ENGINEERING
TOMORROW

Programming Guide

VLT HVAC Drive FC 102

Software version 7.3X

Contents

1 Introduction

1.1 Supported Software Versions

Supported software versions: 7.3X

This programming guide can be used for all FC 102 drives and for VLT® Decentral Drive FCD 302. The software version number can be read from *parameter 15-43 Software Version*.

1.2 Type Approvals and Certifications

The following list is a selection of possible type approvals and certifications for Danfoss drives:

NOTICE

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

Table 1: Type Approvals and Certifications

CE	ErP READY		DNV·GL
c UL us	EAC	089	OSHPD
BUREAU VERITAS	LR		RINA 1861
ClassNK			
ABS			

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 (ADN), refer to the section ADN-compliant Installation in the product-specific Design Guide.

2 Safety

2.1 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 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, causing risk of death, serious injury, and equipment or property damage. The motor may start by activation of an external switch, a fieldbus command, an input reference signal from the LCP or LOP, via remote operation using MCT 10 Set-up software, or after a cleared fault condition.

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

⚠ 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 can result in death or serious injury.

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

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- Verify full discharge by measuring the voltage level.

NOTICE

USING THE SAFE TORQUE OFF

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

NOTICE

CONTROL SIGNALS

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

NOTICE

HAZARDOUS SITUATIONS

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

2.2 Safety Regulations

Crane, lifts, and hoists

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

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

Protection mode

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

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

NOTICE

Disabling protection mode in hoisting applications is recommended.

3 Electrical Diagrams

3.1 Wiring Schematic

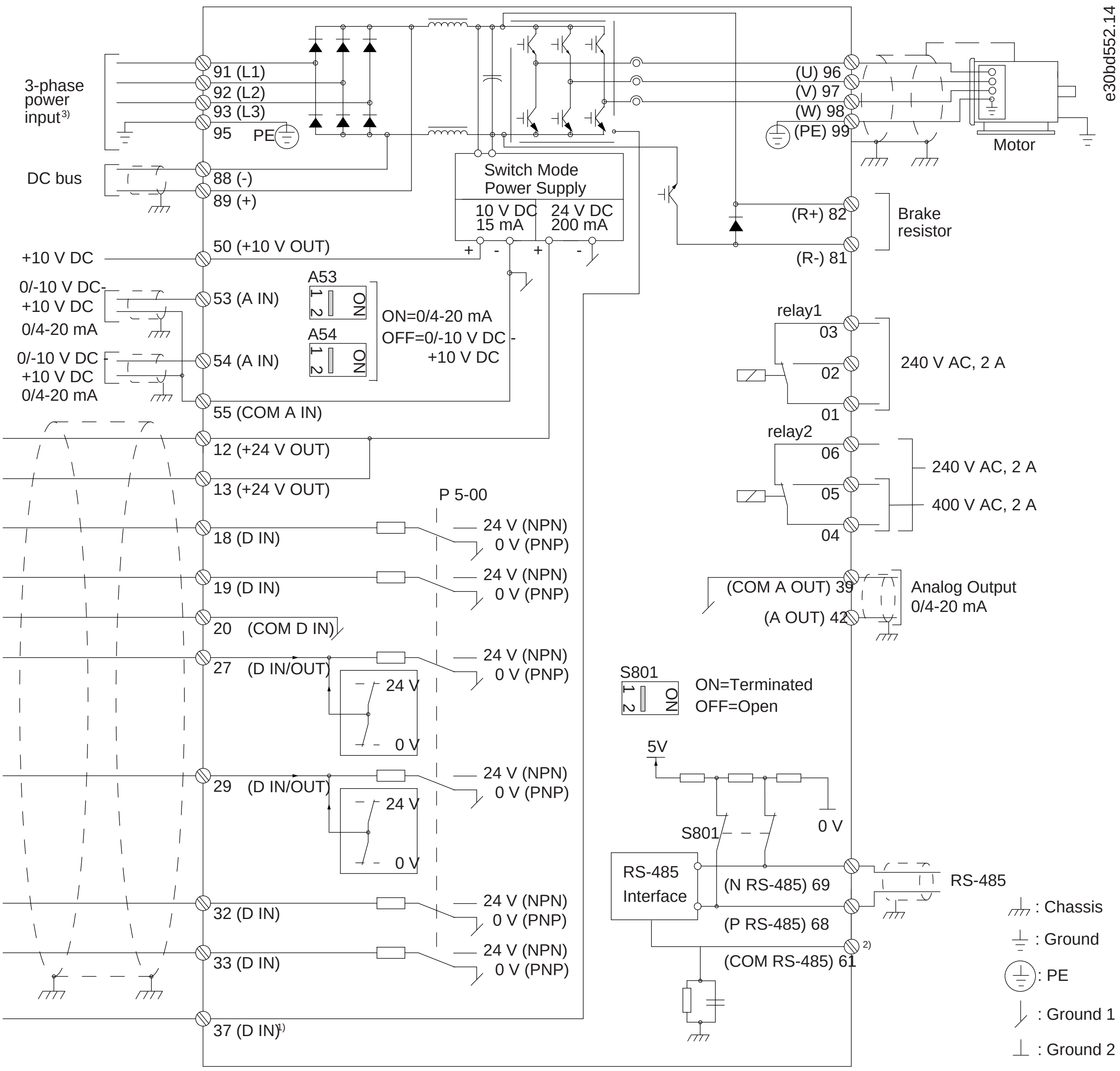


Illustration 1: Wiring Diagram

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.

Input polarity of control terminals

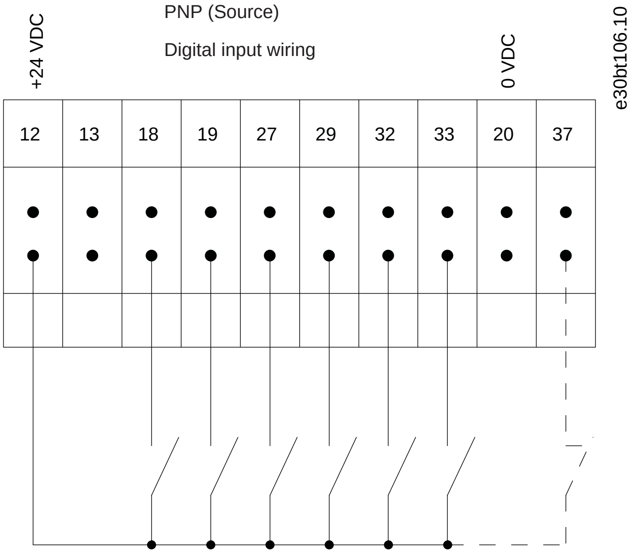


Illustration 2: PNP (Source)

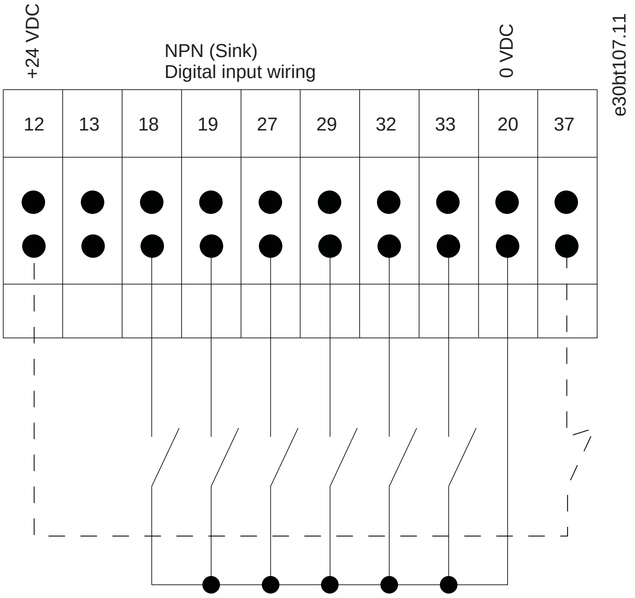


Illustration 3: NPN (Sink)

N O T I C E

Control cables must be shielded/armored.

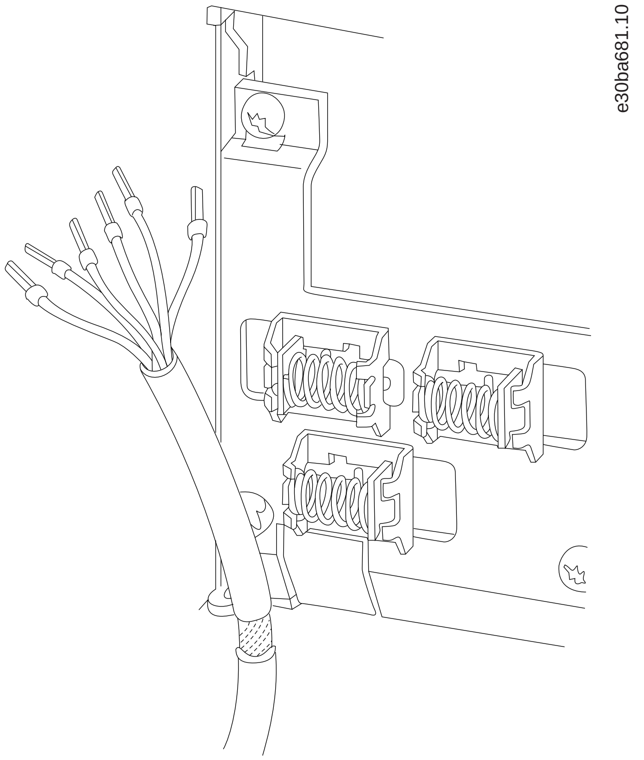


Illustration 4: Grounding of Shielded/Armored Control Cables

3.1.1 Start/Stop

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

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

Terminal 37 = Safe Torque Off.

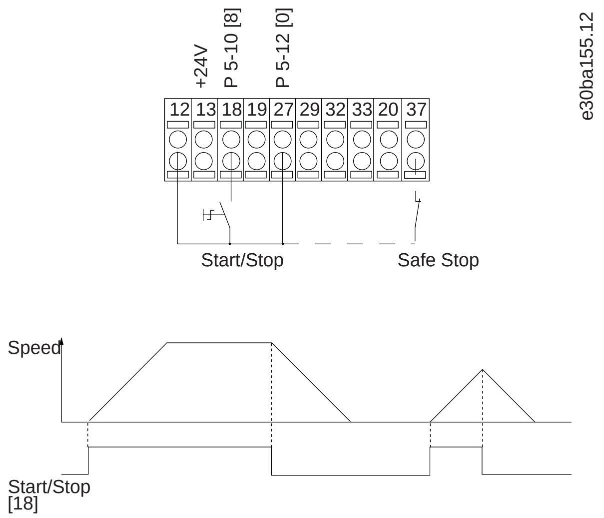


Illustration 5: Start/Stop

3.1.2 Pulse Start/Stop

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

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

Terminal 37 = Safe Torque Off.

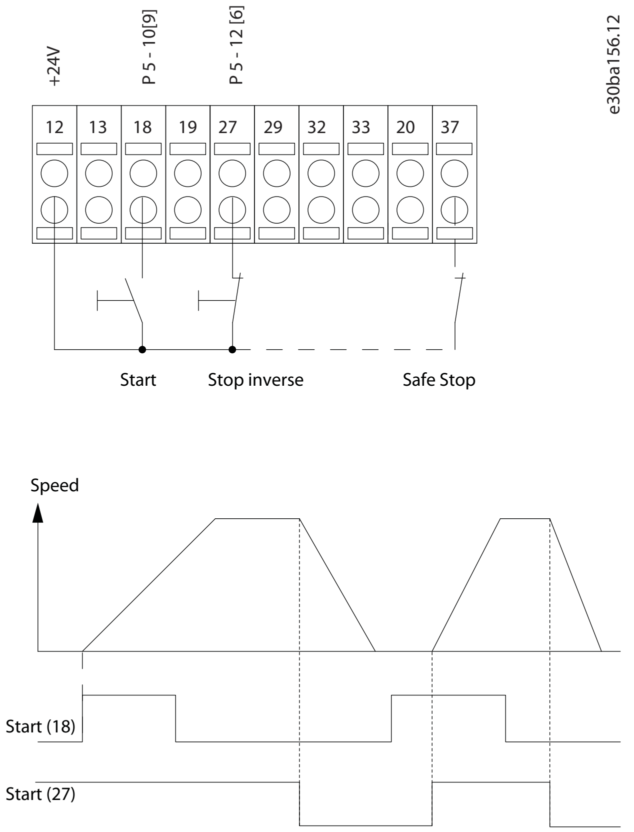


Illustration 6: Pulse Start/Stop

3.1.3 Speed Up/Speed Down

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

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

Terminal 37 = Safe Torque Off.

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

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

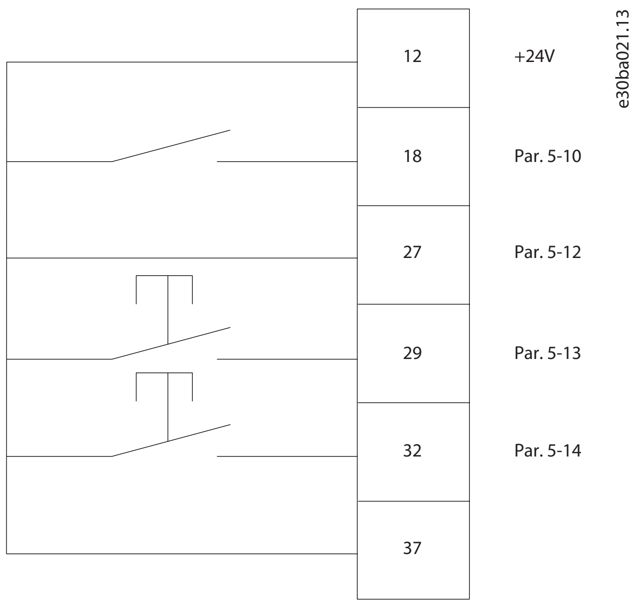


Illustration 7: Speed Up/Speed Down

3.1.4 Potentiometer Reference

Voltage reference via a potentiometer

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

Terminal 53, low voltage = 0 V.

Terminal 53, high voltage = 10 V.

Terminal 53, low reference/feedback = 0 RPM.

Terminal 53, high reference/feedback = 1500 RPM.

Switch S201 = OFF (U)

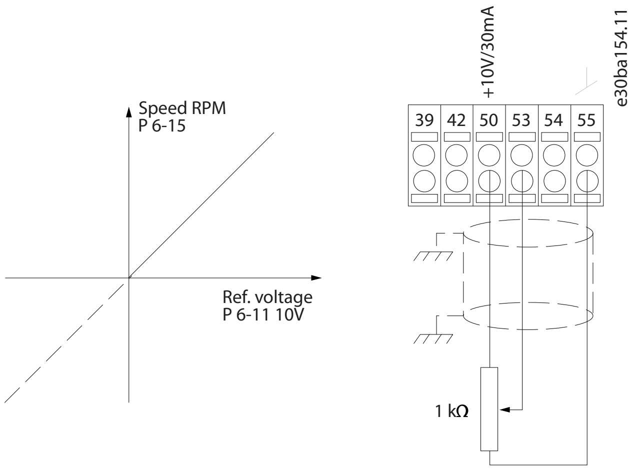


Illustration 8: Potentiometer Reference

4 How to Program

4.1 Local Control Panel

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

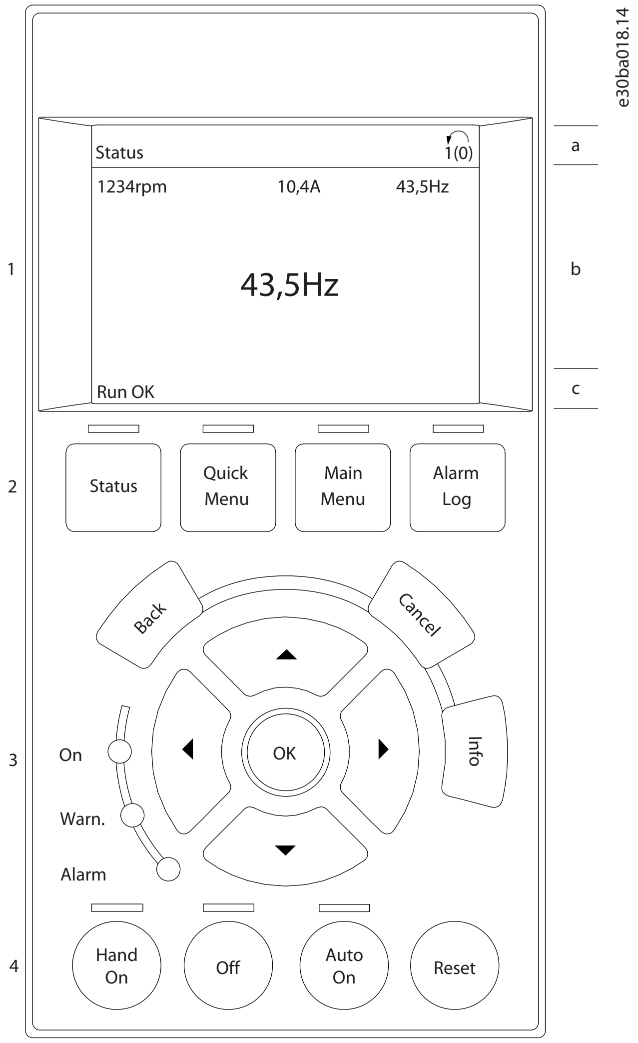


Illustration 9: LCP

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

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

N O T I C E

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

4.1.1 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.

N O T I C E

The FM-x number in the middle of the top line indicates the active setup in *parameter groups 24-0x Fire Mode* and *24-4X Fire Mode 2*. The active fire mode setup can also be read in *parameter 0-17 Active Fire Mode 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.

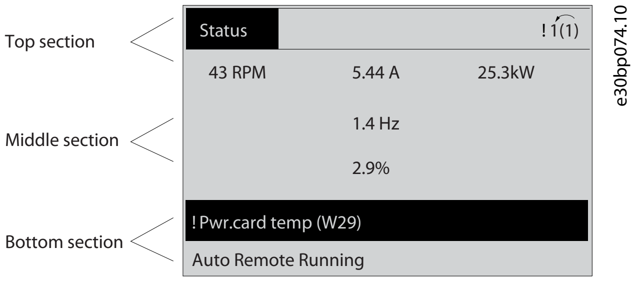


Illustration 10: Display

The active setup (selected as the active setup in *parameter 0-10 Active Set-up*) is shown. When programming another setup than the active set-up, 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 or 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.

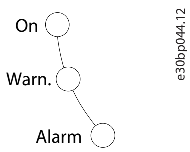


Illustration 11: Indicator Lights

4.1.1.1 LCP Keys

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

Table 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 • 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]	Is used 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 an alarm list of the 5 latest alarms (numbered A1– A5). To obtain extra 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].
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 • Reversing • Setup select bit 0 - Setup select bit 1 • Stop command from serial communication

LCP keys	Description
	• 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 external stop function is not selected and the *[Off]* key is inactive, the motor can be stopped by disconnecting the voltage.
[Auto On]	Enables the drive to be controlled via the control terminals and/or serial communication. When a start signal is applied on the control terminals and/or the bus, the drive starts. The key can be selected as *[1] Enable* or *[0] Disable* via *parameter 0-42 [Auto on] Key on LCP*. **Note:** An active HAND-OFF-AUTO signal via the digital inputs has higher priority than the control keys [Hand On] – [Auto On].
[Reset]	Is used for resetting the drive after an alarm (trip). It can be selected as *[1] Enable* or *[0] Disable via parameter 0-43 [Reset] Key on LCP*. The parameter shortcut can be carried out by pressing down the [Main Menu] key for 3 s. The parameter shortcut provides direct access to any parameter.

