI53 mA	
[185]	Mirror AI54 mA	

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***.

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%

$$10\text{mA}: \frac{20}{10} \times 100 = 200\%$$

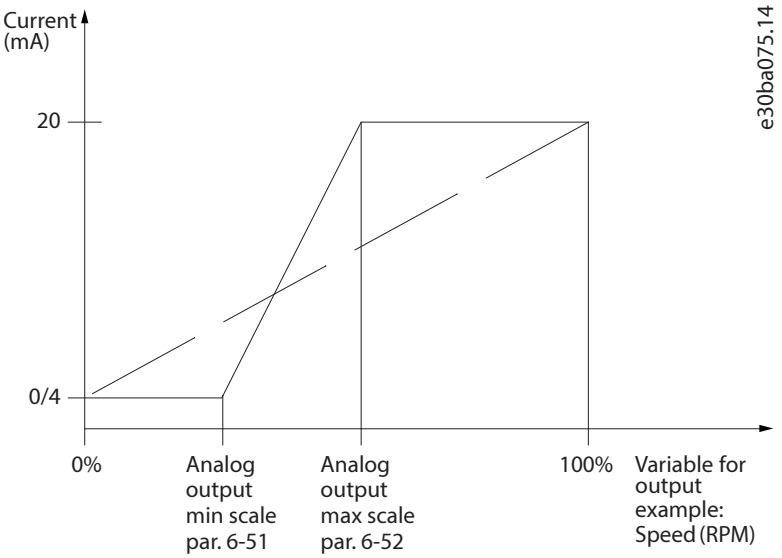


Figure 69: Output Maximum Scale

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.

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.

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 37: 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]

Table 37: Readout Parameters (continued)

Selection	0–20 mA	4–20 mA
Power (0–P_{nom})	[106]	[136]
Speed (0–$Speed_{max}$)	[107]	[137]

Option	Name	Description
[0]*	Off	Filter off.
[1]	On	Filter on.

6.8.7 6-6* Analog Output 2 MCB 101

Analog outputs are current outputs: 0/4–20 mA. Common terminal (terminal 30/8) is the same terminal and electrical potential for analog common communication. The resolution on analog output is 12 bit.

6-60 Terminal X30/8 Output

Default value:	–	**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	The analog value is set by the MCO 305 application program using the command OUTDA.
[53]	MCO 4–20mA	The analog value is set by the MCO 305 application program using the command OUTDA.
[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. $\frac{20\ mA \times 22\ A}{38.4\ A} = 11.46 mA$ 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.

Option	Name	Description
[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 4–20mS	
[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 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. $\frac{16\ mA \times 22\ A}{38.4\ A} = 13.17 mA$ 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.

Option	Name	Description
[147]	Main act val	An output value based on main actual value from serial communication.
[148]	Main act val 4-20mA	An output value based on main actual value from serial communication.
[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.	An output value based on actual motor voltage.
[159]	Motor Volt. 4-20mA	An output value based on actual motor voltage.
[184]	Mirror AI53 mA	
[185]	Mirror AI54 mA	

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.

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%

$$10\text{mA}: \frac{20-4}{10} \times 100 = 160\%$$

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.

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.

6.8.8 6-7* Analog Output 3 MCB 113

This parameter group contains 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. The resolution of analog output is 12 bit.

6-70 Terminal X45/1 Output

Default value:	[0] No operation	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8		

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	The analog value is set by the MCO 305 application program using the command OUTDA.
[100]	Output frequency	0 Hz = 0 mA; 100 Hz = 20 mA.
[101]	Reference	Parameter ***3-00 Reference Range [-Max - 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. $\frac{20mA \times 22A}{38.4A} = 11.46mA$ 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 4–20mA	
[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. $\frac{16mA \times 22A}{38.4A} = 13.17mA$ 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	

Option	Name	Description
[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	

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***.

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):

$$\frac{I_{RANGE}[mA]}{I_{DESIREDMAX}[mA]} \times 100\,\% = \frac{20 - 4\ mA}{10\ mA} \times 100\,\% = 160\,\%$$

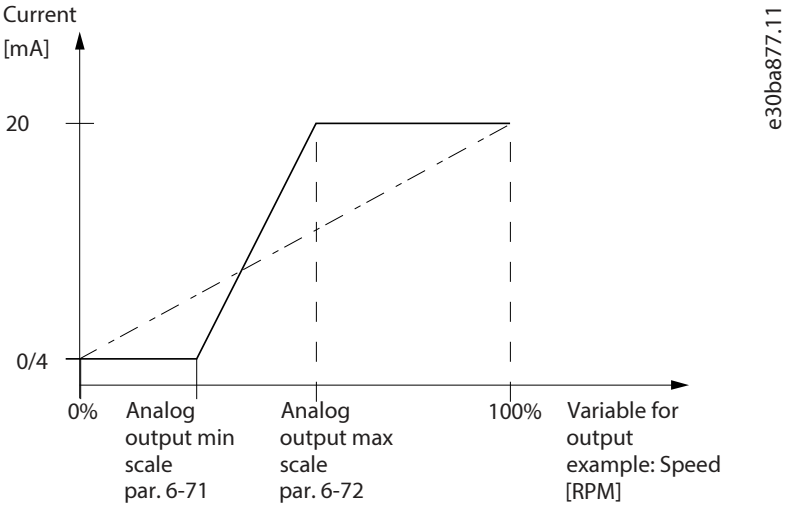


Figure 70: Output Maximum Scale

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.

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.

6.8.9 6-8* Analog Output 4 MCB 113

This parameter group contains parameters for configuring the scaling and limits for analog output 4, terminals X45/3 and X45/4. Analog outputs are current outputs, 0/4–40 mA. The resolution on the analog output is 11 bit.

6-80 Terminal X45/3 Output

Default value:	[0] No operation	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:Uint8	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	The analog value is set by the MCO 305 application program using the command OUTDA.
[100]	Output frequency	0 Hz = 0 mA; 100 Hz = 20 mA.

Option	Name	Description
[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. $\frac{20mA \times 22A}{38.4A} = 11.46mA$ 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.
[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. $\frac{16mA \times 22A}{38.4A} = 13.17mA$ If the normal motor current is equal to 20 mA, the output setting of parameter ***6-52 Terminal 42 Output Max Scale*** is: $\frac{I_{VLT,MAX} \times 100}{I_{Motor,Nom}} = \frac{38.4 \times 100}{22} = 175\,\%$

Option	Name	Description
[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	

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.

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):

$$\frac{I_{RANGE}[mA]}{I_{DESIREDMAX}[mA]} \times 100\,\% = \frac{20 - 4\ mA}{10\ mA} \times 100\,\% = 160\,\%$$

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.

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.

6.9 Parameter Group 7-** Controllers

6.9.1 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.

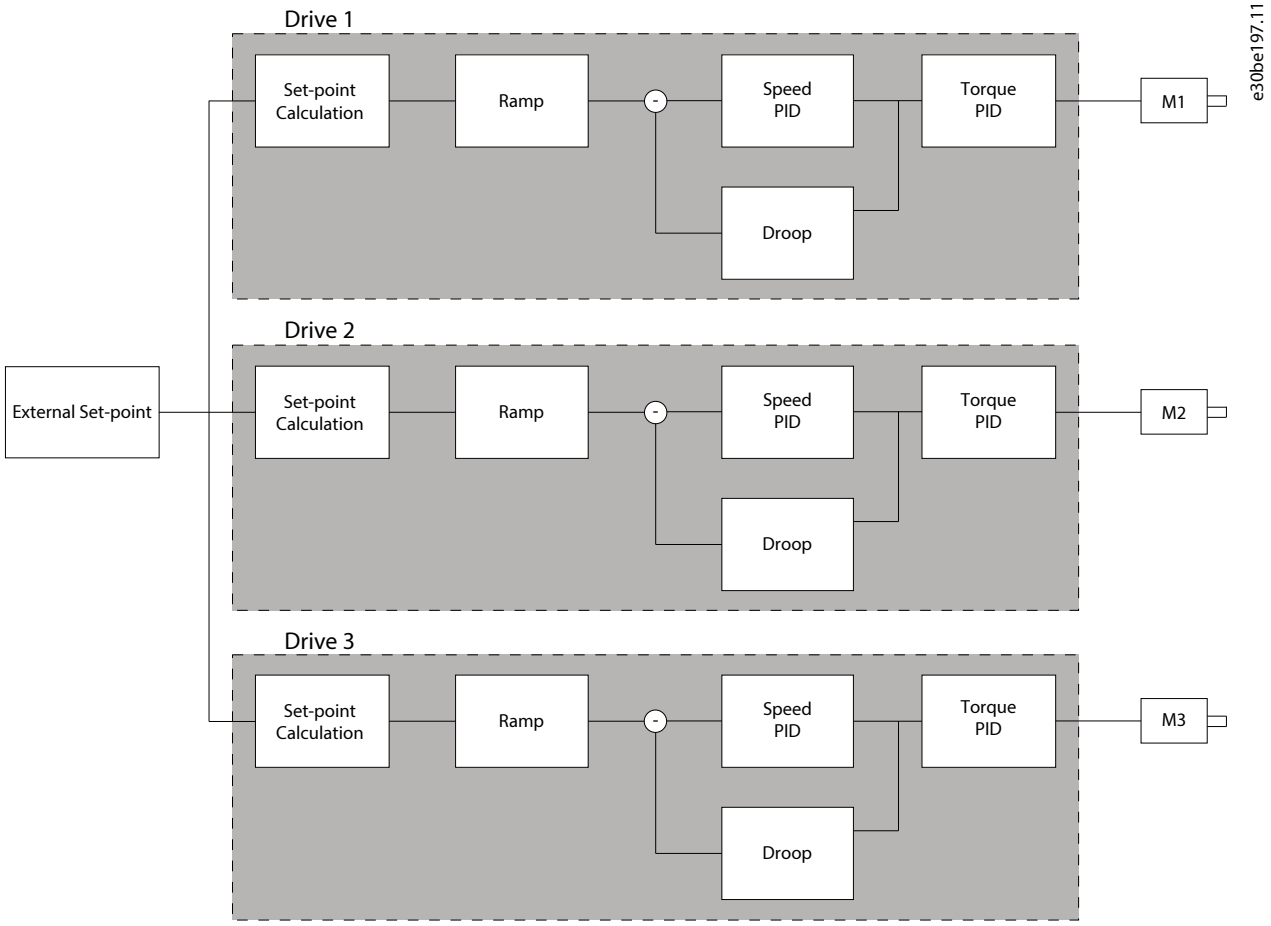


Figure 71: Concept of Speed PID Droop

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***.

NOTE: Do not use overvoltage control when using the PID droop function (select ***[0] Disabled*** in parameter ***2-17 Overvoltage Control***).

NOTE: 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.

6.9.2 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.

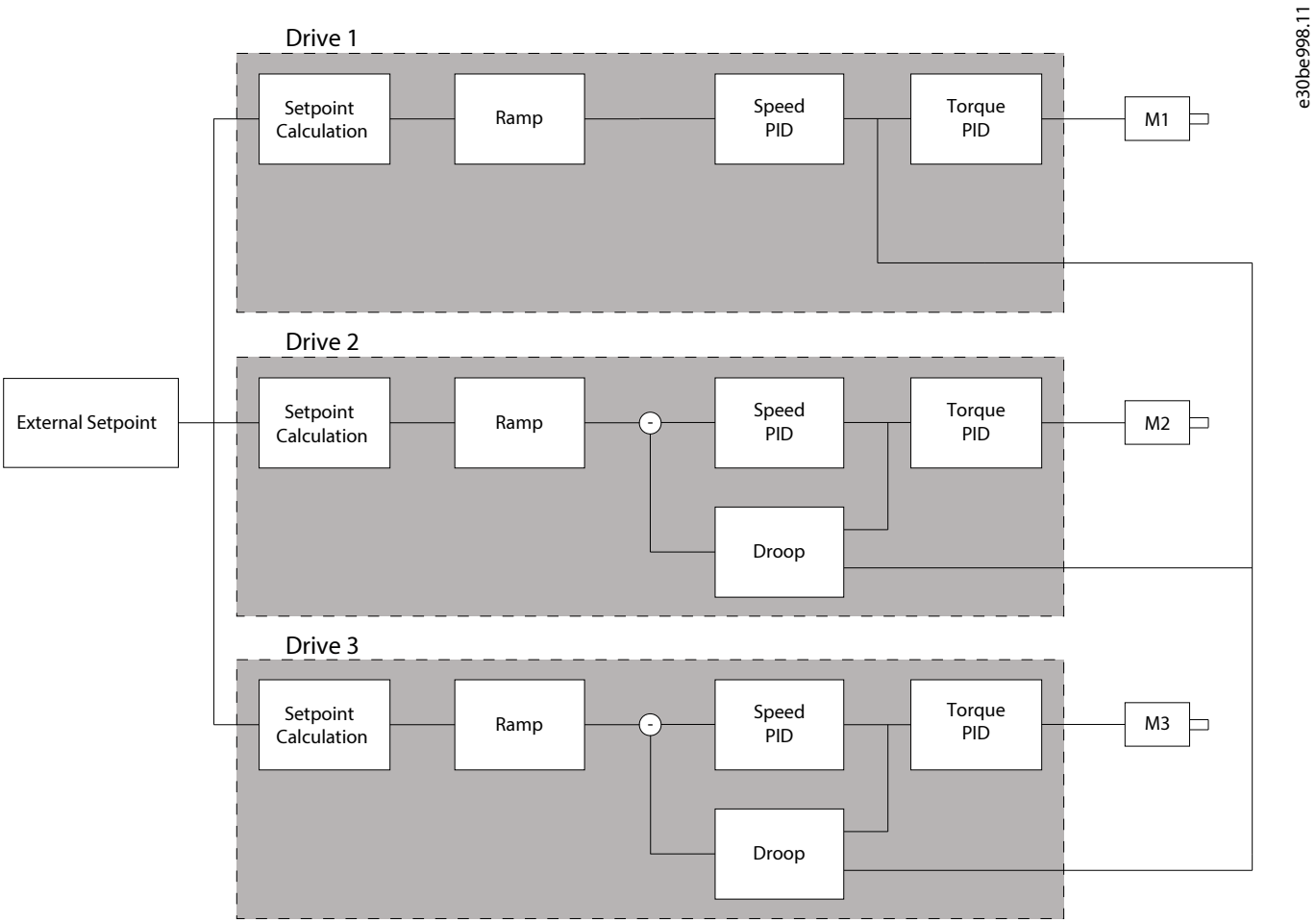


Figure 72: Concept of Speed Trim

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.

6.9.3 7-0* Speed PID Ctrl.

NOTE: If separate encoders are used, adjust the ramp-related parameters according to the gear ratio between 2 encoders.

7-00 Speed PID Feedback Source

Default value:	–	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	False

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 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	Feedback source from analog input 53.
[7]	Analog input 54	Feedback source from analog input 54.
[8]	Frequency input 29	Feedback source from frequency input 29.
[9]	Frequency input 33	Feedback source from frequency input 33.
[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***.
[20]	None	

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.

7-02 Speed PID Proportional Gain

Default value:	0.015	**Paramter 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***.

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***.

7-04 Speed PID Differentiation Time

Default value:	Size related	**Parameter type:**	Range, 0 - 200 ms
Setup:	Alll 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***.

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***.

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

NOTE: 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 38: 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

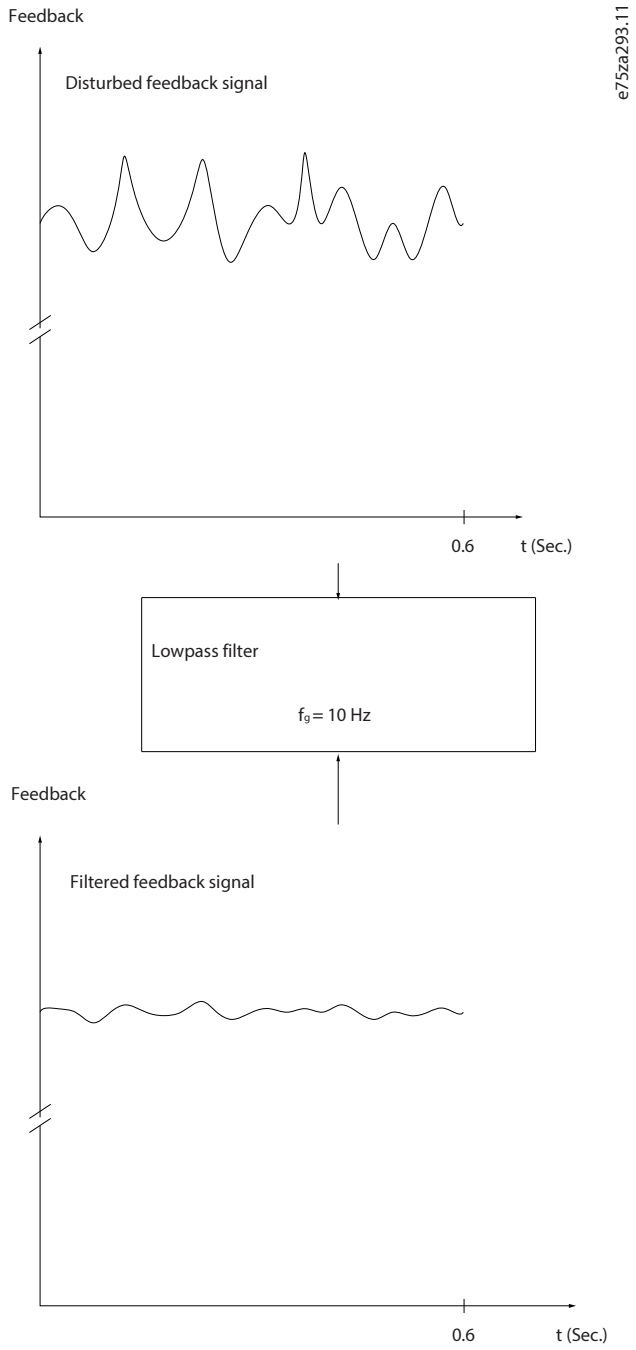


Figure 73: Feedback Signal

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.

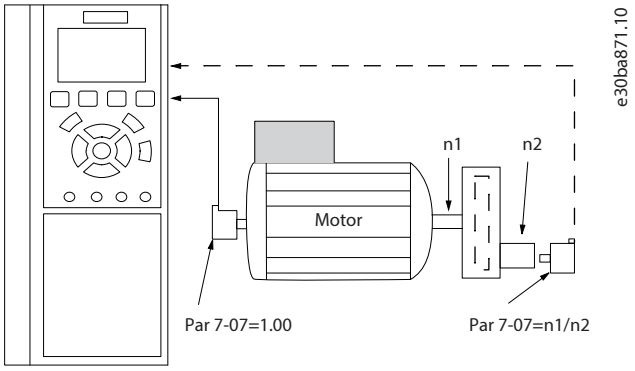


Figure 74: Speed PID Feedback Gear Ratio

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.

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.

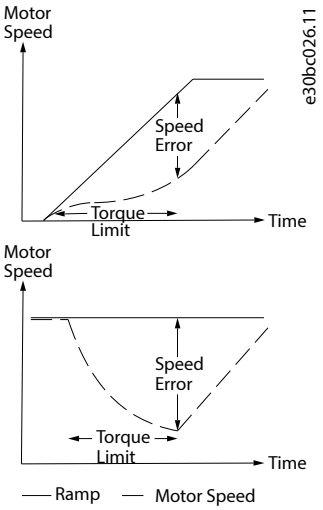


Figure 75: Speed Error Between Ramp and Actual Speed

6.9.4 7-1* Torque PI Control

This parameter group contains parameters for configuring the torque PI control.

7-10 Torque PID Feedback Source

Default value:	[0] Controller off	**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]*	Controller off	Select to operate in open loop.
[1]	Analog input 53	Select to use torque feedback from the analog input.
[2]	Analog input 54	Select to use torque feedback from the analog input.
[3]	Estimated torque	Select to use the torque feedback estimated by the drive.

7-12 Torque PI Proportional Gain

Default value:	100%	**Parameter type:**	Range, 0 - 500%
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

Enter the proportional gain value for the torque controller. Selection of a high value makes the controller react faster. Too high a setting leads to controller instability.

7-13 Torque PI Integration Time

Default value:	0.020 s	**Parameter type:**	Range, 0.002 - 2 s
Setup:	All setups	**Conversion index:**	-3
Data type:	Uint16	**Change during operation:**	True

Enter the integration time for the torque controller. Selection of a low value makes the controller react faster. Too low a setting leads to controller instability.

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.

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.

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.

6.9.5 7-2* Process Ctrl. Feedb.

Select the feedback sources for the process PID control and how this feedback should be handled.

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	
[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	
[99]	Normal feedback	

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	

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	
[99]	Normal feedback	

6.9.6 7-3* Process PID Ctrl.

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.

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.

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.

7-33 Process PID Proportional Gain

Default value:	Size related	**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.

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.

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.

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.

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***.

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.

6.9.7 7-4* Advanced 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***.

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.

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.

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.

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.***).

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.***).

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	
[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	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]).

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.

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***.

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.

6.9.8 7-5* Adv. Process PID II

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***.

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.

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.

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.

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.

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.

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 worsen dynamic performance.

6.10 Parameter Group 8-** Communications and Options

6.10.1 8-0* General Settings

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.

8-02 Control Word Source

Default value:	–	**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	Control via serial communication is disabled.
[1]	FC RS485	Control via RS485 terminals 68/69 on the control card.
[2]	FC USB	Control via USB on the control card.
[3]	Option A	Control via option A.
[4]	Option B	Control via option B.
[5]	Option C0	Control via option C0.
[6]	Option C1	Control via option C1.
[30]	External Can	Internal
[35]	Option A fast	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	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.

8-03 Control Word Timeout Time

Default value:	Size related	**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.

8-04 Control Word Timeout Function

Default value:	–	**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 is not updated within the time period specified in parameter ***8-03 Control Word Timeout Time***.

NOTE: 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: • Via the fieldbus. • Via [Reset]. • Via a digital input.
[6]	Qstop and trip	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	Only available with VLT® Motion Controller Option MCO 302.

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.

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.

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.	

8-08 Readout Filtering

Default value:	–	**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***

6.10.2 8-1* Ctrl. Word Settings

8-10 Control Word Profile

Default value:	–	**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	
[5]	ODVA	
[7]	CANopen DSP 402	
[8]	MCO	
[22]	PROFIdrive v4_2 profile	

8-13 Configurable Status Word STW

Default value:	–	**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***.

Option	Name	Description
[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 active.
[3]	Trip excl Alarm 68	
[9]	Vir. master on ref	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	
[19]	X30/4 DI status	
[20]	CTW timeout toggle inverse	
[21]	Thermal warning	
[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	

Option	Name	Description
[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 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	
[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	
[231]	In power lim. mot.	See parameter group *4-8* Power Limit*. Use this option in motor mode only.
[232]	In power lim. gen.	See parameter group *4-8* Power Limit*. Use this option in generating mode only.
[233]	In power limit	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.

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	
[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	

Option	Name	Description
[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	
[78]	Tracking error warning	
[89]	Mech brake sliding warning	
[163]	ATEX ETR cur limit warning	
[165]	ATEX ETR freq limit 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	

Option	Name	Description
[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	
[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	

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.

6.10.3 8-2* Counters

8-20 Invalid Memory Write Counter

Default value:	0 N/A	**Parameter type:**	Range (0 - 65535)
Setup:	1 setup	**Conversion index:**	–
Data type:	Uint16	**Change during operation:**	True

The error counter is incremented each time the Ethernet-based fieldbus options writes to an invalid memory.

6.10.4 8-3* FC Port Settings

8-30 Protocol

Default value:	–	**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	

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.

8-32 FC Port Baud Rate

Default value:	–	**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	

8-33 Parity/Stop Bits

Default value:	–	**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	

8-34 Estimated Cycle Time

Default value:	0 ms	**Parameter type:**	Range, 0 - 1000000 ms
Setup:	2 setups	**Conversion:**	-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.

8-35 Minimum Response Delay

Default value:	10 ms	**Parameter type:**	Range, 1 - 10000 ms
Setup:	1 setup	**Conversion index:**	-3
Data type:	Unt16	**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.

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.

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***.

8-39 Protocol/Profile Firmware Version

Default value:	0	**Parameter type:**	Range, 0 - 10, Array [8]
Setup:	All setups	**Conversion index:**	0
Data type:	VisStr [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

6.10.5 8-4* FC MC Protocol Select

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	
[108]	PPO 8	
[109]	PPO 9	

Option	Name	Description
[200]	Custom telegram 1	Enables use of freely configurable telegrams or standard telegrams for the FC port.
[202]	Custom telegram 3	

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	
[311]	Jog speed [Hz]	
[312]	Catch up/slow down value	
[319]	Jog speed [RPM]	
[330]	Min. speed ramp time	
[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	
[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 #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	
[1501]	Running hours	
[1502]	kWh counter	
[1583]	Motor Ud	
[1584]	Motor Uq	
[1585]	Motor Id	
[1586]	Motor Iq	
[1600]	Control word	
[1601]	Reference [unit]	
[1602]	Reference %	
[1603]	Status word	
[1605]	Main actual value [%]	
[1606]	Actual position	

Option	Name	Description
[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.	
[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	

Option	Name	Description
[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	
[1682]	Fieldbus REF 1	
[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	
[1767]	Raw inc. quad counter	

Option	Name	Description
[1768]	Raw abs. pos. low	
[1769]	Raw abs. pos. high	
[1804]	Mech brake count	
[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 out X49/7	
[1844]	Analog out X49/9	
[1845]	Analog out X49/11	
[1846]	X49 digital output [bin]	
[1847]	X9 digital output [bin]	
[1848]	Last warning count	
[1860]	Digital input 2	
[1861]	Temp. input X48 max	
[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	

Option	Name	Description
[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	
[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	
[3644]	Terminal X49/7 bus control	
[3654]	Terminal X49/9 bus control	
[3664]	Terminal X49/11 bus control	
[4027]	Back EMF voltage	
[4029]	B-EMF protection log readout	
[4030]	Acc. delta speed	
[4031]	Acc. delta time	
[4032]	Dec. delta speed	
[4033]	Dec. delta time	
[4034]	Error code	

Option	Name	Description
[4035]	DS402 Qstop	
[4036]	DS402 current actual	
[4280]	Safe option status	
[4281]	Safe option status 2	
[4282]	Safe control word	
[4283]	Safe status word	
[4285]	Active safe func.	
[4287]	Time until manual test	
[4520]	Type	
[4521]	Status	
[4523]	Baseline result info	
[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]	

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.

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.

8-45 BTM Transaction Command

Default value:	[0] Off	**Parameter type:**	Option

Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	False

NOTE: This parameter cannot be adjusted while the motor is running.

Option	Name	Description
[0]*	Off	
[1]	Write to active setup	
[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	**NOTE:** This option is only available with software version 9.XX and newer.
[5]	Write to setup 2	**NOTE:** This option is only available with software version 9.XX and newer.
[6]	Write to setup 3	**NOTE:** This option is only available with software version 9.XX and newer.
[7]	Write to setup 4	**NOTE:** This option is only available with software version 9.XX and newer.
[8]	Cancel BTM transaction	**NOTE:** This option is only available with software version 9.XX and newer. Abort any BTM activity. Parameters are not committed.

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.	

Option	Name	Description
[5]	Err. par. out of range	
[6]	Transaction failed	
[7]	SO config check	
[8]	SO config check done	

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.

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.

8-49 BTM Error Log

Defaul 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).

6.10.6 8-5* Digital/Bus

This parameter group contains parameters for configuring the control word merging.

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.

Option	Name	Description
[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.

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.

8-52 DC Brake Select

Default value:	–	**Parameter type:**	Option
Setup:	All seutps	**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.

NOTE: 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.

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.

8-54 Reversing Select

Default value:	–	**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.