4.1.2 Quick Transfer of Parameter Settings between Multiple Drives

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

4.1.2.1 Transferring Data from the Drive to the LCP

Procedure

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

4.1.2.2 Transferring Data from the LCP to the Drive

Procedure

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

4.1.3 Display Mode

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

4.1.4 Display Mode - Selection of Readouts

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

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

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

Define the links via:

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

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

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

Table 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	
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

Operating variable	Unit
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]
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

Operating variable	Unit
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

4.1.4.1 Status View I

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

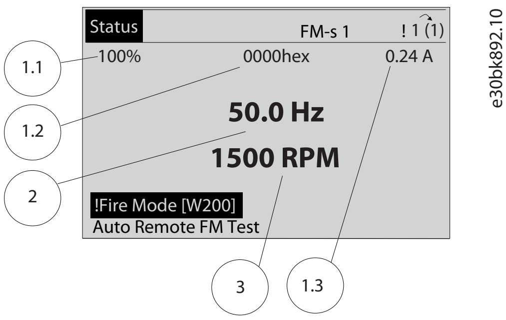


Illustration 12: Status View I

4.1.4.2 Status View II

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

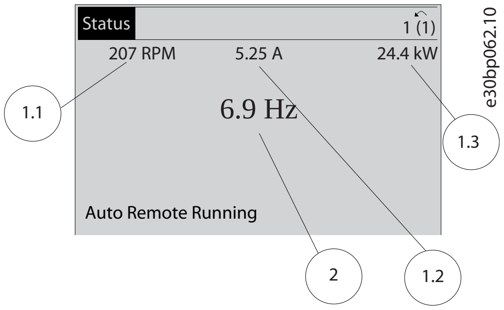


Illustration 13: Status View II

4.1.4.3 Status View III

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

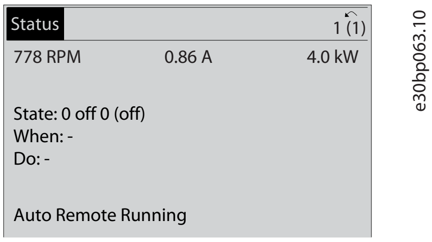


Illustration 14: Status View III

4.1.5 Parameter Setup

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

- Main menu mode
- Quick menu mode

Main menu provides access to all parameters.

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

4.1.6 Quick Menu Key Functions

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

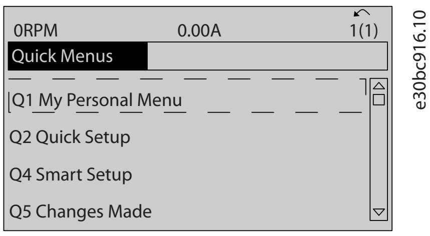


Illustration 15: Quick Menus

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).

The parameter selection is effected with the navigation keys. The parameters in the following table 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*(1)
Parameter 1-29 Automatic Motor Adaptation (AMA)	*[1] Enable complete AMA*
Parameter 3-02 Minimum Reference	[RPM]
Parameter 3-03 Maximum Reference	[RPM]
Parameter 3-41 Ramp 1 Ramp Up Time	[s]
Parameter 3-42 Ramp 1 Ramp Down Time	[s]
Parameter 3-13 Reference Site	Select whether to control the drive via digital inputs, LCP, or remote control.

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

Select *Changes made* to get information about:

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

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

4.1.7 Quick Setup

The parameters can easily be set up for most HVAC applications only by using the Quick Setup. After pressing [Quick Menu], the different options in the Quick Menu are listed.

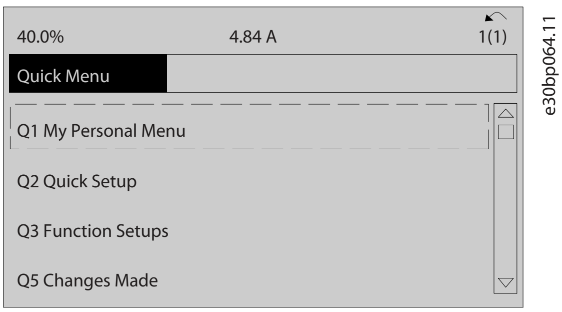


Illustration 16: Quick Menu View

The Quick Setup provides access to the 18 most important setups in the drive.

Table 6: Quick Setup Parameters

Parameter	[Unit]
Parameter 0-01 Language	
Parameter 1-20 Motor Power [kW]	[kW]
Parameter 1-21 Motor Power [HP]	[hp]
Parameter 1-22 Motor Voltage(1)	[V]
Parameter 1-23 Motor Frequency	[Hz]
Parameter 1-24 Motor Current	[A]
Parameter 1-25 Motor Nominal Speed	[RPM]
Parameter 1-28 Motor Rotation Check	[Hz]
Parameter 3-41 Ramp 1 Ramp Up Time	[s]
Parameter 3-42 Ramp 1 Ramp Down Time	[s]
Parameter 4-11 Motor Speed Low Limit [RPM]	[RPM]
Parameter 4-12 Motor Speed Low Limit [Hz](1)	[Hz]
Parameter 4-13 Motor Speed High Limit [RPM]	[RPM]
Parameter 4-14 Motor Speed High Limit [Hz](1)	[Hz]
Parameter 3-19 Jog Speed [RPM]	[RPM]
Parameter 3-11 Jog Speed [Hz](1)	[Hz]
Parameter 5-12 Terminal 27 Digital Input	
Parameter 5-40 Function Relay(2)	

1 The information shown in the display depends on the selections made 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 which region of the world the drive is supplied to, but can be reprogrammed as required.

2 *Parameter 5-40 Function Relay* is an array. Select between *[0] Relay1* or *[1] Relay2*. Standard setting is *[0] Relay1* with the default option *[9] Alarm*.

N O T I C E

If *[0] No Operation* is selected in *parameter 5-12 Terminal 27 Digital Input*, start can be enabled without connecting +24 V on terminal 27.

4.1.7.1 Programming in the Quick Setup

This procedure shows an example of how to program the ramp-down time in the Quick Setup.

Procedure

1. Select *Quick Setup*.

   Parameter 0-01 Language appears in Quick Setup.

2. Press [▿] repeatedly until *parameter 3-42 Ramp 1 Ramp Down Time* appears with the default setting of 20 s.
3. Press [OK].
4. Press [◃] to highlight the 3rd digit before the comma.
5. Change *0* to *1* by pressing [▵].
6. Press [▹] to highlight the digit *2*.

7. Change *2* to *0* by pressing [▿].
8. Press [OK].

The new ramp-down time is now set to 100 s.

4.1.8 Function Setups

The Function Setup provides quick and easy access to all parameters required for most HVAC applications, including:

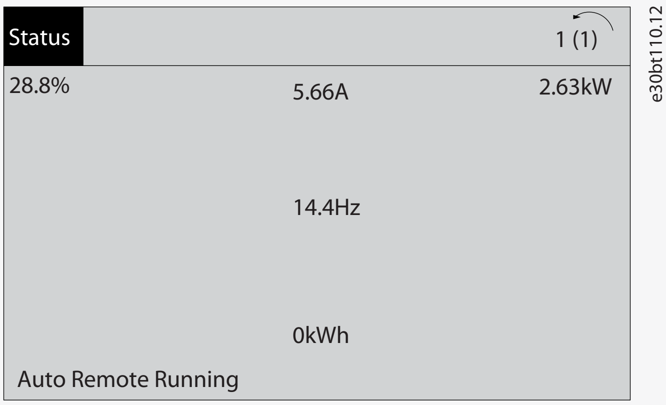
- Most VAV and CAV supply and return fans.
- Cooling tower fans.
- Primary pumps.
- Secondary pumps.
- Condenser water pumps.
- Other pump, fan, and compressor applications.

4.1.8.1 Accessing the Function Setup

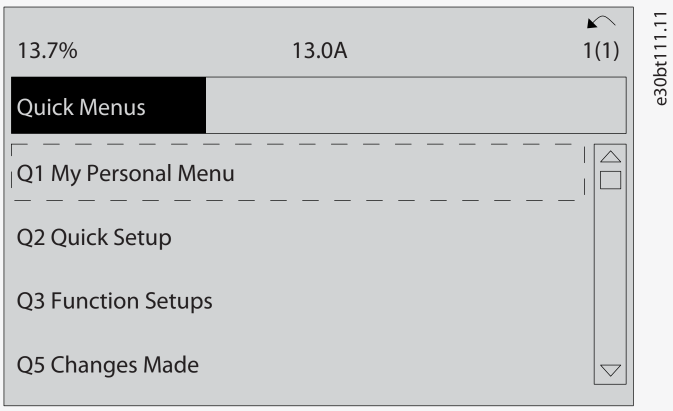
Procedure

1. Turn on the drive.

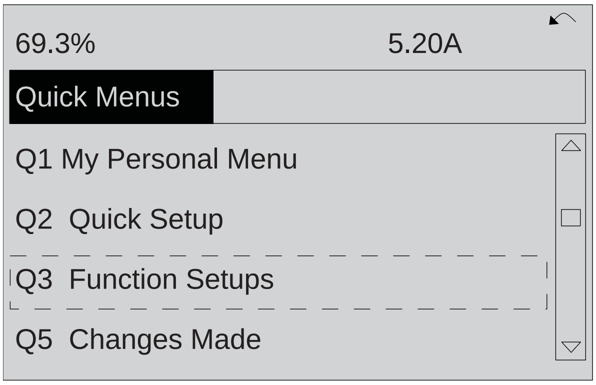
The yellow LED lights up and data is visible on the display.



2. Press [Quick Menu].



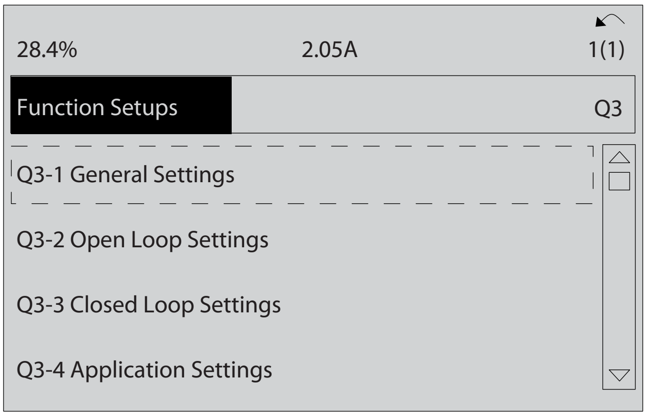
3. Press [▵] and [▿] to scroll down to *Function Setups*.



e30bt112.12

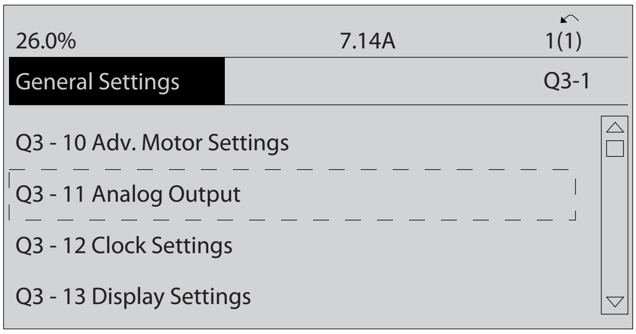
The Function Setups options appear.

4. Select *Q3-1 General Settings* and press [OK].



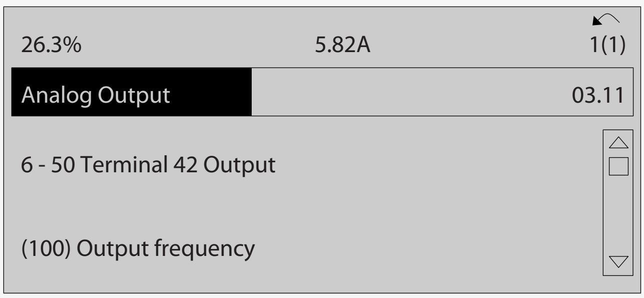
e30bt113.11

5. Press [▵] and [▿] to scroll down to *Q3-11 Analog Outputs* and press [OK].



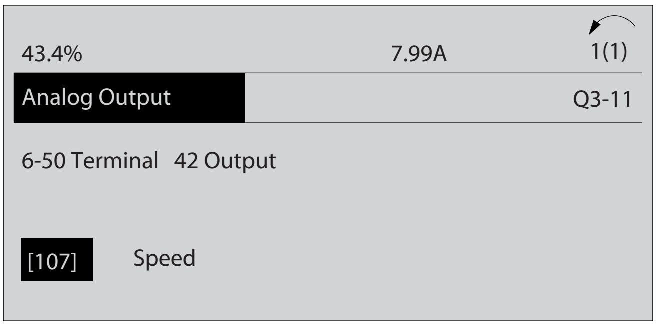
e30bt114.12

6. Select *parameter 6-50 Terminal 42 Output* and press [OK].



e30bt115.11

7. Press [▵] and [▿] to select between the different options and press [OK] to select.



e30bt116.11

4.1.8.2 Function Setups Parameters

Table 7: Q3-1 General Settings

Q3-10 Adv. motor settings	Q3-11 Analog output	Q3-12 Clock settings	Q3-13 Display settings
Parameter 1-90 Motor Thermal Protection	*Parameter 6-50 Terminal 42 Output*	*Parameter 0-70 Date and Time*	*Parameter 0-20 Display Line 1.1 Small*
Parameter 1-93 Thermistor Source	*Parameter 6-51 Terminal 42 Output Min Scale*	*Parameter 0-71 Date Format*	*Parameter 0-21 Display Line 1.2 Small*
Parameter 1-29 Automatic Motor Adaptation (AMA)	*Parameter 6-52 Terminal 42 Output Max Scale*	*Parameter 0-72 Time Format*	*Parameter 0-22 Display Line 1.3 Small*
Parameter 14-01 Switching Frequency	–	*Parameter 0-74 DST/Summertime*	*Parameter 0-23 Display Line 2 Large*
Parameter 4-53 Warning Speed High	–	*Parameter 0-76 DST/Summertime Start*	*Parameter 0-24 Display Line 3 Large*
–	–	*Parameter 0-77 DST/Summertime End*	*Parameter 0-37 Display Text 1*
–	–	–	*Parameter 0-38 Display Text 2*
–	–	–	*Parameter 0-39 Display Text 3*

Table 8: Q3-2 Open-loop Settings

Q3-20 Digital reference	Q3-21 Analog reference
Parameter 3-02 Minimum Reference	*Parameter 3-02 Minimum Reference*
Parameter 3-03 Maximum Reference	*Parameter 3-03 Maximum Reference*
Parameter 3-10 Preset Reference	*Parameter 6-10 Terminal 53 Low Voltage*
Parameter 5-13 Terminal 29 Digital Input	*Parameter 6-11 Terminal 53 High Voltage*
Parameter 5-14 Terminal 32 Digital Input	*Parameter 6-12 Terminal 53 Low Current*
Parameter 5-15 Terminal 33 Digital Input	*Parameter 6-13 Terminal 53 High Current*
–	*Parameter 6-14 Terminal 53 Low Ref./Feedb. Value*
–	*Parameter 6-15 Terminal 53 High Ref./Feedb. Value*

Table 9: Q3-3 Closed-loop Settings

Q3-30 Single zone int. setpoint	Q3-31 Single zone ext. setpoint	Q3-32 Multi zone/adv
Parameter 1-00 Configuration Mode	*Parameter 1-00 Configuration Mode*	*Parameter 1-00 Configuration Mode*
Parameter 20-12 Reference/Feedback Unit	*Parameter 20-12 Reference/Feedback Unit*	*Parameter 3-15 Reference 1 Source*
Parameter 20-13 Minimum Reference/Feedb.	*Parameter 20-13 Minimum Reference/Feedb.*	*Parameter 3-16 Reference 2 Source*
Parameter 20-14 Maximum Reference/Feedb.	*Parameter 20-14 Maximum Reference/Feedb.*	*Parameter 20-00 Feedback 1 Source*
Parameter 6-22 Terminal 54 Low Current	*Parameter 6-10 Terminal 53 Low Voltage*	*Parameter 20-01 Feedback 1 Conversion*
Parameter 6-24 Terminal 54 Low Ref./Feedb. Value	*Parameter 6-11 Terminal 53 High Voltage*	*Parameter 20-02 Feedback 1 Source Unit*
Parameter 6-25 Terminal 54 High Ref./Feedb. Value	*Parameter 6-12 Terminal 53 Low Current*	*Parameter 20-03 Feedback 2 Source*
Parameter 6-26 Terminal 54 Filter Time Constant	*Parameter 6-13 Terminal 53 High Current*	*Parameter 20-04 Feedback 2 Conversion*
Parameter 6-27 Terminal 54 Live Zero	*Parameter 6-14 Terminal 53 Low Ref./Feedb. Value*	*Parameter 20-05 Feedback 2 Source Unit*
Parameter 6-00 Live Zero Timeout Time	*Parameter 6-15 Terminal 53 High Ref./Feedb. Value*	*Parameter 20-06 Feedback 3 Source*
Parameter 6-01 Live Zero Timeout Function	*Parameter 6-22 Terminal 54 Low Current*	*Parameter 20-07 Feedback 3 Conversion*
Parameter 20-21 Setpoint 1	*Parameter 6-24 Terminal 54 Low Ref./Feedb. Value*	*Parameter 20-08 Feedback 3 Source Unit*
Parameter 20-81 PID Normal/ Inverse Control	*Parameter 6-25 Terminal 54 High Ref./Feedb. Value*	*Parameter 20-12 Reference/Feedback Unit*
Parameter 20-82 PID Start Speed [RPM]	*Parameter 6-26 Terminal 54 Filter Time Constant*	*Parameter 20-13 Minimum Reference/Feedb.*
Parameter 20-83 PID Start Speed [Hz]	*Parameter 6-27 Terminal 54 Live Zero*	*Parameter 20-14 Maximum Reference/Feedb.*
Parameter 20-93 PID Proportional Gain	*Parameter 6-00 Live Zero Timeout Time*	*Parameter 6-10 Terminal 53 Low Voltage*
Parameter 20-94 PID Integral Time	*Parameter 6-01 Live Zero Timeout Function*	*Parameter 6-11 Terminal 53 High Voltage*
Parameter 20-70 Closed Loop Type	*Parameter 20-81 PID Normal/ Inverse Control*	*Parameter 6-12 Terminal 53 Low Current*
Parameter 20-71 PID Performance	*Parameter 20-82 PID Start Speed [RPM]*	*Parameter 6-13 Terminal 53 High Current*
Parameter 20-72 PID Output Change	*Parameter 20-83 PID Start Speed [Hz]*	*Parameter 6-14 Terminal 53 Low Ref./Feedb. Value*
Parameter 20-73 Minimum Feedback Level	*Parameter 20-93 PID Proportional Gain*	*Parameter 6-15 Terminal 53 High Ref./Feedb. Value*

Q3-30 Single zone int. setpoint	Q3-31 Single zone ext. setpoint	Q3-32 Multi zone/adv
Parameter 20-74 Maximum Feed-back Level	*Parameter 20-94 PID Integral Time*	*Parameter 6-16 Terminal 53 Filter Time Constant*
Parameter 20-79 PID Autotuning	*Parameter 20-70 Closed Loop Type*	*Parameter 6-17 Terminal 53 Live Zero*
–	*Parameter 20-71 PID Performance*	*Parameter 6-20 Terminal 54 Low Voltage*
–	*Parameter 20-72 PID Output Change*	*Parameter 6-21 Terminal 54 High Voltage*
–	*Parameter 20-73 Minimum Feedback Lev-el*	*Parameter 6-22 Terminal 54 Low Current*
–	*Parameter 20-74 Maximum Feedback Lev-el*	*Parameter 6-23 Terminal 54 High Current*
–	*Parameter 20-79 PID Autotuning*	*Parameter 6-24 Terminal 54 Low Ref./Feedb. Value*
–	–	*Parameter 6-25 Terminal 54 High Ref./Feedb. Value*
–	–	*Parameter 6-26 Terminal 54 Filter Time Constant*
–	–	*Parameter 6-27 Terminal 54 Live Zero*
–	–	*Parameter 6-00 Live Zero Timeout Time*
–	–	*Parameter 6-01 Live Zero Timeout Function*
–	–	*Parameter 4-56 Warning Feedback Low*
–	–	*Parameter 4-57 Warning Feedback High*
–	–	*Parameter 20-20 Feedback Function*
–	–	*Parameter 20-21 Setpoint 1*
–	–	*Parameter 20-22 Setpoint 2*
–	–	*Parameter 20-81 PID Normal/ Inverse Control*
–	–	*Parameter 20-82 PID Start Speed [RPM]*
–	–	*Parameter 20-83 PID Start Speed [Hz]*
–	–	*Parameter 20-93 PID Proportional Gain*
–	–	*Parameter 20-94 PID Integral Time*
–	–	*Parameter 20-70 Closed Loop Type*
–	–	*Parameter 20-71 PID Performance*
–	–	*Parameter 20-72 PID Output Change*
–	–	*Parameter 20-73 Minimum Feedback Level*
–	–	*Parameter 20-74 Maximum Feedback Level*
–	–	*Parameter 20-79 PID Autotuning*