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.

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.

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	

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	

6.10.7 8-8* FC Port Diagnostics

This parameter group contains parameters for monitoring the bus communication via the RS485 port terminals 68 and 69 on the drive.

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.

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.

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.

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.

6.10.8 8-9* Bus Jog

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.

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.

6.11 Parameter Group 9-** PROFIBUS

9-00 Setpoint

Default value:	0	**Parameter type:**	Range, 0 - 65535
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

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.

9-07 Actual Value

Default value:	0	**Parameter type:**	Range, 0 - 65535
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	False

This parameter delivers the MAV for a master class 2. The parameter is valid if the control priority is set to master class 2.

9-15 PCD Write Configuration

Default value:	–	**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
[0]	None	
[302]	Minimum reference	
[303]	Maximum reference	
[311]	Jog speed [Hz]	
[312]	Catch up/slow down value	
[319]	Jog speed [RPM]	
[330]	Min. speed ramp time	
[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 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]	

Option	Name	Description
[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	
[891]	Bus jog 2 speed	
[1680]	Fieldbus CTW 1	
[1681]	Fieldbus sync. REF	
[1682]	Fieldbus REF 1	
[1685]	FC port CTW 1	
[1686]	FC port REF 1	
[1688]	Fieldbus torque FF.	

9-16 PCD Read Configuration

Default value:	–	**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
[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	
[1500]	Operating hours	
[1501]	Running hours	
[1502]	kWh counter	
[1583]	Motor Ud	
[1584]	Motor Uq	
[1585]	Motor Id	
[1586]	Motor Iq	
[1600]	Control word	
[1601]	Reference [unit]	
[1602]	Reference %	
[1603]	Status word	
[1605]	Main actual value [%]	
[1606]	Actual position	
[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	

Option	Name	Description
[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	
[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]	

Option	Name	Description
[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	
[1767]	Raw inc. quad counter	
[1768]	Raw abs. pos. low	
[1769]	Raw abs. pos. high	
[1804]	Mech brake count	
[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	

Option	Name	Description
[1846]	X49 digital output [bin]	
[1847]	Last warning	
[1848]	Last warning count	
[1860]	Digital input 2	
[1861]	Temp. input X48 max	
[1899]	Speed PID torque FF. [Nm]	

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.

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	
[109]	PPO 9	

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	
[15]	Readout: actual setup	
[302]	Minimum reference	
[303]	Maximum reference	
[311]	Jog speed [Hz]	
[312]	Catch up/slow down value	
[319]	Jog speed [RPM]	
[330]	Mn. speed ramp time	
[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 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	

Option	Name	Description
[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	
[1583]	Motor Ud	
[1584]	Motor Uq	
[1585]	Motor Id	
[1586]	Motor Iq	
[1600]	Control word	
[1601]	Reference [unit]	
[1602]	Reference %	
[1603]	Status word	
[1605]	Main actual value [%]	
[1606]	Actual position	
[1609]	Custom readout	
[1610]	Power [kW]	
[1611]	Power [hp]	
[1612]	Motor voltage	
[1613]	Frequency	
[1614]	Motor current	
[1615]	Frequency [%]	

Option	Name	Description
[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	
[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]	

Option	Name	Description
[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	
[1682]	Fieldbus REF 1	
[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]	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	
[1767]	Raw. inc. quad counter	
[1768]	Raw abs. pos. low	
[1769]	Raw abl. pos. high	
[1804]	Mech brake count	
[1820]	Commanded position	
[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]	
[1847]	Last warning	
[1848]	Last warning count	
[1860]	Digital input 2	
[1861]	Temp. input X48 max	
[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	

Option	Name	Description
[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 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	
[4027]	Back EMF voltage	
[4029]	B-EMF protection log readout	
[4030]	Acc. delta speed	
[4031]	Acc. delta time	
[4032]	Dec. delta speed	
[4033]	Dec. delta time	
[4034]	Error code	
[4035]	DS402 Qstop	
[4036]	DS402 current actual	
[4280]	Safe option status	
[4281]	Safe option status 2	
[4282]	Safe control word	
[4283]	Safe status word	

Option	Name	Description
[4285]	Active safe func.	
[4287]	Time until manual test	
[4520]	Type	
[4521]	Status	
[4523]	Baseline failure	
[4590]	Stator [%]	
[4591]	Load [%]	
[4592]	Sensor 1 [%]	
[4593]	Sensor 1 [unit]	
[4594]	Sensor 2 [%]	
[4595]	Sensor 3 [unit]	
[4596]	Sensor 3 [%]	
[4597]	Sensor 3 [unit]	
[4598]	Sensor 4 [%]	
[4599]	Sensor 4 [unit]	

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	

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	

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:**	True

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.

9-45 Fault Code

Default value:	0	**Parameter type:**	Range, 0 - 0 N/A
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

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.

9-47 Fault Number

Default value:	0	**Parameter type:**	Range, 0 - 0 N/A
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

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.

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:**	True

Indicates the number of fault events that have occurred since the last reset or power-up.

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 39: 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.
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.

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	

9-64 Device Identification

Default value:	0	**Parameter type:**	Range, 0 - 0, Array [10]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

NOTE: 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)
[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

9-65 Profile Number

Default value:	0	**Parameter type:**	Range, 0 - 0
Setup:	All setups	**Conversion index:**	0
Data type:	OctStr[2]	**Change during operation:**	True

NOTE: 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.

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:**	False

This parameter accepts the control word from a master class 2 in the same format as PCD 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:**	True

This parameter delivers the status word for a master class 2 in the same format as PCD 2.

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	

9-71 PROFIBUS Save Data Value

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	

9-75 DO Identification

Default value:	0	**Parameter type:**	Range, 0 - 65535, Array [8]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

Provides information about the DO (direct object). This parameter is for PROFINET only.

9-80 Defined Parameters (1)

Default value:	0	**Parameter type:**	Range, 0 - 9999, Array [116]
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.

9-81 Defined Parameters (2)

Default value:	0	**Parameter type:**	Range, 0 - 9999, Array [116]
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.

9-82 Defined Parameters (3)

Default value:	0	**Parameter type:**	Range, 0 - 9999, Array [116]
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.

9-83 Defined Parameters (4)

Default value:	0	**Parameter type:**	Range, 0 - 9999, Array [116]
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.

9-84 Defined Parameters (5)

Default value:	0	**Parameter type:**	Range, 0 - 9999, Array [116]
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.

9-85 Defined Parameters (6)

Default value:	0	**Parameter type:**	Range, 0 - 9999, Array [116]
Setup:	All setup	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	False

This parameter shows a list of all the defined drive parameters available for PROFIBUS.

9-90 Changed Parameters (1)

Default value:	0	**Parameter type:**	Range, 0 - 9999, Array [116]
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.

9-91 Changed Parameters (2)

Default value:	0	**Parameter type:**	Range, 0 - 9999, Array [116]
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.

9-92 Changed Parameters (3)

Default value:	0	**Parameter type:**	Range, 0 - 9999, Array [116]
Setup:	All setups	**Conversion index:**	0
Change during operation:	False		

This parameters shows a list of all the drive parameters deviating from default setting.

9-93 Changed Parameters (4)

Default value:	0	**Parameter type:**	Range, 0 - 9999, Array [116]
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.

9-94 Changed Parameters (5)

Default value:	0	**Parameter type:**	Range, 0 - 9999, Array [116]
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.

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:**	True

Readout of revision count.

6.12 Parameter Group 10-** CAN Fieldbus

6.12.1 10-0* Common Settings

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	

10-01 Baud Rate Select

Default value:	–	**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	
[20]	125 Kbps	
[21]	250 Kbps	
[22]	500 Kbps	

10-02 MAC ID

Default value:	Size related	**Parameter type:**	Range, 1 - 127 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.

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.

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.

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

View the number of fieldbus off events since the last power-up.

6.12.2 10-1* DeviceNet

10-10 Process Data Type Selection

Default value:	–	**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 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.

NOTE: 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	

10-11 Process Data Config Write

Default value:	Size related	**Parameter type:**	Option, Array [4]
Setup:	All setups	**Conversion index:**	–
Data type:	Uint16	**Change during operation:**	True

Option	Name	Description
[0]	None	
[302]	Minimum reference	
[303]	Maximum reference	
[311]	Jog speed [Hz]	
[312]	Catch up/slow down value	
[319]	Jog speed [RPM]	
[330]	Min. speed ramp time	
[341]	Ramp 1 ramp up time	
[342]	Ramp 1 ramp down time	

Option	Name	Description
[351]	Ramp 2 ramp up time	
[352]	Ramp 2 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	
[708]	Speed PID feed forward factor	
[748]	PCD feed forward	
[890]	Bus jog 1 speed	
[891]	Bus jog 2 speed	
[1680]	Fieldbus CTW 1	

Option	Name	Description
[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.	

10-12 Process Data Config Read

Default value:	Size related	**Parameter type:**	Option, Array [4]
Setup:	All setups	**Conversion index:**	–
Data type:	Uint16	**Chagne during operation:**	True

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	
[1500]	Operating hours	
[1501]	Running hours	
[1502]	kWh counter	
[1583]	Motor Ud	
[1584]	Motor Uq	
[1585]	Motor Id	
[1586]	Motor Iq	
[1600]	Control word	
[1601]	Reference [unit]	
[1602]	Reference %	
[1603]	Status word	
[1605]	Main actual value [%]	
[1606]	Actual position	
[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	
[1657]	Feedback [RPM]	
[1660]	Digital input	
[1661]	Terminal 53 switch setting	
[1662]	Analog input 53	
[1663]	Terminal 54 switch setting	

Option	Name	Description
[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	
[1698]	Warning word 3	
[1767]	Raw inc. quad counter	
[1768]	Raw abs. pos. low	
[1769]	Raw abs. pos. high	
[1804]	Mech brake count	
[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	

Option	Name	Description
[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]	
[1847]	Last warning	
[1848]	Last warning count	
[1860]	Digital input 2	
[1861]	Temp. input X48 max	
[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	

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	
[4027]	Back EMF voltage	
[4029]	B-EMF protection log readout	
[4030]	Acc. delta speed	
[4031]	Acc. delta time	
[4032]	Dec. delta speed	
[4033]	Dec. delta time	
[4034]	Error code	
[4035]	DS402 Qstop	
[4036]	DS402 actual current	
[4280]	Safe option status	
[4281]	Safe option status 2	
[4282]	Safe control word	
[4283]	Safe status word	
[4285]	Active safe func.	
[4287]	Time until manual reset	
[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]	

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 40: 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

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	

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	

6.12.3 10-2* COS Filters

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.

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.

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.

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.

6.12.4 10-3* Parameter Access

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.

10-31 Store Data Value

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	Deactivates the non-volatile storage function.
[1]	Store edit setup	Stores all parameter values from the active setups in the non-volatile memory. The selection returns to ***[0] Off*** when all values have been stored.
[2]	Store all setups	Stores all parameter values for all setups in the non-volatile memory. The selection returns to ***[0] Off*** when all parameter values have been stored.

10-32 Devicenet Revision

Default value:	0	**Parameter type:**	Range, 0 - 65535, Array 2
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.

10-33 Store Always

Default value:	[0] Off	**Parameter type:**	Option
Setup:	1 setup	**Conversion index:**	–
Data value:	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	Deactivates non-volatile storage of data.
[1]	On	Stores parameter data received via VLT® DeviceNet MCA 104 in EEPROM non-volatile memory as default.

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.

10-39 Devicenet F Parameters

Default value:	0	**Parameter type:**	Range, 0 - 0, Array [1000]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	True

Use this parameter to configure the drive via DeviceNet and build the EDS file.

6.12.5 10-5* CANopen

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
[0]	None	
[302]	Minimum reference	
[303]	Maximum reference	
[311]	Jog speed [Hz]	
[312]	Catch up/slow down value	
[319]	Jog speed [RPM]	
[330]	Min. speed ramp time	
[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 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]	

Option	Name	Description
[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.	

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
[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	
[1500]	Operating hours	
[1501]	Running hours	
[1502]	kWh counter	
[1583]	Motor Ud	
[1584]	Motor Uq	
[1585]	Motor Id	
[1586]	Motor Iq	
[1600]	Control word	
[1601]	Reference [unit]	
[1602]	Reference %	
[1603]	Status word	
[1605]	Main actual value [%]	
[1606]	Actual position	
[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	

Option	Name	Description
[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]	
[1671]	Relay output [bin]	
[1672]	Counter A	
[1673]	Counter B	
[1674]	Prec. stop counter	
[1675]	Analog in X30/11	
[1676]	Analog in X30/12	

Option	Name	Description
[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	
[1767]	Raw inc. quad counter	
[1768]	Raw abs. pos. low	
[1769]	Raw abs. pos. high	
[1804]	Mech brake count	
[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]	
[1847]	Last warning	
[1848]	Last warning counter	
[1860]	Digital input 2	

Option	Name	Description
[1861]	Temp. input X48 max	
[1899]	Speed PID torque FF. [Nm]	

6.13 Parameter Group 12-** Ethernet

6.13.1 12-0* IP Settings

12-00 IP Address Assignment

Default value:	–	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Select the method for assigning the IP address.

Option	Name	Description
[0]	Manual	Set the IP address in parameter ***12-01 IP Address***.
[1]	DHCP	Assign the IP address via DHCP server.
[2]	BOOTP	Assign the IP address via BOOTP server.
[10]	DCP	Assign the IP address via DCP server.
[20]	From node ID	

12-01 IP Address

Default value:	0	**Parameter type:**	Range, 0 - 4294967295
Setup:	1 setup	**Conversion index:**	0
Data type:	OctStr[4]	**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 by of parameter ***12-60 Node ID*** and the 1st part is fixed to 192.168.100 (node ID).

12-02 Subnet Mask

Default value:	0	**Parameter type:**	Range, 0 - 4294967295
Setup:	1 setup	**Conversion index:**	0
Data type:	OctStr[4]	**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***.

12-03 Default Gateway

Default value:	0	**Parameter type:**	Range, 0 - 4294967295
Setup:	1 setup	**Conversion index:**	0
Data type:	OctStr[4]	**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.

12-04 DHCP Server

Default value:	0	**Parameter type:**	Range, 0 - 2147483647
Setup:	All setups	**Conversion index:**	0
Data type:	OctStr[4]	**Change during operation:**	True

NOTE: 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.

12-05 Lease Expires

Default value:	Size related	**Parameter type:**	Range, 0 - 0
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.

12-06 Name Servers

Default value:	0	**Parameter type:**	Range, 0 -4294967295, Array [2]
Setup:	1 setup	**Conversion index:**	0
Data type:	OctStr[4]	**Change during operation:**	True

IP addresses of the domain name servers. Can be automatically assigned when using DHCP.

12-07 Domain Name

Default value:	0	**Parameter type:**	Range, 0 - 48
Setup:	1 setup	**Conversion index:**	0
Data type:	VisStr[48]	**Change during operation:**	True

Domain name of the attached network. Can be automatically assigned when using DHCP network.

12-08 Host Name

Default value:	0	**Parameter type:**	Range, 0 - 48
Setup:	1 setup	**Conversion index:**	0
Data type:	VisStr[48]	**Change during operation:**	True

NOTE: The display of the drive only shows the 1st 19 characters, but the remaining characters are stored in the drive.

Logical (given) name of the option.

12-09 Physical Address

Default value:	0	**Parameter type:**	Range, 0 - 17
Setup:	1 setup	**Conversion index:**	0
Data type:	VisStr[17]	**Change during operation:**	True

This parameter is read-only. It shows the physical (MAC) address of the option.

6.13.2 12-1* Ethernet Link Parameters

12-10 Link Status

Default value:	[0] No link	**Parameter type:**	Option, Array [2]
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	

12-11 Link Duration

Default value:	Size related	**Parameter type:**	Range, 0 - 0, Array [2]
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.

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	

12-13 Link Speed

Default value:	–	**Parameter type:**	Option, Array [2]
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Forces the link speed for each port 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	

12-14 Link Duplex

Default value:	–	**Parameter type:**	Option, Array [2]
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

NOTE: 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	

12-18 Supervisor MAC

Default value:	0	**Parameter type:**	Range, 0 - 2147483647, Array [2]
Setup:	2 setups	**Conversion index:**	0
Data type:	OctStr[6]	**Change during operation:**	True

MAC addresses of currently active supervisors.

12-19 Supervisor IP Addr.

Default value:	0	**Parameter type:**	Range, 0 - 2147483647, Array [2]
Setup:	2 setups	**Conversion index:**	0
Data type:	OctStr[4]	**Change during operation:**	True

IP addresses of currently active supervisors.

6.13.3 12-2* Process Data

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).

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
[0]	None	
[302]	Minimum reference	
[303]	Maximum reference	
[311]	Jog speed [Hz]	
[312]	Catch up/slow down value	
[319]	Jog speed [RPM]	
[330]	Min. speed ramp time	
[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 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	

Option	Name	Description
[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	
[1682]	Fieldbus REF 1	
[1685]	FC port CTW 1	
[1686]	FC port REF 1	
[1688]	Fieldbus torque FF.	

12-22 Process Data Config Read

Default value:	–	**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	
[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	
[1583]	Motor Ud	

Option	Name	Description
[1584]	Motor Uq	
[1585]	Motor Id	
[1586]	Motor Iq	
[1600]	Control word	
[1601]	Reference [unit]	
[1602]	Reference %	
[1603]	Status word	
[1605]	Main actual value [%]	
[1606]	Actual position	
[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	
[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	

Option	Name	Description
[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]	
[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	

Option	Name	Description
[1696]	Maintenance word	
[1697]	Alarm word 3	
[1698]	Warning word 3	
[1767]	Raw inc. quad counter	
[1768]	Raw abs. pos. low	
[1769]	Raw abs. pos. high	
[1804]	Mech brake count	
[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]	
[1847]	Last warning	
[1848]	Last warning counter	
[1860]	Digital input 2	
[1861]	Temp. input X48 max	
[1899]	Speed PID torque FF. [Nm]	

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

NOTE: This parameter is only valid for EtherCat.

Use this parameter to configure the PCD write size in bits. Only values of multiples of 8 are valid.

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

NOTE: This parameter is only valid for EtherCAT.

Use this parameter to configure the PCD read size in bits. Only values of multiples of 8 are valid.

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	

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	

6.13.4 12-3* EtherNet/IP

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 41: 16-Bit Status Word, EtherNet/IP

Bit	Description
0	Owned
1	Not used

Table 41: 16-Bit Status Word, EtherNet/IP (continued)

Bit	Description
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

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	

12-32 Net Control

Default value:	[0] Off	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uin8	**Change during operation:**	True

Shows the control source in instance 21/71.

Option	Name	Description
[0]*	Off	
[1]	On	

12-33 CIP Revision

Default value:	Size related	**Parameter type:**	Range, 0 - 65535, Array [2]
Setup:	All setups	**Conversion index:**	0

Data type:	Uint16	**Change during operation:**	True

This parameter is read-only. It shows the CIP version of the option software.

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.

12-35 EDS Parameter

Default value:	0	**Parameter type:**	Range, 0 - 0, Array [1000]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	True

This parameter is used to configure the drive via DeviceNet and build the EDS-file.

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.

12-38 COS Filter

Default value:	0	**Parameter type:**	Range, 0 - 65535, Array [10]
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.

6.13.5 12-4* Modbus TCP

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 42: 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

12-41 Slave Message Count

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 number of Modbus messages received and processed by the follower drive.

12-42 Slave Exception Message

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.

6.13.6 12-4* Fieldbus Extension

12-49 Ethernet Extended Status

Default value:	0	**Parameter type:**	Range, 0 - 0xFFFFFFFF, Array [8]
Setup:	1 setup	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	True

This parameter provides extra information from Ethernet-based communication.

6.13.7 12-5* EtherCAT

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.

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.

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 43: 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	–	–

Table 43: Bit Interpretation (continued)

Bit	Description	Bit = [0]	Bit = [1]
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
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	–	–

6.13.8 12-6* Ethernet POWERLINK

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.

12-62 SDO Timeout

Default value:	15000 ms	**Parameter type:**	Range, 0 - 2000000000 ms
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.

12-66 Threshold

Default value:	15	**Parameter type:**	Range, 0 - 2000000000, Array [6]
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***.

12-67 Threshold Counters

Default value:	0	**Parameter type:**	Range, 0 - 4294967295, Array [6]
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.

12-68 Cumulative Counters

Default value:	0	**Parameter type:**	Range, 0 - 2147483647, Array [6]
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.

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.

6.13.9 12-8* Other Ethernet Services

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	

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	Disable the built-in HTTP (web) server.
[1]	Enabled	Enable the built-in HTTP (web) 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	Disable the built-in HTTP (web) server.
[1]	Enabled	Enable the built-in HTTP (web) server.

12-82 SMTP Service

Default value:	[0] Disabled	**Parameter type:**	Option
Setup:	All 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	Disable the SMTP (e-mail) service on the option.
[1]	Enabled	Enable the SMTP (e-mail) service on the option.

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	Disable the SNMP agent.
[1]*	Enabled	Enable the SNMP agent.

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	

12-85 ACD Last Conflict

Default value:	0	**Parameter type:**	Range, 0 - 2147483647
Setup:	2 setups	**Comversion index:**	0
Data type:	OctStr[35]	**Change during operation:**	True

The name of the IP address causing the most recent address conflict.

12-89 Transparent Socket Channel Port

Default value:	Size related	**Parameter type:**	Range, 0 - 65535
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.

6.13.10 12-9* Advanced Ethernet Services

12-90 Cable Diagnostics

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.

NOTE: 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

Default value:	[1] Enabled	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

NOTE: Disabling of the auto-crossover function requires crossed Ethernet cables for daisy-chaining the options.

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

12-92 IGMP Snooping

Default value:	[1] Enabled	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Enabling the IGMP snooping function prevents flooding of the Ethernet protocol stack. Multicast packets are only forwarded to ports that are a member of the multicast group.

Option	Name	Description
[0]	Disabled	The IGMP snooping function is disabled.
[1]*	Enabled	The IGMP snooping function is enabled.

12-93 Cable Error Length

Default value:	0	**Parameter type:**	Range, 0 - 65535, Array [2]
Setup:	1 setup	**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.

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.

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.

12-96 Port Config

Default value:	–	**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	

12-97 QoS Priority

Default value:	Size related	**Parameter type:**	Range, 0 - 63, Array [7]
Setup:	2 setups	**Conversion index:**	0
Data type:	Int8	**Change during operation:**	True

Each index sets the DSCP value of different types of QoS prioritized messages.

12-98 Interface Counters

Default value:	4000	**Parameter type:**	Range, 0 - 4294967296, Array [10]
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.

12-99 Media Counters

Default value:	0	**Parameter type:**	Range, 0 - 4294967296, Array [10]
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.

6.14 Parameter Group 13-** Smart Logic Control

6.14.1 Introduction to Smart Logic Control

With SLC, it is possible to run up to 4 sequences in parallel. Link between the sequences to create customer- and application-specific behaviors by using logic rules. In active fire mode/emergency mode, operation related to the motor control is disabled.

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:

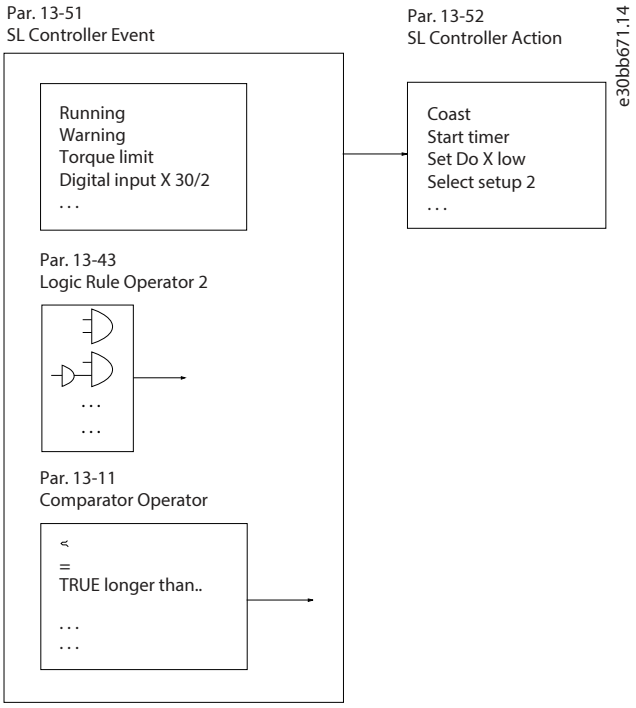


Figure 76: Smart Logic Control (SLC)

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.

NOTE: Comparators, flip-flops, timers, and logic rules are shared between sequences.

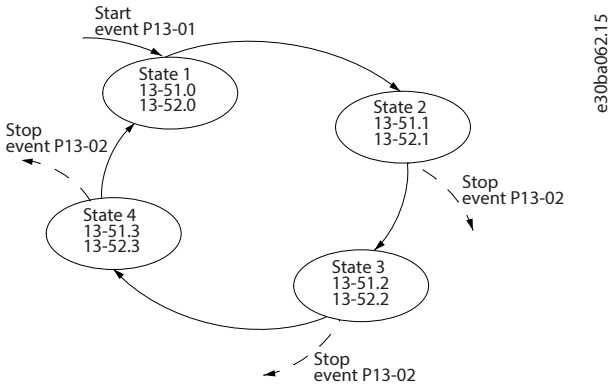


Figure 77: Example of Events and Actions

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. ***13-03 Reset SLC***resets all SLC parameters and starts programming from scratch.

NOTE: SLC is only active in auto-on mode, not in hand-on mode.

6.14.2 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.

13-00 SL Controller Mode

Default value:	–	**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.

13-01 Start Event

Default value:	–	**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.

Option	Name	Description
[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.
[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	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).
[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*.

Option	Name	Description
[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	
[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*.

13-02 Stop Event

Default value:	–	**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	

Option	Name	Description
[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 timeout 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	
[44]	Reset key	
[45]	Left key	
[46]	Right key	
[47]	Up key	

Option	Name	Description
[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	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).
[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).
[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 1*3-1* 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	
[228]	Comparator 6	Use the result of comparator 6.
[229]	Comparator 7	Use the result of comparator 7.
[230]	Comarator 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.
[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	

13-03 Reset SLC

Default value:	[0] Do 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*

6.14.3 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.

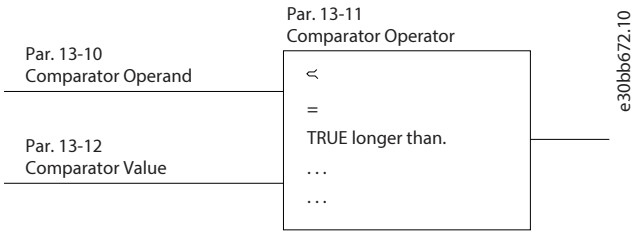


Figure 78: Comparators

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.

13-10 Comparator Operand

Default value:	–	**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 %.

Option	Name	Description
[14]	Analog input AIFB10	AIFB10 is internal 10 V supply.
[15]	Analog input AIS24V	AIS24V is a 24 V switch mode power supply.
[17]	Analog input AICCT	Value is in degrees. AICCT is control card temperature.
[18]	Pulse input FI29	The value is in %.
[19]	Pulse input FI33	The value is in %.
[20]	Alarm number	Shows the actual alarm number. **NOTE:** With this selection, it is not possible to use < and > as comparator operators. **NOTE:** 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. **NOTE:** With this selection, it is not possible to use < and > as comparator operators. **NOTE:** 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	
[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.

Option	Name	Description
[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.

Option	Name	Description
[90]	Bus OK	Active communication (no timeout) via the serial communication port.
[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	
[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.
[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.

Option	Name	Description
[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	
[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.

Option	Name	Description
[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	
[249]	Therm. sensor temp.	

13-11 Comparator Operator

Default value:	–	**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]	<	**NOTE:** If ***[20] Alarm number*** or ***[21] Warning number*** is selected in parameter ***13-10 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]	>	**NOTE:** If *[20] Alarm number* or *[21] Warning number* is selected in parameter *13-10 Comparator Operand*, *[2]* > cannot be selected in this parameter. Inverse logic of option *[0]* <.
[5]	TRUE longer than..	
[6]	FALSE longerthan..	
[7]	TRUE shorter than..	
[8]	FALSE shorter than..	

13-12 Comparator Value

Default value:	Size related	**Parameter type:**	Range, -10000.000 - 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.

6.14.4 13-1* RS Flip Flops

The reset/set flip flops hold the signal until set/reset.

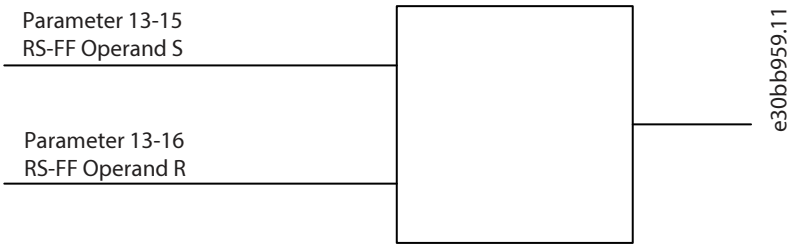


Figure 79: Reset/Set Flip Flops

Two parameters are used and the output can be used in the logic rules and as events.

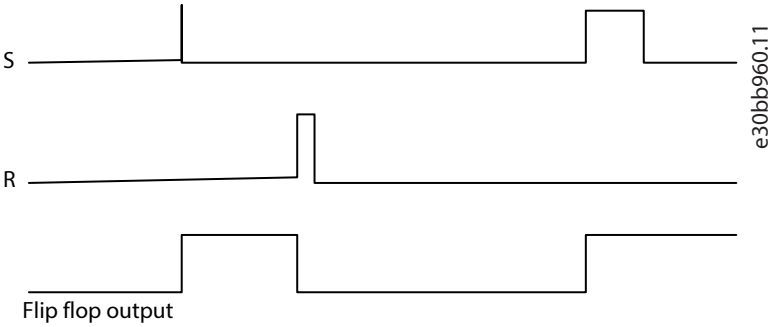


Figure 80: Flip Flop Outputs

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 44: 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 Logic Rule Operator 1*** [0].
Parameter ***13-16 RS-FF Operand R*** [0]	***[27] Logic rule 1***	Output from parameter ***13-41 Logic 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 ***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***	–

13-15 RS-FF Operand S

Default value:	–	**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	

Option	Name	Description
[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	
[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.

Option	Name	Description
[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	
[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	

Option	Name	Description
[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	
[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	

13-16 RS-FF Operand R

Default value:	–	**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	

Option	Name	Description
[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	
[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	

Option	Name	Description
[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	
[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	

Option	Name	Description
[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	
[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	

6.14.5 13-2* Timers

Use the result (true or false) from timers directly to define an event (see parameter ***13-51 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 indexes 0–9. Select index 0 to program timer 0, select index 1 to program timer 1, and so on.

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.

6.14.6 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***.

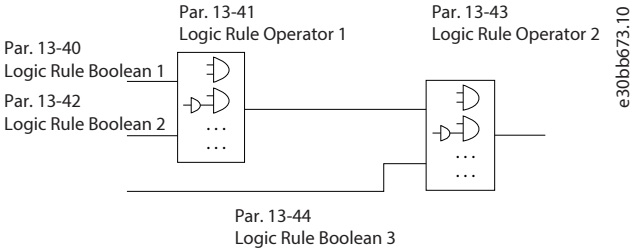


Figure 81: Logic Rules

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.

13-40 Logic Rule Boolean 1

Default value:	–	**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	

Option	Name	Description
[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	
[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	

Option	Name	Description
[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	
[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.

Option	Name	Description
[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	
[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	

Option	Name	Description
[244]	SL digital output E	
[245]	SL digital output F	

13-41 Logic Rule Operator 1

Default value:	–	**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 1***3-44 Logic Rule Boolean 3***.
[1]	AND	Evaluates the expression [13-40] AND [13-42].
[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].

13-42 Logic Rule Boolean 2

Default value:	–	**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	

Option	Name	Description
[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	
[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.

Option	Name	Description
[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	
[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*.

Option	Name	Description
[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	
[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	

13-43 Logic Rule Operator 2

Default value:	–	**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	

13-44 Logic Rule Boolean 3

Default value:	–	**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*** 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	

Option	Name	Description
[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	
[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.

Option	Name	Description
[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*.
[97]	RS Flipflop 3	See parameter group *13-1* Comparators*.
[98]	RS Flipflop 4	See parameter group *13-1* Comparators*.

Option	Name	Description
[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	
[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	

6.14.7 13-5* States

13-51 SL Controller 1 Event

Default value:	–	**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	
[31]	SL time-out 1	
[32]	SL time-out 2	
[33]	Digital input DI18	
[34]	Digital input DI19	

Option	Name	Description
[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	
[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.

Option	Name	Description
[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	
[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	

Option	Name	Description
[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	

13-52 SL Controller 1 Action

Default value:	–	**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.

Option	Name	Description
[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.
[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.

Option	Name	Description
[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.
[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.
[75]	Start timer 8	Starts timer 8, see parameter ***13-20 SL Controller Timer*** for further description.
[76]	Start timer 9	Starts timer 9, see parameter ***13-20 SL Controller Timer*** for further description.

13-53 SL Controller 2 Event

Default value:	–	**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	

Option	Name	Description
[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	
[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.

Option	Name	Description
[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	
[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	
[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	

13-54 SL Controller 2 Action

Default value:	–	**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.
[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.

Option	Name	Description
[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.
[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.

Option	Name	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.
[75]	Start timer 8	Starts timer 8, see parameter ***13-20 SL Controller Timer*** for further description.
[76]	Start timer 9	Starts timer 9, see parameter ***13-20 SL Controller Timer*** for further description.

13-55 SL Controller 3 Event

Default value:	–	**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	

Option	Name	Description
[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	
[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	

Option	Name	Description
[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*.
[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.

Option	Name	Description
[109]	Relay 8	X34/VLT® Relay Card MCB 105.
[110]	Relay 9	X34/VLT® Relay Card MCB 105.
[212]	Emergency mode	
[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	

13-56 SL Controller 3 Action

Default value:	–	**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.

Option	Name	Description
[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.
[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.

Option	Name	Description
[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.
[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.
[75]	Start timer 8	Starts timer 8, see parameter ***13-20 SL Controller Timer*** for further description.
[76]	Start timer 9	Starts timer 9, see parameter ***13-20 SL Controller Timer*** for further description.

13-57 SL Controller 4 Event

Default value:	–	**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	

Option	Name	Description
[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	
[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	
[80]	Digital input X46/3	
[81]	Digital input X46/5	
[82]	Digital input X46/7	
[83]	Digital input X46/9	

Option	Name	Description
[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	
[228]	Comparator 6	
[229]	Comparator 7	
[230]	Comparator 8	
[231]	Comparator 9	
[232]	Logic rule 6	
[233]	Logic rule 7	
[234]	Logic rule 8	

Option	Name	Description
[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	

13-58 SL Controller 4 Action

Default value:	–	**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.

Option	Name	Description
[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.
[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.

Option	Name	Description
[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.
[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.
[75]	Start timer 8	Starts timer 8, see parameter ***13-20 SL Controller Timer*** for further description.
[76]	Start timer 9	Starts timer 9, see parameter ***13-20 SL Controller Timer*** for further description.

6.14.8 13-9* User-defined Alerts

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 1***3-90 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 45: 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

Table 45: Example of Setting up Triggers, Actions, and Readouts (continued)

ID	Name	Setup 1
1392.1	Alert Text	Dig In 32
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].

NOTE: 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*.

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	
[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	
[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	

Option	Name	Description
[237]	SL time-out 9	
[238]	RS flipflop 8	
[239]	RS flipflop 9	

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

NOTE: 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 trip w manual reset	
[12]	Trip	
[13]	Trip w manual reset	
[14]	Trip lock	

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 defined in parameter ***13-90 Alert Trigger*** occurs.

6.14.9 13-9* User-defined Readouts

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.

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.

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.

6.15 Parameter Group 14-** Special Functions

6.15.1 14-0* Inverter Switching

14-00 Switching Pattern

Default value:	–	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Select the switching pattern: 60° AVM or SFAVM.

NOTE: The drive may adjust the switching pattern automatically to avoid a trip.

Option	Name	Description
[0]	60 AVM	
[1]	SFAVM	

14-01 Switching Frequency

Default value:	–	**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 rating.

NOTE: The output frequency value of the drive must not 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.

NOTE: 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 hp], 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	
[12]	12.0 kHz	
[13]	14.0 kHz	
[14]	16.0 kHz	

14-02 Switching Pattern Shift Frequency

Default value:	Size related	**Parameter type:**	Range, 15 - 590 Hz
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	False

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***.

14-03 Overmodulation

Default value:	–	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–

Data type:	Uint8	**Change during operation:**	False

NOTE: 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***.

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.

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.

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.

6.15.2 14-1* Mains On/Off

This parameter group contains 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.

14-10 Mains Failure

Default value:	–	**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***

NOTE: 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

Option	Name	Description
		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.

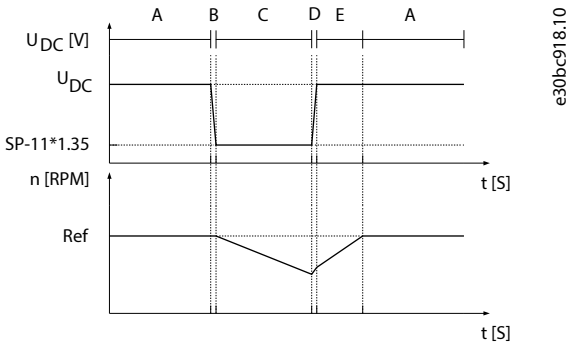


Figure 82: Kinetic Backup

A	Normal operation	**B**	Mains failure
C	Kinetic back-up	**D**	Mains return
E	Normal operation: Ramping		

The DC level during ***[4] Kinetic back-up*** 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.

Option	Name	Description
		• 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 the motor runs 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.
[6]	Alarm	
[7]	Kin. back-up, trip w recovery	This option is valid in VVC+ only. Kinetic backup with recovery combines the features of kinetic backup and kinetic backup with trip. This feature makes it possible to select between kinetic back-up and kinetic backup 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 backup 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.

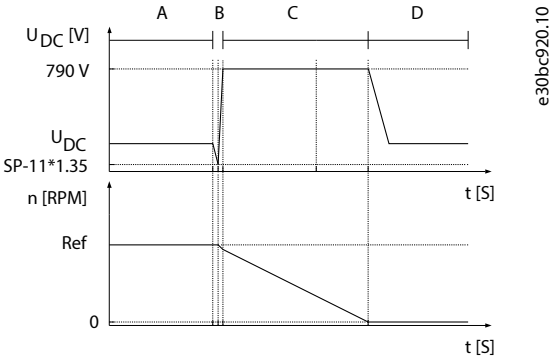


Figure 83: Kinetic Backup Trip

A	Normal operation	**B**	Mains failure
C	Kinetic backup	**D**	Trip

Option	Name	Description

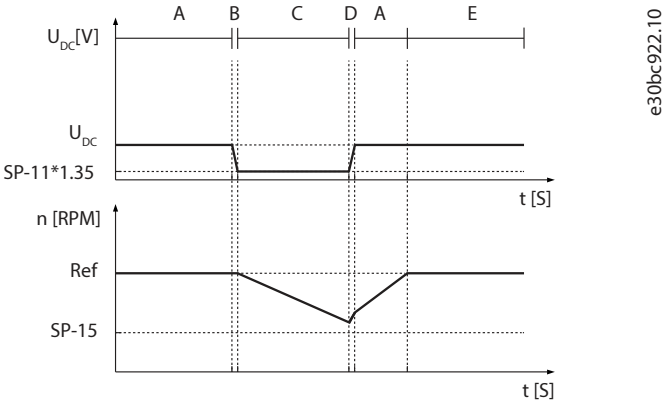


Figure 84: Kinetic Backup Trip w/Recovery, Mains Returns Above Parameter *14-15 Kin. Back-up Trip Recovery Level*

A	Normal operation	**B**	Mains failure
C	Kinetic backup	**D**	Mains return
E	Normal operation: Ramping		

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).

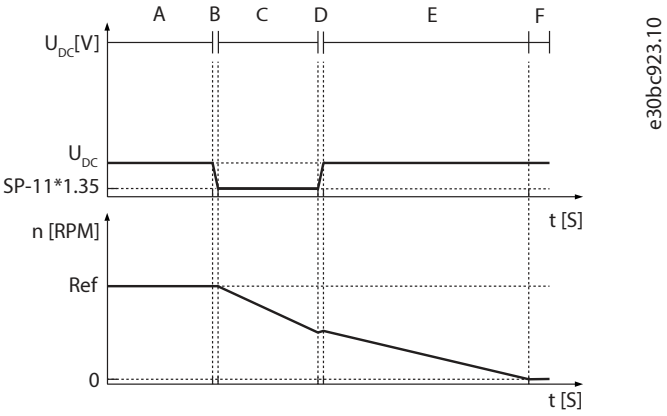
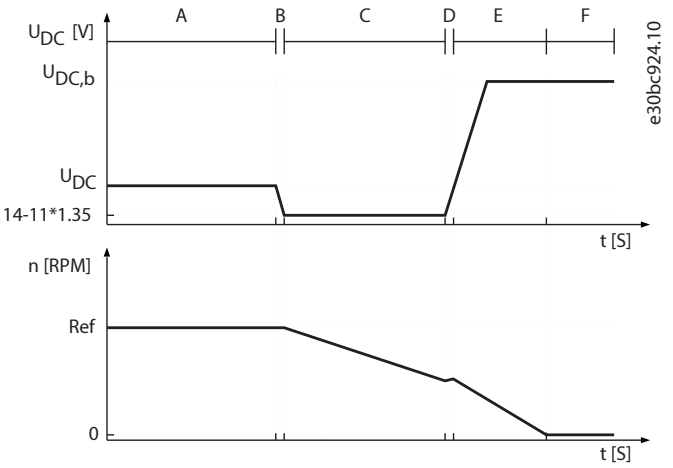


Figure 85: Kinetic Backup Trip w/Recovery, Slow Ramp, Mains Returns Below Parameter *14-15 Kin. Back-up Trip Recovery Level*

A	Normal operation	**B**	Mains failure
C	Kinetic backup	**D**	Mains return
E	Kinetic backup, ramping to trip	**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.

Option	Name	Description
		 **Figure 86: Kinetic Backup Trip w/Recovery, Quick Ramp, Mains Returns Below Parameter *14-15 Kin. Back-up Trip Recovery Level*** **A** Normal operation **B** Mains failure **C** Kinetic backup **D** Mains return **E** Kinetic backup ramping to trip **F** Trip
[8]	Fast Active Power Derating	
[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 parameter up if the start command is still valid from PLC and mains voltage is back. When ***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. 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

Option	Name	Description
		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.

14-11 Mains Fault Voltage Level

Default value:	Size related	**Parameter type:**	Range, 140 - 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).

NOTE: 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).

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

NOTE: 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.

Option	Name	Description
[7]	Fast Warning	A warning occurs when a mains input phase is missing.
[8]	Fast derate	

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 backup 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.

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 backup trip recovery level. The unit is defined in parameter ***0-02 Motor Speed Unit***.

14-16 Kin. Back-up Gain

Default value:	Size related	**Parameter type:**	Range, 0 - 500%
Setup:	All setups	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	True

Enter the kinetic backup gain value in %.

14-17 Fast Mains Phase Loss Level

Default value:	100%	**Parameter type:**	Range, 0 - 500%
Setup:	1 setup	**Conversion index:**	0
Data type:	Uint16	**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.

NOTE: A lower level than default might cause false alarms as it increases sensitivity.

14-18 Fast Mains Phase Loss Min Power

Default value:	2%	**Parameter type:**	Range, 0 - 100%
Setup:	1 setup	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

Set the minimum power level (% of nominal power) 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.

NOTE: A minimum power level of 2% is a prerequisite for the Fast Mains Phase Loss function to work.

6.15.3 14-2* Trip Reset

This parameter group contains parameters for configuring auto reset handling, special trip handling, and control card self-test or initialization.

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.

NOTE: 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	
[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	

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***.

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.

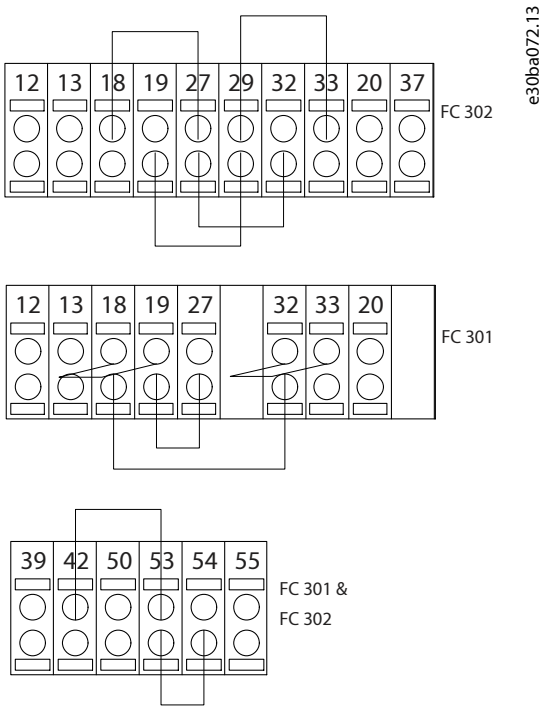


Figure 87: Test Plugs

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	**NOTE:** 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	

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.

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.

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.

NOTE: Disable protection mode in hoisting applications.

6.15.4 14-3* Current Limit Control

The drive features an integral current limit controller, which is activated when the motor current, and thus the torque, exceeds the torque limit 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, since the drive is coasted. If a quick stop is necessary, use the mechanical brake control function along with an external electromechanical brake attached to the application.

14-30 Current Lim Ctrl, Proportional Gain

Default value:	Size related	**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.

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.

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.

14-33 Torque Change Detection

Default value:	–	**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.

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.

NOTE: 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*.

14-35 Stall Protection

Default value:	[1] Enabled	**Parmaeter type:**	Option
Setup:	All setups	**Conversion index:**	–

Data type:	Uint8	**Change during operation:**	False

NOTE: 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.

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.

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***.

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.

14-39 Torque Change Threshold Limit

Default value:	Size related	**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.

6.15.5 14-4* Energy Optimizing

This parameter group contains parameters for adjusting the energy optimization level in both variable torque (VT) and automatic energy optimization (AEO) mode in parameter ***1-03 Torque Characteristics***.

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

NOTE: This parameter cannot be adjusted while the motor is running.

NOTE: 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.

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

NOTE: 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.

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

NOTE: This parameter is not active when parameter ***1-10 Motor Construction*** is set to ***[1] PM non-salient SPM***.

Enter the minimum frequency at which the automatic energy optimization (AEO) is to be active.

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.

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.

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*.

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	

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	

Option	Name	Description
[10]	Mains off	
[13]	External fan off	
[255]*	Ready to operate	

14-49 PROFIEnergy Info

Default value:	0	**Parameter type:**	Range, 0 - 0x7fffffff, Array [115]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	True

Read-out information about PROFIEnergy.

6.15.6 14-5* Environment

AMA and motor filters

The following table details the recommended AMA options when motor filters are connected between the drive and the motor. AMA is independent of the selection made in parameter ***1-00 Configuration Mode*** and parameter ***1-01 Motor Control Principle***.

Table 46: Motor Filter Types

Motor construction	Filter type	
	MCC 102 dU/dt filters	MCC 101 Sine-wave filters and MCC 201 All-mode filters
	Valid options in parameter *1-29 Automatic Motor Adaptation (AMA)*	
Induction and SPM	***[1] Complete AMA***	***[2] Reduced AMA***
	[2] Reduced AMA	***[4] Enabled 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	–

NOTE: 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.

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	

14-51 DC-link Compensation

Default value:	–	**Parameter type:**	Option
Setup:	All setups	**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. **NOTE:** Parameter ***0-03 Regional Setting*** must be set correctly according to the actual mains grid.

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).

Option	Name	Description
[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*.

14-53 Fan Monitor

Default value:	–	**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	

14-55 Output Filter

Default value:	[0] No filter	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	False

⚠ CAUTION

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.

NOTE: This parameter cannot be adjusted while the motor is running.

NOTE: 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	**NOTICE** **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.

Option	Name	Description
[2]	Sine-Wave Filter Fixed	**NOTICE** **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 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** **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.

14-56 Capacitance Output Filter

Default value:	Size related	**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.

14-57 Inductance Output Filter

Default value:	Size related	**Parameter type:**	Range, 0.001 - 65 mH
Setup:	All setups	**Conversion index:**	-6
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.

14-59 Actual Number of Inverter Units

Default value:	Size related	**Parameter type:**	Range, 1 - 1
Setup:	1 setup	**Conversion index:**	0
Data type:	Uint8	**Change during operation:**	False

Set the actual number of power units.

6.15.7 14-6* Auto Derate

This parameter group contains parameters for derating the drive if the ambient temperature is high.

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.

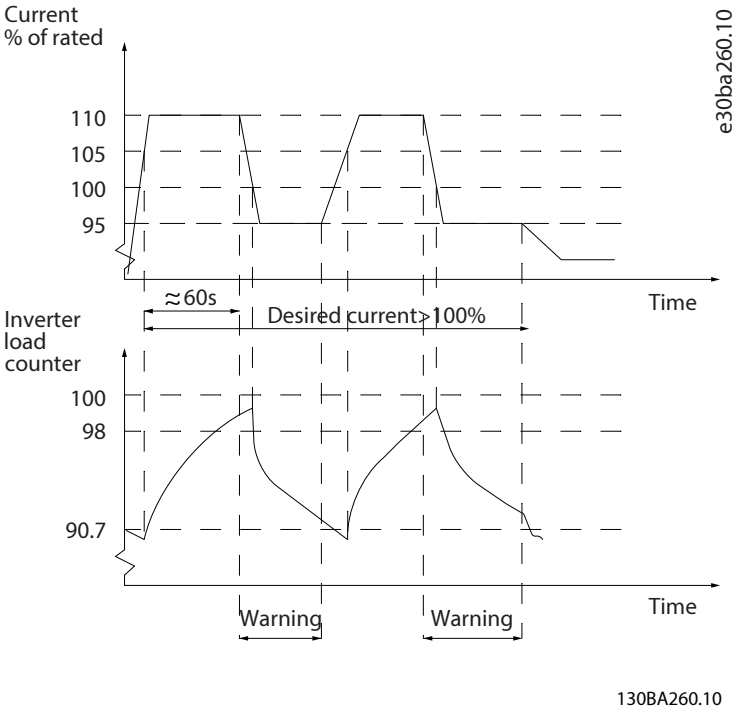


Figure 88: Output Current in Overload Condition

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.

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.

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.

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).

6.15.8 14-6* Mains Failure Derate

14-68 Power Derating Ratio

Default value:	Size related	**Parameter type:**	Range, 30 - 250%
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

Adjust the fast active power derating gain during low voltage ride through. High derating gain values cannot increase the torque beyond the limits set in either parameter ***4-16 Torque Limit Motor Mode*** or parameter ***4-17 Torque Limit Generator Mode***.

6.15.9 14-7* Compatibility

This parameter group contains parameters for compatibility of VLT® 3000 and VLT® 5000 with FC 300 series drives.

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.

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.

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.

6.15.10 14-8* Options

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

NOTE: To activate the parameter change, 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.

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.

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.

6.15.11 14-9* Fault Settings

14-90 Fault Level

Default value:	–	**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 47: Possible Actions when Selected Alarms Appear

Failure	Parameter	Alarm	Off	Warning	Trip	Trip lock	Trip with delayed reset
10 V low	1490.0	1	X(1)	D(2)	–	–	–
24 V low	1490.1	47	X	–	–	D	–
1.8 V low	1490.2	48	X	–	–	D	–
Voltage limit	1490.3	64	X	D	–	–	–
Ground fault during ramping	1490.4	14	–	–	D	X	–
Ground fault 2 during continuous operation	1490.5	45	–	–	D	X	–
Torque limit	1490.6	12	X	D	–	–	–
Overcurrent	1490.7	13	–	–	–	D	X
Short circuit	1490.8	16	–	–	X	D	–
Heat sink temp.	1490.9	29	–	–	X	D	–

Table 47: Possible Actions when Selected Alarms Appear (continued)

Failure	Parameter	Alarm	Off	Warning	Trip	Trip lock	Trip with delayed reset
Heat sink sensor	1490.10	39	–	–	X	D	–
Control card temp.	1490.11	65	–	–	X	D	–
Power card temp.	1490.12	69	–	(3)	X	D	–
Heat sink temperature(4)	1490.13	244	–	–	X	D	–
Heat sink sensor(4)	1490.14	245	–	–	X	D	–
Power card temperature(4)	1490.15	247	–	–	X	D	–
Motor phase U missing	1490.16	30	–	–	X	D	–
Motor phase V missing	1490.16	31	–	–	X	D	–
Motor phase W missing	1490.16	32	–	–	X	D	–
Derag limit fault	1490.17	100	–	–	–	D	–
Inverter overload	1490.18	9	–	–	–	D	–
Current limit(5)	1490.19	59	X	D	–	–	–
Locked rotor	1490.20	99	–	–	D	X	–
AIC earth fault	1490.21	407	X	X	X	D	X
DC-link voltage out of range	1490.22	404	X	X	X	D	X
Mains contactor fault	1490.23	300	X	X	X	D	X
Not used	1490.24	x	X	X	X	D	X
Fan contactor	1490.25	431	–	–	X	D	–
Inrush fault	1490.26	33	X	X	X	D	X
Fieldbus fault	1490.27	34	X	D	–	–	–

1) X = Possible selection

2) D = Default value

3) In small and medium power drives, alarm 69, Power card temperature is only a warning.

4) Only high-power drives.

5) Warning 59 is configured in 1490.19. The current limit warning can be shown 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.

6.16 Parameter Group 15-** Drive Information

6.16.1 15-0* Operating Data

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.

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.

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***.

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.

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.

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.

15-06 Reset kWh Counter

Default value:	[0] Do not reset	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	0
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***). The reset date is stored in parameter ***15-28 kWh Counter Reset Time***.

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.

6.16.2 15-1* Data Log Settings

The data log enables continuous logging of up to 4 data sources (parameter ***15-10 Logging Sources***) 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.

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	

Option	Name	Description
[1474]	Leg. ext. status word	
[1583]	Motor Ud	
[1584]	Motor Uq	
[1585]	Motor Id	
[1586]	Motor Iq	
[1600]	Control word	
[1601]	Reference [Unit]	
[1602]	Reference %	
[1603]	Status word	
[1606]	Actual position	
[1610]	Power [kW]	
[1611]	Power [hp]	
[1612]	Motor voltage	
[1613]	Frequency	
[1614]	Motor current	
[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	
[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	

Option	Name	Description
[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	
[1690]	Alarm word	
[1692]	Warning word	
[1694]	Ext. status word	
[1695]	Ext. status word 2	
[1697]	Alarm word 3	
[1698]	Warning word 3	
[1767]	Raw inc. quad counter	
[1768]	Raw abs. pos. low	
[1769]	Raw abs. pos. high	
[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	
[1889]	Mode of operation display	
[1899]	Speed PID torque FF. [Nm]	
[3110]	Bypass status word	
[3466]	SPI error counter	
[3470]	MCO alarm word 1	
[3471]	MCO alarm word 2	

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.