Table 10: Q3-4 Application Settings

Q3-40 Fan function	Q3-41 Pump functions	Q3-42 Compressor functions
Parameter 22-60 Broken Belt Function	*Parameter 22-20 Low Power Auto Set-up*	*Parameter 1-03 Torque Characteristics*
Parameter 22-61 Broken Belt Torque	*Parameter 22-21 Low Power Detection*	*Parameter 1-71 Start Delay*
Parameter 22-62 Broken Belt Delay	*Parameter 22-22 Low Speed Detection*	*Parameter 22-75 Short Cycle Protection*
Parameter 4-64 Semi-Auto Bypass Set-up	*Parameter 22-23 No-Flow Function*	*Parameter 22-76 Interval between Starts*
Parameter 1-03 Torque Characteristics	*Parameter 22-24 No-Flow Delay*	*Parameter 22-77 Minimum Run Time*
Parameter 22-22 Low Speed Detection	*Parameter 22-40 Minimum Run Time*	*Parameter 5-01 Terminal 27 Mode*
Parameter 22-23 No-Flow Function	*Parameter 22-41 Minimum Sleep Time*	*Parameter 5-02 Terminal 29 Mode*
Parameter 22-24 No-Flow Delay	*Parameter 22-42 Wake-up Speed [RPM]*	*Parameter 5-12 Terminal 27 Digital Input*
Parameter 22-40 Minimum Run Time	*Parameter 22-43 Wake-up Speed [Hz]*	*Parameter 5-13 Terminal 29 Digital Input*
Parameter 22-41 Minimum Sleep Time	*Parameter 22-44 Wake-up Ref./FB Difference*	*Parameter 5-40 Function Relay*
Parameter 22-42 Wake-up Speed [RPM]	*Parameter 22-45 Setpoint Boost*	*Parameter 1-73 Flying Start*
Parameter 22-43 Wake-up Speed [Hz]	*Parameter 22-46 Maximum Boost Time*	*Parameter 1-86 Trip Speed Low [RPM]*
Parameter 22-44 Wake-up Ref./FB Difference	*Parameter 22-26 Dry Pump Function*	*Parameter 1-87 Trip Speed Low [Hz]*
Parameter 22-45 Setpoint Boost	*Parameter 22-27 Dry Pump Delay*	–
Parameter 22-46 Maximum Boost Time	*Parameter 22-80 Flow Compensation*	–
Parameter 2-10 Brake Function	*Parameter 22-81 Square-linear Curve Approximation*	–
Parameter 2-16 AC brake Max. Current	*Parameter 22-82 Work Point Calculation*	–
Parameter 2-17 Over-voltage Control	*Parameter 22-83 Speed at No-Flow [RPM]*	–
Parameter 1-73 Flying Start	*Parameter 22-84 Speed at No-Flow [Hz]*	–
Parameter 1-71 Start Delay	*Parameter 22-85 Speed at Design Point [RPM]*	–
Parameter 1-80 Function at Stop	*Parameter 22-86 Speed at Design Point [Hz]*	–
Parameter 2-00 DC Hold/Preheat Current	*Parameter 22-87 Pressure at No-Flow Speed*	–
Parameter 4-10 Motor Speed Direction	*Parameter 22-88 Pressure at Rated Speed*	–
–	*Parameter 22-89 Flow at Design Point*	–

Q3-40 Fan function	Q3-41 Pump functions	Q3-42 Compressor functions
–	*Parameter 22-90 Flow at Rated Speed*	–
–	*Parameter 1-03 Torque Characteristics*	–
–	*Parameter 1-73 Flying Start*	–

4.1.9 Main Menu Mode

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

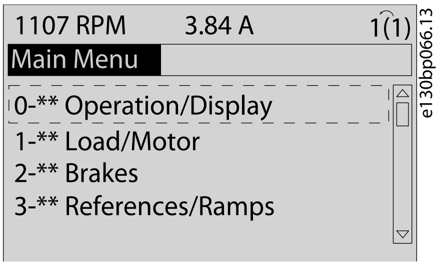


Illustration 17: Main Menu Mode

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

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

4.1.10 Parameter Selection

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

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

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

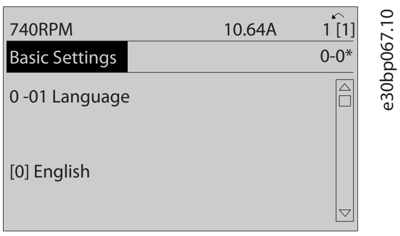


Illustration 18: Parameter Selection

4.1.11 Changing Data

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

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

4.1.12 Changing a Text Value

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

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

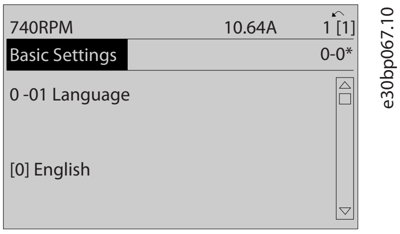


Illustration 19: Changing a Text Value

4.1.13 Changing a Data Value

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

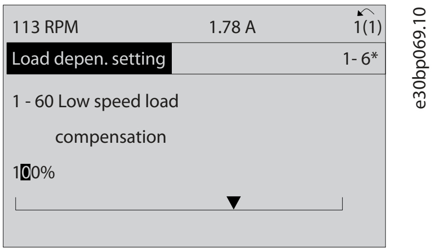


Illustration 20: Changing a Data Value

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

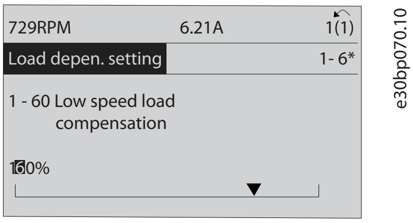


Illustration 21: Saving a Data Value

4.1.14 Infinitely Variable Change of Numeric Data Value

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

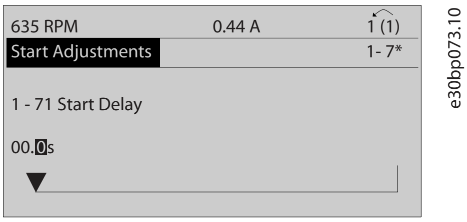


Illustration 22: Selecting a Digit

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

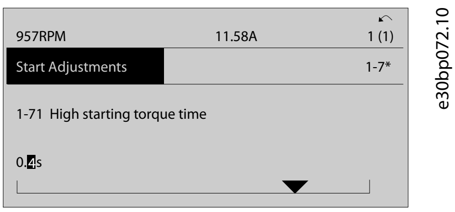


Illustration 23: Saving

4.1.15 Value, Step by Step

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

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

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

4.1.16 Readout and Programming of Indexed Parameters

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

4.1.16.1 Changing Values of Indexed Parameters

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

Procedure

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

4.2 Numerical Local Control Panel

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

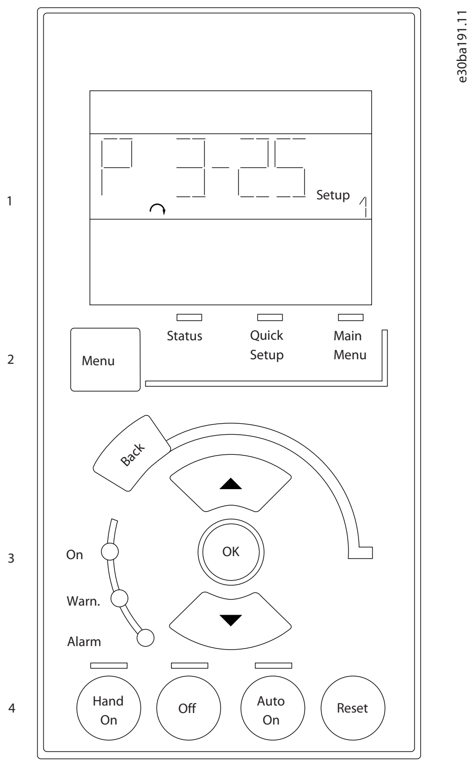


Illustration 24: NLCP

The NLCP is divided into 4 functional groups:

Table 11: Functional Groups of NLCP

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

Display line

Status messages showing icons and numeric value.

Indicator lights

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

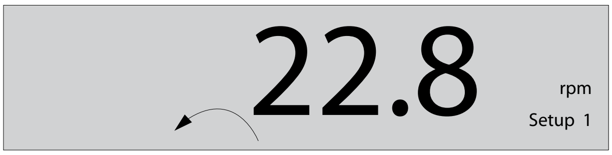
4.2.1 LCP Keys

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

Table 12: LCP Keys and Description

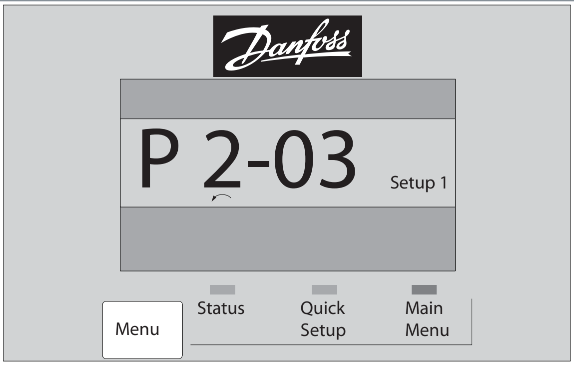
<table>
<tr><th>LCP keys</th><th>Description</th></tr>
<tr><td>[Status]</td><td>Indicates the status of the drive and/or the motor.
If an alarm occurs, the NLCP automatically switches to status mode. Several alarms can be shown.

NOTICE
Parameter copy is not possible with LCP 101 numerical local control panel.



e30bp077.10
Illustration 25: Status Mode

e30bp078.10
Illustration 26: Alarm</td></tr>
<tr><td>[Quick Menu]/ [Main Menu]</td><td>Used for programming the parameters in the Quick Menu and Main Menu, respectively. When the value flashes, press [▵] or [▿] to change parameter values. Parameters with functional options show values such as [1], [2], and so on. For a description of the different options, see the individual parameter descriptions in the section Parameter Descriptions.</td></tr>
</table>

LCP keys	Description
	 e30bp079.10 **Illustration 27: Main Menu/Quick Setup**
[Back]	Returns to the previous step or layer in the navigation structure.
Naviga-tion keys	The 2 navigation keys are used to navigate between the different options available in Quick Menu and Main Menu. Press the keys to move the cursor. **[OK]** Press to select a parameter marked by the cursor and to enable the change of a parameter.

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

Table 13: Local Control Keys and Description

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

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

4.3 Restoring Factory Default Settings Using the Recommended Initialization

NOTICE

LOSS OF DATA

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

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

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

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

4.4 Restoring Factory Default Settings Using Manual Initialization

NOTICE

LOSS OF DATA

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

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

Procedure

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

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

   Start-up takes slightly longer than normal.

NOTICE

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

5 Parameter Descriptions

5.1 Parameter Group 0-** Operation and Display

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

5.1.1 0-0* Basic Settings

Parameter 0-01 Language

Table 14: Parameter 0-01 Language

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

Defines the language to be used in the display. The drive is delivered with 4 different language packages. English and German are included in all packages. English cannot be erased or manipulated.

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

Option	Name	Description
[47]	Czech	Part of language package 3.
[48]	Polski	Part of language package 4.
[49]	Russian	Part of language package 3.
[50]	Thai	Part of language package 2.
[51]	Bahasa Indonesia	Part of language package 2.
[52]	Hrvatski	
[53]	Arabic	

Parameter 0-02 Motor Speed Unit

Table 15: Parameter 0-02 Motor Speed Unit

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

NOTICE

This parameter cannot be adjusted while the motor is running.

NOTICE

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

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

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

Parameter 0-03 Regional Settings

Table 16: Parameter 0-03 Regional Settings

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

NOTICE

This parameter cannot be adjusted while the motor is running.

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

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

Table 17: Parameter 0-04 Operating State at Power-up (Hand)

0-04 Operating State at Power-up (Hand)		
Default value: [0] Resume	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

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

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

Parameter 0-05 Local Mode Unit

Table 18: Parameter 0-05 Local Mode Unit

0-05 Local Mode Unit		
Default value: [0] As motor speed unit	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: False

This parameter defines if the local reference unit should be shown as the motor shaft speed (in RPM/Hz) or as percent.

Option	Name	Description
[0]*	As motor speed unit	
[1]	%	

5.1.2 0-1* Set-up Operations

Define and control the individual parameter setups. The drive has 4 parameter setups that can be programmed independently of each other. This makes the drive very flexible and able to meet the requirements of many different HVAC system control schemes, often saving the cost of external control equipment. For example, these can be used to program the drive to operate according to 1 control scheme in setup 1 (for exampe, daytime operation) and another control scheme in another setup (for example, night set-back). Alternatively, they can be used by an AHU or a packaged OEM unit to identically program all their factory-fitted drives for different equipment models within a range to have the same parameters. During production/commissioning a specific setup can then be selected depending on which model within that range the drive is installed on.

The active setup (that is the setup in which the drive is currently operating) can be selected in *parameter 0-10 Active Set-up* and is shown in the LCP. By using multi setup, it is possible to switch between setups with the drive running 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. For most HVAC applications, it is not necessary to program *parameter 0-12 This Set-up Linked to* even if change of setup while running is required. However, for complex applications using the full flexibility of the multiple setups, it may be required. By using *parameter 0-11 Edit Set-up*, it is possible to edit parameters within any of the setups while continuing the operation of the drive in its active setup, which can be a different setup to the one being edited.

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

Parameter 0-10 Active Set-up

Table 19: Parameter 0-10 Active Set-up

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

Select the setup to control the drive functions.

Option	Name	Description
[0]	Factory setup	Cannot be changed. It contains the Danfoss data set and can be used as a data source when returning the other setups to a known state.
[1]*	Set-up 1	*[1] Set-up 1* to *[4] Set-up 4* are the 4 separate parameter setups within which all parameters can be programmed.
[2]	Set-up 2	
[3]	Set-up 3	
[4]	Set-up 4	
[9]	Multi Set-up	Remote setup selections using digital inputs and the serial communication port. This setup used the settings from *parameter 0-12 This Set-up Linked to*. Stop the drive before making changes to open-loop and closed-loop functions.

Parameter 0-11 Edit Set-up

Table 20: Parameter 0-11 Edit Set-up

0-11 Edit Set-up		
Default value: [9] Active set-up	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

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

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

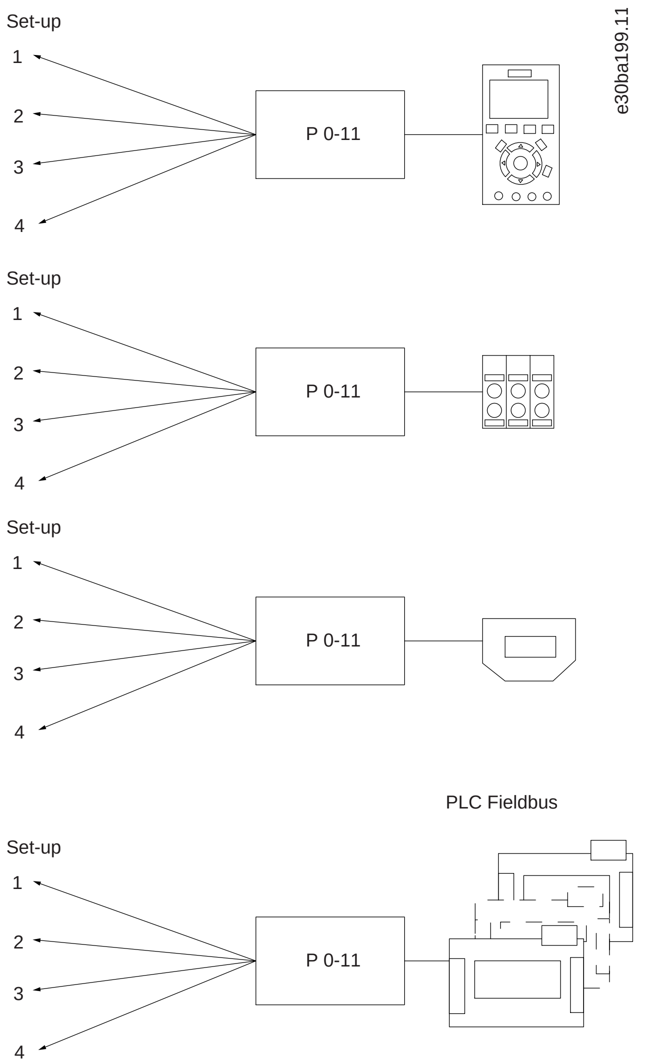


Illustration 28: Edit Setup

Parameter 0-12 This Set-up Linked to

Table 21: Parameter 0-12 This Set-up Linked to

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

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

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

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

Example

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

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

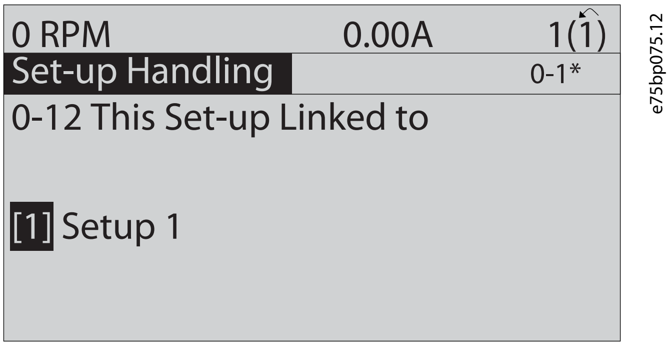


Illustration 29: Setup 1

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

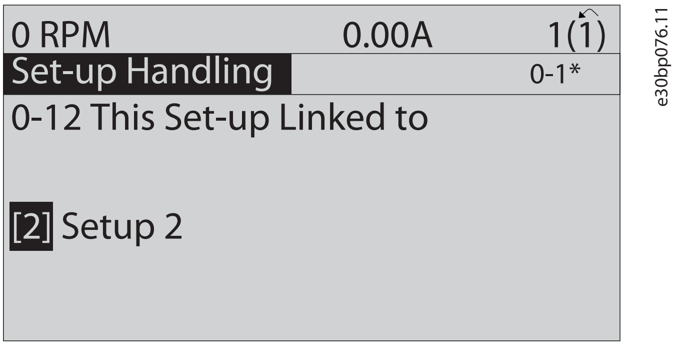


Illustration 30: Setup 2

Parameter 0-13 Readout: Linked Set-ups

Table 22: Parameter 0-13 Readout: Linked Set-ups

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

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

Table 23: Setup Link Example

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

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

Table 24: Parameter 0-14 Readout: Edit Set-ups/Channel

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

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

Example

The number AAAAAA21h means the following:

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

Parameter 0-15 Readout: Actual Set-up

Table 25: Parameter 0-15 Readout: Actual Set-up

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

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

Parameter 0-17 Active Fire Mode Setup

Table 26: Parameter 0-17 Active Fire Mode Setup

0-17 Active Fire Mode Setup		
Default value: 0	Parameter type: Range, 0–255	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

Read out the active fire mode setup selected by either digital inputs or via fieldbus.

5.1.3 0-2* LCP Display

Define the variables shown in the LCP.

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

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

Parameter 0-20 Display Line 1.1 Small

Table 27: Parameter 0-20 Display Line 1.1 Small

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.
[15]	Readout: actual setup	
[17]	Active fire mode 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.
[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.
[1115]	LON warning word	
[1117]	XIF revision	
[1118]	LonWorks revision	
[1230]	Warning Parameter	
[1397]	Alert Alarm Word	
[1398]	Alert Warning Word	
[1399]	Alert Status Word	
[1500]	Operating Hours	
[1501]	Running Hours	View the number of running hours of the motor.
[1502]	kWh Counter	View the mains power consumption in kWh.
[1580]	Fan Running Hours	
[1587]	kWh Counter Hires	

Option	Name	Description
[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 %.
[1609]	Custom Readout	View the user-defined readouts as defined in: • *Parameter 0-30 Custom Readout Unit* • *Parameter 0-31 Custom Readout Min Value* • *Parameter 0-32 Custom Readout Max Value*
[1610]	Power [kW]	Actual power consumed by the motor in kW.
[1611]	Power [hp]	Actual power consumed by the motor in hp.
[1612]	Motor Voltage	Voltage supplied to the motor.
[1613]	Frequency	Motor frequency, that is, the output frequency from the drive in Hz.
[1614]	Motor Current	Phase curent of the motor measured as effective value.
[1615]	Frequency [%]	Motor frequency, that is, the output frequency from the drive in percent.
[1616]	Torque [Nm]	Actual motor torque in Nm.
[1617]	Speed [RPM]	Speed in RPM (revolutions per minute), that is, the motor shaft speed in closed loop.
[1618]	Motor Thermal	Thermal load on the motor calculated by the ETR function.
[1619]	Thermistor Sensor Temperature	
[1620]	Motor Angle	
[1622]	Torque [%]	Present motor load as a percentage of the rated motor torque.
[1623]	Motor Shaft Power [kW]	
[1624]	Calibrated Stator Resistance	
[1626]	Power filtered [kW]	
[1627]	Power filtered [hp]	
[1630]	DC Link Voltage	DC-link voltage in the drive.
[1631]	System Temp.	
[1632]	Brake Energy /s	Present brake power transferred to an external brake resistor. Stated as an instant value.
[1633]	Brake Energy Average	Brake power transferred to an external brake resistor. The mean power is calculated continuously for the most recent 120 s.

Option	Name	Description
[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 drive.
[1637]	Inv. Max. Current	Maximum current of the drive.
[1638]	SL Controller State	State of the event executed by the control.
[1639]	Control Card Temp.	Temperature of the control card.
[1642]	Service Log Counter	
[1643]	Timed Actions Status	See *parameter group 23-0* Timed Actions*.
[1645]	Motor Phase U Current	
[1646]	Motor Phase V Current	
[1647]	Motor Phase W Current	
[1650]	External Reference	Sum of the external reference as a percentage, that is, the sum of analog/pulse/bus.
[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.
[1654]	Feedback 1 [Unit]	
[1655]	Feedback 2 [Unit]	
[1656]	Feedback 3 [Unit]	
[1658]	PID output [%]	
[1659]	Adjusted setpoint	
[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 low=0; Signal high=1.
[1661]	Terminal 53 Switch Setting	Setting of input terminal 54. 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]	Pulse Input #29 [Hz]	Actual value of the frequency applied at terminal 29 as an impulse input.
[1668]	Pulse 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.

Option	Name	Description
[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).
[1675]	Analog In X30/11	Actual value at input X30/11 either as reference or protection value.
[1676]	Analog In X30/12	Actual value at input X30/12 either as reference or protection value.
[1677]	Analog Out X30/8 [mA]	Actual value at output X30/8 in mA. Use *parameter 6-60 Terminal X30/8 Output* to select the value to be shown.
[1678]	Analog Out X45/1 [mA]	
[1679]	Analog Out X45/3 [mA]	
[1680]	Fieldbus CTW 1	Control word (CTW) received from the bus master.
[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	
[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 s 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	
[1698]	Warning Word 3	
[1830]	Analog input X42/1	
[1831]	Analog input X42/3	
[1832]	Analog input X42/5	
[1833]	Analog input X42/7	
[1834]	Analog input X42/9	
[1835]	Analog input X42/11	
[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 Out X49/7	
[1844]	Analog Out X49/9	
[1845]	Analog Out X49/11	
[1846]	X49 Digital Output [bin]	
[1850]	Sensorless readout [Unit]	
[1857]	Air pressure to flow air flow	
[1860]	Digital Input 2	
[1870]	Mains Voltage	
[1871]	Mains Frequency	
[1872]	Mains Imbalance	
[1873]	Worst Inrush	
[1874]	Inrush Mode	
[1875]	Rectifier DC Volt.	
[1876]	Mains Voltage2	
[1877]	Mains Frequency2	
[1878]	Mains Imbalance2	
[1879]	Rectifier DC volt.2	
[2117]	Ext. 1 reference [Unit]	
[2118]	Ext. 1 feedback [Unit]	
[2119]	Ext. 1 output [%]	
[2137]	Ext. 2 reference [Unit]	
[2138]	Ext. 2 feedback [Unit]	
[2139]	Ext. 2 output [%]	
[2157]	Ext. 3 reference [Unit]	
[2158]	Ext. 3 feedback [Unit]	
[2159]	Ext. 3 output [%]	
[2230]	No-flow power	

Option	Name	Description
[2316]	Maintenance text	
[2580]	Cascade status	
[2581]	Pump status	
[3110]	Bypass Status Word	
[3111]	Bypass Running Hours	
[3126]	Pressure sensor 1	
[3127]	Pressure sensor 2	
[3128]	Pressure sensor 3	
[3129]	Pressure sensor 4	
[3130]	Press sens cmp state	
[3131]	Press sens toggle	
[3401]	PCD 1 Write to MCO	
[3402]	PCD 2 Write to MCO	
[3403]	PCD 3 Write to MCO	
[3404]	PCD 4 Write to MCO	
[3405]	PCD 5 Write to MCO	
[3406]	PCD 6 Write to MCO	
[3407]	PCD 7 Write to MCO	
[3408]	PCD 8 Write to MCO	
[3409]	PCD 9 Write to MCO	
[3410]	PCD 10 Write to MCO	
[3421]	PCD 1 Read from MCO	
[3422]	PCD 2 Read from MCO	
[3423]	PCD 3 Read from MCO	
[3424]	PCD 4 Read from MCO	
[3425]	PCD 5 Read from MCO	
[3426]	PCD 6 Read from MCO	
[3427]	PCD 7 Read from MCO	
[3428]	PCD 8 Read from MCO	
[3429]	PCD 9 Read from MCO	
[3430]	PCD 10 Read from MCO	
[4521]	Status	

Option	Name	Description
[4522]	Progress	
[4523]	Baseline Failure	
[4590]	Stator [%]	
[4591]	Load [%]	
[4592]	Sensor 1 [%]	
[4593]	Sensor 1 [unit]	
[4594]	Sensor 2 [%]	
[4595]	Sensor 2 [unit]	
[4596]	Sensor 3 [%]	
[4597]	Sensor 3 [unit]	
[4598]	Sensor 4 [%]	
[4599]	Sensor 4 [unit]	

Parameter 0-21 Display Line 1.2 Small

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

Parameter 0-22 Display Line 1.3 Small

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

Parameter 0-23 Display Line 2 Large

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

Parameter 0-24 Display Line 3 Large

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

Parameter 0-25 My Personal Menu

Table 28: Parameter 0-25 My Personal Menu

0-25 My Personal Menu		
Default value: Size related	Parameter type: Range, 0–9999, Array [20]	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

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

5.1.4 0-3* LCP Custom Readout

It is possible to customize the display elements for various purposes:

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

Custom reaout

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

- *Parameter 0-30 Custom Readout Unit*.
- *Parameter 0-31 Custom Readout Min Value* (linear only).
- *Parameter 0-32 Custom Readout Max Value*.
- *Parameter 4-13 Motor Speed High Limit [RPM]*.

- *Parameter 4-14 Motor Speed High Limit [Hz]*.
- Actual speed.

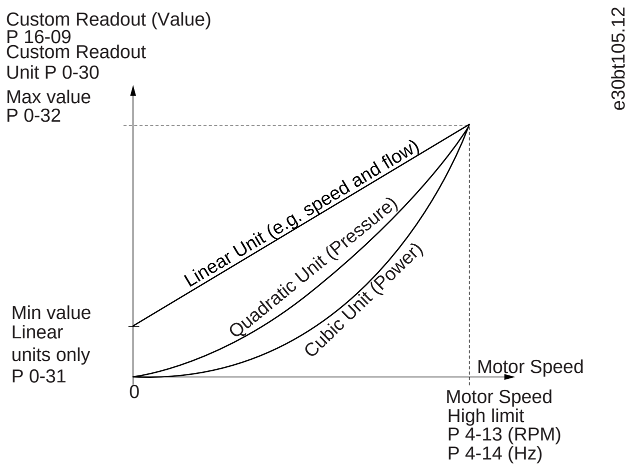


Illustration 31: Custom Readout

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

Table 29: Speed Relations for Different Unit Types

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

Parameter 0-30 Unit for User-defined Readout

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

0-30 Unit for User-defined Readout		
Default value: [1] %	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 selected (see Table 3.2). 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]*	%	

Option	Name	Description
[5]	PPM	
[10]	1/min	
[11]	RPM	
[12]	Pulse/s	
[20]	l/s	
[21]	l/min	
[22]	l/h	
[23]	m^3/s	
[24]	m^3/min	
[25]	m^3/h	
[30]	kg/s	
[31]	kg/min	
[32]	kg/h	
[33]	t/min	
[34]	t/h	
[40]	m/s	
[41]	m/min	
[45]	m	
[60]	°C	
[70]	mbar	
[71]	bar	
[72]	Pa	
[73]	kPa	
[74]	m WG	
[75]	mm Hg	
[80]	kW	
[120]	GPM	
[121]	gal/s	
[122]	gal/min	
[123]	gal/h	
[124]	CFM	
[125]	ft^3/s	

Option	Name	Description
[126]	ft^3/min	
[127]	ft^3/h	
[130]	lb/s	
[131]	lb/min	
[132]	lb/h	
[140]	ft/s	
[141]	ft/min	
[145]	ft	
[160]	°F	
[170]	psi	
[171]	lb/in^2	
[172]	in WG	
[173]	ft WG	
[174]	in Hg	
[180]	hp	

Parameter 0-31 Min Value of User-defined Readout

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

0-31 Min Value of User-defined Readout		
Default value: Size related	Parameter type: Range, -999999.99 CustomReadoutUnit - 100.00 CustomReadoutUnit	Setup: All setups
Conversion index: -2	Data type: Int32	Change during operation: True

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

Parameter 0-32 Max Value of User-defined Readout

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

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

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

Parameter 0-37 Display Text 1

Table 33: Parameter 0-37 Display Text 1

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

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

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

Parameter 0-38 Display Text 2

Table 34: Parameter 0-38 Display Text 2

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

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

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

Parameter 0-39 Display Text 3

Table 35: Parameter 0-39 Display Text 3

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

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

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

5.1.5 0-4* LCP Keypad

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

Parameter 0-40 [Hand On] Key on LCP

Table 36: Parameter 0-40 [Hand On] Key on LCP

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

Option	Name	Description
[0]	Disabled	No effect when [Hand On] is pressed. Select *[0] Disabled* to avoid accidental start of the drive in hand-on mode.
[1]*	Enabled	The LCP switches to hand-on mode directly when [Hand On] is pressed.
[2]	Password	After pressing [Hand On] a password is required. If *parameter 0-40 [Hand on] Key on LCP* is included in *My Personal Menu*, define the password in *parameter 0-65 Personal Menu Password*. Otherwise define the password in *parameter 0-60 Main Menu Password*.
[3]	Enabled without OFF	
[4]	Password without OFF	
[5]	Enabled with OFF	
[6]	Password with OFF	
[9]	Enabled, ref=0	

Parameter 0-41 [Off] Key on LCP

Table 37: Parameter 0-41 [Off] Key on LCP

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

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

Parameter 0-42 [Auto On] Key on LCP

Table 38: Parameter 0-42 [Auto On] Key on LCP

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

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

Parameter 0-43 [Reset] Key on LCP

Table 39: Parameter 0-43 [Reset] Key on LCP

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

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

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

Table 40: Parameter 0-44 [Off/Reset] Key on LCP

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

Enable or disable the [Off/Reset] key.

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

Parameter 0-45 [Drive Bypass] Key on LCP

Table 41: Parameter 0-45 [Drive Bypass] Key on LCP

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

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

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

5.1.6 0-5* Copy/Save

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

Parameter 0-50 LCP Copy

Table 42: Parameter 0-50 LCP Copy

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

N O T I C E

This parameter cannot be adjusted while the motor is running.

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

Parameter 0-51 Set-up Copy

Table 43: Parameter 0-51 Set-up Copy

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

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

5.1.7 0-6* Password

Parameter 0-60 Main Menu Password

Table 44: Parameter 0-60 Main Menu Password

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

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

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

Table 45: Parameter 0-61 Access to Main Menu w/o Password

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

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

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

N O T I C E

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

Parameter 0-65 Personal Menu Password

Table 46: Parameter 0-65 Personal Menu Password

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

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

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

Table 47: Parameter 0-66 Access to Personal Menu w/o Password

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

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

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

Table 48: How Combinations of Parameters 0-61 and 0-66 Work with LCP

Combination number	Option selected in *parameter 0-66 Access to Personal Menu w/o Password*	Option selected in *parameter 0-61 Access to Main Menu w/o Password*	LCP behavior when pressing [Quick Menu] after power-up
1	*[1] LCP: Read only*	*[1] LCP: Read only*	Users can see *My Personal Menu* and all other submenus in Quick Menus. After entering the password from *parameter 0-65 Personal Menu Password*, users can edit both parameters inside *My Personal Menu* and parameters in all other submenus in *Quick Menus*.
2	*[1] LCP: Read only*	*[2] LCP: No access*	Users can read *My Personal Menu* and parameters inside *My Personal Menu* only. After entering the password from *parameter 0-65 Personal Menu Password*, users can edit and see parameters inside *My Personal Menu* only.
3	*[1] LCP: Read only*	*[5] All: Read only*	Same as combination 1.
4	*[1] LCP: Read only*	*[6] All: No access*	Same as combination 2.
5	*[2] LCP: No access*	*[1] LCP: Read only*	Same as combination 1.
6	*[2] LCP: No access*	*[2] LCP: No access*	Users get the Access denied message and the password dialog appears. Users must enter the password from *parameter 0-60 Main Menu Password*, not the password from *parameter 0-65 Personal Menu Password*.
7	*[2] LCP: No access*	*[5] All: Read only*	Same as combination 1.

Combi-nation number	Option selected in *parameter 0-66 Access to Personal Menu w/o Password*	Option selected in *parameter 0-61 Access to Main Menu w/o Password*	LCP behavior when pressing [Quick Menu] after power-up
8	*[2] LCP: No access*	*[6] All: No access*	Same as combination 6.
9	*[6] All: No access*	*[1] LCP: Read only*	Same as combination 1.
10	*[6] All: No access*	*[2] LCP: No access*	Same as combination 2.
11	*[6] All: No access*	*[5] All: Read only*	Same as combination 1.
12	*[6] All: No access*	*[6] All: No access*	Same as combination 10.

Parameter 0-67 Bus Password Access

Table 49: Parameter 0-67 Bus Password Access

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

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

5.1.8 0-7* Clock Settings

Set the time and date of the internal clock. The internal clock can be used for timed actions, energy log, trend analysis, date/time stamps on alarms, logged data, preventive maintenance, and so on.

It is possible to program the clock for daylight saving time/summertime, weekly working days/non-working days including 20 exceptions, for example, holidays. Although the clock settings can be set via the LCP, they can also be set along with timed actions and preventive maintenance functions using the VLT Motion Control Tool MCT 10.

N O T I C E

The drive has no back-up of the clock function and 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. If no module with back-up is installed, only use the clock function if the drive is integrated into the BMS using serial communications, with the BMS maintaining synchronization of control equipment clock times. In *parameter 0-79 Clock Fault*, it is possible to program the occurrence of a warning if the clock has not been set properly, for example, after a power-down.

N O T I C E

If mounting VLT® Analog I/O Option MCB 109, a battery back-up of the date and time is included.

Parameter 0-70 Date and Time

Table 50: Parameter 0-70 Date and Time

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

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

Parameter 0-71 Date Format

Table 51: Parameter 0-71 Date Format

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

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

Parameter 0-72 Time Format

Table 52: Parameter 0-72 Time Format

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

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

Parameter 0-73 Time Zone Offset

Table 53: Parameter 0-73 Time Zone Offset

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

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

Parameter 0-74

Table 54: Parameter 0-74 DST/Summertime

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

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

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

Parameter 0-75 Last Power Off Time

Table 55: Parameter 0-75 Last Power Off Time

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, whereas index [4] is the oldest.

Parameter 0-76 DST/Summertime Start

Table 56: Parameter 0-76 DST/Summertime Start

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

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

Parameter 0-77 DST/Summertime End

Table 57: Parameter 0-77 DST/Summertime End

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

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

Parameter 0-79 Clock Fault

Table 58: Parameter 0-79 Clock Fault

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

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

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

Parameter 0-81 Working Days

Table 59: Parameter 0-81 Working Days

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

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

Option	Name	Description
[0]	No	
[1]	Yes	

Parameter 0-82 Additional Working Days

Table 60: Parameter 0-82 Additional Working Days

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

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

Parameter 0-83 Additional Non-working Days

Table 61: Parameter 0-83 Additional Non-working Days

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

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

Parameter 0-84 Time for Fieldbus

Table 62: Parameter 0-84 Time for Fieldbus

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

Shows the time for fieldbus.

Parameter 0-85 Summer Time Start for Fieldbus

Table 63: Parameter 0-85 Summer Time Start for Fieldbus

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

Shows the summer time start for fieldbus.

Parameter 0-86 Summer Time End for Fieldbus

Table 64: Parameter 0-86 Summer Time End for Fieldbus

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

Shows the summer time end for fieldbus.

Parameter 0-89 Date and Time Readout

Table 65: Parameter 0-89 Date and Time Readout

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

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

5.1.9 0-9* Varia

Parameter 0-95 Warning LED Blinking

Table 66: Parameter 0-95 Warning LED Blinking

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	

5.2 Parameter Group 1-** Load and Motor

5.2.1 1-0* General Settings

Define whether the drive operates in open loop or closed loop.

Parameter 1-00 Configuration Mode

Table 67: Parameter 1-00 Configuration Mode

1-00 Configuration Mode		
Default value: [0] Open loop	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

N O T I C E

This parameter cannot be changed while the motor is running.

N O T I C E

When set to *[3] Closed loop*, the commands reversing and start reversing do not reverse the motor direction.

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]*	Open loop	Motor speed is determined by applying a speed reference or by setting the speed when in hand-on mode. Open loop is also used if the drive is part of a closed-loop system based on an external PID controller providing a speed reference signal as output.
[3]	Closed loop	Motor speed is determined by a reference from the built-in PID controller varying the motor speed as in a closed-loop control process (for example, constant pressure or flow). Configure the PID controller in *parameter group 20-** Feedback* or via the Function Set-ups accessed by pressing [Quick Menu].

Parameter 1-01 Motor Control Principle

Table 68: Parameter 1-01 Motor Control Principle

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

Select which motor control principle to employ.

Option	Name	Description
[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.

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

Parameter 1-03 Torque Characteristics

Table 69: Parameter 1-03 Torque Characteristics

1-03 Torque Characteristics		
Default value: [3] Auto energy optim. VT	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

N O T I C E

This parameter cannot be adjusted while the motor is running.

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

Option	Name	Description
[0]	Compressor torque	For speed control of screw and scroll compressors. Provides a voltage which is optimized for a constant torque load characteristic of the motor in the entire range down to 10 Hz.
[1]	Variable torque	For speed control of centrifugal pumps and fans. Also to be used when controlling more than 1 motor from the same drive (for example, multiple condenser fans or cooling tower fans). Provides a voltage which is optimized for a squared torque load characteristic of the motor.
[2]	Auto energy optim. CT	For optimum energy-efficient speed control of screw and scroll compressors. Provides a voltage which is optimized for a constant torque load characteristic of the motor in the entire range down to 15 Hz. In addition, the AEO feature adapts the voltage exactly to the current load situation, thereby reducing energy consumption and audible noise from the motor. To obtain optimum performance, set the motor power factor cos phi correctly. This value is set in *parameter 14-43 Motor Cosphi*. The parameter has a default value, which

Op-tion	Name	Description
		is automatically adjusted when the motor data is programmed. These settings ensure optimum motor voltage. If the motor power factor cos phi requires tuning, an AMA function can be carried out using *parameter 1-29 Automatic Motor Adaptation (AMA)*. It is rarely necessary to adjust the motor power factor parameter manually.
[3]	Auto energy optim. VT	For optimum energy-efficient speed control of centrifugal pumps and fans. Provides a voltage optimized for a squared torque load characteristic of the motor. In addition, the AEO feature adapts the voltage exactly to the current load situation, thereby reducing energy consumption and audible noise from the motor. To obtain optimum performance, set the motor power factor cos phi correctly. This value is set in *parameter 14-43 Motor Cosphi*. The parameter has a default value and is automatically adjusted when the motor data is programmed. These settings ensure optimum motor voltage. If the motor power factor cos phi requires tuning, an AMA function can be carried out using *parameter 1-29 Automatic Motor Adaptation (AMA)*. It is rarely necessary to adjust the motor power factor parameter manually.

Parameter 1-06 Clockwise Direction

Table 70: Parameter 1-06 Clockwise Direction

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

N O T I C E

This parameter cannot be adjusted while the motor is running.

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

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

5.2.2 Motor Selection

5.2.2.1 Active Parameters, Asynchron and PM Non-Salient Motors

N O T I C E

This parameter group cannot be adjusted while the motor is running.