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	

Option	Name	Description
[24]	Comparator 2	
[25]	Comparator 3	
[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	
[37]	Digital input DI32	
[38]	Digital input DI33	
[50]	Comparator 4	
[51]	Comparator 5	
[60]	Logic rule 4	
[61]	Logic rule 5	

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***.

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***.

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.

15-17 Service Log Trigger Alarm

Default value:	0	**Parameter type:**	Range, 0=Off - 9999
Setup:	All setups	**Conversion index:**	-3
Data type:	Uint16	**Change during operation:**	True

Enter alarm number that triggers the Service Log write to flash. By default Service Log will log motor specific data during motor related alarms. Using Displayline parameters ***0-20 Display Line 1.1 Small***, ***0-21 Display Line 1.2 Small***, and ***0-22 Display Line 1.3 small*** with current parameter, the Service Log can be configured for custom data logging events.

15-18 Service Log Trigger SLC

Default value:	[0] False	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

The service log can be used for troubleshooting. The SLC operands trigger the service log when an event occurs. The maximum number of service logs is 24. To clear the service logs, use parameter ***14-22 Operation Mode*** followed by a power cycle.

Option	Name	Description
[0]*	False	
[18]	Reversing	
[19]	Warning	
[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	

Option	Name	Description
[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	
[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	

6.16.3 Service Log

The service log is a data logger extension (alarm data saved in drive memory and exportable to VLT® Motion Control Tool MCT 10). If certain alarms occur, the system saves a detailed log in 5 s increments.

Service technicians can analyze this information to troubleshoot and optimize the drive.

The drive saves up to 24 service log records in the flash memory. If the RTC (real-time clock) has been set in the drive, all errors and log files are date- and time-stamped.

The relevant service log file can then be analyzed as a scope in MCT 10. Danfoss specifies the channels. All scope functions such as Auto-scale and Diagnostics can be used. The HEX ad binary value can be shown, which also helps with the analysis.

Table 48: Alarms Triggering a Service Log Record

Alarm	Alarm log data	Parameter
1	Time of trip (1 of the values): • Priority RTC (if available). • Priority operating time (if RTC is not available).	Parameter ***0-89 Date and Time Readout*** or parameter ***15-32 Fault Log: Time***
2	Alarm code	Parameter ***15-30 Fault Log: Error Code***
3	Frequency	Parameter ***16-13 Frequency***
4	Speed (RPM)	Parameter ***16-17 Speed [RPM]***
5	Reference %	Parameter ***16-02 Reference %***
7	DC-link voltage	Parameter ***16-30 DC Link Voltage***
9	Motor phase U current	Parameter ***16-45 Motor Phase U Current***
10	Motor phase V current	Parameter ***16-46 Motor Phase V Current***
11	Motor phase W current	Parameter ***16-47 Motor Phase W Current***
12	Motor phase voltage	Parameter ***16-12 Motor Current***
15	Control word	Parameter ***16-00 Control Word***
16	Status word	Parameter ***16-03 Status Word***

Application-dependent trips/alarms such as Safe Torque Off (STO), do not trigger a service log record.

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.

NOTE: 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 49: Logged Channels

Polling	Color	Name
CH 1	Light gray	Frequency
CH 2	Dark gray	Speed [RPM]
CH 3	Red	Reference [%]

Table 49: Logged Channels (continued)

Polling	Color	Name
CH 4	Orange	DC-link voltage
CH 5	Yellow	Motor current
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 parameter ***0-20*** to ***0-22***, which are reflected in the 3 upper lines in the LCP.

6.16.4 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.

6.16.5 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.

6.16.6 Alarms that Trigger a Service Log Record

Table 50: Alarms Triggering a Service Log Record

#	Alarm title
4	Mains phase loss
5	DC voltage high

Table 50: Alarms Triggering a Service Log Record (continued)

#	Alarm title
6	DC voltage low
7	DC overvolt
8	DC undervolt
9	Inverter overld.
10	Motor ETR over
12	Torque limit
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

NOTE: If an alarm has 2 states (warning/alarm), it only triggers a service log record when going into the alarm state.

6.16.7 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 stamps 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 a service following a trip. View the historic log contained in this parameter via the serial communication port or via the display.

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.

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.

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 drive start. This is an array parameter containing event times 0-49.

6.16.8 15-2* Operating Data Log

15-28 kWh Counter Reset Time

Default value:	Size related	**Parameter type:**	Range, 0 - 0

Setup:	All setups	**Conversion index:**	0
Data type:	TimeOfDay	**Change during operation:**	True

View the date and time for the last kWh counter reset.

15-29 Running Hour Reset Time

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

View date and time for the last running hour counter reset.

6.16.9 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 stamps can be viewed for all logged data.

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 *chapter Troubleshooting*.

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*.

15-32 Fault Log: Time

Default value:	0 s	**Parameter type:**	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.

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.

15-38 Alarm Log: Speed

Default value:	0 RPM	**Parameter type:**	Range, -30000 - 30000 RPM, Array [10]
Setup:	All setups	**Conversion index:**	67
Data type:	Int32	**Change during operation:**	False

View the actual motor speed value when the logged event occurred.

6.16.10 15-4* Drive Identification

This parameter group contains parameters with read-only information about the hardware and software configuration of the drive.

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.

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.

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.

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.

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.

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.

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***.

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.

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.

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.

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.

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.

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.

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.

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 Smart Setup file name.

15-59 Filename

Default value:	Size related	**Parameter type:**	Range, 0 - 16
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.

6.16.11 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.

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.

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.

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.

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.

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*.

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.

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*.

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.

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*.

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.

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*.

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.

6.16.12 15-8* Operating Data II

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.

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.

15-83 Motor Ud

Default value:	0.0 V	**Parameter type:**	Range, -3276.8 - 3276.7 V
Setup:	All setups	**Conversion index:**	-1
Data type:	Int16	**Change during operation:**	False

View the motor voltage on the d-axis. The value is a calculated value used for controlling the motor.

15-84 Motor Uq

Default value:	0.0 V	**Parameter type:**	Range, -3276.8 - 3276.7 V
Setup:	All setups	**Conversion index:**	-1
Data type:	Int16	**Change during operation:**	False

View the motor voltage on the q-axis. The value is a calculated value used for controlling the motor.

15-85 Motor Id

Default value:	0.0 A	**Parameter type:**	Range, -3276.8 - 3276.7 A
Setup:	All setups	**Conversion index:**	-1
Data type:	Int16	**Change during operation:**	False

View the motor d-axis current measured as a mean value, I_{RMS}.

15-86 Motor Iq

Default value:	0.0 A	**Parameter type:**	Range, -3276.8 - 3276.7 A
Setup:	All setups	**Conversion index:**	-1
Data type:	Int16	**Change during operation:**	False

View the motor q-axis current measured as a mean value, I_{RMS}.

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.

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

NOTE: This parameter cannot be adjusted while the motor is running.

6.16.13 15-9* Parameter Info

15-92 Defined Parameters

Default value:	0	**Parameter typa:**	Range, 0 - 9999, Array [2000]
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.

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.

15-94 Extended Version

Default value:	Size related	**Parameter type:**	Range, 0 - 65, Array [10]
Setup:	All setups	**Conversion index:**	0
Data type:	VisStr[65]	**Change during operation:**	True

View a list of SW build IDs in the drive. In a service case, Hotline can ask for SW build IDs.

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.

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.

6.17 Parameter Group 16-** Data Readouts

6.17.1 16-0* General Status

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.

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).

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.

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.

16-06 Actual Position

Default value:	0 AbsolutePositionUnit	**Parameter type:**	Range, -2000000000 AbsolutePositionUnit - 2000000000 AbsolutePositionUnit
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*.

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***.

6.17.2 16-1* Motor Status

16-10 Power [kW]

Default value:	0 kW	**Parameter type:**	Range, 0 - 10000 kW
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.

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.

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.

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.

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.

16-15 Frequency [%]

Default value:	0%	**Parameter type:**	Range, -100 - 100%
Setup:	All seutps	**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.

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.

16-17 Speed [RPM]

Default value:	0 RPM	**Parameter type:**	Range, -30000 - 30000 RPM
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.

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***.

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*.

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).

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 percentage of nominal torque, with sign and 0.1% resolution, applied to the motor shaft.

16-22 Torque [%]

Default value:	0%	**Parameter type:**	Range, -200 - 200%
Setup:	All setups	**Conversion index:**	0
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.

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.

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.

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]***.

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.

6.17.3 16-3* Drive Status

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.

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.

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***.

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).

16-35 Inverter Thermal

Default value:	0%	**Parameter type:**	Range, 0 - 100%
Setup:	All setups	**Conversion index:**	0
Data type:	Uint8	**Conversion index:**	False

View the percentage load on the inverter.

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.

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.

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.

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.

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	

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.

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	

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

Shows the difference between the speed reference and the actual speed.

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.

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.

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.

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.

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

6.17.4 16-5* Ref. & Feedb.

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.

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.

16-52 Feedback[Unit]

Default value:	0 ReferenceFeedbackUnit	**Parameter type:**	Range, -999999.999 ReferenceFeedbackUnit - 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***.

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.

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***.

6.17.5 16-6* Inputs and Outputs

16-60 Digital Input

Default value:	0	**Parameter type:**	Range, 0 - 65535
Setup:	All setup	**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 51: 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.

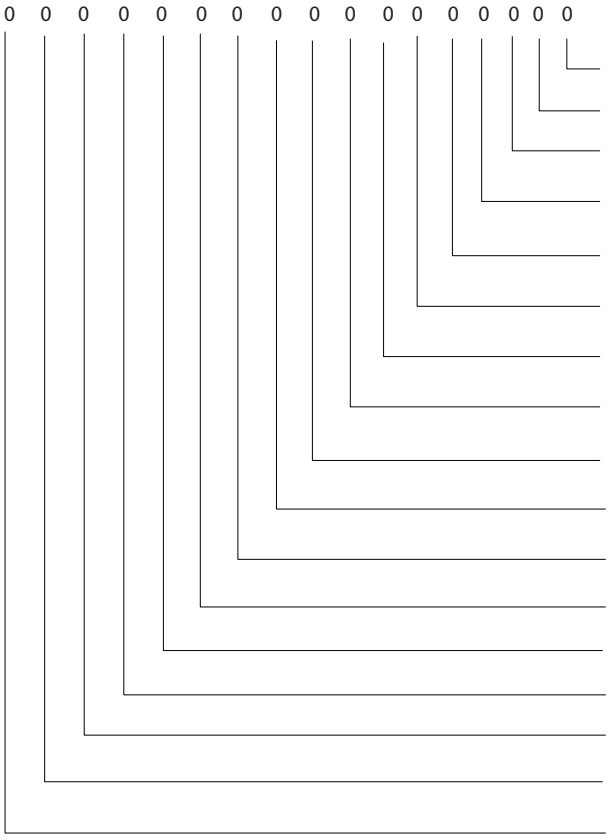


Figure 89: Relay Settings

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	

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.

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	

16-64 Analog Input 54

Default value:	0	**Parameter type:**	Range, -20 - 20
Setup:	All setups	**Conversion index:**	-3
Data type:	Int32	**Changes during operation:**	False

View the actual value at input 54.

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***.

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.

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.

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.

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.

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.

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.

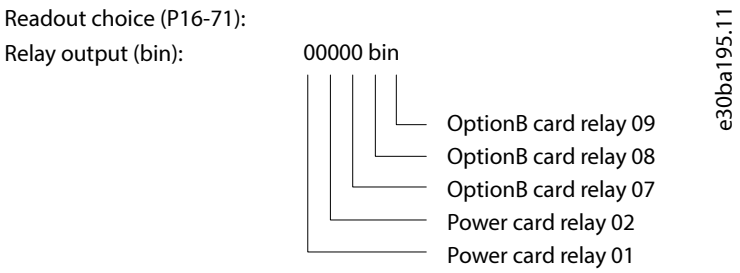


Figure 90: Relay Settings

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***).

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***).

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***).

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.

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.

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.

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***.

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***.

6.17.6 16-8* Fieldbus & FC Port

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.

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.

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

Shows the status word of the extended fieldbus communication option. For more information, refer to the relevant fieldbus manual.

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***.

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***.

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.

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

parameter 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***.

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.

6.17.7 16-9* Diagnosis Readouts

Use the parameters to show alarm, warning, and extended status words.

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.

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

Shows the alarm word sent via the serial communication port in hex code.

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

Shows the warning word sent via the serial communication port in hex code.

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.

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 warning word sent via the serial communication port in hex code.

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.

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 52: 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}	–	+	+	+
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.

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.

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.

6.18 Parameter Group 17-** Feedback

6.18.1 17-0* Encoder Interface

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.

6.18.2 17-1* Inc. Enc. Interface

NOTE: Do not use incremental encoders with PM motors. In a closed-loop control, consider absolute encoders or resolvers.

NOTE: These parameters cannot be adjusted while the motor is running.

This parameter group contains parameters for configuring the incremental interface of the VLT® Encoder Input MCB 102. Both the incremental and the absolute interfaces are active at the same time.

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	

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).

6.18.3 17-2* Abs. Enc. Interface

This parameter group contains parameters for configuring the absolute interface of the VLT® Encoder Input MCB 102. Both the incremental and absolute interfaces are active at the same time.

17-20 Protocol Selection

Default value:	[0] None	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	False

NOTE: This parameter cannot be changed 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.

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:**	True

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***.

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.

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.

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.

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.

17-34 HIPERFACE Baudrate

Default value:	[4] 9600	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	False

NOTE: 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	

6.18.4 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.

17-50 Poles

Default value:	2	**Parameter type:**	Range, 2 - 64
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.

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.

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.

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:

$$T_{ratio} = \frac{V_{out}}{V_{in}}$$

The value is stated in the datasheet for resolvers.

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	

Option	Name	Description
[4]	4096	
[5]	Enable encoder sim. adv.	Set the encoder simulation resolution via 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***.

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]	Enabled	

6.18.5 17-6* Monitoring and Application

This parameter group is for selecting extra functions when VLT® Encoder Input 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.

17-60 Feedback Direction

Default value:	[0] Clockwise	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

NOTE: 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	

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	

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

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***.

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

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***.

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

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***.

6.18.6 17-7* Position Scaling

Parameters in this group define how the drive scales and handles the position values.

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.
[5]	rad	Radian.
[6]	%	Percent.
[7]	qc	Quad count, which is ¼ of an encoder pulse when using quadrature encoder signal.

17-71 Position Unit Scale

Default value:	0	**Parameter type:**	Range, -5 - 5, Array [4]
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***.

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. 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:

$$\text{Positionunit} = \frac{\text{Par.17-72}}{\text{Par.17-73}} \times \text{Motorrevolutions}$$

- 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***.

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***.

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***.

6.19 Parameter Group 18-** Data Readouts 2

6.19.1 18-0* Maintenance Log

This parameter 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.

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***.

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***.

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.

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.

NOTE: 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***.

NOTE: 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.

NOTE: When mounting a VLT® Analog I/O MCB 109 option card, a battery back-up of date and time is included.

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 times the mechanical brake has been engaged.

6.19.2 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.

18-10 Emergency Mode Log: Event

Default value:	0	**Parameter type:**	Range, 0 - 255, Array [10]
Setup:	All setups	**Conversion index:**	0

Data type:	Uint16	**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 *Alarm/Warning Code List*in *chapter Troubleshooting*.

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.

18-12 Emergency Mode Log: Date and Time

Default value:	Size related	**Parameter type:**	Range, 0 - 0, Array [10]
Setup:	All seutps	**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*.

6.19.3 18-1* Parameter Log

18-13 Parameter Number

Default value:	0 N/A	**Parameter type:**	Range, 0 - 0xFFFF N/A, Array [10]
Setup:	All setups	**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.

18-14 Parameter Index

Default value:	0 N/A	**Parameter type:**	Range, 0 - 0xFFFF N/A, Array [10]
Setup:	All setups	**Conversion index:**	–
Data type:	Uint16	**Change during operation:**	False

This parameter shows the index of the parameter which was changed.

18-15 Change 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 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.

18-16 Operating Hours

Default value:	0	**Parameter type:**	Range, 0 - 2147483647, Array [10]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	False

Shows operating hours of the drive at the instance when the parameter was changed.

18-17 Running Hours

Default value:	0	**Parameter type:**	Range, 0 - 2147483647, Array [10]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	False

Shows running hours of the motor when the parameter is changed.

18-18 Value Before Change as Integer

Default value:	0	**Parameter type:**	Range, -2147483648 - 2147483647, Array [10]
Setup:	All setups	**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.

18-19 Value Before Change

Default value:	Size related	**Parameter type:**	Range, 0-30, Array [10]
Setup:	All setups	**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.

6.19.4 18-2* Ref. & Feedb. 2

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

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.

18-29 Safe Opt. Speed Error

Default value:	0 RPM	**Parameter type:**	Range, -30000 - 30000 RPM
Setup:	All setups	**Conversion index:**	67
Data type:	In t32	**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.

6.19.5 18-3* Analog Input

Parameters in this group show data related to analog inputs.

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.

18-37 Temp. Input X48/4

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 X48/4. The temperature unit is based on the selection in parameter ***35-00 Term. X48/4 Temperature Unit***.

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***.

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***.

6.19.6 18-4* PGIO Data Readouts

This parameter group contains parameters for configuring the readout of VLT® Programmable I/O MCB 115.

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.

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.

18-42 Analog Input X49/5

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 X49/5 either as a voltage, current, or a temperature value.

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***.

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***.

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***.

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.

6.19.7 18-4* Last Warning

18-47 Last Warning

Default value:	0	**Parameter type:**	Range, 0 - 65535
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

This parameter shows which was the latest warning.

18-48 Last Warning Count

Default value:	0	**Parameter type:**	Range, 0 - 65535
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

This parameter shows how many times the last warning has been active.

6.19.8 18-5* Active Alarms/Warnings

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.

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.

6.19.9 18-6* Inputs & Outputs 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

6.19.10 18-7* Rectifier Status

18-70 Mains Voltage

Default value:	0 V	**Parameter type:**	Range, 0 - 1000 V, Array [4]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

This parameter shows the mains line-to-line voltage.

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.

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.

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.

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

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.

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

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:	Int16	**Change during operation:**	True

View the mains frequency measurement. The indices are as follows:

- 0 = inrush1
- 1 = inrush2

18-78 Mains Imbalance 2

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [4]
Setup:	All seutps	**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

18-79 Rectifier DC Volt. 2

Default value:	0 V	**Parameter type:**	Range, 0 - 1000 V, Array [4]
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

6.19.11 18-9* PID Readouts

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.

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.

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.

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.

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***.

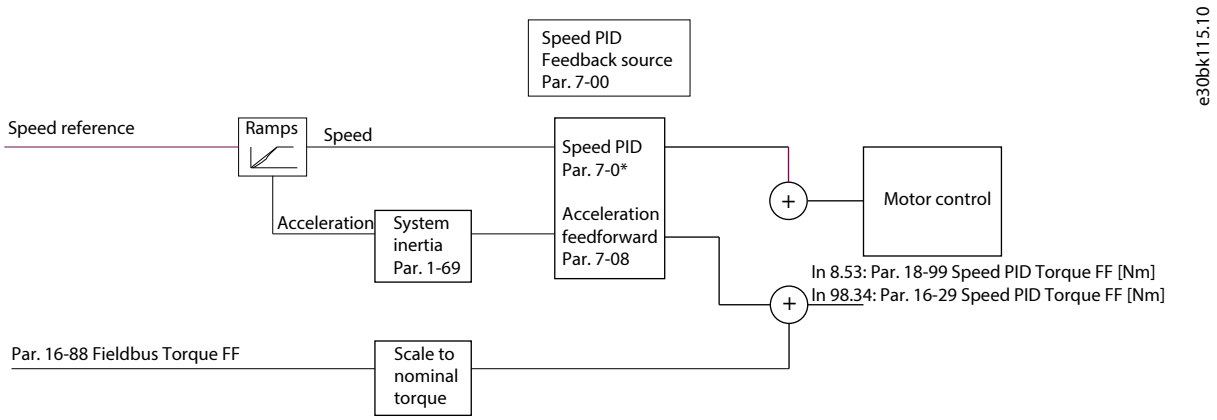


Figure 91: Torque Feed Forward Diagram

6.20 Parameter Group 22-** Appl. Functions

6.20.1 22-0* Miscellaneous

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.

22-03 Start Command Delay

Default value:	0 ms	**Parameter type:**	Range, 0 - 100 ms
Setup:	All setups	**Conversion index:**	-3
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.

6.21 Parameter Group 23-** Time-based Functions

6.21.1 23-0* Timed Actions

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***).

NOTE: 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*.

NOTE: Program the clock (parameter group *0-7* Clock Settings*) correctly for timed actions to function.

TIP: The PC-based configuration tool VLT® Motion Control Tool MCT 10 comprises a special guide for easy programming of timed actions.

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.

NOTE: 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.

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

NOTE: 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	

Option	Name	Description
[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	
[28]	Freeze output	
[29]	Start timer 0	
[30]	Start timer 1	
[31]	Start timer 2	
[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	

Option	Name	Description
[62]	Counter A (up)	
[63]	Counter A (down)	
[64]	Counter B (up)	
[65]	Counter B (down)	
[70]	Start timer 3	
[71]	Start timer 4	
[72]	Start timer 5	
[73]	Start timer 6	
[74]	Start timer 7	
[75]	Start timer 8	
[76]	Start timer 9	

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.

NOTE: 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.

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	

Option	Name	Description
[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	
[28]	Freeze output	
[29]	Start timer 0	
[30]	Start timer 1	
[31]	Start timer 2	
[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)	
[70]	Start timer 3	

Option	Name	Description
[71]	Start timer 4	
[72]	Start timer 5	
[73]	Start timer 6	
[74]	Start timer 7	
[75]	Start timer 8	
[76]	Start timer 9	

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/non-working 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	
[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	

Option	Name	Description
[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	

6.21.2 23-0* Timed Actions Settings

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.

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.

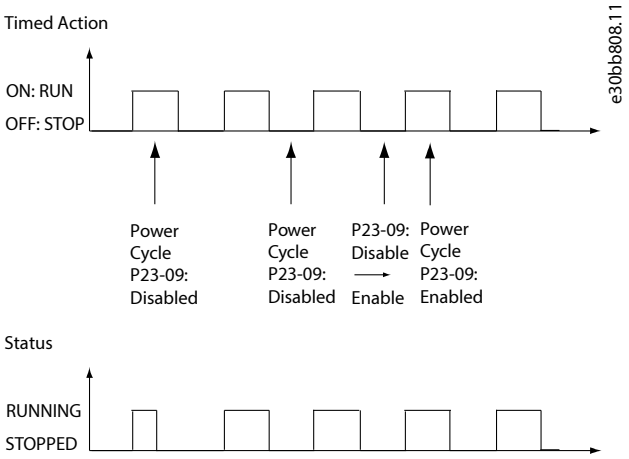


Figure 92: Example of Reactivation Test

6.21.3 23-1* Maintenance

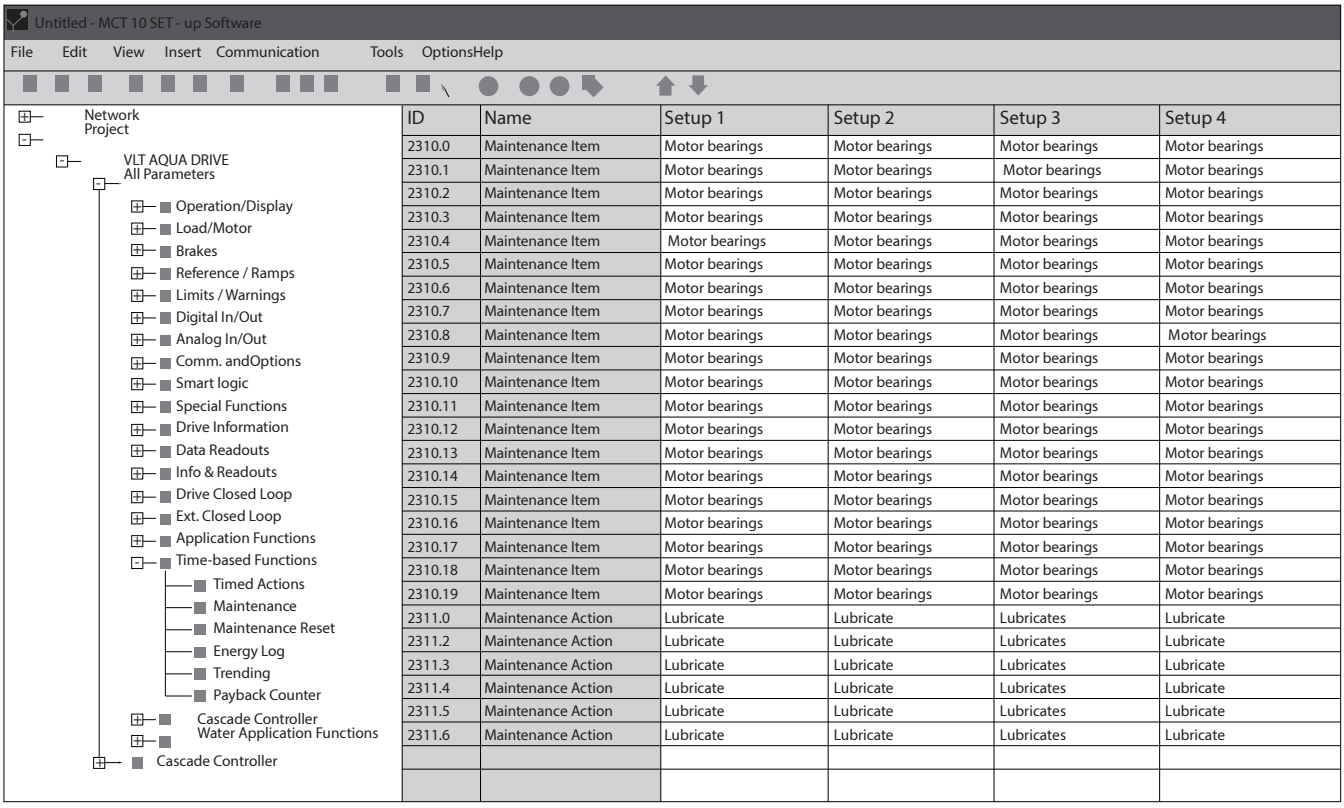
Wear and tear calls for periodic inspection and service of elements in the application, for example, motor bearings, feedback sensors, seals, and filters. With preventive maintenance, the service intervals may be programmed into the drive. The drive gives a message when maintenance is required. 20 preventive 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 the next maintenance.

TIP: 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 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

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The LCP indicates (with a wrench icon and letter M) when it is time for 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***.

NOTE: The preventive maintenance events are defined in a 20-element array. Hence, each preventive maintenance event must use the same array element in parameter ***23-10 Maintenance Item*** to parameter ***23-14 Maintenance Date and Time***.

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	

Option	Name	Description
[22]	Maintenance text 2	
[23]	Maintenance text 3	
[24]	Maintenance text 4	
[25]	Maintenance text 5	
[26]	Service log full	

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	
[24]	Maintenance text 4	
[25]	Maintenance text 5	
[28]	Clear logs	

23-12 Maintenance Base

Default value:	–	**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***.

Option	Name	Description
[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	

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***.

23-14 Maintenance Date 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***.

NOTE: 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.

NOTE: When mounting a VLT® Analog I/O option MCB 109 option card, a battery back-up of the date and time is included.

6.21.4 23-1* Maintenance Reset

23-15 Reset Maintenance Word

Default value:	[0] Do not reset	**Parameter type:**	Option
Setup:	All setups	**Conversion inde:**	–
Data type:	Uint8	**Change during operation:**	True

NOTE: 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	

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***.

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.

6.22 Parameter Group 24-** Application Functions

6.22.1 24-0* Emergency Mode

NOTE: 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 disappear 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 53: 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)	+ (bit 8)	–
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*.

NOTE: 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.

NOTE: 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.

NOTE: 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.

24-00 Emergency Mode Function

Default value:	[0] Disabled	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

NOTE: 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 information and status word is updated as the emergency mode operation is logged in the emergency mode log.

24-01 Emergency Mode Configuration

Default value:	–	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

NOTE: Before adjusting the PID controller, set ***parameter 24-09 Emergency Mode Alarm Handling*** to ***[9] Trip, all alarms/test***.

NOTE: 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	

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	
[4]	Nm	
[5]	PPM	
[10]	1/min	

Option	Name	Description
[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	
[126]	ft^3/min	
[127]	ft^3/h	
[130]	lb/s	
[131]	lb/min	
[132]	lb/h	
[140]	ft/s	
[141]	ft/min	

Option	Name	Description
[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	

24-03 Emergency Mode Min Reference

Default value:	Size related	**Parameter type:**	Range, -999999.999 - par. 24-04 EmergencyModeMaxReference
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***.

24-04 Emergency Mode Max Reference

Default value:	Size related	**Parameter type:**	Range, par. 24-03 - 999999.999 EmergencyModeMinReference
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***.

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*.

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	
[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	
[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.

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	
[4]	Frequency input 33	
[7]	Analog input X30/11	
[8]	Analog input X30/12	
[16]	Analog input X49/1	
[17]	Analog input X49/3	

Option	Name	Description
[18]	Analog input X49/5	
[99]	Normal feedback	

24-09 Emergency Mode Alarm Handling

Default value:	[0] Trip+reset, critical alarms	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	False

NOTE: 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.

NOTE: 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 the Warning/Alarm Code List in the chapter *Troubleshooting*.

Table 54: 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)	

Table 54: Emergency Mode Alarm Handling (continued)

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
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
245	Heatsink sensor	Ignore	Ignore	(Trip/trip lock)	X
247	Pwr.card temp	Ignore	Ignore	(Trip/trip lock)	X
280	Emergency m service warning	Ignore	Ignore		
281	Emcy OPR unexpected	Ignore	Ignore		

6.22.2 **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 Figure 93 and Figure 94.

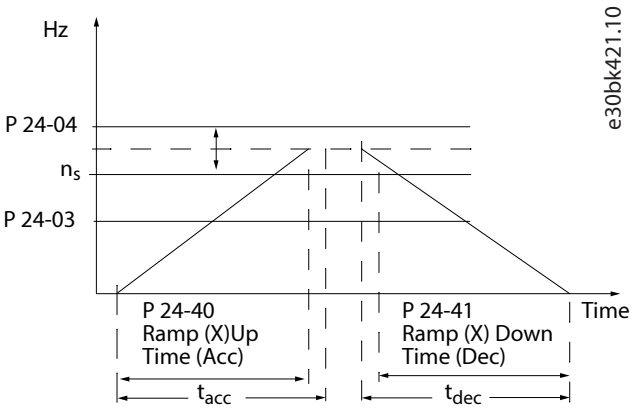

Figure 93: Linear Ramping Times

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.

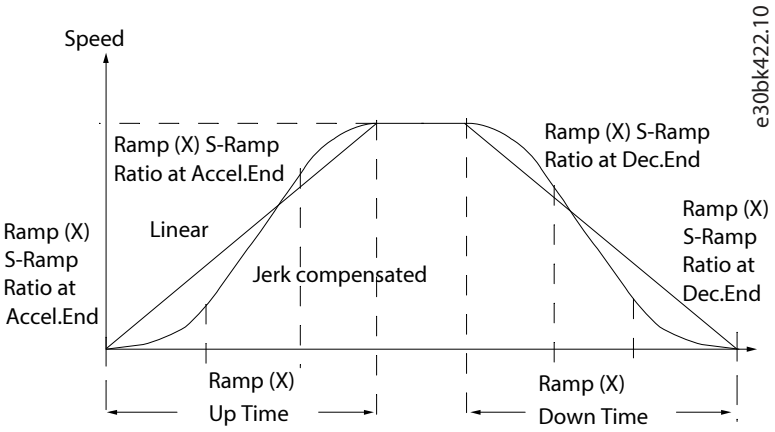

Figure 94: Non-linear Ramping Times

24-40 Emergency Mode 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

This ramp time is used for acceleration while emergency mode is active.

24-41 Emergency Mode Ramp Down Time

Default value:	Size related	**Parameter type:**	Range, 0.01 - 3600 s
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint32	**Changes during operation:**	True

This ramp time is used for deceleration while emergency mode is active.

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.

24-43 Emergency Mode Signal Operation

Default value:	–	**Parameter type:**	Option
Setup:	1 setup	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

NOTE: 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.

NOTE: 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. **NOTE:** LCP copy and software download only accept parameter changes if parameter ***24-00 Emergency Mode*** is set to ***[0] Disabled***.

6.23 Parameter Group 30-** Special Features

6.23.1 30-0* Wobbler

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.

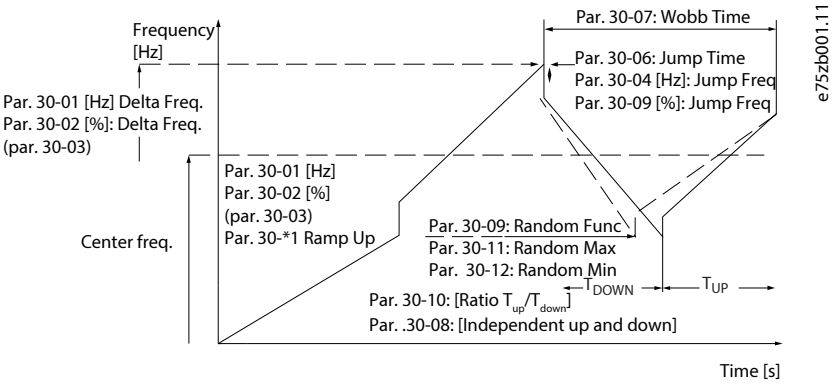

Figure 95: Wobble Function

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

NOTE: 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	

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*.

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]***.

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	
[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	
[99]	Normal feedback	

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.

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]***.

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.

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.

$$\text{Wobbletime} = t_{up} + t_{down}$$

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.

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	

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}.

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.

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.

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.

6.23.2 30-2* Adv. Start Adjust

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.

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

30-22 Locked Rotor Protection

Default value:	Size related	**Parameter type:**	Option
Setupe:	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.

30-23 Locked Rotor Detection Time [s]

Default value:	Size related	**Parameter type:**	Range, 0.05 - 1 s
Setup:	All setups	**Conversion size**	-2
Data type:	Uint8	**Change during operation:**	True

Time period for detecting the locked rotor condition. A low parameter value leads to faster detection.

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.

6.23.3 30-2* Light Load Detection

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.

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.

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.

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.

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.

6.23.4 30-5* Unit Configuration

This parameter group contains parameters for configuring the operation of internal units that communicate with the drive. The settings affect the behavior of hardware components inside the drive.

30-50 Heat Sink Fan Mode

Default value:	–	**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	

6.23.5 30-7* Power Low Monitor Protection

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.

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.

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***.

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.

6.23.6 30-8* Compatibility (I)

30-80 d-axis Inductance (Ld)

Default value:	Size related	**Parameter type:**	Range, 0.001 - 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.

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.

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.

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.

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

NOTE: Changing this parameter affects the settings of other parameters.

Select the motor frequency from the motor nameplate data.

30-89 Trip Delay at Current Limit

Default value:	60.00 s	**Parameter type:**	Range, 0 - 60.00 s
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

When the output current reaches the current limit set in parameter ***4-18 Current Limit***, a warning is triggered. If the current limit warning is continuously present for the time specified in this parameter, the drive trips. Enter 60 s to disable the feature.

6.23.7 30-9* Wifi LCP

Use the parameters in this group for configuring the wireless LCP 103.

30-90 SSID

Default value:	Size related	**Parameter type:**	Range, 1 - 32
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***.

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.

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.

30-93 Security Type

Default value:	[2] WPA_WPA2	**Parameter type:**	Option
Setup:	1 setup	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Wireless network security type.

Option	Name	Description
[2]	WPA_WPA2	

30-94 IP Address

Default value:	Size related	**Parameter type:**	Range, 0 - 4294967295
Setup:	1 setup	**Conversion index:**	0
Data type:	OctStr[4]	**Change during operation:**	True

Enter the IP address to connect to.

30-95 Submask

Default value:	Size related	**Parameter type:**	Range, 0 - 4294967295
Setup:	1 setup	**Conversion index:**	0
Data type:	OctStr[4]	**Change during operation:**	True

Enter the subnet mask.

30-96 Port

Default value:	5001	**Parameter type:**	Range, 1024 - 65535
Setup:	1 setup	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

Enter the TCP port to connect to.

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).

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

Minimum length of the SSID is 1 character. Maximum length is 32 characters.

30-99 Wifi Network Mode

Default value:	[0] Access point	**Parameter type:**	Option
Setup:	1 setup	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Option	Name	Description
[0]*	Access point	
[1]	Client	

6.24 Parameter Group 40-** Special Settings

6.24.1 40-1* Aux. Functions Control

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 backup 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***.

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.

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

NOTE: 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.

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.

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.

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.

6.24.2 40-2* PM Motor Specific

40-26 Individual Currents

Default value:	[0] Off	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Select whether or not to use individual axis currents for induction calculations.

Option	Name	Description
[0]*	Off	
[1]	On	

40-27 Back EMF Voltage

Default value:	0.0 V	**Parameter type:**	Range, -3276.8 - 3276.7 V
Setup:	All setups	**Conversion index:**	-1
Data type:	Int16	**Change during operation:**	False

View the calculated back EMF voltage.

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	

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.

6.24.3 40-3* Fieldbus Profile

40-30 Acc. Delta Speed

Default value:	0	**Parameter type:**	Range, 0 - 2147483647
Setup:	All setups	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	True

Define the value of delta speed in either rotations per minute or user-defined velocity units. To achieve the best resolution, use the motor synchronous RMP x 100.

40-31 Acc. Delta Time

Default value:	0 s	**Parameter type:**	Range, 0 - 65535 s
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

Define the value of delta time in seconds. To achieve the best resolution, use values >100.

40-32 Dec. Delta Speed

Default value:	0	**Parameter type:**	Range, 0 - 2147483647
Setup:	All setups	**Conversion index:**	0
Data type:	Uint32	**Change during operation:**	True

Define the value of delta speed in rotations per minute or in user-defined velocity units.

To achieve the best resolution, use the motors synchronous RMP x 100.

40-33 Dec. Delta Time

Default value:	0 s	**Parameter type:**	Range, 0 - 65535 s
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

Define the value of delta time in seconds. To achieve the best resolution, use values >100.

40-34 Error Code

Default value:	0	**Parameter type:**	Range, 0 - 65535
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

View the error code of the last error which occurred in the drive.

40-35 DS402 Qstop

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

40-36 DS 402 Current Actual

Default value:	0	**Parameter type:**	Range, 0 - 65535
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

View the actual current with respect to the rated motor current of the motor current.

6.24.4 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.

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.

40-41 Alarm Log: Frequency

Default value:	0 Hz	**Parameter type:**	Range, -3276.8 - 3276.7 [Hz], Array [10]
Setup:	All setups	**Conversion index:**	-1
Data type:	Int16	**Change during operation:**	False

View the actual motor frequency when the logged event occurred.

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.

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.

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.

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.

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.

40-47 Alarm Log: Torque

Default value:	0 Nm	**Parameter type:**	Range, -30000 - 30000 [Nm], Array [10]
Setup:	All setups	**Conversion index:**	-1
Data type:	Int32	**Change during operation:**	False

View the actual motor torque when the logged event occurred.

6.24.5 40-5* Advanced Control Settings

This parameter group contains parameters for configuring the advanced motor control settings.

40-50 Flux Sensorless Model Shift

Default value:	–	**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	Shifting between flux models 1 and 2 is disabled.
[1]	On	Shifting between flux models 1 and 2 is enabled.

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.

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***

40-53 Current PID Anti Windup Gain

Default value:	Size related	**Paramter 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***

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

NOTE: 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.

40-56 Rotor Position Estimation Gain

Default value:	100%	**Parameter type:**	Range, 10 - 100%
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

When running IPM with high speed, high load, and low mains voltage, there is an increased risk of nuisance alarms. To reduce the risk of alarms, decrease the value, which then increases control stability.

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	
[30]	External Can	
[35]	Option A fast	
[37]	Option C0 fast	

6.25 Parameter Group 44-** Motor Protection

6.25.1 44-2* Check Motor

This parameter group contains parameters for configuration and readout for the "check for correct motor" functionality enabled in parameter ***1-47 Torque Calibration*** by selecting either ***[5] 1st start check motor*** or ***[6] Every st. check motor***.

44-20 Max Cable Resistance

Default value:	0.0 Ohm	**Parameter type:**	Range, 0.0 - 100.0000 Ohm
Setup:	All setups	**Conversion index:**	-4
Data type:	Uint32	**Change during operation:**	True

Enter the resistance to be used as an offset for the Rs maximum value used in parameter ***1-47 Torque Calibration***, options ***[5] 1st start check motor*** and ***[6] Every st. check motor***.

44-27 Estimated D-axis Inductance (Ld)

Default value:	0.000 mH	**Parameter type:**	Range, 0.000 - 1000000.000
Setup:	All setups	**Conversion index:**	-6
Data type:	Uint32	**Change during operation:**	True

When ***[5] 1st start check motor*** or ***[6] Every st. check motor*** is selected in parameter ***1-47 Torque Characteristics***, the last estimated Ld is shown.

44-29 Estimated Back EMF at 1000 RPM

Default value:	0 V	**Parameter type:**	Range, 0 - 65000 V
Setup:	All setups	**Conversion index:**	-1
Data type:	Uint32	**Change during operation:**	True

When ***[5] 1st start check motor*** or ***[6] Every st. check motor*** is selected in parameter ***1-47 Torque Characteristics***, the last estimated Back EMF at 1000 RPM is shown.

6.26 Parameter Group 45-** Condition Based Monitoring

6.26.1 45-0* Cockpit: Monitor

Use this parameter group to enable condition-based monitoring, define units, baseline computation, input sources, view baseline status, and progress.

45-00 Function

Default value:	–	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	False

Set type of notification level and to enable monitoring of the drive.

Option	Name	Description
[0]	Off	Notification is disabled.
[1]	Warning	Warning notifications are triggered.
[2]	Alarm & warning	Both alarm and warning notifications are triggered.

Table 55: Parameter Index

Parameter ID	Description
45-00.0	Select the required option to enable stator winding monitoring.
45-00.1	Select the required option to enable load envelope
45-00.2	Select the required option to enable sensor 1 vibration.
45-00.3	Select the required option to enable sensor 2 vibration.

45-01 Status

Default value:	[0] Off	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	False

Set the parameter to view current monitoring status.

Option	Name	Description
[0]*	Off	Status is disabled.
[1]	On	Shows current monitoring status.
[2]	Waiting for baseline	Baseline computation is in progress.
[3]	On - while baseline	

45-02 Start Time

Default value:	Size related	**Parameter type:**	Range, 0 - 0, Array [6]
Setup:	All setups	**Conversion index:**	0
Data type:	TimeOfDay	**Change during operation:**	True

This parameter shows at which date and time the monitoring function was started.

45-03 Stop Time

Default value:	Size related	**Parameter type:**	Range, 0 - 0, Array [6]
Setup:	All setups	**Conversion index:**	0
Data type:	TimeOfDay	**Change during operation:**	True

This parameter shows at which date and time the monitoring function was stopped.

45-09 Readout Setting

Default value:	[0] Actual	**Paramete type:**	Option, Array [6]
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Set the readout setting.

Option	Name	Description
[0]*	Actual	
[1]	Actual rel. To S1 High	
[2]	Actual rel. To S2 High	
[3]	Actual rel. To Alarm High	
[4]	Actual rel. To S1 Low (Only For Load)	
[5]	Actual rel. To S2 Low (Only For Load)	
[6]	Actual rel. To Alarm Low (Only For Load)	

Table 56: Parameter Index

Parameter ID	Description
45-00.0	Select the required option to enable stator winding monitoring.
45-00.1	Select the required option to enable load envelope
45-00.2	Select the required option to enable sensor 1 vibration.
45-00.3	Select the required option to enable sensor 2 vibration.

6.26.2 45-1* Cockpit: Actl Status

Use the parameters in this group to compare the actual monitor values to all thresholds at the current motor output speed.

45-10 Alarm High Threshold

Default value:	0%	**Parameter type:**	Range 0 - 655.35%, Array [8]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the maximum threshold limit. The drive triggers a notification when threshold limit is exceeded.

Table 57: Options

Parameter ID	Description
45-10.0	Stator Winding
45-10.1	Stator Winding Active
45-10.2	Stator Winding Load
45-10.3	Load Envelope
45-10.4	Sensor 1 Vibration
45-10.5	Sensor 2 Vibration

45-11 Warning S2 High Threshold

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [8]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the maximum threshold limit for warning stage 2 for the index. The drive triggers a warning notification when threshold limit is exceeded.

Table 58: Parameter Index

Parameter ID	Description
45-11.0	Stator Winding
45-11.1	Stator Winding Active
45-11.2	Stator Winding Load
45-11.3	Load Envelope
45-11.4	Sensor 1 Vibration
45-11.5	Sensor 2 Vibration

45-12 Warning S1 High Threshold

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [8]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the maximum threshold limit for warning stage 1, in the parameter index. The drive triggers a warning notification when threshold limit is exceeded. Entering a value in the parameter indicates a user specified threshold limit.

Table 59: Parameter Index

Parameter ID	Description
45-12.0	Stator Winding
45-12.1	Stator Winding Active
45-12.2	Stator Winding Load
45-12.3	Load Envelope
45-12.4	Sensor 1 Vibration
45-12.5	Sensor 2 Vibration

45-13 Actual Monitor Value

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [8]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

This parameter shows the current value of selected signal.

Table 60: Parameter Index

Parameter ID	Description
45-13.0	Stator Winding
45-13.1	Stator Winding Active
45-13.2	Stator Winding Load
45-13.3	Load Envelope
45-13.4	Sensor 1 Vibration
45-13.5	Sensor 2 Vibration

45-14 Warning S1 Low Threshold

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [8]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the minimum threshold limit for warning stage 1 notification in the parameter index. The drive triggers a notification when the actual monitoring value falls below the minimum threshold limit.

Table 61: Parameter Index

Parameter ID	Description
45-14.0	Stator Winding
45-14.1	Stator Winding Active
45-14.2	Stator Winding Load
45-14.3	Load Envelope
45-14.4	Sensor 1 Vibration
45-14.5	Sensor 2 Vibration

45-15 Warning S2 Low Threshold

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [8]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the minimum threshold limit for warning stage 2 notification, in the parameter index. The drive triggers a warning stage 2 notification when the actual monitoring value falls below the threshold limit specified in the parameter.

Table 62: Parameter Index

Parameter ID	Description
45-15.0	Stator Winding
45-15.1	Stator Winding Active
45-15.2	Stator Winding Load
45-15.3	Load Envelope
45-15.4	Sensor 1 Vibration
45-15.5	Sensor 2 Vibration

45-16 Alarm Low Threshold

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [8]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the minimum threshold limit, in the parameter index. The drive triggers an alarm notification when the actual falls below the minimum threshold limit.

Table 63: Parameter Index

Parameter ID	Description
45-16.0	Stator Winding
45-16.1	Stator Winding Active
45-16.2	Stator Winding Load
45-16.3	Load Envelope
45-16.4	Sensor 1 Vibration
45-16.5	Sensor 2 Vibration

6.26.3 45-2* Baseline Settings

Use the parameters in this group to configure how to capture baseline data.

45-20 Type

Default value:	[0] Off	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Use the parameter to select type of baseline computation.

Option	Name	Description
[0]*	Off	Baseline computation type is not set.
[1]	Baseline Run	Select the option when the application can operate from minimum to maximum speed in one sweep. On enabling this option, the condition-based monitoring function sets speed points. On completion of baseline computation, the motor is ramped down to 0. The option can only operate when Hand On mode is set via control panel.
[2]	Online Baseline	Select the option in applications where baseline run cannot be utilized. In this type of baseline computation, the drive is controlled by the application baseline and speed points are recorded and saved during the duration specified in ***Parameter 45-24 Duration***. The option can only operate when Auto On mode is set via control panel.

45-21 Status

Default value:	[0] Not started	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

This parameter shows the current status of baseline computation.

Option	Name	Description
[0]*	Not started	
[1]	Baseline run running	
[2]	Online baseline running	
[3]	Baseline completed	
[4]	Baseline failed	
[5]	Online inadequate data	

45-22 Progress

Default value:	0%	**Parameter type:**	Range, 0 - 100%
Setup:	All setups	**Conversion index:**	0
Data type:	Uint8	**Change during operation:**	True

Shows the progress of baseline computation. 0% indicates that the baseline computation is not started, and 100% indicates that baseline computation is completed.

45-23 Baseline Result Info

Default value:	[0] None	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Select the required selection for baseline during both baseline run and online baseline.

Option	Name	Description
[0]*	None	
[1]	Baseline run OFF	
[2]	Reverse direction	
[3]	Speed limit exceeded	
[4]	Speed diff low	
[5]	Step ramp timeout	
[6]	Stator supply imbalance	
[7]	Online baseline OFF	
[8]	Online baseline count limit	
[9]	Not allowed - motor running	

45-24 Duration

Default value:	–	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Select a suitable duration for baseline computation. If a value is not selected, by default, the system considers 2 minutes for baseline run and 1 hour for online baseline.

Option	Name	Description
[0]	1 min	
[1]	2 mins	
[3]	4 mins	
[6]	10 mins	
[9]	30 mins	
[13]	1 hour	
[16]	2 hours	
[19]	4 hours	
[23]	8 hours	
[27]	1 day	
[30]	2 days	
[33]	5 days	
[36]	1 week	
[40]	2 weeks	
[43]	1 month	
[46]	2 months	
[49]	4 months	
[52]	6 months	

45-25 Online Speed Band

Default value:	5%	**Parameter type:**	Range, 0 - 5%
Setup:	2 setups	**Conversion index:**	0
Data type:	Uint8	**Change during operation:**	True

Use this parameter to define a window to capture the baseline data for different speed points when the speed of drive is within the specified band percentage. Setting the parameter increases a chance to capture all speed points in online baseline mode.

45-26 Min. Speed

Default value:	Size related	**Parameter type:**	Range, 0 - 35700 [RPM]
Setup:	2 setups	**Conversion index:**	67
Data type:	Uint16	**Change during operation:**	True

Use this parameter to set the minimum speed of the drive to begin condition-based monitoring functions. Ensure to set a value which exceeds the minimum speed limit of motor. The minimum limit of motor speed corresponds to the setting in ***parameter 4-11 Motor Speed Low Limit [RPM]***. For more information, refer to the drive-specific programming guide.

45-27 Max. Speed

Default value:	Size related	**Parameter type:**	Range, 100 - 35700 [RPM]
Setup:	2 setups	**Conversion index:**	67
Data type:	Uint16	**Change during operation:**	True

Use this parameter to set the maximum speed of the drive for condition-based monitoring functions. Setting the minimum and maximum speed defines the speed range for condition-based monitoring functions to perform effectively. Ensure to set a value which does not exceed the maximum limit of motor speed. The maximum limit of motor speed corresponds to the setting in ***parameter 4-13 Motor Speed High Limit [RPM]***. For more information, refer to the drive-specific programming guide.

45-28 Speed Points

Default value:	Size related	**Parameter type:**	Range, par. 45-26 - par. 45-27, Array [20]
Setup:	2 setups	**Conversion index:**	67
Data type:	Uint32	**Change during operation:**	True

Shows the baseline speed points calculated within the range defined in ***parameter 45-26 Min. Speed*** and ***parameter 45-27 Max. speed***.

6.26.4 45-3* Threshold Config.

45-30 Baseline Statistics

Default value:	[3] Mean ± 3 standard deviation	**Parameter type:**	Option, Array [6]
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Select the type of baseline statistical data for visualizing calculated threshold limits for each parameter index. The calculated threshold is used for monitoring purposes.

Option	Name	Description
[1]	Mean	Average of the baseline data is shown.
[2]	Maximum/minimum	Maximum and minimum of the baseline data is shown.
[3]*	Mean +/- 3 standard deviation	Mean and +/-3 standard deviations of the baseline data is shown.

Table 64: Parameter Index

Parameter ID	Description
45-30.0	Stator Winding
45-30.1	Load Envelope
45-30.2	Sensor 1 Vibration
45-30.3	Sensor 2 Vibration

45-31 Warning Mode

Default value:	[1] Offset	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Select a mode to define threshold limit for warnings.

Option	Name	Description
[0]	Absolute	Absolute value is considered as threshold limit.
[1]*	Offset	Calculates threshold as a sum of the computed baseline data and the offset values.
[2]	Factor	Calculates threshold as baseline data x factor.

The values can be specified in ***parameter 45-34 Warning S2 High***, ***parameter 45-35 Warning S1 High***, ***Parameter 45-36 Warning S1 Low***, and ***parameter 45-37 Warning S2 Low***. For example, if selecting ***[0] Absolute***, a warning S2 low value of 200, and a warning S1 high value of 300, the threshold limit for warning stage 2 ranges from 200–300.

Table 65: Parameter Index

Parameter ID	Description
45-31.0	Stator Winding
45-31.1	Load Envelope
45-31.2	Sensor 1 Vibration
45-31.3	Sensor 2 Vibration

45-32 Alarm Mode

Default value:	–	**Parameter type:**	Option, Array [6]
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Select a mode to define the threshold limits for alarms.

Option	Name	Description
[0]	Absolute	Absolute value is considered as threshold.
[1]	Offset	Calculates threshold as a sum of the computed baseline data and the offset values.
[2]	Factor	Calculates threshold as baseline data * factor.

The values can be specified in ***parameter 45-33 Alarm High*** and ***parameter 45-38 Alarm Low***. For example, if selecting ***[0] Absolute***, setting an alarm low value of 200, and an alarm high value of 300, the threshold limit for alarms ranges from 200 to 300.

Table 66: Parameter Index

Parameter ID	Description
45-32.0	Stator Winding
45-32.1	Load Envelope
45-32.2	Sensor 1 Vibration
45-32.3	Sensor 2 Vibration

45-33 Alarm High

Default value:	Size related	**Parameter type:**	Range, 0 - 100%, Array [6]
Setup:	2 setup	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Type the threshold value for high alarm notification. Based on the type of alarm mode selected by the user, a high alarm threshold is calculated.

Table 67: Options

Parameter ID	Description
45-33.0	Stator Winding
45-33.1	Load Envelope
45-33.2	Sensor 1 Vibration
45-33.3	Sensor 2 Vibration

45-34 Warning S2 High

Default value:	Size related	**Parameter type:**	Range, 0 - 100%, Array [6]
Setup:	2 setups	**Conversion index:**	-2
Data type:	Uint16	**Change during option:**	True

Type the threshold value for computing a warning S2 high notification. Based on the type of warning mode selected by the user, a warning S2 high threshold is calculated.

Table 68: Options

Parameter ID	Description
45-34.0	Stator Winding
45-34.1	Load Envelope

Table 68: Options (continued)

45-34.2	Sensor 1 Vibration
45-34.3	Sensor 2 Vibration

45-35 Warning S1 High

Default value:	Size related	**Parameter type:**	Range, 0 - 100%
Setup:	2 setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Type the threshold value for computing a warning S1 high notification. Based on the type of warning mode selected by the user, a warning S1 high threshold is calculated.

Table 69: Options

Parameter ID	Description
45-35.0	Stator Winding
45-35.1	Load Envelope
45-35.2	Sensor 1 Vibration
45-35.3	Sensor 2 Vibration

45-36 Warning S1 Low

Default value:	Size related	**Parameter type:**	Range, 0 - 100%, Array [6]
Setup:	2 setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Type the threshold value for computing a warning S1 low notification. Based on the type of warning mode selected by the user, a warning S1 low threshold is calculated.