Table 71: Active Parameters with Asynchron and PM Non-salient Motors

Parameter 1-10 Motor Construction	[0] Asynchron	[1] PM Motor Non Salient
Parameter 1-00 Configuration Mode	x	x
Parameter 1-03 Torque Characteristics	x	
Parameter 1-06 Clockwise Direction	x	x
Parmeter 1-14 Damping Gain		x

Parameter 1-10 Motor Construction	**[0] Asynchron**	**[1] PM Motor Non Salient**
Parameter 1-15 Low Speed Filter Time Const.		x
Parameter 1-16 High Speed Filter Time Const.		x
Parameter 1-17 Voltage Filter Time Const.		x
Parameter 1-20 Motor Power [kW]	x	
Parameter 1-21 Motor Power [hp]	x	
Parameter 1-22 Motor Voltage	x	
Parameter 1-23 Motor Frequency	x	
Parameter 1-24 Motor Current	x	x
Parameter 1-25 Motor Nominal Speed	x	x
Parameter 1-26 Motor Cont. Rated Torque		x
Parameter 1-28 Motor Rotation Check	x	x
Parameter 1-29 Automatic Motor Adaptation (AMA)	x	
Parameter 1-30 Stator Resistance (Rs)	x	x
Parameter 1-31 Rotor Resistance (Rr)	x	
Parameter 1-35 Main Reactance (Xh)	x	
Parameter 1-37 d-axis Inductance (Ld)		x
Parameter 1-39 Motor Poles	x	x
Parameter 1-40 Back EMF at 1000 RPM		x
Parameter 1-50 Motor Magnetization at Zero Speed	x	
Parameter 1-51 Min Speed Normal Magnetising [RPM]	x	
Parameter 1-52 Min Speed Normal Magnetising [Hz]	x	
Parameter 1-58 Flying Start Test Pulses Current	x	x
Parameter 1-59 Flying Start Test Pulses Frequency	x	x
Parameter 1-60 Low Speed Load Compensation	x	
Parameter 1-61 High Speed Load Compensation	x	
Parameter 1-62 Slip Compensation	x	
Parameter 1-63 Slip Compensation Time Constant	x	
Parameter 1-64 Resonance Dampening	x	
Parameter 1-65 Resonance Dampening Time Constant	x	
Parameter 1-66 Min. Current at Low Speed		x
Parameter 1-70 Start Mode		x
Parameter 1-71 Start Delay	x	x

Parameter 1-10 Motor Construction	**[0] Asynchron**	**[1] PM Motor Non Salient**
Parameter 1-72 Start Function	x	x
Parameter 1-73 Flying Start	x	x
Parameter 1-77 Compressor Start Max Speed [RPM]	x	
Parameter 1-78 Compressor Start Max Speed [Hz]	x	
Parameter 1-79 Compressor Start Max Time to Trip	x	
Parameter 1-80 Function at Stop	x	x
Parameter 1-81 Min Speed for Function at Stop [RPM]	x	x
Parameter 1-82 Min Speed for Function at Stop [Hz]	x	x
Parameter 1-86 Trip Speed Low [RPM]	x	x
Parameter 1-87 Trip Speed Low [Hz]	x	x
Parameter 1-90 Motor Thermal Protection	x	x
Parameter 1-91 Motor External Fan	x	x
Parameter 1-93 Thermistor Source	x	x
Parameter 2-00 DC Hold/Preheat Current	x	
Parameter 2-01 DC Brake Current	x	x
Parameter 2-02 DC Braking Time	x	
Parameter 2-03 DC Brake Cut In Speed [RPM]	x	
Parameter 2-04 DC Brake Cut In Speed [Hz]	x	
Parameter 2-06 Parking Current		x
Parameter 2-07 Parking Time		x
Parameter 2-10 Brake Function	x	x
Parameter 2-11 Brake Resistor (ohm)	x	x
Parameter 2-12 Brake Power Limit (kW)	x	x
Parameter 2-13 Brake Power Monitoring	x	x
Parameter 2-15 Brake Check	x	x
Parameter 2-16 AC Brake Max. Current	x	
Parameter 2-17 Over-voltage Control	x	
Parameter 4-10 Motor Speed Direction	x	x
Parameter 4-11 Motor Speed Low Limit [RPM]	x	x
Parameter 4-12 Motor Speed Low Limit [Hz]	x	x
Parameter 4-13 Motor Speed High Limit [RPM]	x	x
Parameter 4-14 Motor Speed High Limit [Hz]	x	x

Parameter 1-10 Motor Construction	**[0] Asynchron**	**[1] PM Motor Non Salient**
Parameter 4-16 Torque Limit Motor Mode	x	x
Parameter 4-17 Torque Limit Generator Mode	x	x
Parameter 4-18 Current Limit	x	x
Parameter 4-19 Max Output Frequency	x	x
Parameter 4-58 Missing Motor Phase Function	x	
Parameter 14-40 VT Level	x	
Parameter 14-41 AEO Minimum Magnetisation	x	
Parameter 14-42 Minimum AEO Frequency	x	
Parameter 14-43 Motor Cosphi	x	

5.2.3 1-1* Motor Selection

Parameter 1-10 Motor Construction

Table 72: Parameter 1-10 Motor Construction

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

Select the motor design type.

Option	Name	Description
[0]*	Asynchron	Use for ASM/IM motors.
[1]	PM, non salient SPM	Use for SPM motors, surface-mounted magnet. PM motors are divided into 2 groups, with either surface-mounted (SPM)/non-salient magnets or interior-mounted (IPM)/ salient magnets.
[2]	PM, salient IPM	Use for IPM motors, interior-mounted magnet. PM motors are divided into 2 groups, with either surface-mounted (SPM)/non-salient magnets or interior-mounted (IPM)/ salient magnets.
[5]	SynRM	Use for SynRM, synchronous reluctance motors. **N O T I C E** This option has the following firmware version limitations: – Version 4.2x and earlier - do not use this option. There is a risk of damage to the drive. – Version 4.3x and later - use this option only when flying start is enabled in *parameter 1-73 Flying Start*.
[6]	PMaSynRM	Use for PMaSynRM, Permanent Magnet assisted synchronous reluctance motors.

5.2.4 1-1* VVC+ PM/Syn RM

The default control parameters for VVC+ PM motor control core are optimized for applications and inertia load in the range of 50>Jl/Jm>5. Jl is load inertia from the application and Jm is machine inertia. For low inertia applications (Jl/Jm<5), it is recommended that *parameter 1-17 Voltage Filter Time Const.* is increased with a factor of 5–10. Sometimes, *parameter 14-08 Damping Gain Factor* should also be reduced to improve performance and stability. For high-inertia applications (Jl/Jm>50), increase *parameter 1-15 Low Speed Filter Time Const.* and *parameter 1-16 High Speed Filter Time Const.* to improve performance and stability. For high load at low speed (<30% of rated speed), it is recommended that *parameter 1-17 Voltage Filter Time Const.* is increased due to non-linearity in the inverter at low speed.

Parameter 1-14 Damping Gain

Table 73: Parameter 1-14 Damping Gain

1-14 Damping Gain		
Default value: 120%	Parameter type: Range, 0 - 250%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

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

Parameter 1-15 Low Speed Filter Time Const.

Table 74: Parameter 1-15 Low Speed Filter Time Const.

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

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

Parameter 1-16 High Speed Filter Time Const.

Table 75: Parameter 1-16 High Speed Filter Time Const.

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

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

Parameter 1-17 Voltage Filter Time Const.

Table 76: Parameter 1-17 Voltage Filter Time Const.

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

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

5.2.5 1-2* Motor Data

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

N O T I C E

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

NOTICE

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

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

Parameter 1-20 Motor Power [kW]

Table 77: Parameter 1-20 Motor Power [kW]

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

NOTICE

This parameter cannot be adjusted while the motor is running.

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

Parameter 1-21 Motor Power [HP]

Table 78: Parameter 1-21 Motor Power [HP]

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

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

Parameter 1-22 Motor Voltage

Table 79: Parameter 1-22 Motor Voltage

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

NOTICE

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

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

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

Parameter 1-23 Motor Frequency

Table 80: Parameter 1-23 Motor Frequency

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

NOTICE

This parameter cannot be adjusted while the motor is running.

Select the motor frequency value from the motor nameplate data. For 87 Hz operation with 230/400 V motors, set the nameplate data for 230 V/50 Hz. Adapt *parameter 4-13 Motor Speed High Limit [RPM]* and *parameter 3-03 Maximum Reference* to the 87 Hz application.

Parameter 1-24 Motor Current

Table 81: Parameter 1-24 Motor Current

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

NOTICE

This parameter cannot be adjusted while the motor is running.

NOTICE

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

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

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

Parameter 1-25 Motor Nominal Speed

Table 82: Parameter 1-25 Motor Nominal Speed

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

NOTICE

This parameter cannot be adjusted while the motor is running.

NOTICE

Changing this parameter will affect settings of other parameters.

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

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

Parameter 1-26 Motor Cont. Rated Torque

Table 83: Parameter 1-26 Motor Cont. Rated Torque

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

NOTICE

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

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

Parameter 1-28 Motor Rotation Check

Table 84: Parameter 1-28 Motor Rotation Check

1-28 Motor Rotation Check		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

WARNING

HIGH VOLTAGE

Drives contain high voltage when connected to AI mains input, DC supply, or load sharing. Disconnecting motor cables while mains power is turned on can result in death or serious injury.

– Remove mains power before disconnecting motor phase cables.

NOTICE

Once the motor rotation check is enabled, the display shows: *Note! Motor may run in wrong direction*. Pressing [OK], [Back], or [Cancel] dismisses the message and shows a new message: *Press [Hand On] to start the motor. Press [Cancel] to abort*. Pressing [Hand On] starts the motor at 5 Hz in forward direction and the display shows: *Motor is running*. Check if the motor rotation direction is correct. Press [Off] to stop the motor. Pressing [Off] stops the motor and resets *parameter 1-28 Motor Rotation Check*. If motor rotation direction is incorrect, interchange 2 motor phase cables.

Following installation and connection of the motor, this function allows the correct motor rotation direction to be verified. Enabling this function overrides any bus commands or digital inputs, except external interlock and STO (if Included).

Option	Name	Description
[0]*	Off	Motor rotation check is not active.
[1]	Enabled	Motor rotation check is enabled.

Parameter 1-29 Automatic Motor Adaptation

Table 85: Parameter 1-29 Automatic Motor Adaptation (AMA)

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

NOTICE

This parameter cannot be adjsuted while the motor is running.

The AMA function optimizes dynamic motor performance by automatically optimizing the advanced motor parameters (*parameter 1-30 Stator Resistance (Rs)* to *parameter 1-35 Main Reactance (Xh))* at motor standstill. Activate the AMA function by pressing [Hand On] after selecting *[1] Enable Complete AMA* or *[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.

NOTICE

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

Option	Name	Description
[0]*	Off	
[1]	Enable complete AMA	Performs • AMA of the stator resistance R_s • The rotor resistance R_r • The stator leakage reactance X_1 • The rotor leakage reactance X_2, and • The main reactance X_h Do **not** select this option if an LC filter is used between the drive and the motor. For best performance, it is recommended to obtain the advanced motor data from the motor manufacturer to enter into *parameter 1-31 Rotor Resistance (Rr)* through *parameter 1-36 Iron Loss Resistance (Rfe)*. Complete AMA cannot be performed on permanent magnet motors.
[2]	Enable Reduced AMA	Performs a reduced AMA of the stator resistance R_s in the system only. This option is available for standard asynchronous motors and non-salient PM motors. Select this option if an LC filter is installed between the drive and the motor.
[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.

N O T I C E

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

N O T I C E

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

N O T I C E

Avoid generating external torque during AMA.

N O T I C E

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

N O T I C E

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

5.2.6 1-3* Adv. Motor Data

Parameters for advanced motor data. 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.

NOTICE

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

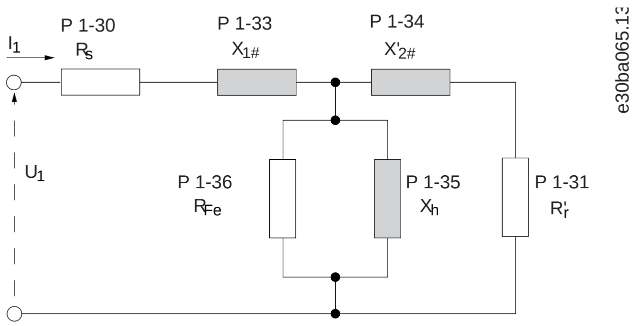


Illustration 32: Motor Equivalent Diagram of an Asynchronous Motor

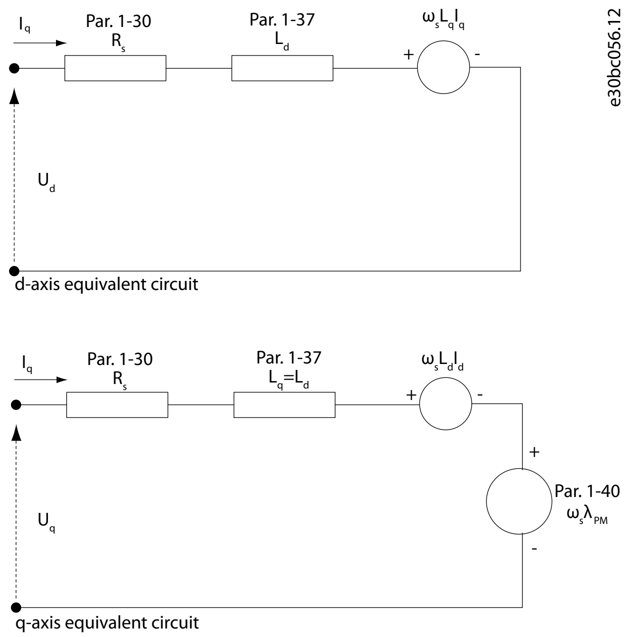


Illustration 33: Motor Equivalent Circuit Diagram for a PM Non-salient Motor

Parameter 1-30 Stator Resistance (Rs)

Table 86: Parameter 1-30 Stator Resistance (Rs)

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

NOTICE

This parameter cannot be adjusted while the motor is running.

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

NOTICE

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

NOTICE

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

Parameter 1-31 Rotor Resistance (Rr)

Table 87: Parameter 1-31 Rotor Resistance (Rr)

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

NOTICE

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

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

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

Parameter 1-33 Stator Leakage Reactance (X1)

Table 88: Parameter 1-33 Stator Leakage Reactance (X1)

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

NOTICE

This parameter is only relevant for asynchronous motors.

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

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

NOTICE

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

Parameter 1-34 Rotor Leakage Reactance (X2)

Table 89: Parameter 1-34 Rotor Leakage Reactance (X2)

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

NOTICE

This parameter is only relevant for asynchronous motors.

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

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

NOTICE

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

Parameter 1-35 Main Reactance (Xh)

Table 90: Parameter 1-35 Main Reactance (Xh)

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

NOTICE

This parameter cannot be adjusted while the motor is running.

NOTICE

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

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

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

NOTICE

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

Parameter 1-36 Iron Loss Resistance (Rfe)

Table 91: Parameter 1-36 Iron Loss Resistance (Rfe)

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

N O T I C E

This parameter cannot be adjusted while the motor is running.

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

Parameter 1-37 d-axis Inductance (Ld)

Table 92: Parameter 1-37 d-axis Inductance (Ld)

1-37 d-axis Inductance (Ld)		
Default value: 0.0 mH	Parameter type: Range, 0.0 - 1000.0 mH	Setup: All setups
Conversion index: -6	Data type: Uint32	Change during operation: False

Enter line-to-common direct axis inductance of the PM motor. Obtain the value from the permanent magnet motor datasheet. If only line-line data is available, divide the line-line value by 2 to achieve the line-common (star point) value. Alternatively, measure the value with an inductance meter. This also takes the inductance of the cable into account. Divide the measured value by 2 and enter the result. This parameter is only active when *parameter 1-10 Motor Construction* is set to *[1] PM, non-salient SPM* (Permanent Magnet Motor) or *[5] Sync. Reluctance*. For a selection with 1 decimal, use this parameter. For a selection with 3 decimals, use *parameter 30-80 d-axis Inductance (Ld)*.

N O T I C E

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

Parameter 1-38 q-axis Inductance (Lq)

Table 93: Parameter 1-38 q-axis Inductance (Lq)

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

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

Parameter 1-39 Motor Poles

Table 94: Parameter 1-39 Motor Poles

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

N O T I C E

This parameter cannot be adjusted while the motor is running.

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

Table 95: Pole Number for Normal Speed Ranges

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

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

Parameter 1-40 Back EMF at 1000 RPM

Table 96: Parameter 1-40 Back EMF at 1000 RPM

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

N O T I C E

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

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

Back EMF = (Voltage ÷ RPM) × 1000

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

(320 ÷ 1800) × 1000 = 178

N O T I C E

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

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

Table 97: Parameter 1-44 d-axis Inductance Sat. (LdSat)

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

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

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

Table 98: Parameter 1-45 q-axis Inductance Sat. (LqSat)

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.

Parameter 1-46 Position Detection Gain

Table 99: Parameter 1-46 Position Detection Gain

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

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

Parameter 1-47 Torque Calibration

Table 100: Parameter 1-47 Torque Calibration

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

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

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

Op-tion	Name	Description
		• *Parameter 1-30 Stator Resistance (Rs).* • *Parameter 1-33 Stator Leakage Reactance (X1).* • *Parameter 1-34 Rotor Leakage Reactance (X2).* • *Parameter 1-37 d-axis Inductance (Ld).*

Parameter 1-48 d-axis Inductance Sat. Point

Table 101: Parameter 1-48 d-axis Inductance Sat. Point

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

N O T I C E

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

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

Parameter 1-49 q-axis Inductance Sat. Point

Table 102: Parameter 1-49 q-axis Inductance Sat. Point

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

N O T I C E

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

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

5.2.7 1-5* Load Indep. Setting

Parameter 1-50 Motor Magnetization at Zero Speed

Table 103: Parameter 1-50 Motor Magnetization at Zero Speed

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

N O T I C E

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

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

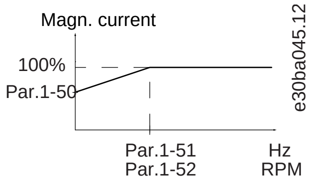


Illustration 34: Motor Magnetization

Parameter 1-51 Min Speed Normal Magnetising [RPM]

Table 104: Parameter 1-51 Min Speed Normal Magnetising [RPM]

1-51 Min Speed Normal Magnetising [RPM]		
Default value: Size related	Parameter type: Range, 10 - 300 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

NOTICE

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

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

Parameter 1-52 Min Speed Normal Magnetising [Hz]

Table 105: Parameter 1-52 Min Speed Normal Magnetising [Hz]

1-52 Min Speed Normal Magnetising [Hz]		
Default value: Size Related	Parameter type: Range, 0.3 - 10.0 Hz	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

NOTICE

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

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

Parameter 1-53 Model Shift Frequency

Table 106: Parameter 1-53 Model Shift Frequency

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

NOTICE

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 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*.

Variable current - flux model - sensorless: This model is used when *parameter 1-00 Configuration Mode* is set to *[0] Speed open loop* and *parameter 1-01 Motor Control Principle* is set to *[2] Flux sensorless*. In speed open loop in flux mode, the speed is determined from the current measurement. Below f_{norm} x 0.1, the drive runs on a variable current model. Above f_{norm} x 0.125 the drive runs on a flux model.

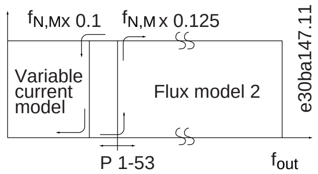


Illustration 35: Parameter 1-00 Configuration Mode = [0] Speed Open Loop, Parameter 1-01 Motor Control Principle = [2] Flux Sensorless

Parameter 1-54 Voltage Reduction in Fieldweakening

Table 107: Parameter 1-54 Voltage reduction in fieldweakening

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

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

Parameter 1-58 Flying Start Test Pulses Current

Table 108: Parameter 1-58 Flying Start Test Pulses Current

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

N O T I C E

This parameter is only available in VVC+.

N O T I C E

This parameter has effect on PM motors only.

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

Parameter 1-59 Flying Start Test Pulses Frequency

Table 109: Parameter 1-59 Flying Start Test Pulses Frequency

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

The parameter is active when *parameter 1-73 Flying Start* is enabled. The value range and function depend on *parameter 1-10 Motor Construction*: *[0] Asynchron*: [0-500%] Control the percentage of the frequency for the pulses used to detect the motor direction. Increasing this value reduces the generated torque. In this mode, 100% means 2 times the slip frequency. *[1] PM non salient*: [0-10%]

This parameter defines the motor speed (in % of nominal motor speed) below which the parking function (see *parameter 2-06 Parking Current* and *parameter 2-07 Parking Time*) becomes active. This parameter is only active when *parameter 1-70 Start Mode* is set to *[1] Parking* and only after starting the motor.