Table 70: Options

Parameter ID	Description
45-36.0	Stator Winding
45-36.1	Load Envelope
45-36.2	Sensor 1 Vibration
45-36.3	Sensor 2 Vibration

45-37 Warning S2 Low

Default value:	Size related	**Parameter type:**	Range, 0 - 100%, Array [6]
Setup:	2 setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Type the threshold value for computing a warning S2 low notification. Based on the type of warning mode selected by the user, a warning S2 low threshold is calculated.

Table 71: Options

Parameter ID	Description
45-37.0	Stator Winding
45-37.1	Load Envelope
45-37.2	Sensor 1 Vibration
45-37.3	Sensor 2 Vibration

45-38 Alarm Low

Default value:	Size related	**Parameter type:**	Range, 0 - 100%
Setup:	2 setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Type the threshold value for computing a low alarm notification. Based on the type of alarm mode selected, a low alarm threshold is calculated.

Table 72: Options

Parameter ID	Description
45-38.0	Stator Winding
45-38.1	Load Envelope
45-38.2	Sensor 1 Vibration
45-38.3	Sensor 2 Vibration

45-39 Online Baseline Counter

Default value:	2	**Parameter type:**	Range, 0 - 65535, Array [6]
Setup:	2 setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	True

Type the minutes during which monitoring values are captured for a speed point during baseline generation. Speed points are captured for different types of condition-based monitoring during the minutes specified in this parameter.

Table 73: Options

Parameter ID	Description
45-39.0	Stator Winding
45-39.1	Load Envelope
45-39.2	Sensor 1 Vibration
45-39.3	Sensor 2 Vibration

45-40 Extend Factor

Default value:	1.00f	**Parameter type:**	Range, 0.05 - 5.00f, Array [6]
Setup:	2 setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

In this parameter, consider the extended factor required for setting the extended threshold generation via parameter ***45-45 Threshold Generation***

6.26.5 45-4* Threshold Generation

The parameters in this parameter group support the generation of the CBM thresholds.

45-45 Threshold Generation

Default value:	[0] Off	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Option	Name	Description
[0]*	Off	Not applicable.
[1]	Generate now	Based on the selections, threshold for all functions is generated from actual baseline data.
[2]	Auto generate	Not applicable.
[3]	Generate now - previous	Based on the selections, threshold for all functions is generated from previous baseline data.
[4]	Gen. now - stator	Based on the selections, threshold for stator is generated from actual baseline data.
[5]	Gen. now - load	Based on the selections, threshold for load is generated from actual baseline data.
[6]	Gen. now - sensor 1	Based on the selections, threshold for sensor 1 is generated from actual baseline data.
[7]	Gen. now - sensor 2	Based on the selections, threshold for sensor 2 is generated from actual baseline data.
[8]	Gen. now - sensor 3	Based on the selections, threshold for sensor 3 is generated from actual baseline data.
[9]	Gen. now - sensor 4	Based on the selections, threshold for sensor 4 is generated from actual baseline data.
[10]	Extended auto gen.	

45-46 Threshold Limits

Default value:	[0] Limits OK	**Parameter type:**	Option
Setup:	All setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Clear the threshold limit warning when the threshold is at an acceptable level.

Option	Name	Description
[0]*	Limits OK	
[1]	Limits Exceeded	

6.26.6 45-5* Sensor Config.

Select the analog input for sensor and unit configuration.

45-50 Source

Default value:	[0] None	**Parameter type:**	Option, Array [4]
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Select an analog input source for receiving sensor signals. Scaling of analog inputs is performed as defined in *parameter group 6-** Analog In/Out*. For more information on *parameter group 6-** Analog In/Out*, refer to the drive-specific programming guide.

Option	Name	Description
[0]*	None	
[1]	Analog Input 53	
[2]	Analog Input 54	
[3]	Analog Input X30/11	
[4]	Analog Input X30/12	
[5]	Analog Input X42/1	
[6]	Analog Input X42/3	
[7]	Analog Input X42/5	
[8]	Analog Input X48/2	
[9]	Analog Input X49/1	
[10]	Analog Input X49/3	
[11]	Analog Input X49/5	

Table 74: Option

Parameter ID	Description
45-50.0	Sensor 1 Vibration
45-50.1	Sensor 2 Vibration

45-51 Sensor 1 Unit

Default value:	[0] None	**Parameter type:**	Option, Array [4]
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Use the parameter to set unit of monitoring signals from the sensor. The unit is specified on the vibration sensor.

Option	Name	Description
[0]*	None	
[1]	mm/s	
[2]	inch/s	
[3]	m/s2	

Option	Name	Description
[4]	g	
[5]	bar	
[6]	psi	
[7]	Pa	
[8]	kPa	
[9]	MPa	
[10]	kg/cm2	
[11]	inHg	
[12]	m3/h	
[13]	US gpm	
[14]	l/h	
[15]	cfm	

45-52 Sensor Name

Default value:	Size related	**Parameter type:**	Range, 0 - 20, Array [4]
Setup:	2 setups	**Conversion index:**	0
Data type:	VisStr[12]	**Change during operation:**	True

Enter a name for the sensor.

6.26.7 45-6* Stator Res. Setting

45-60 Active Threshold

Default value:	2%	**Parameter type:**	0 - 100%
Setup:	2 setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Use this parameter to activate the resonance region supply imbalance control. Enter the threshold offset value from the baseline data.

45-61 Load Mode

Default value:	[0] Absolute	**Parameter type:**	Option
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Option	Name	Description
[0]*	Absolute	Absolute value specified in parameter ***45-33 Alarm High*** is considered as notification threshold.
[1]	Offset	Notification threshold is a sum of the computed baseline data and the offset values specified in parameter ***45-33*** through parameter ***45-38***.
[2]	Factor	Threshold limits is calculated as baseline data * factor value specified in parameter ***45-33*** through parameter ***45-38***.

45-62 Load Threshold

Default value:	Size related	**Parameter type:**	Range, 0 - 200%
Setup:	2 setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

45-63 Imbalance Limit

Default value:	0.50%	**Parameter type:**	Range, 0.05 - 10%
Setup:	2 setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

45-64 Imbalance Value

Default value:	0%	**Parameter type:**	Range, 0 - 100%
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

This parameter shows the actual value of the supply imbalance.

45-65 DC-link Ripple Limit

Default value:	0.35%	**Parameter type:**	0.05 - 10%
Setup:	2 setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

When the motor output frequency matches the frequency of the DC-link voltage ripple, the threshold offset value activates.

45-66 DC-link Ripple Value

Default value:	0%	**Parameter type:**	Range, 0 - 100%
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

View the actual value of the DC-link voltage ripple.

6.26.8 45-9* Actual Readouts

The parameters in this group are readout parameters showing the actual monitoring values.

45-90 Stator [%]

Default value:	0%	**Parameter type:**	0 - 655.35%
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

This parameter shows the actual stator monitor value at motor output speed.

45-91 Load [%]

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%
Setup:	All setups	**Conversion index:**	-2

Data type:	Uint16	**Change during operation:**	True

This parameter shows the actual load monitor value at motor output speed.

45-92 Sensor 1 [%]

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

This parameter shows the actual sensor 1 monitor value in % at motor output speed.

45-93 Sensor 1 [Unit]

Default value:	0	**Parameter type:**	Range, -999999.999 - 999999.999
Setup:	All setups	**Conversion index:**	-3
Data type:	Int32	**Change during operation:**	True

This parameter shows the actual sensor 1 monitor value in the selected unit at motor output speed.

45-94 Sensor 2 [%]

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

This parameter shows the actual sensor 2 monitor value in % at motor output speed.

45-95 Sensor 2 [Unit]

Default value:	0	**Parameter type:**	Range, -999999.999 - 999999.999
Setup:	All setups	**Conversion index:**	-3
Data type:	Int32	**Change during operation:**	True

This parameter shows the actual sensor 2 monitor value in the selected unit at motor output speed.

45-96 Sensor 3 [%]

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

This parameter shows the actual sensor 3 value in % at motor output speed.

45-97 Sensor 3 [Unit]

Default value:	0	**Parameter type:**	Range, -999999.999 - 999999.999
Setup:	All setups	**Conversion index:**	-3
Data type:	Int32	**Change during operation:**	True

This parameter shows the actual sensor 3 monitor value in the selected unit at motor output speed.

45-98 Sensor 4 [%]

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

This parameter shows the actual sensor 4 monitor value in % at motor output speed.

45-99 Sensor 4 [Unit]

Default value:	0	**Parameter type:**	Range, -999999.999 - 999999.999
Setup:	All setups	**Conversion index:**	-3
Data type:	Int32	**Change during operation:**	True

This parameter shows the actual sensor 4 monitor value in the selected unit at motor output speed.

6.27 Parameter Group 46-** BCM Adv. Thresholds

6.27.1 46-0* History

The parameters in this group hold threshold history, such as timestamps of the last modification.

46-00 Last Change Time

Default value:	Size related	**Parameter type:**	Range, 0 - 0, Array [6]
Setup:	All setups	**Conversion index:**	0
Data type:	TimeOfDay	**Change during operation:**	True

This parameter shows the time stamp of the latest modification to a notification threshold.

6.27.2 46-0* General

46-07 Monitoring Min Speed

Default value:	0 RPM	**Parameter type:**	Range, 0 - 35700 [RPM]
Setup:	All setups	**Conversion index:**	67
Data type:	Uint16	**Change during operation:**	True

This parameter monitors the minimum speed as defined in parameter ***45-45 Threshold Generation***.

46-08 Monitoring Max Speed

Default value:	0 RPM	**Parameter type:**	Range, 0 - 35700 [RPM]
Setup:	All setups	**Conversion index:**	67
Data type:	Uint16	**Change during operation:**	True

This parameter monitors the maximum speed as defined in parameter ***45-45 Threshold Generation***.

46-09 Monitoring Speeds

Default value:	0 RPM	**Parameter type:**	Range, 0 - 37500 [RPM], Array [20]
Setup:	All setups	**Conversion index:**	67
Data type:	Int32	**Change during operation:**	True

This parameter shows the 20 speed points in RPM. By default, the baseline minimum speed is considered.

6.27.3 46-1* Timing

46-10 Alarm Time

Default value:	10 s	**Parameter type:**	Range, 0 - 60000 s, Array [6]
Setup:	2 setups	**Conversion index:**	-2
Data type:	Uint32	**Change during operation:**	True

Set the time in seconds to define duration during which the alarm is not triggered. When the value which is monitored exceeds or falls below the alarm threshold for more than the time specified in the parameter, an alarm is triggered. Alarm time is the amount of time in seconds a monitoring state should be over alarm threshold before triggering an alarm.

Table 75: Parameter Index

Parameter ID	Description
46-10.0	Stator Winding
46-10.1	Load Envelope
46-10.2	Sensor 1 Vibration
46-10.3	Sensor 2 Vibration

46-11 Warning S2 Time

Default value:	10 s	**Parameter type:**	Range, 0 - 60000 s, Array [6]
Setup:	2 setups	**Conversion index:**	-2
Data type:	Uint32	**Change during operation:**	True

Set the time in seconds to define duration during which the warning S2 is not triggered. When the value which is monitored exceeds or falls below the warning S2 threshold for more than the time specified in the parameter, a warning S2 is triggered.

Table 76: Parameter Index

Parameter ID	Description
46-11.0	Stator Winding
46-11.1	Load Envelope
46-11.2	Sensor 1 Vibration
46-11.3	Sensor 2 Vibration

46-12 Warning S1 Time

Default value:	10 s	**Parameter type:**	Range, 0 - 60000 s, Array [6]
Setup:	2 setups	**Conversion index:**	-2

Data type:	Uint32	**Change during operation:**	True

Set the time in seconds to define duration during which the warning S1 is not triggered. When the value which is monitored exceeds or falls below the warning S1 threshold for more than the time specified in the parameter, a warning S1 is triggered.

Table 77: Parameter Index

Parameter ID	Description
46-12.0	Stator Winding
46-12.1	Load Envelope
46-12.2	Sensor 1 Vibration
46-12.3	Sensor 2 Vibration

46-13 Interpolation Type

Default value:	[0] Linear	**Parameter type:**	Option, Array [6]
Setup:	2 setups	**Conversion index:**	–
Data type:	Uint8	**Change during operation:**	True

Set the type of interpolation parameter to construct accurate speed points.

Option	Name	Description
[0]*	Linear	Select this option for stator and load monitoring.
[1]	Staircase	Select this option for vibration monitoring.

Table 78: Index Array

Parameter ID	Description
46-13.0	Stator Winding
46-13.1	Load Envelope
46-13.2	Sensor 1 Vibration
46-13.3	Sensor 2 Vibration

6.27.4 46-2* Stator

46-20 Alarm High

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a high alarm for stator monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a high alarm is triggered. The parameter contains 20 index values to manually configure Stator Winding Monitoring Alarm High Threshold for each individual speed point.

46-21 Warning S2 High

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2

Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a warning S2 alarm for stator monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in warning S2 time, a high warning S2 is triggered. The parameter contains 20 index values to manually configure Stator Winding Monitoring Warning S2 High Threshold for each individual speed point.

46-22 Stator Warning S1

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a high warning S1 for stator monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in warning S1 time, a high warning S1 is triggered. The parameter contains 20 index values which can be used to manually configure Stator Winding Monitoring Warning S1 High Threshold for each individual speed point.

46-23 Resonance Active

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

46-24 Resonance Load

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

6.27.5 46-3* Load

Use the parameters in this group to enter, adjust, and display threshold values for load envelope monitoring function.

46-30 Alarm High

Default value:	0%	**Parameter type:**	Range, 0 - 200%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a high alarm for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a high alarm is triggered. The parameter contains 20 index values which can be used to manually configure Load Alarm High Threshold for each individual speed point.

46-31 Warning S2 High

Default value:	0%	**Parameter type:**	Range, 0 - 200%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a high warning S2 for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in warning S2 time, a warning S2 high is triggered. The parameter contains 20 index values which can be used to manually configure Load Warning S2 High Threshold for each individual speed point.

46-32 Warning S1 High

Default value:	0%	**Parameter type:**	Range, 0 - 200%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a high warning S1 for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in warning S1 time, a high warning S1 is triggered. The parameter contains 20 index values which can be used to manually configure Load Warning S1 High Threshold for each individual speed point.

46-33 Warning S1 Low

Default value	0%	**Parameter type:**	Range, 0 - 200%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a low S1 warning for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in warning S1 time, a low S1 warning is triggered. The parameter contains 20 index values which can be used to manually configure Load Warning S1 Low Threshold for each individual speed point.

46-34 Warning S2 Low

Default value:	0%	**Parameter type:**	Range, 0 - 200%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a low S2 warning for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in warning S2 time, a low S2 warning is triggered. The parameter contains 20 index values which can be used to manually configure Load Warning S2 Low Threshold for each individual speed point.

46-35 Alarm Low

Default value:	0%	**Parameter type:**	Range, 0 - 200%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a low alarm for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a low alarm is triggered. The parameter contains 20 index values which can be used to manually configure Load Alarm Low Threshold for each individual speed point.

6.27.6 46-4* Sensor 1

Use the parameters in this group to enter, adjust, and display threshold values for Sensor 1 monitoring function.

46-40 Alarm High

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a low alarm for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a low alarm is triggered. The parameter contains 20 index values which can be used to manually configure Vibration 1 Alarm High Threshold for each individual speed point.

46-41 Warning S2 High

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a low alarm for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a low alarm is triggered. The parameter contains 20 index values which can be used to manually configure Vibration 1 Warning S2 High Threshold for each individual speed point.

46-42 Warning S1 High

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a low alarm for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a low alarm is triggered. The parameter contains 20 index values which can be used to manually configure Vibration 1 Warning S2 High Threshold for each individual speed point.

46-43 Warning Low

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

46-44 Alarm Low

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

6.27.7 46-5* Sensor 2

Use the parameters in this group to enter, adjust, and display threshold values for Sensor 2 monitoring function.

46-50 Alarm High

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a low alarm for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a low alarm is triggered. The parameter contains 20 index values which can be used to manually configure Vibration 2 Alarm High Threshold for each individual speed point.

46-51 Warning S2 High

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a low alarm for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a low alarm is triggered. The parameter contains 20 index values which can be used to manually configure Vibration 2 Warning S2 High Threshold for each individual speed point.

46-52 Warning S1 High

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a low alarm for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a low alarm is triggered. The parameter contains 20 index values which can be used to manually configure Vibration 2 Alarm High Threshold for each individual speed point.

46-53 Warning Low

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

46-54 Alarm Low

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

6.27.8 46-6* Sensor 3

Use the parameters in this group to enter, adjust, and display threshold values for Sensor 3 monitoring function.

46-60 Alarm High

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a low alarm for load envelope monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a low alarm is triggered. The parameter contains 20 index values which can be used to manually configure Vibration 2 Alarm High Threshold for each individual speed point.

46-61 Warning S2 High

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a warning S2 notification for monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a warning S2 high is triggered. The parameter contains 20 index values which can be used to manually configure warning S2 high threshold for each individual speed point.

46-62 Warning S1 High

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a warning stage 1 high notification for monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a high warning is triggered. The parameter contains 20 index values which can be used to manually configure Warning S1 High Threshold for each individual speed point.

46-63 Warning Low

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

46-64 Alarm Low

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

6.27.9 46-7* Sensor 4

Use the parameters in this group to enter, adjust and display threshold values for Sensor 4 monitoring function.

46-70 Alarm High

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a alarm high notification for monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a high alarm is triggered. The parameter contains 20 index values which can be used to manually configure alarm high threshold for each individual speed point.

46-71 Warning S2 High

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a warning stage 2 high notification for monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a high warning is triggered. The parameter contains 20 index values which can be used to manually configure Warning stage 2 high threshold for each individual speed point.

46-72 Warning S1 High

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

Set the threshold value which defines a warning stage 1 high notification for monitoring. When the value of the monitored value exceeds the threshold specified in the parameter for the duration of time specified in alarm time, a high warning is triggered. The parameter contains 20 index values which can be used to manually configure warning stage 1 high threshold for each individual speed point.

46-73 Warning Low

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

46-74 Alarm Low

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

6.28 Parameter Group 47-** CBM Baseline Data

6.28.1 47-0* History

The parameters in this group holds the baseline history of start and stop timestamps of the active and previous baseline.

47-00 Actual Start Time

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

This parameter shows a timestamp of when the actual baseline capturing was started.

47-01 Actual Time Stop

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

This parameter shows a timestamp of when the actual baseline capturing was stopped.

47-02 Previous Start Time

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

This parameter shows a timestamp of when the previous baseline capturing was started.

47-03 Previous Stop Time

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

This parameter shows a timestamp of when the previous baseline capturing was stopped.

6.28.2 47-0* Speeds

The parameters in this group show the baseline speed points of active and previous baseline data.

47-04 Actual Speed

Default value:	0 RPM	**Parameter type:**	Range, 0 - 65535 [RPM], Array [20]
Setup:	All setups	**Conversion index:**	67
Change during operation:	True		

This parameter shows the baseline speed points of the actual baseline data captured.

47-05 Previous Speed

Default value:	0 RPM	**Parameter type:**	Range, 0 - 65535 [RPM], Array [20]
Setup:	All setups	**Conversion index:**	67
Data type:	Uint16	**Change during operation:**	True

This parameter shows the baseline speed points of the previous baseline data captured.

6.28.3 47-0* Stator

47-06 Actual Max

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

This parameter shows the maximum stator winding readings for the active baseline.

47-07 Actual Mean + 3 Std. Dev.

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

This parameter shows the mean and 3 standard deviations of stator winding readings for the active baseline.

47-08 Actual Mean

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

This parameter shows the average of stator winding readings for the active baseline.

47-09 Actual Min

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

The parameter shows the minimum value of motor stator windings for active baseline.

47-10 Actual Counter

Default value:	0	**Parameter type:**	Range, 0 - 65535, Array [20]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	False

The parameter shows the active minutes to capture monitoring values for speed points.

47-11 Previous Max

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

This parameter shows the maximum stator winding readings for the previous baseline.

47-12 Previous Mean + 3 Std. Dev.

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

This parameter shows the mean and 3 standard deviations of stator winding readings for the previous baseline.

47-13 Previous Mean

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

This parameter shows the average of stator winding readings for the previous baseline.

47-14 Previous Min

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	True

The parameter shows the minimum value of motor stator windings for previous baseline.

47-15 Previous Counter

Default value:	0	**Parameter type:**	Range, 0 - 65535, Array [20]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	False

The parameter shows the previous minutes to capture monitoring values for speed points.

6.28.4 47-1* Stator Res. Active

47-16 Actual Max

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the active stator resistance.

47-17 Actual Mean + 3 Std. Dev.

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]

Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the mean and 3 standard deviations of stator resistance readings for the active baseline.

47-18 Actual Mean

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

Shows the mean of stator resistance recordings for active load in the active baseline.

47-19 Actual Min

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

Shows the minimum of all stator resistance recordings for active load in the active baseline.

47-20 Previous Max

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the maximum stator resistance readings for the previous baseline.

47-21 Previous Mean + 3 Std. Dev.

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the mean and 3 standard deviations of stator resistance readings for the previous baseline.

47-22 Previous Mean

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the average of stator resistance readings for the previous baseline.

47-23 Previous Min

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [10]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

The parameter shows the minimum value of motor stator resistance for previous baseline.

6.28.5 47-2* Stator Res. Load

47-24 Actual Max

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [40]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the maximum load dependent stator resonance. An indexed parameter with 20 pointers showing stator resonance load recordings from minimum to maximum.

47-25 Actual Mean + 3 Std. Dev.

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the average and standard deviation of stator resonance load recordings for the active baseline.

47-26 Actual Mean

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the average of stator resonance load recordings for the active baseline.

47-27 Actual Min

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the minimum value of stator resonance load recordings for the active baseline.

47-28 Previous Max

Default value:	0%	**Parameter Type:**	Range, 0 - 655.35%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the maximum stator resonance readings for the previous baseline.

47-29 Previous Mean + 3 Std. Dev.

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the mean and 3 standard deviations of stator resonance readings for the previous baseline.

47-30 Previous Mean

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the average of stator resonance readings for the previous baseline.

47-31 Previous Min

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

The parameter shows the minimum value of motor stator resonance for the previous baseline.

6.28.6 47-3* Load

47-32 Actual Max

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the maximum positive load envelope recordings for the active baseline. An indexed parameter with 20 pointers of positive load envelope recordings with minimum to maximum.

47-33 Actual Mean + 3 Std. Dev.

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the active mean and 3 standard deviation of load envelope recordings for active baseline.

47-34 Actual Mean

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the active mean of load envelope recordings for the active baseline.

47-35 Actual Mean - 3 Std. Dev.

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the active mean minus 3 standard deviation of load envelope recordings for the active baseline.

47-36 Actual Min

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the minimum value of load envelope recordings for the active baseline.

47-37 Actual Counter

Default value:	0	**Parameter type:**	Range, 0 - 65535, Array [20]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	False

The parameter shows the active minutes to capture monitoring values for load envelope.

47-38 Previous Max

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the maximum value for load envelope readings for the previous baseline.

47-39 Previous Mean + 3 Std. Dev.

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [20]
Setup:	All setups	**Converison index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the mean and 3 standard deviations of load envelope readings for the previous baseline.

47-40 Previous Mean

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the average of load envelope readings for the previous baseline.

47-41 Previous Mean - 3 Std. Dev.

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the mean minus 3 standard deviations of load envelope readings for the previous baseline.

47-42 Previous Min

Default value:	0%	**Parameter type:**	Range, 0 - 655.35%, Array [20]
Setup:	All setups	**Conversion index:**	-2

Data type:	Uint16	**Change during operation:**	False

The parameter shows the minimum value of load envelope for the previous baseline.

47-43 Previous Counter

Default value:	0	**Parameter type:**	Range, 0 - 65535, Array [20]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	False

The parameter shows the previous minutes to capture monitoring values for load envelope.

6.28.7 47-4* Sensor 1

47-44 Actual Max

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the maximum recordings from vibration sensors for the active baseline.

47-45 Actual Mean + 3 Std. Dev.

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the average and 3 standard deviations for upper threshold of recordings from vibration sensors for active baseline.

47-46 Actual Mean

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the average value of recordings from vibration sensors for the active baseline.

47-47 Actual Min

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the minimum value of recordings from vibration sensors for the active baseline.

47-48 Actual Counter

Default value:	0	**Parameter type:**	Range, 0 - 65535, Array [20]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	False

The parameter shows the active minutes to capture monitoring values for Sensor 1.

47-49 Previous Max

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the maximum value for Sensor 1 readings for the previous baseline.

47-50 Previous Mean + 3 Std. Dev.

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the mean and 3 standard deviations of Sensor 1 readings for the previous baseline.

47-51 Previous Mean

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the average of Sensor 1 readings for the previous baseline.

47-52 Previous Min

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

The parameter shows the minimum value of Sensor 1 for the previous baseline.

47-53 Previous Counter

Default value:	0	**Parameter type:**	Range, 0 - 65535, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

The parameter shows the previous minutes to capture monitoring values for Sensor 1.

6.28.8 47-5* Sensor 2

47-54 Actual Max

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [10]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the maximum recordings from vibration sensors for the active baseline.

47-55 Actual Mean + 3 Std. Dev.

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the average and 3 standard deviations for upper threshold of recordings from vibration sensors for active baseline.

47-56 Actual Mean

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

Shows the average value of recordings from vibration sensors for active baseline.

47-57 Actual Min

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the minimum value of recordings from vibration sensors for active baseline.

47-58 Actual Counter

Default value:	0	**Parameter type:**	Range, 0 - 65535, Array [20]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	False

The parameter shows the active minutes to capture monitoring values for Sensor 2.

47-59 Previous Max

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the maximum value for Sensor 2 readings for the previous baseline.

47-60 Previous Mean + 3 Std. Dev.

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the mean and 3 standard deviations of Sensor 2 readings for the previous baseline.

47-61 Previous Mean

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2

Data type:	Uint16	**Change during operation:**	False

This parameter shows the average of Sensor 2 readings for the previous baseline.

47-62 Previous Min

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

The parameter shows the minimum value of Sensor 2 for the previous baseline.

47-63 Previous Counter

Default value:	0	**Parameter type:**	Range, 0 - 65535, Array [20]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	False

The parameter shows the previous minutes to capture monitoring values for Sensor 2.

6.28.9 47-6* Sensor 3

47-64 Actual Max

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the maximum recordings from vibration sensors for the active baseline.

47-65 Actual Mean + 3 Std. Dev.

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the average and 3 standard deviations for upper threshold of recordings from vibration sensors for active baseline.

47-66 Actual Mean

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

Shows the average value of recordings from vibration sensors for active baseline.

47-67 Actual Min

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the minimum value of recordings from vibration sensors for active baseline.

47-68 Actual Counter

Default value:	0	**Parameter type:**	Range, 0 - 65535, Array [20]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	False

The parameter shows the active minutes to capture monitoring values for Sensor 3.

47-69 Previous Max

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the maximum value for Sensor 3 readings for the previous baseline.

47-70 Previous Mean + 3 Std. Dev.

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the mean and 3 standard deviations of Sensor 3 readings for the previous baseline.

47-71 Previous Mean

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the average of Sensor 3 readings for the previous baseline.

47-72 Previous Min

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

The parameter shows the minimum value of Sensor 3 for the previous baseline.

47-73 Previous Counter

Default value:	0	**Parameter type:**	Range, 0 - 65535, Array [20]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	False

The parameter shows the previous minutes to capture monitoring values for Sensor 3.

6.28.10 47-7* Sensor 4

47-74 Actual Max

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the maximum recordings from vibration sensors for the active baseline.

47-75 Actual Mean + 3 Std. Dev.