5.2.8 1-6* Load Depend. Setting

Parameter 1-60 Low Speed Load Compensation

Table 110: Parameter 1-60 Low Speed Load Compensation

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

NOTICE

Parameter 1-60 Low Speed Load Compensation has no effect when *parameter 1-10 Motor Construction = [1] PM, non-salient SPM*.

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 [kW]	Changeover [Hz]
0.25–7.5	<10
11–45	<5
55–550	<3–4

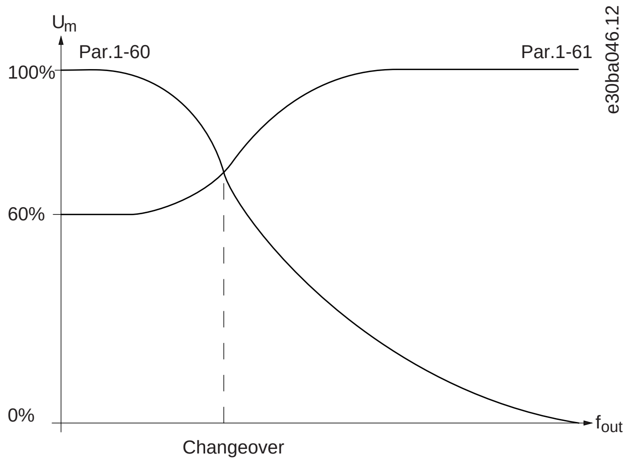


Illustration 36: Low-speed Load Compensation

Parameter 1-61 High Speed Load Compensation

Table 111: Parameter 1-61 High Speed Load Compensation

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

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

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

Parameter 1-62 Slip Compensation

Table 112: Parameter 1-62 Slip Compensation

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

NOTICE

Parameter 1-62 Slip Compensation has no effect when *parameter 1-10 Motor Construction = [1] PM, non-salient SPM*.

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 $n_{M,N}$. Slip compensation is calculated automatically based on the rated motor speed $n_{M,N}$.

Parameter 1-63 Slip Compensation Time Constant

Table 113: Parameter 1-63 Slip Compensation Time Constant

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

NOTICE

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

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

Parameter 1-64 Resonance Damping

Table 114: Parameter 1-64 Resonance Damping

1-64 Resonance Damping		
Default value: Size related	Parameter type: Range, 0 - 500%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

NOTICE

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

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

Parameter 1-65 Resonance Damping Time

Table 115: Parameter 1-65 Resonance Damping Time Constant

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

N O T I C E

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

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

Parameter 1-66 Min. Current at Low Speed

Table 116: Parameter 1-66 Min. Current at Low Speed

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

N O T I C E

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

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

Parameter 1-67 Load Type

Table 117: Parameter 1-67 Load Type

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

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

Parameter 1-68 Motor Inertia

Table 118: Parameter 1-68 Motor Inertia

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.

Parameter 1-69 System Inertia

Table 119: Parameter 1-69 System Inertia

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

NOTICE
This parameter cannot be adjusted while the motor is running.

The system inertia and *parameter 7-08 Speed PID Feed Forward Factor* is used to calculate acceleration feed forward for the speed PID controller. Automatic measurement of system inertia and setting of this parameter is 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*. Accelerate to at least model shift frequency (*parameter 1-53 Model Shift Frequency*) + 10 Hz and decelerate to produce a result. Measurement is possible in both speed, position, or synchronization mode.

5.2.9 1-7* Start Adjustments

Parameter 1-70 Start Mode

Table 120: Parameter 1-70 Start Mode

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

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

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

Parameter 1-71 Start Delay

Table 121: Parameter 1-71 Start Delay

1-71 Start Delay		
Default value: 0 s	Parameter type: Range, 0 - 120 s	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Enter the time delay between the start command and the time when the drive supplies the power to the motor. This parameter refers to the start function selected in *parameter 1-72 Start Function*. Enter the time delay required before commencing acceleration.

Parameter 1-72 Start Function

Table 122: Parameter 1-72 Start Function

1-72 Start Function		
Default value: [2] Coast	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/motor pre-heat	Energize the motor with a DC hold current (*parameter 2-00 DC Hold Current*) during the start delay time.
[2]*	Coast	Motor coasted during the start delay time (inverter off).

Parameter 1-73 Flying Start

Table 123: Parameter 1-73 Flying Start

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

NOTICE

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

NOTICE

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

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

Option	Name	Description
[0]*	Disabled	No function.
[1]	Enabled	Enable after coast.

Option	Name	Description
[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.

The flying-start function used for PM motors is based on an initial speed estimation. The speed is always estimated as the 1st thing after an active start signal is given. Based on the setting of *parameter 1-70 Start Mode*, the following happens:

Parameter 1-70 Start Mode = [0] Rotor Detection: If the speed estimate appears as greater than 0 Hz, the drive catches the motor at that speed and resumes normal operation. Otherwise, the drive estimates the rotor position and starts normal operation from there.

Parameter 1-70 Start Mode = [1] Parking: A speed estimate lower than the setting in *parameter 1-59 Flying Start Test Pulses Frequency* engages the parking function (see *parameter 2-06 Parking Current* and *parameter 2-07 Parking Time*). Otherwise, the drive catches the motor at that speed and resumes normal operation. Refer to the description of *parameter 1-70 Start Mode* for recommended settings.

Current limitations of the flying-start principle used for PM motors:

- The speed range is up to 100% nominal speed or the field weakening speed (whichever is lowest).
- PMSM with high back EMF (>300 VLL(rms)) and high winding inductance (>10 mH) needs more time for reducing short-circuit current to 0 and may be susceptibe to error in estimation.
- Current testing limited to a speed range up to 300 Hz. For certain units, the limit is 250 Hz; all 200–240 V units up to and including 2.2 kW (3.0 hp) and all 380–480 V units up to and including 4 kW (5.0 hp).
- For high-inertia applications (that is, where the load inertia is more than 30 times larger than the motor inertia), use a brake resistor to avoid overvoltage trip during high-speed engagement of the flying-start function.

Parameter 1-77 Compressor Start Max Speed [RPM]

Table 124: Parameter 1-77 Compressor Start Max Speed [RPM]

1-77 Compressor Start Max Speed [RPM]		
Default value: Size related	Parameter type: Range, 0 - *parameter 4-13 Motor Speed High Limit [RPM]*	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

NOTICE

Parameter 1-77 Compressor Start Max Speed [RPM] has no effect when *parameter 1-10 Motor Construction = [1] PM, nonsalient SPM*.

The parameter enables high starting torque. This is a function where the current limit and torque limit are ignored during start of the motor. The time from the start signal is given, until the speed exceeds the speed set in this parameter, becomes a start-zone where the current limit and motoric torque limit is set to what is maximally possible for the drive/motor combination. This parameter is normally set to the same value as *parameter 4-11 Motor Speed Low Limit [RPM]*. When set to 0, the function is inactive. In this starting-zone, *parameter 3-82 Starting Ramp Up Time* is active to ensure extra acceleration during the start and to minimize the time where the motor is operated under the minimum speed for the application. The time without protection from the current limit and torque limit must not exceed the value set in *parameter 1-79 Compressor Start Max Time to Trip*. If the value in *parameter 1-79 Compressor Start Max Time to Trip* is exceeded, the drive trips with *alarm 18, Start failed*. When this function is activated to get a fast start, *parameter 1-86 Trip Speed Low [RPM]* is also activated to protect the application from running below minimum motor speed, for example when in current limit. This function allows high starting torque and use of a fast starting ramp. To ensure the build-up of a high torque during the start, enter appropriate values for start delay/start speed/start current.

Parameter 1-78 Compressor Start Max Speed [Hz]

Table 125: Parameter 1-78 Compressor Start Max Speed [Hz]

1-78 Compressor Start Max Speed [Hz]		
Default value: Size related	Parameter type: Range, 0 - *parameter 4-14 Motor Speed High Limit [Hz]*	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

N O T I C E

Parameter 1-78 Compressor Start Max Speed [Hz] has no effect when *parameter 1-10 Motor Construction = [1] PM, nonsalient SPM*.

The parameter enables high starting torque. This is a function where the current limit and torque limit are ignored during start of the motor. The time, from the start signal is given until the speed exceeds the speed set in this parameter, becomes a start-zone where the current limit and motoric torque limit is set to what is maximally possible for the drive/motor combination. This parameter is normally set to the same value as *parameter 4-11 Motor Speed Low Limit [RPM]*. When set to 0, the function is inactive. In this starting-zone, *parameter 3-82 Starting Ramp Up Time* is active instead of *parameter 3-41 Ramp 1 Ramp Up Time* to ensure extra acceleration during the start, and to minimize the time where the motor is operated under the minimum speed for the application. The time without protection from the current limit and torque limit must not exceed the value set in *parameter 1-79 Compressor Start Max Time to Trip*. If the value in *parameter 1-79 Compressor Start Max Time to Trip* is exceeded, the drive trips with *alarm 18, Start failed*. When this function is activated to get a fast start, *parameter 1-86 Trip Speed Low [RPM]* is also activated to protect the application from running below minimum motor speed, for example when in current limit. This function allows high starting torque and use of a fast starting ramp. To ensure the build-up of a high torque during the start, enter appropriate values for start delay/start speed/start current.

Parameter 1-79 Compressor Start Max Time to Trip

Table 126: Parameter 1-79 Compressor Start Max Time to Trip

1-79 Compressor Start Max Time to Trip		
Default value: 5 s	Parameter type: Range, 0 - 10 s	Setup: All setups
Conversion index: -1	Data type: Uint8	Change during operation: True

N O T I C E

Parameter 1-79 Compressor Start Max Time to Trip has no effect when *parameter 1-10 Motor Construction = [1] PM, nonsalient SPM*.

The time from the start signal is given until the speed exceeds the speed set in *parameter 1-77 Compressor Start Max Speed [RPM]* must not exceed the time set in the parameter. If the time set is exceeded, the drive trips with *alarm 18, Start failed*. Any time set in *parameter 1-71 Start Delay* for use of a start function must be executed within the time limit.

5.2.10 1-8* Stop Adjustments

Parameter 1-80 Function at Stop

Table 127: Parameter 1-80 Function at Stop

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

Select the drive function after a stop command or after the speed is ramped down to the settings in *parameter 1-81 Min Speed for Function at Stop [RPM]*. Available selections depend on *parameter 1-10 Motor Construction*:

- *[0] Asynchronous*:

- *[0] Coast*
- *[1] DC hold*
- *[2] Motor check, warning*
- *[6] Motor check, alarm*

- *[1] PM non-salient*:
  - *[0] Coast*

Option	Name	Description
[0]*	Coast	Leaves motor in free mode. The motor is disconnected from the drive.
[1]	DC hold/motor preheat	Energizes the motor with a DC hold current (see *parameter 2-00 DC Hold Current*).
[2]	Motor check, warning	The drive issues a warning if 1 or more motor phases are missing.
[6]	Motor check, alarm	The drive issues an alarm if 1 or more motor phases are missing.

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

Table 128: Parameter 1-81 Min Speed for Function at Stop [RPM]

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

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

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

Table 129: Parameter 1-82 Min Speed for Function at Stop [Hz]

1-82 Min Speed for Function at Stop [Hz]		
Default value: Size related	Parameter type: Range, 0 - 20.0 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*.

Trip at Motor Speed Low Limit

In *parameter 4-11 Motor Speed Low Limit [RPM]* and *parameter 4-12 Motor Speed Low Limit [Hz]*, it is possible to set a minimum speed for the motor to ensure proper oil distribution. In some cases, for example, if operating in current limit because of a defect in the compressor, the output motor speed can be suppressed below motor speed low limit. To prevent damage to the compressor, it is possible to set a trip limit. If the motor speed drops below this limit, the drive trips and issues alarm (A49). Reset takes place according to the selected function in *parameter 14-20 Reset Mode*.

If the trip must take place at a rather exact speed (RPM), set *parameter 0-02 Motor Speed Unit* for RPM and use slip compensation, which can be set in *parameter 1-62 Slip Compensation*.

N O T I C E

To achieve the highest accuracy with the slip compensation, an Automatic motor adaptation (AMA) should be performed. To be enabled in *parameter 1-29 Automatic Motor Adaptation (AMA)*.

N O T I C E

Trip is not active when using a normal stop or coast command.

Parameter 1-86 Trip Speed Low [RPM]

Table 130: Parameter 1-86 Trip Speed Low [RPM]

1-86 Trip Speed Low [RPM]		
Default value: Size related	Parameter type: Range, 0 - parameter 4-13 Motor Speed High Limit [RPM]	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

NOTICE

This parameter is only available if *parameter 0-02 Motor Speed Unit* is set to *[11] RPM*.

Enter the low limit for the motor speed at which the drive trips. If the value is 0, the function is not active. If the speed at any time after the start (or during a stop) drops below the value in the parameter, the drive trips with *alarm 49, Speed Limit*.

Parameter 1-87 Trip Speed Low [Hz]

Table 131: Parameter 1-87 Trip Speed Low [Hz]

1-87 Trip Speed Low [Hz]		
Default value: Size related	Parameter type: Range, 0 - parameter 4-14 Motor Speed High Limit [Hz]	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

NOTICE

This parameter is only available if *parameter 0-02 Motor Speed Unit* is set to *[1] Hz*.

Enter the low limit for the motor speed at which the drive trips. If the value is 0, the function is not active. If the speed at any time after the start (or during a stop) drops below the value in the parameter, the drive trips with *alarm 49, Speed Limit*.

5.2.11 1-9* Motor Temperature

NOTICE

When using multiple motors, the electronic thermal relay on the drive cannot be used to provide individual motor protection. Supply a separate motor overload for each motor.

Parameter 1-90 Motor Thermal Protection

Table 132: Parameter 1-90 Motor Thermal Protection

1-90 Motor Thermal Protection		
Default value: [4] ETR trip 1	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

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

- Via a PTC sensor in the motor windings connected to 1 of the analog or digital inputs (*parameter 1-93 Thermistor Resource*). See the *chapter PTC Thermistor Connection*.
- Via 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 in the motor reacts if there is a motor overtemperature.
[2]	Thermistor trip	Stops (trips) the drive when connected thermistor in the motor reacts if there is a motor overtemperature.
[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 setup 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	Same as *[3] ETR warning 1*, but for setup 2.
[6]	ETR trip 2	Same as *[4] ETR trip 1* but for setup 2.
[7]	ETR warning 3	Same as *[3] ETR warning 1* but for setup 3.
[8]	ETR trip 3	Same as *[4] ETR trip 1* but for setup 3.
[9]	ETR warning 4	Same as *[3] ETR warning 1* but for setup 4.
[10]	ETR trip 4	Same as *[4] ETR trip 1* but for setup 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	

N O T I C E

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

N O T I C E

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

ETR functions 1–4 calculate the load when the setup where they were selected is active. For example, ETR-3 starts calculating when setup 3 is selected. For the North American market: The ETR functions provide class 20 motor overload protection in accordance with NEC.

N O T I C E

If the temperature of the motor is monitored through a thermistor, the PELV is not complied with if there are short circuits between motor windings and the sensor. To comply with PELV, isolate the motor appropriately.

N O T I C E

Danfoss recommends using 24 V DC as thermistor supply voltage.

N O T I C E

The ETR timer function does not work when *parameter 1-10 Motor Construction = [1] PM, non-salient SPM.*

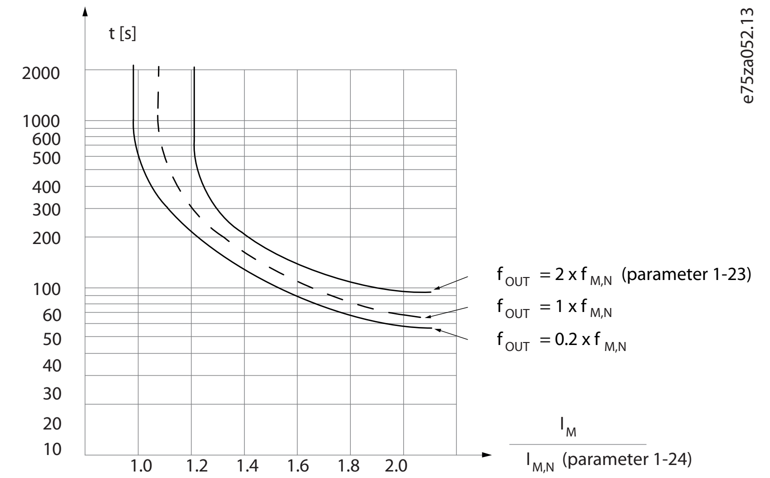
NOTICE

For correct operation of the ETR function, the setting in *parameter 1-03 Torque Characteristics* must fit the application.

Parameter 1-91 Motor External Fan

Table 133: Parameter 1-91 Motor External Fan

1-91 Motor External Fan		
Default value: [0] No	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No	No external fan is required, that is the motor is derated at low speed.
[1]	Yes	Applies an external motor fan (external ventilation), so no derating of the motor is required at low speed. The upper curve in Illustration 37 (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. 

Parameter 1-93 Thermistor Resource

Table 134: Parameter 1-93 Thermistor Resource

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

NOTICE

This parameter cannot be adjusted while the motor is running.

NOTICE

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

NOTICE

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

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

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

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

Table 135: Parameter 1-94 ATEX ETR Cur. Lim. Speed Reduction

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

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

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

Example:

Actual reference = 50 RPM

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

Resulting reference = 40 RPM

Parameter 1-95 Thermistor Sensor Type

Table 136: Parameter 1-95 Thermistor Sensor Type

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

Select the used type of thermistor sensor.

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

Option	Name	Description
		• Siemens LG-Ni1000 • Tasseron RTD Ni1000-TC5 1000 Ohm

Parameter 1-96 Thermistor Sensor Resource

Table 137: Parameter 1-96 Thermistor Sensor Resource

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

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

NOTICE

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

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

Parameter 1-97 Thermistor Threshold Level

Table 138: Parameter 1-97 Thermistor Threshold Level

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

Select the thermistor sensor threshold level for motor thermal protection.

Parameter 1-98 ATEX ETR Interpol. Points Freq.

Table 139: Parameter 1-98 ATEX ETR Interpol. Points Freq.

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

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

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

NOTICE

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

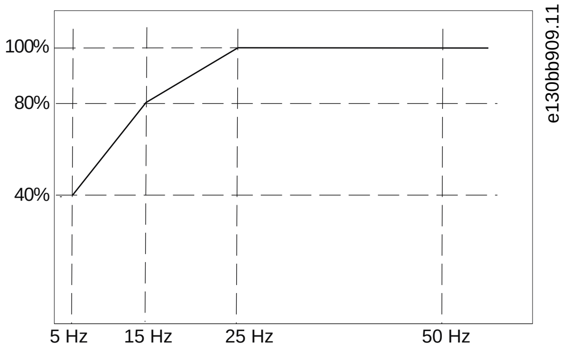


Illustration 37: Example of ATEX ETR Thermal Limitation Curve

x-axis: f_m [Hz]

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

Table 140: Interpolation Points

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

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

Parameter 1-99 ATEX ETR Interpol. Points Current

Table 141: Parameter 1-99 ATEX ETR Interpol. Points Current

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

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

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

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

N O T I C E

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

5.3 Parameter Group 2-** Brakes

5.3.1 2-0* DC Brakes

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

Parameter 2-00 DC Hold Current

Table 142: Parameter 2-00 DC Hold Current

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

NOTICE

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

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

Parameter 2-01 DC Brake Current

Table 143: Parameter 2-01 DC Brake Current

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

NOTICE

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

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

Parameter 2-02 DC Braking Time

Table 144: Parameter 2-02 DC Braking Time

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

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

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

Table 145: Parameter 2-03 DC Brake Cut In Speed [RPM]

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

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

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

Table 146: Parameter 2-04 DC Brake Cut In Speed [Hz]

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

NOTICE

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

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

Parameter 2-06 Parking Current

Table 147: Parameter 2-06 Parking Current

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

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

Parameter 2-07 Parking Time

Table 148: Parameter 2-07 Parking Time

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

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

5.3.2 2-1* Brake Energy Funct.

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

Parameter 2-10 Brake Function

Table 149: Parameter 2-10 Brake Function

2-10 Brake 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	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.

Option	Name	Description
		NOTICE The AC brake is not as efficient as dynamic braking with resistor. AC brake is for VVC+ mode in both open and closed loop.