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the average and 3 standard deviations for upper threshold of recordings from vibration sensors for active baseline.

47-76 Actual Mean

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

Shows the average value of recordings from vibration sensors for active baseline.

47-77 Actual Min

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the minimum value of recordings from vibration sensors for active baseline.

47-78 Actual Counter

Default value:	0	**Parameter type:**	Range, 0 - 65535, Array [20]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	False

The parameter shows the active minutes to capture monitoring values for Sensor 4.

47-79 Previous Max

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the maximum value for Sensor 4 readings for the previous baseline.

47-80 Previous Mean + 3 Std. Dev.

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]

Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the mean and 3 standard deviations of Sensor 4 readings for the previous baseline.

47-81 Previous Mean

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

This parameter shows the average of Sensor 4 readings for the previous baseline.

47-82 Previous Min

Default value:	0%	**Parameter type:**	Range, 0 - 100%, Array [20]
Setup:	All setups	**Conversion index:**	-2
Data type:	Uint16	**Change during operation:**	False

The parameter shows the minimum value of Sensor 4 for the previous baseline.

47-83 Previous Counter

Default value:	0	**Parameter type:**	Range, 0 - 65535, Array [20]
Setup:	All setups	**Conversion index:**	0
Data type:	Uint16	**Change during operation:**	False

The parameter shows the previous minutes to capture monitoring values for Sensor 4.

6.28.11 47-9* Version

47-99 Version

Default value:	0	**Parameter type:**	Range, 0 - 255
Setup:	All setups	**Conversion index:**	0
Data type:	Uint8	**Change during operation:**	True

View the CBM version number. The readout is only shown in VLT® Motion Control Tool MCT 10.

6.28.12 47-9* Min Max Speed

47-95 Actual Min Speed

Default value:	0 RPM	**Parameter type:**	Range, 0 - 35700 [RPM]
Setup:	All setups	**Conversion index:**	67
Data type:	Uint16	**Change during operation:**	True

This parameter shows the minimum speed of the actual baseline data.

47-96 Actual Max Speed

Default value:	0 RPM	**Parameter type:**	Range, 0 - 35700 [RPM]

Setup:	All setups	**Conversion index:**	67
Data type:	Uint16	**Change during operation:**	True

This parameter shows the maximum speed of the actual baseline data.

47-97 Previous Min Speed

Default value:	0 RPM	**Parameter type:**	Range, 0 - 35700 [RPM]
Setup:	All setups	**Conversion index:**	67
Data type:	Uint16	**Change during operation:**	True

This parameter shows the minimum speed of the previous baseline data.

47-98 Previous Max Speed

Default value:	0 RPM	**Parameter type:**	Range, 0 - 35700 [RPM]
Setup:	All setups	**Conversion index:**	67
Data type:	Uint16	**Change during operation:**	True

This parameter shows the maximum speed of the previous baseline data.

6.29 Parameter Group 50-** License

50-00 License Installed

Default value:	0	**Parameter type:**	Range, 0 - 40, Array [3]
Setup:	All setups	**Conversion index:**	0
Data type:	VisStr[40]	**Change during operation:**	False

Shows all licenses activated in the drive.

50-01 License Code

Default value:	Size related	**Parameter type:**	Range, 0 - 19
Setup:	1 setup	**Conversion index:**	0
Data type:	VisStr[19]	**Change during operation:**	True

Enter the license code provided by the 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.

NOTE: 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.

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.

NOTE: 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.

NOTE: 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 Warning/Alarm Code List

NOTE: If more selections are marked as default, it indicates that the warning changes to an alarm after a certain time.

- X = Default
- (X) = Possible selection
- – = Not relevant

Table 79: Alarm/Warning Code List

#	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	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	
1	10V low	X	–	–	Parameter ***14-90.0 Fault Level***	Ignored	Ignored	Warning	–
2	Live zero error	(X)	(X)	–	Parameter ***6-01 Live Zero Timeout Function***, Parameter ***6-02 Emergency Mode Live Zero Timeout Function***	Ignored	Ignored	(Warning/ Trip)	–
3	No motor	(X)	–	–	Parameter ***1-80 Function at Stop*** and parameter ***4-58 Missing Motor Phase*** when set to ***[5] Motor check***	Ignored	Ignored	(Warning/ Trip)	–
4	Mains ph. loss	(X)	(X)	(X)	Parameter ***14-12 Response to Mains Imbalance***	Ignored	Ignored	(Warning/ Trip)	X
5	DC voltage high	X	–	–	–	Ignored	Ignored	Warning	–
6	DC voltage low	X	–	–	–	Ignored	Ignored	Warning	–
7	DC overvolt	X	X	–	–	Trip+ Reset	Trip	Warning/ Trip	–
8	DC undervolt	X	X	–	–	Trip+ Reset	Trip	Warning/ Trip	–

Table 79: Alarm/Warning Code List (continued)

#	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	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	
9	Inverter overld.	X	X	–	Alternatively, parameter ***14-61 Function at Inverter Overload*** can be set to ***[0] De-rate***	Ignored	Ignored	Warning/ Trip	X
		X	–	–	Alternatively, parameter ***14-90 Fault Settings*** can be set to ***[0] Off***				
10	Motor ETR over	(X)	(X)	–	Parameter ***1-90 Motor Thermal Protection***	Ignored	Ignored	(Warning/ Trip)	–
11	Motor th over	(X)	(X)	–	Parameter ***1-90 Motor Thermal Protection***	Ignored	Ignored	(Warning/ Trip)	–
12	Torque limit	X	X	–	Parameter ***14-90.6 Fault level***and parameter ***14-25 Trip Delay at Torque Limit***	Ignored	Ignored	Warning/ Trip	–
13	Overcurrent	X	X	X	–	Trip+Reset	Trip	Trip lock	–
14	Ground fault	–	X	X	Parameter ***14-90.4 Fault Level***	Trip+Reset	Trip	Trip	–
15	Incomp. HW	–	X	X	–	Ignored	Ignored	Trip/Trip lock	–
16	Short circuit	–	X	X	Parameter ***14-90.8 Fault Level***default is Trip Lock	Trip+Reset	Trip	Trip lock	–
17	Ctrl. word TO	(X)	(X)	–	Parameter ***8-04 Control Word Timeout Function***, default ***[0] Off***	Ignored	Ignored	(Warning/ Trip)	–

Table 79: Alarm/Warning Code List (continued)

#	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	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	
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	–	–	Parameter ***14-53 Fan Monitor***	Ignored	Ignored	(Warning/ Trip)	–
24	External fans	X	–	–	Parameter ***14-53 Fan Monitor***	Ignored	Ignored	(Warning/ Trip)	–
25	Brake resistor	X	–	–	–	Ignored	Ignored		–
26	Brake overload	(X)	(X)	–	Parameter ***2-13 Brake Power Monitoring***, default ***[0] Off***	Ignored	Ignored	(Warning/ Trip)	–
27	Brake IGBT	X	X	–	–	Ignored	Ignored	Warning/ Trip	–
28	Brake check	(X)	(X)	–	Parameter ***2-15 Brake Check***	Ignored	Ignored	(Warning/ Trip lock)	–
29	Power module temp	–	X	X	Parameter ***14-90.9 Fault Level***	Ignored	Ignored	Trip lock	X
30	U phase loss	(X)	(X)	(X)	Alternatively, parameter ***4-58 Missing Motor Phase Function*** can be set to ***[0] Disable***.	Ignored	Ignored	Trip lock	–
		–	–	X	Parameter ***14-90.16 Fault Level***				

Table 79: Alarm/Warning Code List (continued)

#	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	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	
31	V phase loss	(X)	(X)	(X)	Alternatively, parameter ***4-58 Missing Motor Phase Function*** can be set to ***[0] Disable***.	Ignored	Ignored	Trip lock	–
		–	–	X	Parameter ***14-90.16 Fault Level***				
32	W phase loss	(X)	(X)	(X)	Alternatively, parameter ***4-58 Missing Motor Phase Function*** can be set to ***[0] Disable***.	Ignored	Ignored	Trip lock	–
		–	–	X	Parameter ***14-90.16 Fault Level***				
33	Inrush fault	–	X	X	–	Ignored	Ignored	Trip lock	X
34	Fieldbus fault	X	–	–	Parameter ***14-90.27 Fault Level***	Ignored	Ignored	Warning/ Trip	–
35	Option fault	–	–	X	–	Ignored	Ignored	Warning	–
36	Mains failure	X	X	–	Parameter ***14-10 Mains Failure***, default ***[0] Off***	Ignored	Ignored	(Warning/ Trip)	–
37	Phase imbalance	–	X	–					
38	Internal fault	–	X	X	–	Ignored	Ignored	Trip/Trip lock	X
39	Heat sink sensor	–	X	X	Parameter ***14-90 Fault Settings***	Ignored	Ignored	Trip lock	X
40	Overload T27	(X)	–	–	Parameter ***5-00 Digital I/O Mode***, parameter ***5-01 Terminal 27 Mode***	Ignored	Ignored	(Warning)	–

Table 79: Alarm/Warning Code List (continued)

#	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	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	
41	Overload T29	(X)	–	–	Parameter ***5-00 Digital I/O Mode***, parameter ***5-02 Terminal 29 Mode***	Ignored	Ignored	(Warning)	–
42	Ovrld X30/6-7	(X)	–	–	–	–	–	–	–
43	Ext. supply (option)	X	–	–	–	–	–	–	–
45	Ground fault 2	–	X[1]	X	Parameter ***14-90.5 Fault Level***	Ignored	Ignored	Trip	–
46	Pwr. card supply	–	X	X	–	Ignored	Ignored	Trip/Trip lock	–
47	24 V supply low	X	X	X	Parameter ***14-90 Fault Settings***	Ignored	Ignored	Trip lock	–
48	1.2 V supply low	–	X	X	Parameter ***14-90 Fault Settings***	Ignored	Ignored	Trip lock	–
49	Speed limit	–	X	–	Parameter ***1-86 Trip Low Speed [RPM]***	Ignored	Ignored	Warning/(Trip)	–
50	AMA calibration	–	X	–	–	Ignored	Ignored	Trip	–
51	AMA U_{nom},I_{nom}	–	X	–	–	Ignored	Ignored	Trip	–
52	AMA low I_{nom}	–	X	–	–	Ignored	Ignored	Trip	–
53	AMA big motor	–	X	–	–	Ignored	Ignored	Trip	–
54	AMA small mot	–	X	–	–	Ignored	Ignored	Trip	–
55	AMA par. range	–	X	–	–	Ignored	Ignored	Trip	–
56	AMA interrupt	–	X	–	–	Ignored	Ignored	Trip	–
57	AMA timeout	–	X	–	–	Ignored	Ignored	Trip	–
58	AMA internal	X	X	–	–	Ignored	Ignored	Trip	–

Table 79: Alarm/Warning Code List (continued)

#	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	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	
59	Current limit	X	X	–	Parameter ***14-90 Fault Settings***	Ignored	Ignored	Warning	–
60	External interlock	X	X	–	–	Ignored	Ignored	Warning	–
61	Feedback error	(X)	(X)	–	–	–	–	–	––
62	Output freq. lim.	X	X	–	–	Ignored	Ignored	Warning	–
63	Mech. brake low	–	(X)	–	–	–	–	–	–
64	Voltage limit	X	–	–	Parameter ***14-90 Fault Settings***	Ignored	Ignored	Warning	–
65	Ctrl. card temp	–	X	X	Parameter ***14-90.11 Fault Level***	Ignored	Ignored	Trip lock	X
66	Low temp.	X	–	–	–	Ignored	Ignored	Warning	–
67	Option change	–	X	–	–	Ignored	Ignored	Trip	–
68	Safe stop	(X)	(X)[1]	–	Parameter ***5-19 Terminal 37 Safe Stop***	Trip	Trip	Trip	–
69	Pwr. card temp	–	X	X	Parameter ***14-90 Fault Settings***	Ignored	Ignored	Trip lock	X
70	Illegal FC config	–	–	X	–	Ignored	Ignored	Trip lock	–
71	PTC 1 safe stop	X	X[1]	–	–	Ignored	Ignored	Warning/ Trip	–
72	Dangerous failure	–	–	X[1]	–	Ignored	Ignored	Trip lock	–
73	Safe stop auto restart	(X)	(X)	–	Parameter ***5-19 Terminal 37 Safe Stop***	Ignored	Ignored	(Warning/ Trip)	–
74	PTC thermistor								
75	Illegal profile sel.								

Table 79: Alarm/Warning Code List (continued)

#	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	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	
76	Power unit setup	X	–	–	–	Ignored	Ignored	Warning	–
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	–	Ignored	Ignored	Trip/Trip lock	–
80	Drive initialized	–	X	–	–	Ignored	Ignored	Trip	–
81	CSIV corrupt	–	X	–	–	–	–	–	–
82	CSIV parameter error	–	X	–	–	–	–	–	–
83	Illegal option combi.	–	–	X	–				
84	Safety opt. replaced								
85	Dang fail PB								
86	Dang fail DI								
88	Option detection	–	–	X	–				
89	Mechanical brake sliding	X	–	–	–				
90	Feedback mon.	(X)	(X)	–	Parameter ***17-61 Feedback Signal Monitoring***	–	–	–	–
91	AI54 set wrong	–	–	X	S202	Ignored	Ignored	Trip lock	–
98	Clock fault	(X)	(X)	(X)	–	Ignored	Ignored	Warning	–
99	Locked rotor	–	X	X	Parameter ***14-90 Fault Settings***	Ignored	Ignored	Trip/Trip lock	–
101	Speed monitor	X	X	–	–	Ignored	Ignored	–	

Table 79: Alarm/Warning Code List (continued)

#	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	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	
102	Too many CAN objects								
103	Illegal axis num.								
104	Mixing fans	X	X	–	Parameter ***14-53 Fan Monitor***	Ignored	Ignored	(Warning/ Trip)	–
105	Error not reset				–				
106	HOME not done								
107	Home vel zero								
108	Position error								
109	Index not found								
110	Unknown cmd.								
111	SW end limit								
112	Unknown par.								
113	FC not enabled								
114	Too many loops								
115	Par. save failed								
116	Par. memory								
117	Progr. memory								
118	Reset by CPU								
119	User aborg								
121	No more SDO channels								
122	Mot. rotat. unexp.	–	X	–	–				
123	Check motor model	–	X	–	–				

Table 79: Alarm/Warning Code List (continued)

#	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	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	
124	User alert	(X)	(X)	(X)	Parameter group *13-9* User Defined Alerts*	Ignored	Ignored	(Warning/ Trip)	–
125	HW end limit								
128	Enc. inc/abs res.								
129	I2C comm. failure	X	–	–	–	–	–	–	–
144	Inrush supply	–	–	–	–	–	–	–	–
145	Ext. SCR disable	–	X	–	–	–	–	–	–
146	Mains voltage	X	X	–	–	–	–	–	–
147	Mains frequency	X	X	–	–	–	–	–	–
148	System temp	X	X	–	–	–	–	–	–
149	Too many inter.								
150	No ext. 24V								
151	GOSUB>limit								
152	Return @ limit								
154	D.out overload								
155	LINK failed								
156	Illegal double arg.								
157	Power limit mot.	–	X	–	Parameter ***4-80 Power Limit Func. Motor Mode***, parameter ***4-82 Power Limit Motor Mode***				

Table 79: Alarm/Warning Code List (continued)

#	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	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	
158	Power limit gen.	–	X	–	Parameter ***4-81 Power Limit Func. Generator Mode***, Parameter ***4-83 Power Limit Generator Mode***				
160	Internal Intr. error								
161	Feedback not ready	X	–	–	–	–	–	–	–
162	Memory error	–	–	–	–	–	–	–	–
163	ATEX ETR cur.lim.warning	X	–	–	–	–	–	–	–
164	ATEX ETR cur.lim.alarm	–	X	–	–	–	–	–	–
165	ATEX ETR freq.lim.warning	X	–	–	–	–	–	–	–
166	ATEX ETR freq.lim.alarm	–	X	–	–	–	–	–	–
170	Array size (DIM)								
171	Array too small								
175	Out of array mem.								
176	Wrong array size								
179	WAITNDX TO.								
180	API error								
181	OEM error								
182	WD error [No]								
184	ONTIME > limit								

Table 79: Alarm/Warning Code List (continued)

#	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	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	
187	Out of memory								
188	CAN guarding error								
189	CAN send-receive error								
190	Memory locked								
191	Ill. cam array								
192	Encoder error								
193	Stack overflow								
194	Out of dyn. mem								
195	Too many test indices								
196	Code too old								
198	Limit sw. violation								
199	MCO app. error								
200	Emergency mode	X	–	–	–	Ignored	Ignored	Warning	–
201	Emerg. m was active	X	–	–	–	Ignored	Ignored	Warning	–
202	Emerg. m limits exceeded	X	–	X	–	Ignored	Ignored	Warning	–
209	Standby encoder failed								
220	Overload trip	X	–	–	–	–	–	–	–
221	Bypass interlock	–	X	–	–	–	–	–	–
222	M2 open failed	–	–	X	–	–	–	–	–
223	M2 close failed	–	–	X	–	–	–	–	–

Table 79: Alarm/Warning Code List (continued)

#	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	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	
224	M3 open failed	–	–	X	–	–	–	–	–
225	Overload X59/3-6	X	–	–	–	–	–	–	–
226	M3 close failed	–	–	X	–	–	–	–	–
227	Bypass com error				–	–	–	–	–
228	APU low voltage	X	–	–	–	–	–	–	–
229	Motor disconn.	X	–	–	–	–	–	–	–
230	Read failed	–	X	–	–	–	–	–	–
231	Read complete	–	X	–	–	–	–	–	–
232	Reading...	–	X	–	–	–	–	–	–
239	SAS file invalid	–	X	–	–	–	–	–	–
240	Write failed	–	X	–	–	–	–	–	–
241	Write complete	–	X	–	–	–	–	–	–
242	Writeing...	–	X	–	–	–	–	–	–
243	Brake IGBT	(X)	(X)	(X)	*Parameter **2-13 Brake Power Monitoring***, default ***[0] Off***	Ignored	Ignored	Warning/ Trip	–
244	Heat sink temp	–	–	X	Parameter ***14-90 Fault Settings***	Ignored	Ignored	Trip lock	X
245	Heat sink sensor	–	–	X	Parameter ***14-90 Fault Settings***	Ignored	Ignored	Trip lock	X
246	Pwr. card supply	–	–	X	–	Ignored	Ignored	Trip/Trip lock	–
247	Pwr. card temp	–	–	X	Parameter ***14-90 Fault Settings***	Ignored	Ignored	Trip lock	X

Table 79: Alarm/Warning Code List (continued)

#	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	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	
248	Illegal PS config	–	–	X	–	Ignored	Ignored	Trip/Trip lock	–
249	Rect. low temp.	X	–	–	–	–	–	–	––
250	New spare part	–	–	X	–	Ignored	Ignored	Trip lock	–
251	New type code	–	X	X	–	Ignored	Ignored	Trip/Trip lock	–
252	Safe option failure	–	–	–	–	–	–	–	–
253	X49/9 overload	–	–	–	–	–	–	–	–
254	X49/11 overload	–	–	–	–	–	–	–	–
255	X49/7 overload								
273	BTM error	–	–	–	–	–	–	–	–
280	Emcy m service warning	X	–	–	–	–	–	–	–
281	Emcy OPR unexpected	X	–	–	–	–	–	–	–
290	Connection to one master is lost	X	–	–	–	–	–	–	–
300	Mains cont. fault	–	–	X	Parameter ***14-90 Fault Settings***	Ignored	Ignored	Trip lock	–
301	SC cont. fault	–	–	–	–	–	–	–	–
329	Torque threshold								
421	FPC temp	–	X	–	–	–	–	–	–
423	FPC updating	–	X	–	–	–	–	–	–
424	FPC update success	–	X	–	–	–	–	–	–
425	FPC update failure	–	–	X	–	–	–	–	–
426	FPC config	–	–	X	–	–	–	–	–

Table 79: Alarm/Warning Code List (continued)

#	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	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	
427	FPC supply	–	X	–	–	–	–	–	–
432	Inrush mode error	–	X	–	–	–	–	–	–
500[2], [3]	Stator S2	(X)	(X)	–	Parameter ***45-00.0 Function***	Ignored	Ignored	Ignored	–
501	Load S2	(X)	(X)	–	Parameter ***45-00.1 Function***	Ignored	Ignored	Ignored	–
502	Sensor 1 S2	(X)	(X)	–	Parameter ***45-00.2 Function***	Ignored	Ignored	Ignored	–
503	Sensor 2 S2	(X)	(X)	–	Parameter ***45-00.3 Function***	Ignored	Ignored	Ignored	–
504	Sensor 3 S2	(X)	(X)	–	Parameter ***45-00.4 Function***	Ignored	Ignored	Ignored	–
505	Sensor 4 S2	(X)	(X)	–	Parameter ***45-00.5 Function***	Ignored	Ignored	Ignored	–
506	Load low S2	(X)	(X)	–	Parameter ***45-00.1 Function***	Ignored	Ignored	Ignored	–
510	Stator	(X)	(X)	–	Parameter ***45-00.0 Function***	Ignored	Ignored	Ignored	–
511	Load	(X)	(X)	–	Parameter ***45-00.1 Function***	Ignored	Ignored	Ignored	–
512	Sensor 1	(X)	(X)	–	Parameter ***45-00.2 Function***	Ignored	Ignored	Ignored	–
513	Sensor 2	(X)	(X)	–	Parameter ***45-00.3 Function***	Ignored	Ignored	Ignored	–
514	Sensor 3	(X)	(X)	–	Parameter ***45-00.4 Function***	Ignored	Ignored	Ignored	–

Table 79: Alarm/Warning Code List (continued)

#	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	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	
515	Sensor 4	(X)	(X)	–	Parameter ***45-00.5 Function***	Ignored	Ignored	Ignored	–
516	Load low	(X)	(X)	–	Parameter ***45-00.1 Function***	Ignored	Ignored	Ignored	–
520	Stator thld at max/min	(X)	–	–	–	–	–	–	–
521	Load thld at max/min	(X)	–	–	–	–	–	–	–
522	Sensor 1 thld at max/min	(X)	–	–	–	–	–	–	–
523	Sensor 2 thld at max/min	(X)	–	–	–	–	–	–	–
524	Sensor 3 thld at max/min	(X)	–	–	–	–	–	–	–
525	Sensor 4 thld at max/min	(X)	–	–	–	–	–	–	–
550	Sensor 1 low	(X)	(X)	–	Parameter ***45-00.2 Function***	Ignored	Ignored	Ignored	–
551	Sensor 2 low	(X)	(X)	–	Parameter ***45-00.3 Function***	Ignored	Ignored	Ignored	–
552	Sensor 3 low	(X)	(X)	–	Parameter ***45-00.4 Function***	Ignored	Ignored	Ignored	–
553	Sensor 4 low	(X)	(X)	–	Parameter ***45-00.5 Function***	Ignored	Ignored	Ignored	–
600	Thread timing	–	–	–	–	–	–	–	–

*1) Cannot be auto reset via parameter **14-20 Reset Mode**.*

2) All warnings and alarms from 500–525 require a CBM license.

3) All CBM warnings and alarms have warning and alarm/trip, where warning is default if the CBM license is installed and monitoring is enabled.

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 80: Indicator Light

Warning	Yellow
Alarm	Flashing red
Trip locked	Yellow and red

7.2 Descriptions of Warnings and Alarms

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.

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 faulty device sending the signal can cause this condition.

Troubleshooting

- Check connections on all the analog input terminals. Control card terminals 53 and 54 for signals, terminal 55 common.
- Check that the drive programming and switch settings match the analog signal type.
- Perform the input terminal signal test.

WARNING 3, No Motor

Cause

No motor is connected to the output of the drive.

Troubleshooting

- Check the cable connection between the drive and the motor.

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 Response to Mains Imbalance***.

Troubleshooting

- Check the supply voltage and supply currents to the drive.

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.

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.

WARNING/ALARM 7, DC Overvoltage

Cause

If the DC-link voltage exceeds the limit, the drive trips after a time.

Troubleshooting

- Extend the ramp time.
- Change the ramp type.

WARNING/ALARM 8, DC Under Voltage

Cause

If the DC-link voltage (DC-link) drops below the undervoltage limit, 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 the input voltage test.
- Perform the soft charge circuit test.

WARNING/ALARM 9, Inverter Overload

Cause

The drive is about to cut out because of an overload (too high current for too long). The counter for electronic, thermal inverter protection issues a warning at 90% and trips at 100%, while giving an alarm. The drive cannot be reset until the counter is below 90%.

The fault occurs when the drive has run with more than 100% overload for too long.

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.

WARNING/ALARM 10, Motor ETR Overtemperature

Cause

According to the electronic thermal protection (ETR), the motor is too hot. Select whether the drive issues a warning or an alarm when the counter reaches 100% in parameter ***1-90 Motor Thermal Protection***. The fault occurs when the motor runs with more than 100% overload for too long.

Troubleshooting

- Check for motor overheating.
- Check if 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 parameter ***1-20*** to parameter ***1-25*** is set correctly.
- Running AMA in parameter ***1-29 Automatic Motor Adaptation (AMA)*** tunes the drive to the motor more accurately and reduces thermal loading.

WARNING/ALARM 11, Motor Thermistor Overtemperature

Cause

Check whether the thermistor is disconnected. Select whether the drive issues a warning or an alarm in parameter ***1-90 Motor Thermal Protection***.

Troubleshooting

- Check for motor overheating.
- Check if 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). Also check that the terminal switch for 53 or 54 is set for voltage. Check that parameter ***1-93 Thermistor Resource*** selects terminal 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***.

WARNING/ALARM 13, Overcurrent

Cause

The inverter peak current limit (approximately 200% of the rated current) is exceeded. The warning lasts about 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 backup. 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***.

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.

Alarm 15, Hardware Mismatch

Cause

A fitted option is not operational with the present control card hardware or software.

Troubleshooting

- Record the values of the following parameters and contact Danfoss.
  - **a.** Parameter ***15-40 FC Type***
  - **b.** Parameter ***15-41 Power Section***
  - **c.** Parameter ***15-42 Voltage***
  - **d.** Parameter ***15-43 Software Version***
  - **e.** Parameter ***15-45 Actual Typecode String***
  - **f.** Parameter ***15-49 SW ID Control Card***
  - **g.** Parameter ***15-50 SW ID Power Card***
  - **h.** Parameter ***15-60 Option Mounted***
  - **i.** Parameter ***15-61 Option SW Version*** (for each option slot).

ALARM 16, Short Circuit

Cause

There is short-circuiting in the motor or motor wiring.

Troubleshooting

⚠ WARNING



HAZARDOUS VOLTAGE

AC drives contain hazardous voltage when connected to the 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.

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. The drive then ramps down to stop and issues 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 the installation adheres to the EMC requirements.

WARNING/ALARM 20, Temp. Input Error

Cause

The temperature detected by VLT® Sensor Input Option MCB 114 exceeds the limit.

This warning/alarm is only active when ***[5] Stop and trip*** is selected in ***parameter 35-06 Temperature Sensor Alarm Function***.

Troubleshooting

- Check the settings of the following parameters:
  - **a.** Parameter group *35-1* Temp. Input X48/4*
  - **b.** Parameter group *35-2* Temp. Input X48/7*
  - **c.** Parameter group *35-3* Temp. Input X48/10*
- Check the feedback temperature from the following parameters:
  - **a.** Parameter ***18-37 Temp. Input X48/4***
  - **b.** Parameter ***18-38 Temp. Input X48/7***
  - **c.** Parameter ***18-39 Temp. Input X48/10***

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.

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***.

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*** by selecting ***[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

- Cycle 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.

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*** by selecting ***[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.

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***.