Parameter 2-11 Brake Resistor (ohm)

Table 150: Parameter 2-11 Brake Resistor (ohm)

2-11 Brake Resistor (ohm)		
Default value: Size related	Parameter type: Range, 5.00 - 65535 Ohm	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

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

Parameter 2-12 Brake Power Limit (kW)

Table 151: Parameter 2-12 Brake Power Limit (kW)

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

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

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

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

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

NOTICE

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

Parameter 2-13 Brake Power Monitoring

Table 152: Parameter 2-13 Brake Power Monitoring

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

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

Option	Name	Description
[0]*	Off	No brake power monitoring required.
[1]	Warning 120s	Activates a warning on the display when the power transmitted during the duty time exceeds 100% of the monitoring limit (*parameter 2-12 Brake Power Limit (kW)*). The warning disappears when the transmitted power drops below 80% of the monitoring limit.
[2]	Trip 120s	Trips the drive and shows an alarm when the calculated power exceeds 100% of the monitoring limit.
[3]	Warning & Trip 120s	Activates both of the above, including warning, trip, and alarm.
[4]	Warning 30s	
[5]	Trip 30s	
[6]	Warning & trip 30s	
[7]	Warning 60s	
[8]	Trip 60s	
[9]	Warning & trip 60s	
[10]	Warning 300s	
[11]	Trip 300s	
[12]	Warning & trip 300s	
[13]	Warning 600s	
[14]	Trip 600s	
[15]	Warning & trip 600s	

Parameter 2-15 Brake Check

Table 153: Parameter 2-15 Brake Check

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

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

NOTICE

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

The testing sequence is as follows:

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

N O T I C E

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

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

Parameter 2-16 AC Brake Max. Current

Table 154: Parameter 2-16 AC Brake Max. Current

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

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

N O T I C E

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

Parameter 2-17 Over-voltage Control

Table 155: Parameter 2-17 Over-voltage Control

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

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

N O T I C E

Do not enable OVC in hoisting applications.

Option	Name	Description
[0]	Disabled	No OVC required.
[2]*	Enabled	Activates OVC.

Parameter 2-19 Over-voltage Gain

Table 156: Parameter 2-19 Over-voltage Gain

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

Select overvoltage gain.

5.4 Parameter Group 3-** Reference/Ramps

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

5.4.1 3-0* Reference Limits

Parameter 3-02 Minimum Reference

Table 157: Parameter 3-02 Minimum Reference

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

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

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

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

Parameter 3-03 Maximum Reference

Table 158: Parameter 3-03 Maximum Reference

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

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

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

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

Parameter 3-04 Reference Function

Table 159: Parameter 3-04 Reference Function

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

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

5.4.2 3-1* References

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

Parameter 3-10 Preset Reference

Table 160: Parameter 3-10 Preset Reference

3-10 Preset Reference		
Default value: 0%	Parameter type: Range, -100 - 100%, Array [8]	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Enter up to 8 different preset references (0–7) in this parameter, using array programming. The preset reference is stated as a percentage of the value Ref_{MAX} (*parameter 3-03 Maximum Reference*). If a Ref_{MIN} different from 0 (*parameter 3-02 Minimum Reference*) is programmed, the preset reference is calculated as a percentage of the full reference range, that is on the basis of the difference between Ref_{MAX} and Ref_{MIN}. Afterwards, the value is added to Ref_{MIN}. When using preset references, select preset reference bit 0/1/2 [16], [17] or [18] for the corresponding digital inputs in *parameter group 5-1* Digital Inputs*.

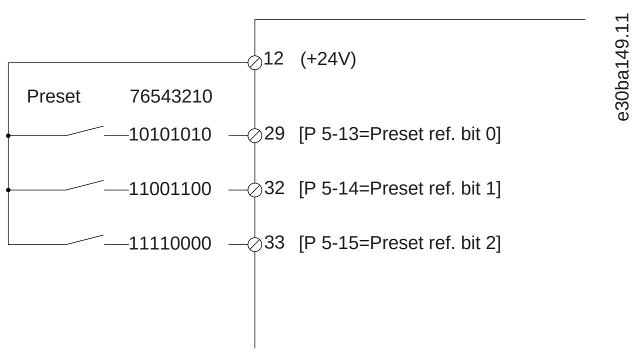


Illustration 38: Preset Reference

Table 161: 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

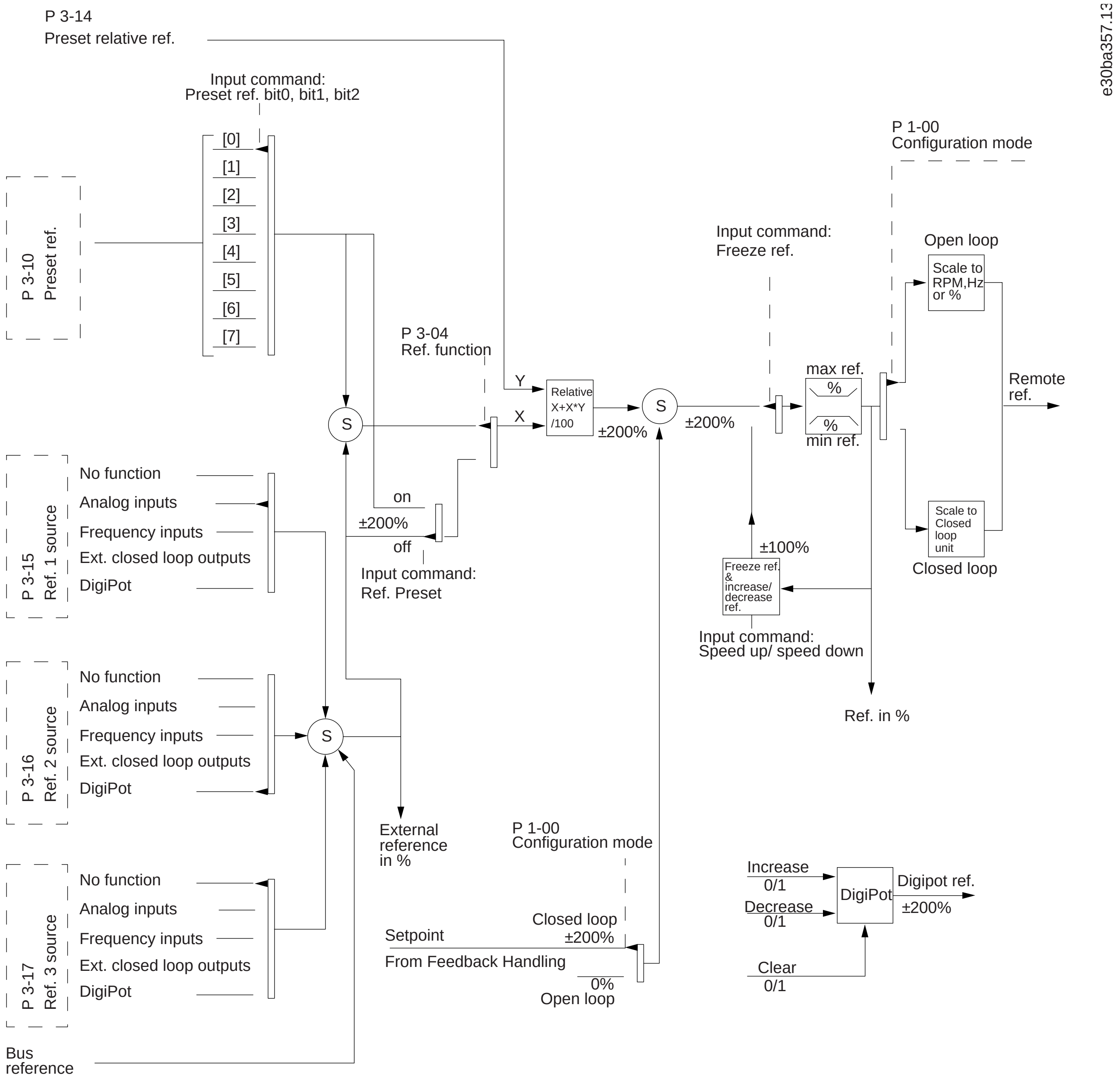


Illustration 39: Example of Open-loop and Closed-loop Operation

Parameter 3-11 Jog Speed [Hz]

Table 162: Parameter 3-11 Jog Speed [Hz]

3-11 Jog Speed [Hz]		
Default value: Size related	Parameter type: Range, 0 - par. 4-14 Hz	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

The jog speed is a fixed output speed at which the drive is running when the jog function is activated. See also *parameter 3-80 Jog/ Homing Ramp Time*.

Parameter 3-13 Reference Site

Table 163: Parameter 3-13 Reference Site

3-13 Reference Site		
Default value: [0] Linked to hand/auto	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select which reference site to activate.

Option	Name	Description
[0]*	Linked to hand/auto	Use local reference when in hand-on mode, or remote reference when in auto-on mode.
[1]	Remote	Use remote reference in both hand-on mode and auto-on mode.
[2]	Local	Use local reference in both hand-on and auto-on mode. **NOTICE** When set to *[2] Local*, the drive starts with this setting again after a power-down.
[3]	Linked to H/A MCO	Select this option to enable the FFACC factor in *parameter 32-66 Acceleration Feed-Forward*. Enabling FFACC reduces jitter and makes the transmission from the motion controller to the control card of the drive faster. This leads to faster response times for dynamic applications and position control. For more information about FFACC, see VLT® Motion Control MCO 305 Operating Instructions.

Parameter 3-14 Preset Relative Reference

Table 164: Parameter 3-14 Preset Relative Reference

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*.

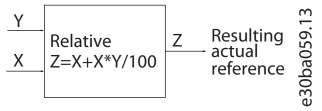


Illustration 40: Preset Relative Reference

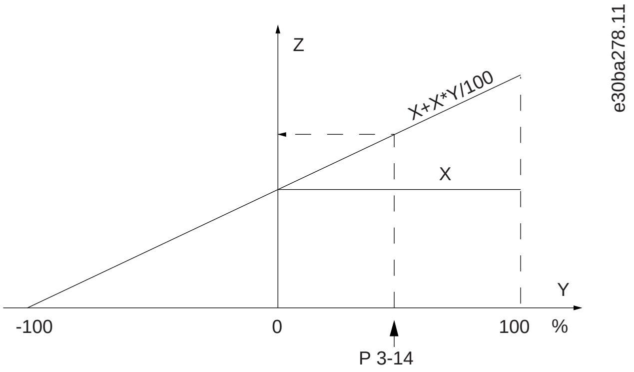


Illustration 41: Actual Reference

Parameter 3-15 Reference Resource 1

Table 165: Parameter 3-15 Reference Resource 1

3-15 Reference Resource 1		
Default value: [1] Analog input 53	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the reference input to be used for the 1st reference signal. *Parameter 3-15 Resource Reference 1*, *parameter 3-16 Resource Reference 2*, and *parameter 3-17 Resource Reference 3* define up to 3 different reference signals. The sum of these reference signals defines the actual reference. Select the speed reference source in *parameter 3-15 Reference Resource 1* when *parameter 1-00 Configuration Mode* is set to *[9] Positioning* in positioning mode.

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
[23]	Analog Input X42/1	
[24]	Analog Input X42/3	
[25]	Analog Input X42/5	
[29]	Analog Input X48/2	
[30]	Ext. closed loop 1	

Option	Name	Description
[31]	Ext. closed loop 2	
[32]	Ext. closed loop 3	
[37]	Analog Input X49/1	
[38]	Analog Input X49/3	
[39]	Analog Input X49/5	
[133]	Fieldbus REF 1	

Parameter 3-16 Reference Resource 2

Table 166: Parameter 3-16 Reference Resource 2

3-16 Reference Resource 2		
Default value: [20] Digital pot.meter	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the reference input to be used for the 2nd reference signal. *Parameter 3-15 Resource Reference 1*, *parameter 3-16 Resource Reference 2*, and *parameter 3-17 Resource Reference 3* define up to 3 different reference signals. The sum of these reference signals defines the actual reference. When *parameter 1-00 Configuration Mode* is set to *[9] Positioning*, configure *parameter 3-16 Reference Resource 2* to select the source for target position.

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.
[15]	MCO Encoder 1 X56	
[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
[23]	Analog Input X42/1	
[24]	Analog Input X42/3	
[25]	Analog Input X42/5	
[29]	Analog Input X48/2	
[30]	Ext. closed loop 1	
[31]	Ext. closed loop 2	
[32]	Ext. closed loop 3	
[37]	Analog Input X49/1	

Option	Name	Description
[38]	Analog Input X49/3	
[39]	Analog Input X49/5	
[133]	Fieldbus REF 1	

Parameter 3-17 Reference Resource 3

Table 167: Parameter 3-17 Reference Resource 3

3-17 Reference Resource 3		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the reference input to be used for the 3rd reference signal. *Parameter 3-15 Resource Reference 1*, *parameter 3-16 Resource Reference 2*, and *parameter 3-17 Resource Reference 3* define up to 3 different reference signals. The sum of these reference signals defines the actual reference.

Option	Name	Description
[0]*	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[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	
[23]	Analog Input X42/1	
[24]	Analog Input X42/3	
[25]	Analog Input X42/5	
[29]	Analog Input X48/2	
[30]	Ext. closed loop 1	
[31]	Ext. closed loop 2	
[32]	Ext. closed loop 3	
[37]	Analog Input X49/1	
[38]	Analog Input X49/3	
[39]	Analog Input X49/5	
[133]	Fieldbus REF 1	

Parameter 3-19 Jog Speed [RPM]

Table 168: Parameter 3-19 Jog Speed [RPM]

3-19 Jog Speed [RPM]		
Default value: Size related	Parameter type: Range, 0 - par. 4-13 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Enter a value for the jog speed n_{JOG}, which is a fixed output speed. The drive runs at this speed when the jog function is activated. The maximum limit is defined in *parameter 4-13 Motor Speed High Limit [RPM]*. See also *parameter 3-80 Jog/Homing Ramp Time*.

5.4.3 3-4* Ramp 1

For each of the 2 ramps (*parameter groups 3-4* Ramp 1*, and *3-5* Ramp 2* configure the ramp parameters:

- Ramp type
- Ramping times (duration of acceleration and deceleration)
- Level of jerk compensation for S-ramps

Start by setting the linear ramping times corresponding to Illustration 42 and Illustration 43.

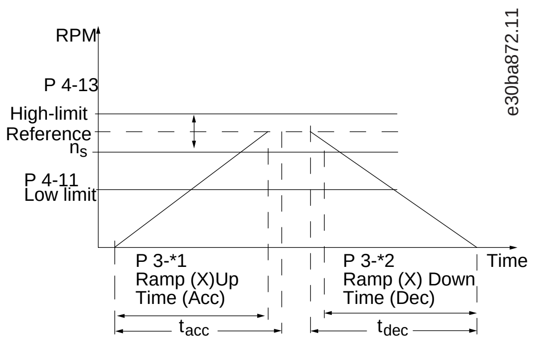


Illustration 42: Linear Ramping Times

If S-ramps are selected, set the level of non-linear jerk compensation required. Set jerk compensation by defining the proportion of ramp-up and ramp-down times where acceleration and deceleration are variable (that is, increasing or decreasing). The S-ramp acceleration and deceleration settings are defined as a percentage of the actual ramp time.

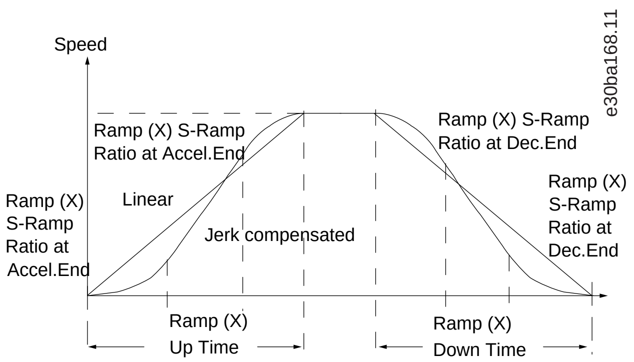


Illustration 43: Non-linear Ramping Times

Parameter 3-41 Ramp 1 Ramp Up Time

Table 169: Parameter 3-41 Ramp 1 Ramp Up Time

3-41 Ramp 1 Ramp Up Time		
Default value: Size related	Parameter type: Range, 1.00 - 3600 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the ramp-up time, that is the acceleration time from 0 RPM to the synchronous motor speed n_S. Select a ramp-up time which prevents the output current from exceeding the current limit in *parameter 4-18 Current Limit during ramping*. The value 0.00 corresponds to 0.01 s in speed mode. See ramp-down time in *parameter 3-42 Ramp 1 Ramp Down Time*.

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

Parameter 3-42 Ramp 1 Ramp Down Time

Table 170: Parameter 3-42 Ramp 1 Ramp Down Time

3-42 Ramp 1 Ramp Down Time		
Default value: Size related	Parameter type: Range, 1.00 - 3600 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the ramp-down time, that is the deceleration time from the synchronous motor speed n_s to 0 RPM. Select a ramp-down time such that no overvoltage occurs in the inverter due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in *parameter 4-18 Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See ramp-up time in *parameter 3-41 Ramp 1 Ramp Up Time*.

$$\text{Par. } 3-42 = \frac{t_{dec}[s] \times n_s[\text{RPM}]}{\text{ref [RPM]}}$$

5.4.4 3-5* Ramp 2

Parameter 3-51 Ramp 2 Ramp Up Time

Table 171: Parameter 3-51 Ramp 2 Ramp Up Time

3-51 Ramp 2 Ramp Up Time		
Default value: Size related	Parameter type: Range, 1.00 - 3600 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the ramp-up time, that is the acceleration time from 0 RPM to the nominal motor speed ns. Select a ramp-up time such that the output current does not exceed the current limit in *parameter 4-18 Current Limit* during ramping. The value 0.00 corresponds to 0.01 s in speed mode. See ramp-down time in *parameter 3-52 Ramp 2 Ramp Down Time*.

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

Parameter 3-52 Ramp 2 Ramp Down Time

Table 172: Parameter 3-52 Ramp 2 Ramp Down Time

3-52 Ramp 2 Ramp Down Time		
Default value: Size related	Parameter type: Range, 1.00 - 3600 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the ramp-down time, that is the deceleration time from the nominal motor speed n_s to 0 RPM. Select a ramp-down time such that no overvoltage occurs in the drive due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in *parameter 4-18 Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See ramp-up time in *parameter 3-51 Ramp 2 Ramp Up Time*.

$$\text{Par. } 3-52 = \frac{t_{dec}[s] \times n_s[\text{RPM}]}{\text{ref [RPM]}}$$

5.4.5 3-8* Other Ramps

Parameter 3-80 Jog/Homing Ramp Time

Table 173: Parameter 3-80 Jog Ramp Time

3-80 Jog Ramp Time		
Default value: Size related	Parameter type: Range, 1.00 - 3600 s	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the jog ramp time, that is the acceleration/deceleration time between 0 RPM and the rated motor frequency n_s. Ensure that the resulting output current required for the given jog ramp time does not exceed the current limit in *parameter 4-18 Current Limit*. The jog ramp time starts after activation of a jog signal via the LCP, a selected digital input, or the serial communication port. When jog state is disabled, then the normal ramping times are valid.

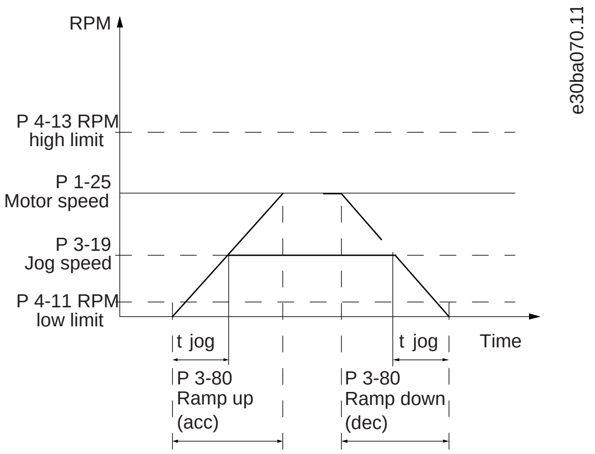


Illustration 44: Jog Ramp Time

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

Parameter 3-81 Quick Stop Ramp Time

Table 174: Parameter 3-81 Quick Stop Ramp Time

3-81 Quick Stop Ramp Time		
Default value: Size related	Parameter type: Range, 1.00 - 3600 s	Setup: 2 setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the quick–stop ramp-down time, that is the deceleration time from the synchronous motor speed to 0 RPM. Ensure that no resulting overvoltage occurs in the inverter due to regenerative operation of the motor required to achieve the given ramp-down time. Ensure also that the generated current required to achieve the given ramp-down time does not exceed the current limit (set in *parameter 4-18 Current Limit*). Quick stop is activated with a signal on a selected digital input, or via the serial communication port.