WARNING/ALARM 26, Brake Resistor Power Limit

Cause

The power transmitted to the brake resistor is calculated as an average 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 Brake Max. Current***. The warning is active when the dissipated braking power is higher than 90% of the brake resistor power. If ***[2] Trip*** is selected in parameter ***2-13 Brake Power Monitoring***, the drive trips when the dissipated braking power reached 100%.

Troubleshooting

- Decrease brake energy via lower speed or longer ramp time.

ALARM 27, Brake IGBT/Brake Chopper Short-circuited

Cause

The brake transistor is monitored during start-up. If a short circuit occurs, the brake function is disabled, and an alarm is issued. The drive is tripped.

Troubleshooting

- Remove the power to the drive and remove the brake resistor.

ALARM 28, Brake Check

Cause

The brake resistor is not connected or not working.

Troubleshooting

- Check if brake resistor is connected or it is too large for the drive.

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.

ALARM 30, Motor Phase U Missing

Cause

⚠ WARNING



HAZARDOUS VOLTAGE

AC drives contain hazardous voltage when connected to the 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.

Motor phase U between the drive and the motor is missing.

Troubleshooting

- Disconnect power from the drive and check motor phase U.

ALARM 31, Motor Phase V Missing

Cause

⚠ WARNING



HAZARDOUS VOLTAGE

AC drives contain hazardous voltage when connected to the 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.

Motor phase V between the drive and the motor is missing.

Troubleshooting

- Disconnect power from the drive and check motor phase V.

ALARM 32, Motor Phase W Missing

Cause

⚠ WARNING



HAZARDOUS VOLTAGE

AC drives contain hazardous voltage when connected to the 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.

Motor phase W between the drive and the motor is missing.

Troubleshooting

- Disconnect power from the drive and check motor phase W.

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.

WARNING/ALARM 34, Fieldbus Fault

Cause

The fieldbus on the communication option card is not working.

Troubleshooting

- Check the fieldbus communication option card.

ALARM 35, Option Fault

Cause

Fieldbus or option B detects internal faults.

Troubleshooting

- Contact the local supplier.

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.

ALARM 37, Phase Imbalance

Cause

There is a current imbalance between the power units.

ALARM 38, Internal Fault

Cause

When an internal fault occurs, a code number is shown.

Table 81: Internal Fault List

Fault number	Cause	Solution
0	The serial port cannot be initialized.	Contact the supplier or service department.
256–258	The power EEPROM data is defective or too old.	Replace the power card.
512–519	Internal fault.	Contact the supplier or service department.
783	Parameter value outside of the minimum/maximum limits.	Adjust the parameter value to match the limits.
1024–1284	Internal fault.	Contact the supplier or service department.
1299	The option software in slot A is too old.	Upgrade the software in the drive to the latest version.
1300	The option software in slot B is too old.	Upgrade the software in the drive to the latest version.
1302	The option software in slot C1 is too old.	Upgrade the software in the drive to the latest version.
1315	The option software in slot A is not supported/allowed.	The software version of the option or the fieldbus variant is not compatible with the drive software.
1316	The option software in slot B is not supported/allowed.	The software version of the option or the fieldbus variant is not compatible with the drive software.
1318	The option software in slot C1 is not supported/allowed.	The software version of the option or the fieldbus variant is not compatible with the drive software.
1379–2819	Internal fault.	Contact the supplier or 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.	Check for poor EMC protection and 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.	Adjust the parameter value to match the limits.

Table 81: Internal Fault List (continued)

Fault number	Cause	Solution
5123	Option in slot A: Hardware incompatible with the control board hardware.	Change either the fieldbus hardware or the control board hardware.
5124	Option in slot B: Hardware incompatible with the control board hardware.	Change either the fieldbus hardware or the control board hardware.
5125	Option in slot C0: Hardware incompatible with the control board hardware.	Change either the fieldbus hardware or the control board hardware.
5126	Option in slot C1: Hardware incompatible with the control board hardware.	Change either the fieldbus hardware or the control board hardware.
5376–6231	Internal fault.	Contact the supplier or service department.

Troubleshooting

- See the above table for the causes and solutions for different internal faults. If the fault persists, contact the Danfoss supplier or service department for assistance.

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.

WARNING 40, Overload T27

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***.

WARNING 41, Overload T29

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***.

WARNING 42, Ovrld X30/6-7

Troubleshooting, 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).

Troubleshooting, 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).

WARNING 43, Ext. Supply

Cause

VLT® Extended Relay Option MCB 113 is mounted without 24 V DC. Select 1 of the options in the troubleshooting list.

Troubleshooting

- Connect a 24 V DC external supply.
- Specify that no external supply is used via parameter ***14-80 Option Supplied by External 24VDC*** set to ***[0] No***. A change in parameter ***14-80 Option Supplied by External 24VDC*** requires a power cycle.

ALARM 45, Earth (Ground) Fault 2

Cause

A ground fault has occurred.

Troubleshooting

- Check for proper grounding and loose connections.
- Check for proper wire size.
- Check the motor cables for short circuits or leakage currents.

ALARM 46, Gate Drive Voltage Fault

Cause

The supply for the gate drive on the power card is out of range. It is generated by the switch mode supply (SMPS) on the power card.

Troubleshooting

- Check for a defective power card.

WARNING/ALARM 47, 24 V Supply Low

Cause

The 24 V DC is measured on the control card.

Troubleshooting

- Check for a defective control card.

ALARM 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 is installed, check for overvoltage.

WARNING 49, SPEED LIMIT

Cause

The warning is shown when the speed is outside of the specified range in parameter ***4-12 Motor Speed Low Limit [Hz]***and parameter ***4-14 Motor Speed High Limit [Hz]***.

Troubleshooting

- Check if the system ran outside of the speed range.
- Check if parameter ***4-12 Motor Speed Low Limit [Hz]*** and parameter ***4-14 Motor Speed High Limit [Hz]*** are set correctly..

ALARM 50, AMA Calibration

Cause

A calibration error has occurred.

Troubleshooting

- Contact a Danfoss supplier or the Danfoss service department.

ALARM 51, AMA check U_{nom} and I_{nom}

Cause

The settings for motor voltage, motor current, and motor power are wrong.

Troubleshooting

- Check the settings in parameter ***1-20*** to parameter ***1-25***.

ALARM 52, AMA Low I_{nom}

Cause

The motor current is too low.

Troubleshooting

- Check the setting in parameter ***1-24 Motor Current***.

ALARM 53, AMA Big Motor

Cause

The power size of the motor is too large for the AMA to operate.

Troubleshooting

- Check the settings in parameter group ***1-2* Motor Data***.

ALARM 54, AMA Small Motor

Cause

The power size of the motor is too small for the AMA to operate.

Troubleshooting

- Check the settings in parameter group ***1-2* Motor Data***.

ALARM 55, AMA Parameter Range

Cause

The parameter values of the motor are outside of the acceptable range. The AMA does not run.

Troubleshooting

- Check the settings in parameter group ***1-2* Motor Data***.

ALARM 56, AMA Interrupted

Cause

The AMA is manually interrupted.

Troubleshooting

- Re-run the AMA calibration.

ALARM 57, AMA Timeout

Cause

AMA timeout.

Troubleshooting

- Try to restart the AMA. Repeated restarts can overheat the motor.

ALARM 58, AMA Internal Fault

Cause

An AMA internal fault occurs.

Troubleshooting

- Contact a local Danfoss supplier.

WARNING/ALARM 59, Current Limit

Cause

The current is higher than the value in ***parameter 4-18 Current Limit***.

Troubleshooting

- Ensure that the motor data in ***parameter 1-20*** to ***parameter 1-25*** is set correctly.
- Possibly increase the current limit.
- Be sure that the system can operate safely at a higher limit.

ALARM 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.

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***.

WARNING/ALARM 62, Output Frequency Limit

Cause for Flux Mode

If the output frequency reaches the value set in parameter ***4-19 Max Output Frequency***, the drive issues a warning. The warning ceases when the output drops below the maximum limit. If the drive is unable to limit the frequency, it trips and issues an alarm. The latter may happen in the Flux mode if the drive loses control of the motor.

Troubleshooting for Flux Mode

- Check the application for possible causes. The load torque could be too significant to drag the motor run to a high speed.
- Increase the output frequency limit. Ensure that the system can operate safely at a higher output frequency.

Cause for VVC TCL Mode

The output speed limit is reached, and the torque reference is derated. If the system is designed to reduce the speed by speed limit function, the warning only means that the speed limit is active.

Troubleshooting for VVC TCL Mode

- The system speed exceeds the speed limit, in this case, adjust the system speed or adjust the speed limit.
- If the speed limit function is used to control system speed, the warning can be ignored.

ALARM 63, Mechanical Brake Low

Cause

The actual motor current has not exceeded the release brake current within the start delay time window.

WARNING 64, VOLTAGE LIMIT

Cause

The load and speed combination demands a motor voltage higher than the actual DC-link voltage.

Troubleshooting

- Check if the mains input is not high enough.
- Check if the output frequency is too high above motor nominal frequency.

WARNING/ALARM 65, Control Card Over Temperature

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 the fan operation.
- Check the control card.

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***.

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.

ALARM 68, Safe Stop Activated

Cause

The 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].

WARNING/ALARM 69, Power Card Temperature

Cause

The cutout temperature of the power card has exceeded the upper limit.

Troubleshooting

- Check that the ambient operating temperature is within limits.
- Check fan operation.
- Check the power card.

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.

ALARM 71, PTC 1 Safe Stop

Cause

Because the motor is too warm, the VLT® PTC Thermistor Card MCB 112 activated 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].

ALARM 72, Dangerous Failure

Cause

Safe Torque Off (STO) with trip lock. An unexpected combination of STO commands has occurred.

Troubleshooting

- VLT® PTC Thermistor Card MCB 112 enables X44/10, but STO is not enabled.
- MCB 112 is the only device using STO (specified via ***[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.

WARNING 73, Safe Stop Auto Restart

Cause

STO is activated.

Troubleshooting

- With automatic restart enabled, the motor can start when the fault is cleared.

ALARM 74, PTC Thermistor

Cause

The PTC is not working. This alarm is related to VLT® PTC Thermistor Card MCB 112.

Troubleshooting

-

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***.

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 code number.

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.

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 ***4-35 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***.

ALARM 79, Illegal Power Section Configuration

Cause

The scaling card has an incorrect code number or is not installed. The MK102 connector on the power card could not be installed.

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.

ALARM 81, CSIV Corrupt

Cause

The CSIV file has syntax errors.

ALARM 82, CSIV Parameter Error

Cause

CSIV failed to initialize a parameter.

ALARM 83, Illegal Option Combination

Cause

The mounted options are incompatible.

ALARM 84, No Safety Option

Cause

The safety option was removed without applying a general reset.

Troubleshooting

- Reconnect the safety option.

ALARM 88, Option Detection

Cause

A new option configuration has been detected.

Troubleshooting

- Set parameter ***14-89 Option Detection*** to ***[1] Enable Option Change***, and power cycle the drive to accept the new configuration.

WARNING 89, HOIST BRAKE SLIDING

Cause

This warning occurs when the motor speed feedback is bigger than 10 RPM during torque building time before the brake is open (parameter ***2-27 Torque Ramp Up Time***).

Troubleshooting

- Check if the mechanical brake is broken or opened before start.
- Check that the feedback is not zero before opening the brake.

WARNING/ALARM 90, Feedback Monitor

Cause

A feedback fault is detected by option B.

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.

WARNING 98, Clock Fault

Cause

Time is not set or the RTC clock has failed.

Troubleshooting

- Reset the clock in parameter ***0-70 Date and Time***.

ALARM 99, Locked Rotor

Cause

The rotor is blocked. It is only enabled for PM motor control.

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]***.

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.

WARNING/ALARM 122, Mot. Rotat. Unexp.

Cause

The drive performs a function that requires the motor to be at a standstill, for example, DC hold for PM motors.

WARNING 123, Motor Mod. Changed

Cause

The motor selected in parameter ***1-11 Motor Model*** is not correct.

Troubleshooting

- Check the motor model.

ALARM 144, Inrush Supply

Cause

A supply voltage on the inrush card is out of range.

Troubleshooting

- See the bit field result report value for more details.
  - **a.** Bit 2: Vcc high
  - **b.** Bit 3: Vcc low
  - **c.** Bit 4: Vdd high
  - **d.** Bit 5: Vdd low

ALARM 145, External SCR Disable

Cause

The alarm indicates a series DC-link capacitor voltage imbalance.

WARNING/ALARM 146, Mains Voltage

Cause

Mains voltage is outside valid operating range.

Troubleshooting

- See the following report values for details.
  - **a.** Voltage too low: 0=R-S, 1=S-T, 2=T-R
  - **b.** Voltage too high: 3=R-S, 4=S-T, 5=T-R

WARNING/ALARM 147, Mains Frequency

Cause

Mains frequency is outside valid operating range.

Troubleshooting

- The following report values provide more information:
  - **a.** 0: frequency too low
  - **b.** 1: frequency too high

WARNING/ALARM 148, System Temp

Cause

One or more of the system temperature measurements is too high.

WARNING/ALARM 154, D.out Overload

Cause

A digital output is overloaded.

WARNING/ALARM 157, Power Limit Mot.

Cause

The output power exceeds the value defined in parameter ***4-82 Power Limit Motor Mode***.

WARNING 158, POWER LIMIT GEN

Cause

The output power exceeds the value defined in parameter ***4-83 Power Limit Generator Mode***.

Troubleshooting

- Check if parameter ***4-83 Power Limit Generator Mode*** is set too small to fit the application.
- Check if actual generic load is bigger than parameter ***4-83 Power Limit Generator Mode***.

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.

Alarm 164, ATEX ETR Cur.Lim.Alarm

Cause

Running above the characteristic curve for more than 60 s within a period of 600 s activated the alarm, and the drive trips.

WARNING 165, ATEX ETR Freq.Lim.Warning

Cause

The drive has run for more than 50 s below the allowed minimum frequency as set in parameter ***1-98 ATEX ETR Interpol. Points.Freq.)***.

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 as set in parameter ***1-98 ATEX ETR Interpol. Points. Freq.***).

Warning 200, Emergency Mode

Cause

Emergency mode is active.

Troubleshooting

- The warning clears when emergency mode is removed.
- See the emergency mode data in the alarm log.

Warning 201, Emerg. M Was Active

Cause

Emergency mode is no longer active.

Troubleshooting

- Cycle power to the unit to remove the warning. See the emergency mode data in the alarm log.

Warning 202, Emerg. M Limits Exceeded

Cause

While operating in emergency mode, 1 or more alarm conditions have been ignored, which would normally trip the unit. Operating in this condition voids the warranty of the unit.

Troubleshooting

- Cycle power to the unit to remove this warning. See the emergency mode data in the alarm log. See parameter ***18-10 Emergency Mode Log*** for further details.

WARNING 220, Configuration File Version not Supported

Cause

The drive does not support the current configuration file version. Customization is aborted.

ALARM 243, Brake IGBT

Cause

This alarm is only for multi-drive systems. It is equivalent to *alarm 27, Brake chopper fault*. The report value in thie alarm log indicates which drive module generated the alarm. This IGBT fault can be caused by any of the following:

- The DC fuse is blown.
- The brake jumper is not in position.
- The Klixon switch opened due to an overtemperature condition in the brake resistor.

Indication of the drive module generating the alarm:

- 1 = Left drive module.
- 2 = Second drive module from left.
- 3 = Third drive module from left (in 4-module systems).
- 4 = Fourth drive module from left (in 4-module systems).

ALARM 244, Heat Sink Temperature

Cause

The maximum temperature of the heat sink has been exceeded. The temperature fault cannot reset until the temperature drops below the defined heat sink temperature. The trip and reset points are different, based on the power size. This alarm is equivalent to *Alarm 29, Power module temp*.

Troubleshooting

- Check for the following:
  - **a.** Ambient temperature too high.
  - **b.** Motor cables too long.
  - **c.** Incorrect airflow clearance above or below the AC drive.
  - **d.** Blocked airflow around the unit.
  - **e.** Damaged heat sink fan.
  - **f.** Dirty heat sink.

ALARM 245, Heat Sink Sensor

Cause

There is no feedback from the heat sink temperature sensor. This signal form the IGBT thermal sensor is not available on the power card. This alarm is equivalent to *Alarm 39, Heat sink sensor*.

The report value in the alarm log indicates which drive module generated the alarm:

- 1 = Left drive module.
- 2 = Second drive module from the left.
- 3 = Third drive module from the left (in 4-module systems).
- 4 = Fourth drive module from the left (in 4-module systems).

Troubleshooting

- Check the power card.
- Check the gate drive card.
- Check the ribbon cable between the power card and the gate drive card.

ALARM 246, Power Card Supply

Cause

The supply on the power card is out of range. This alarm is only for multi-drive systems. It is equivalent to *Alarm 46, Power card supply*.

The report value in the alarm log indicates which drive module generated the alarm:

- 1 = Left drive module.
- 2 = Second drive module from left.
- 3 = Third drive module from left (in 4-module systems).
- 4 = Fourth drive module from left (in 4-module systems).

ALARM 247, Power Card Temperature

Cause

This alarm is only for multi-drive systems. It is equivalent to *Alarm 69, Power card temperature*.

The report value in the alarm log indicates which drive module generated the alarm:

- 1 = Left drive module.
- 2 = Second drive module from left.
- 3 = Third drive module from left (in 4-module systems).
- 4 = Fourth drive module from left (in 4-module systems).

ALARM 248, Illegal Power Section Configuration

Cause

This alarm is only for multi-drive systems. It is equivalent to *Alarm 79, Illegal power section configuration*.

The report value in the alarm log indicates which drive module generated the alarm:

- 1 = Left drive module.
- 2 = Second drive module from left.
- 3 = Third drive module from left (in 4-module systems).
- 4 = Fourth drive module from left (in 4-module systems).

Troubleshooting

- Check the current scaling cards on the MDCIC.

WARNING 249, Rect. Low Temperature

Cause

The temperature of the rectifier heat sink is too low, which indicates that the temperature sensor may be detect.

WARNING 250, New Spare Part

Cause

A component in the drive system has been replaced.

Troubleshooting

- Enter the serial number and type code for canceling the trip lock status after a power cycle.

WARNING 251, New Typecode

Cause

The power card or other components have been replaced, and the type code has changed.

Troubleshooting

- Reset the drive for normal operation.

ALARM 421, FPC Temp

Cause

A fault caused by the on-board temperature sensor is detected on the fan power card. The report values identify which fan power card detected the fault.

Troubleshooting

- Check the wiring.
- Check the on-board temperature sensor.
- Replace the fan power card.

ALARM 423, FPC Updating

Cause

The alarm is generated when the fan power card reports that it has an invalid PUD. The control card attempts to update the PUD. A subsequent alarm can result depending on the update. See *Alarm 424, FPC Update Successful* and *Alarm 425, FPC Update Failure*.

ALARM 424, FPC Update Successful

Cause

This alarm is generated when the control card has updated the fan power card PUD successfully.

Troubleshooting

- Press [Reset] to stop the alarm.

ALARM 425, FPC Update Failure

Cause

This alarm is generated after the control card failed to update the fan power card PUD.

Troubleshooting

- Check the fan power card wiring.
- Replace the fan power card.
- Contact supplier.

ALARM 426, FPC Config

Cause

The number of found fan power cards does not match the number of configured fan power cards. See *parameter group 15-6* Option Ident* for the number of configured fan power cards.

Troubleshooting

- Check fan power card wiring.
- Replace the fan power card.

ALARM 427, FPC Supply

Cause

Supply voltage faults (5 V, 24 V, or 48 V) on the fan power card is detected.

Troubleshooting

- Check fan power card wiring.
- Replace the fan power card.

ALARM 432, Inrush Mode Error

Cause

An active inrush card reported the wrong mode. The report value indicates which inrush card reported the alarm.

Troubleshooting

- Check inrush card wiring.
- Replace the inrush card.

Warning 500, Motor Stator Winding Warning 2

Cause

The stator winding reached condition orange. A severe fault might occur soon in the motor.

Troubleshooting

- Check the stator windings.

Warning 501, Load Envelope Warning 2

Cause

Application load has reached condition yellow.

Troubleshooting

- Investigate the root cause for the increased motor load.

Warning 502, Vibration Monitoring Warning 2

Cause

A significant increase in motor vibration is detected. The vibration levels have reached condition orange.

Troubleshooting

- Investigate the root cause for severe vibration.

Warning 506, Load Envelope Low Warning 2

The application load has reached condition orange low limit.

Troubleshooting

- Investigate the root cause for the decrease in motor load and then check the load specified for the application

ALARM 510, Motor Stator Winding Alarm

Cause

Stator winding has reached condition red. A severe fault is detected in the motor.

Troubleshooting

- Check motor stator winding.

WARNING 510, Motor Stator Winding Warning 1

Cause

Stator winding reached condition yellow. An early fault is detected in the motor.

Troubleshooting

- Check the motor stator winding.

ALARM 511, Load Envelope Alarm

Cause

Application load has reached condition red.

Troubleshooting

- Check root cause for excessive overload or underload.

WARNING 511, Load Envelope Warning 1

Troubleshooting for Warning 511, Load Envelope Warning 1

Cause

Application load has reached condition yellow.

Troubleshooting

- Check root cause for high motor load.

Alarm 512, Sensor 1 Monitoring Alarm

Cause

There is an excessive amount of motor vibration on sensor 1. The vibration levels have reached condition red.

Troubleshooting

- Investigate the root cause for the excessive vibration. Before commissioning of condition-based monitoring, ensure to comply with the ISO10816 standard for machinery.

Warning 512, Sensor 1 Monitoring Warning 1

Cause

An increase in the Sensor 1 value is detected. The value levels in Sensor 1 have reached condition yellow.

Troubleshooting

- Investigate the root cause for the increased values.

Alarm 513, Sensor 2 Monitoring Warning 1

Cause

There is an excessive amount of motor vibration on sensor 2. The vibration levels have reached condition red.

Troubleshooting

- Investigate the root cause for the excessive vibration. Before commissioning of condition-based monitoring, ensure to comply with the ISO10816 standard for machinery.

Warning 514, Sensor 3 Monitoring Warning 1

Cause

An increase in the Sensor 3 value is detected. The value levels in Sensor 3 have reached condition yellow.

Troubleshooting

- Investigate the root cause for the increased values.

Alarm 515, Sensor 4 Monitoring Alarm

Cause

There is an excessive amount of motor vibration on sensor 4. The vibration levels have reached condition red.

Troubleshooting

- Investigate the root cause for the excessive vibration. Before commissioning of condition-based monitoring, ensure to comply with the ISO10816 standard for machinery.

Warning 515, Sensor 4 Monitoring Warning 1

Cause

An increase in the Sensor 4 value is detected. The value levels in Sensor 4 have reached condition yellow.

Troubleshooting

- Investigate the root cause for the increased values.

Alarm 516, Load Envelope Low Alarm

The application load has reached low-level condition red.

Troubleshooting

- Investigate the root cause for the decrease in motor load and then check the load specified for the application.

Warning 516, Load Envelope Low Warning 1

The application load has reached low-level condition yellow.

Troubleshooting

- Investigate the root cause for the decrease in motor load and then check the load specified for the application.

Warning 520, Stator Thld At Max/Min

Cause

The stator in the condition-based monitoring is either at its minimum or maximum limit.

Troubleshooting

- Check the threshold values at maximum or minimum in *parameter group 46-** CBM Adv Thresholds* to *parameter group 46-2* Stator* and adjust the values if needed.
- Acknowledge the generation by setting ***parameter 45-46 Threshold Limit*** to ***[0] Limit OK***.

Warning 521, Load Thld At Max/Min

Cause

The load threshold in the condition-based monitoring is either at its minimum or maximum.

Troubleshooting

- Check the threshold values at maximum or minimum in *parameter group 46-** CBM Adv Thresholds* to *parameter group 46-3* Load* and adjust the values if needed.
- Acknowledge the generation by setting ***parameter 45-46 Threshold Limit*** to ***[0] Limit OK***.

Warning 522, Sensor 1 Thld At Max/Min

Cause

The sensor 1 threshold in the condition-based monitoring is at its minimum or maximum value of the Sensor 1 function.

Troubleshooting

- Check the threshold values at maximum or minimum in *parameter group 46-** CBM Adv Thresholds* to *parameter group 46-4* Sensor 1* and adjust the values if needed.
- Acknowledge the generation by setting parameter ***45-46 Threshold Limit*** to ***[0] Limit OK***.

Warning 523, Sensor 2 Thld At Max/Min

Cause

The sensor 2 threshold in the condition-based monitoring is at its minimum or maximum value of the Sensor 2 function.

Troubleshooting

- Check the threshold values at maximum or minimum in *parameter group 46-** CBM Adv Thresholds* to *parameter group 46-5* Sensor 2* and adjust the values if needed.
- Acknowledge the generation by setting parameter ***45-46 Threshold Limit*** to ***[0] Limit OK***.

Warning 524, Sensor 3 Thld At Max/Min

Cause

The sensor 3 threshold in the condition-based monitoring is at its minimum or maximum value of the Sensor 3 function.

Troubleshooting

- Check the threshold values at maximum or minimum in *parameter group 46-** CBM Adv Thresholds* to *parameter group 46-6* Sensor 3* and adjust the values if needed.
- Acknowledge the generation by setting parameter ***45-46 Threshold Limit*** to ***[0] Limit OK***.

Warning 525, Sensor 4 Thld At Max/Min

Cause

The sensor 4 threshold in the condition-based monitoring is at its minimum or maximum value of the Sensor 4 function.

Troubleshooting

- Check the threshold values at maximum or minimum in *parameter group 46-** CBM Adv Thresholds* to *parameter group 46-7* Sensor 4* and adjust the values if needed.
- Acknowledge the generation by setting parameter ***45-46 Threshold Limit*** to ***[0] Limit OK***.

Alarm 550, Sensor 1 Low Monitoring Alarm

The value measured on Sensor 1 is very low and has reached condition red low.

Troubleshooting

- Investigate the root cause for the value reaching the red low level. For example, lost connection to analog inputs or no proper data communication on fieldbus sensors.

Warning 550, Sensor 1 Low Monitoring Warning 1

The value measured on Sensor 1 is very low and has reached condition yellow low.

Troubleshooting

- Investigate the root cause for the value reaching the red low level. For example, lost connection to analog inputs or no proper data communication on fieldbus sensors.

Alarm 551, Sensor 2 Low Monitoring Alarm

The value measured on Sensor 2 is very low and has reached condition red low.

Troubleshooting

- Investigate the root cause for the value reaching the red low level. For example, lost connection to analog inputs or no proper data communication on fieldbus sensors.

Warning 551, Sensor 2 Low Monitoring Warning 1

The value measured on Sensor 2 is very low and has reached condition yellow low.

Troubleshooting

- Investigate the root cause for the value reaching the red low level. For example, lost connection to analog inputs or no proper data communication on fieldbus sensors.

Alarm 552, Sensor 3 Low Monitoring Alarm

The value measured on Sensor 3 is very low and has reached condition red low.

Troubleshooting

- Investigate the root cause for the value reaching the red low level. For example, lost connection to analog inputs or no proper data communication on fieldbus sensors.

Warning 552, Sensor 3 Low Monitoring Warning 1

The value measured on Sensor 3 is very low and has reached condition yellow low.

Troubleshooting

- Investigate the root cause for the value reaching the red low level. For example, lost connection to analog inputs or no proper data communication on fieldbus sensors.

Alarm 553, Sensor 4 Low Monitoring Alarm

The value measured on Sensor 4 is very low and has reached condition red low.

Troubleshooting

- Investigate the root cause for the value reaching the red low level. For example, lost connection to analog inputs or no proper data communication on fieldbus sensors.

Warning 553, Sensor 4 Low Monitoring Warning 1

The value measured on Sensor 4 is very low and has reached condition yellow low.

Troubleshooting

- Investigate the root cause for the value reaching the red low level. For example, lost connection to analog inputs or no proper data communication on fieldbus sensors.

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