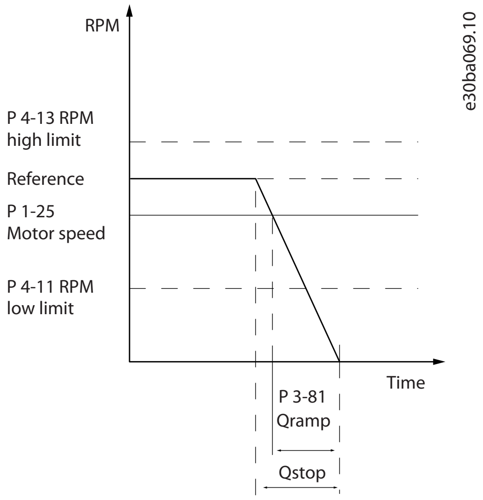


Illustration 45: Quick Stop Ramp Time

Parameter 3-82 Quick Stop Ramp Type

Table 175: Parameter 3-82 Starting Ramp Up Time

3-82 Starting Ramp Up 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

The ramp-up time is the acceleration time from 0 RPM to the nominal motor speed set in *parameter 3-82 Starting Ramp Up Time* when *[0] Compressor Torque* is active in *parameter 1-03 Torque Characteristics*.

5.4.6 3-9* Digital Pot.Meter

The digital potentiometer enables increase or decrease of the actual reference by adjusting the setup of the digital inputs using the functions increase, decrease, or clear. To activate the function, set at least 1 digital input to increase or decrease.

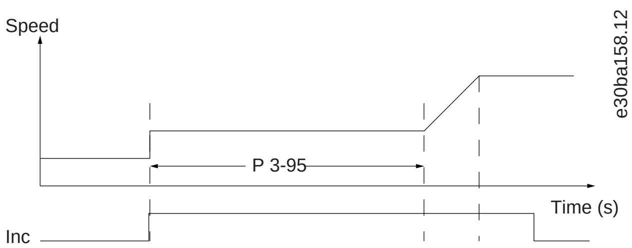


Illustration 46: Increase Actual Reference

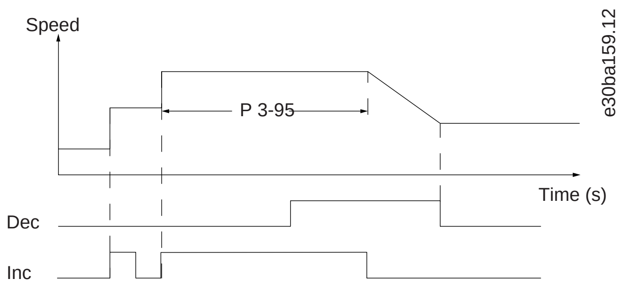


Illustration 47: Increase/Decrease Actual Reference

Parameter 3-90 Step Size

Table 176: Parameter 3-90 Step Size

3-90 Step Size		
Default value: 0.1%	Parameter type: Range, 0.01 - 200%	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

Enter the increment size required for increase/decrease as a percentage of the synchronous motor speed, n_s. If increase/decrease is activated, the resulting reference is increased or decreased by the value set in this parameter.

Parameter 3-91 Ramp Time

Table 177: Parameter 3-91 Ramp Time

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*.

Parameter 3-92 Power Restore

Table 178: Parameter 3-92 Power Restore

3-92 Power Restore		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Off	Resets the digital potentiometer reference to 0% after power-up.
[1]	On	Restores the most recent digital potentiometer reference at power-up.

Parameter 3-93 Maximum Limit

Table 179: Parameter 3-93 Maximum Limit

3-93 Maximum Limit		
Default value: 100%	Parameter type: Range, -200 - 200%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Set the maximum allowed value for the resulting reference. This is recommended if the digital potentiometer is used for fine-tuning of the resulting reference.

Parameter 3-94 Minimum Limit

Table 180: Parameter 3-94 Minimum Limit

3-94 Minimum Limit		
Default value: 0%	Parameter type: Range, -200 - 200%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Set the minimum allowed value for the resulting reference. This is recommended if the digital potentiometer is used for fine-tuning of the resulting reference.

Parameter 3-95 Ramp Delay

Table 181: Parameter 3-95 Ramp Delay

3-95 Ramp Delay		
Default value: Size related	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: -3	Data type: TimeDiff w/o DateIdent.	Change during operation: True

Enter the delay required from activation of the digital potentiometer function until the drive starts to ramp the reference. With a delay of 0 ms, the reference starts to ramp when increase/decrease is activated. See also *parameter 3-91 Ramp Time*.

5.5 Parameter Group 4-** Limits/Warnings

5.5.1 4-1* Motor Limits

Define torque, current, and speed limits for the motor, and the reaction of the drive when the limits are exceeded. A limit may generate a message in the display. A warning always generates a message in the display or on the fieldbus. A monitoring function may initiate a warning or a trip, after which the drive stops and generates an alarm message.

Parameter 4-10 Motor Speed Direction

Table 182: Parameter 4-10 Motor Speed Direction

4-10 Motor Speed Direction		
Default value: [2] Both directions	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

NOTICE

This parameter cannot be adjusted while the motor is running.

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.
[2]*	Both directions	Allows the motor to rotate in both directions.

Parameter 4-11 Motor Speed Low Limit [RPM]

Table 183: Parameter 4-11 Motor Speed Low Limit [RPM]

4-11 Motor Speed Low Limit [RPM]		
Default value: Size related	Parameter type: Range, 0 - setting in par. 4-13 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Enter the minimum limit for motor speed. The motor speed low limit can be set to correspond to the manufacturer's recommended minimum motor speed. The motor speed low limit must not exceed the setting in *parameter 4-13 Motor Speed High Limit [RPM]*.

Parameter 4-12 Motor Speed Low Limit [Hz]

Table 184: Parameter 4-12 Motor Speed Low Limit [Hz]

4-12 Motor Speed Low Limit [Hz]		
Default value: Size related	Parameter type: Range, 0 - setting in par. 4-14 Hz	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Enter the minimum limit for motor speed. The motor speed low limit can be set to correspond to the minimum output frequency of the motor shaft. The motor speed low limit must not exceed the setting in *parameter 4-14 Motor Speed High Limit [Hz]*.

Parameter 4-13 Motor Speed High Limit [RPM]

Table 185: Parameter 4-13 Motor Speed High Limit [RPM]

4-13 Motor Speed High Limit [RPM]		
Default value: Size related	Parameter type: Range, Setting in par. 4-11 - 60000 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Enter the maximum limit for motor speed. The motor speed high limit can be set to correspond to the manufacturer's maximum nominal motor speed. The motor speed high limit must exceed the setting in *parameter 4-11 Motor Speed Low Limit [RPM]*.

Parameter 4-14 Motor Speed High Limit [Hz]

Table 186: Parameter 4-14 Motor Speed High Limit [Hz]

4-14 Motor Speed High Limit [Hz]		
Default value: Size related	Parameter type: Range, Setting in par. 4-12 - setting in par. 4-19	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Enter the maximum limit for motor speed in Hz. *Parameter 4-14 Motor Speed High Limit [Hz]* can be set to correspond to the manufacturer's recommended maximum motor speed. The motor speed high limit must exceed the value in *parameter 4-12 Motor Speed Low Limit [Hz]*. The output frequency must not exceed 10% of the switching frequency (*parameter 14-01 Switching Frequency*).

Parameter 4-16 Torque Limit Motor Mode

Table 187: Parameter 4-16 Torque Limit Motor Mode

4-16 Torque Limit Motor Mode		
Default value: Size related	Parameter type: Range, 0 - 1000.0%	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

N O T I C E

If changing *parameter 4-16 Torque Limit Motor Mode* when *parameter 1-00 Configuration Mode* is set to *[0] Speed open loop*, *parameter 1-66 Min. Current at Low Speed* is automatically readjusted.

N O T I C E

The torque limit reacts to the actual, non-filtered torque, including torque spikes. This is not the torque that is seen from the LCP or the fieldbus as the torque is filtered.

This function limits the torque on the shaft to protect the mechanical installation.

Parameter 4-17 Torque Limit Generator Mode

Table 188: Parameter 4-17 Torque Limit Generator Mode

4-17 Torque Limit Generator Mode		
Default value: 100%	Parameter type: Range, 0 - 1000.0%	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

This function limits the torque on the shaft to protect the mechanical installation.

Parameter 4-18 Current Limit

Table 189: Parameter 4-18 Current Limit

4-18 Current Limit		
Default value: Size related	Parameter type: Range, 1.0 - 1000.0%	Setup: All setups
Conversion index: -1	Data type: Uint32	Change during operation: True

NOTICE

If *[20] ATEX ETR* is selected in *parameter 1-90 Motor Thermal Protection*, set *parameter 4-18 Current Limit* current limit to 150%.

This is a true current limit function that continues in the oversynchronous range. However, due to field weakening the motor torque at current limit will drop accordingly when the voltage increase stops above the synchronized speed of the motor.

Parameter 4-19 Max Output Frequency

Table 190: Parameter 4-19 Max Output Frequency

4-19 Max Output Frequency		
Default value: Size related	Parameter type: Range, 1 - 590 Hz	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: False

NOTICE

This parameter cannot be adjusted while the motor is running.

NOTICE

Maximum output frequency cannot exceed 10% of the inverter switching frequency (*parameter 14-01 Switching Frequency*).

Provides a final limit on the output frequency for improved safety in applications where overspeeding is to be avoided. This limit is final in all configurations (independent of the setting in *parameter 1-00 Configuration Mode*).

5.5.2 4-4* Speed Monitor

Parameter 4-49 Motor Check Time Interval

Table 191: Parameter 4-49 Motor Check Time Interval

4-49 Motor Check Time Interval		
Default value: [0] As fast as possible	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the time interval at which the connections between the motor and the drive are checked, when the motor is stopped. The motor check is performed at a specified interval, unless the motor is started in between.

Option	Name	Description
[0]*	As fast as possible	The motor time constant (x10) is used as the time interval to check the motor.
[5]	Every 1 hour	
[10]	Every 2 hours	
[15]	Every 12 hours	
[20]	Every 24 hours	

5.5.3 4-5* Adjustable Warnings

Use these parameters for adjusting warning limits for current, speed, reference, and feedback.

Warnings are shown on the LCP and can be programmed to be outputs or to be read out via fieldbus in the extended status word.

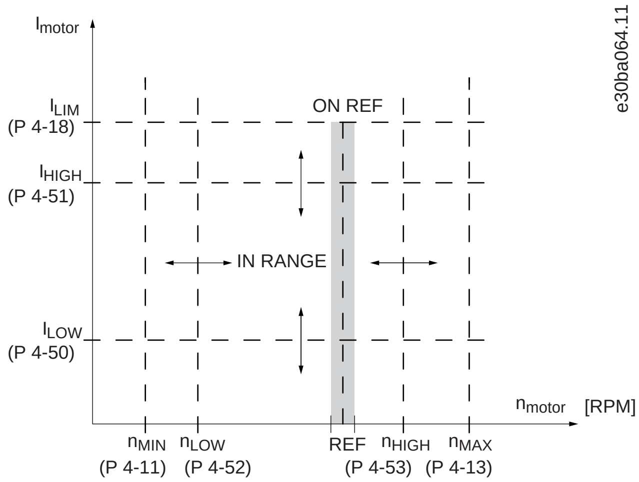


Illustration 48: Adjustable Warnings

Parameter 4-50 Warning Current Low

Table 192: Parameter 4-50 Warning Current Low

4-50 Warning Current Low		
Default value: 0 A	Parameter type: Range, 0 - setting in par. 4-51	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the I_{LOW} value. When the motor current drops below this limit, the display reads *Current Low*. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02. Refer to Illustration 48.

Parameter 4-51 Warning Current High

Table 193: Parameter 4-51 Warning Current High

4-51 Warning Current High		
Default value: Size related	Parameter type: Range, setting in par. 4-50 - setting in par. 16-37	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Enter the I_{HIGH} value. When the motor current exceeds this limit, the display reads *Current High*. The signal outputs can be programmed to produce a status signal on terminal 27 or 29. Refer to Illustration 48.

Parameter 4-52 Warning Speed Low

Table 194: Parameter 4-52 Warning Speed Low

4-52 Warning Speed Low		
Default value: 0 RPM	Parameter type: Range, 0 - setting in par. 4-53 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Enter the n_{LOW} value. When the motor speed exceeds this limit, the display reads *Speed low*. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02.

Parameter 4-53 Warning Speed High

Table 195: Parameter 4-53 Warning Speed High

4-53 Warning Speed High		
Default value: Size related	Parameter type: Range, setting in par. 4-52 - 60000 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Enter the n_{HIGH} value. When the motor speed exceeds this value, the display reads *Speed high*. The signal outputs can be programmed to produce a status signal on terminals 27 or 29 and on relay outputs 01 or 02. Refer to Illustration 48.

Parameter 4-54 Warning Reference Low

Table 196: Parameter 4-54 Warning Reference Low

4-54 Warning Reference Low		
Default value: -999999.999	Parameter type: Range, -999999.999 - setting in par. 4-55	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the lower reference limit. When the actual reference drops below this limit, the display indicates Ref_{LOW}. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02.

Parameter 4-55 Warning Reference High

Table 197: Parameter 4-55 Warning Reference High

4-55 Warning Reference High		
Default value: 999999.999	Parameter type: Range, setting in par. 4-55 - 999999.999	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the upper reference limit. When the actual reference exceeds this limit, the display reads Ref_{high}. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02.

Parameter 4-56 Warning Feedback Low

Table 198: Parameter 4-56 Warning Feedback Low

4-56 Warning Feedback Low		
Default value: -999999.99ProcessCtrlUnit	Parameter type: Range, -999999.999 WarningFeedbackHigh - setting in par. 4-57	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.

Parameter 4-57 Warning Feedback High

Table 199: Parameter 4-57 Warning Feedback High

4-57 Warning Feedback High		
Default value: 999999.99 ProcessCtrlUnit	Parameter type: Range, par 4-56 - 999999.999 ProcessCtrlUnit	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.

Parameter 4-58 Missing Motor Phase Function

Table 200: Parameter 4-58 Missing Motor Phase Function

4-58 Missing Motor Phase Function		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The function detects missing motor phase while the motor is running. Shows alarms 30, 31, 32 if a motor phase is missing. Enable this function to protect the application and motor from malfunctioning if a motor phase is missing.

Option	Name	Description
[0]	Disabled	The drive does not issue a missing motor phase alarm.
[1]	Trip 100 ms	The drive performs a scan for 100 ms to detect missing motor phase. When a missing motor phase is detected, the drive trips. This selection is recommended when the motor is running at a speed of 10 Hz and above.
[2]	Trip 1000 ms	The drive performs a scan for 1000 ms to detect missing motor phase. When a missing motor phase is detected, the drive trips. This selection is recommended when the motor is running at a low speed of 1 Hz and above.
[5]	Motor check	**NOTICE** The motor automatically resumes operation when the motor is reconnected. This option allows disconnection of the motor with a service switch without issuing an alarm. The drive coasts and automatically resumes operation when the motor is reconnected.

The following table details the detection of missing motor phase function for different motor control principles:

Table 201: Missing Motor Phase for Different Motor Control Principles

Option	Missing motor phase function	U/f	VVC^{+}	Flux open loop	Flux closed loop
[0]	Disabled	No function			
[1]	Trip 100 ms	Detects missing 1 phase	Detects missing 1 phase	Detects 1–3 phase	Detects 1–3 phase
[2]	Trip 1000 ms	Detects missing 1 phase	Detects missing 1 phase	Detects missing 1 phase	N/A
[3]	Trip 100 ms 3 phase limit	N/A[1]			Detects 1–3 phase
[5]	Motor check (service switch)	Coasts if motor is disconnected or auto started when the motor is reconnected.			

[1] When *parameter 4-59 Motor Check at Start* is set to *[1] On*, then 3-phase detection is enabled for U/f and VVC+ motor control.

Parameter 4-59 Motor Check at Start

Table 202: Parameter 4-59 Motor Check at Start

4-59 Motor Check at Start		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

NOTICE

Adjusting this parameter while the motor is running will not have effect until the next motor start.

This function detects missing motor phase before each start. Shows *alarm 30*, *alarm 31*, *alarm 32* if motor phases are missing. In these cases, the drive trips and an alarm is issued. The function has been developed to avoid disengaging a mechanical brake if motor phases are missing, for example, in lift applications.

Option	Name	Description
[0]*	Off	**CAUTION** **RISK OF MOTOR DAMAGE** Using this option may lead to motor damage. The drive does not issue a missing motor phase alarm.
[1]	On	Before each start, the drive checks if all 3 motor phases are present. The check is performed without any shaft movement. The function also enables 3-phase detection in U/f and VVC+ mode. See description in *parameter 4-58 Missing Motor Phase Function*.

The table details the motor check at start for different motor control principles.

Table 203: Motor Check at Start for Different Motor Control Principles

Option	Motor Check at Start	U/f	VVC⁺	Flux open loop	Flux closed loop
[0]	*Off*	No function.			
[1]	*On*	Check for missing motor phase before start is executed and enables 3-phase detection for U/f and VVC+ in *parameter 4-58 Missing Motor Phase Function*.			

5.5.4 4-6* Speed Bypass

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

Parameter 4-60 Bypass Speed From [RPM]

Table 204: Parameter 4-60 Bypass Speed From [RPM]

4-60 Bypass Speed From [RPM]		
Default value: Size related	Parameter type: Range, 0 - setting in par. 4-13 RPM, Array [4]	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Some systems call for avoiding certain output speeds due to resonance problems in the system. Enter the lower limits of the speeds to be avoided.

Parameter 4-61 Bypass Speed From [Hz]

Table 205: Parameter 4-61 Bypass Speed From [Hz]

4-61 Bypass Speed From [Hz]		
Default value: Size related	Parameter type: Range, 0 - setting in par. 4-14 Hz, Array [4]	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Some systems require that certain output frequencies or speeds are avoided due to resonance problems in the system. Enter the lower limits of the speeds to be avoided.

Parameter 4-62 Bypass Speed To [RPM]

Table 206: Parameter 4-62 Bypass Speed To [RPM]

4-62 Bypass Speed To [RPM]		
Default value: Size related	Parameter type: Range, 0 - setting in par. 4-13 RPM, Array [4]	Setup: All setups
Conversion index: 67	Data type: Uint16]	Change during operation: True

Some systems call for avoiding certain output speeds due to resonance problems in the system. Enter the upper limits of the speeds to be avoided.

Parameter 4-63 Speed Bypass To [Hz]

Table 207: Parameter 4-63 Bypass Speed To [Hz]

4-63 Bypass Speed To [Hz]		
Default value: Size related	Parameter type: Range, 0 - setting in par. 4-14 Hz, Array [4]	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Some systems require that certain output frequencies or speeds are avoided due to resonance problems in the system. Enter the upper limits of the speeds to be avoided.

Parameter 4-64 Semi-auto Bypass Set-up

Table 208: Parameter 4-64 Semi-auto Bypass Set-up,

4-64 Semi-auto Bypass Set-up,		
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 function.
[1]	Enabled	Starts the semi-automatic bypass setup, which facilitates programming of the frequencies to be skipped due to resonances in the system.

5.5.4.1 Semi-automatic Bypass Speed Setup

Use semi-automatic bypass speed setup to facilitate the programming of frequencies to be skipped due to resonances in the system.

Procedure

1. Stop the motor.
2. Select *[1] Enabled* in *parameter 4-64 Semi-auto Bypass Set-up*.
3. Press [Hand On] on the LCP to start the search for frequency bands causing resonances. The motor ramps up according to the ramp set.
4. When Sweeping through a resonance band, press [OK] on the LCP when leaving the band. The actual frequency is stored as the 1st element in *parameter 4-62 Bypass Speed To [RPM]* or *parameter 4-63 Bypass Speed To [Hz]* (array). Repeat this step for each resonance band identified at the ramp-up (maximum 4 can be adjusted).

   Then maximum speed has been reached, the motor automatically begins to ramp down.

5. Repeat the preceding procedure when speed is leaving the resonance bands during deceleration. The actual frequencies registered when pressing [OK] are stored in *parameter 4-60 Bypass Speed From [RPM]* or *parameter 4-61 Bypass Speed From [Hz]*.
6. When the motor has ramped down to stop, press [OK].

   Parameter 4-64 Semi-auto Bypass Set-up automatically resets to Off. The drive stays in hand-on mode until [Off] or [Auto On] is pressed on the LCP. If the frequencies for a certain resonance band are not registered in the right order, all registrations are canceled, and the following message is shown: *Collected speed areas overlapping or not completely determined. Press [Cancel] to abort*. Registration in the wrong order is when frequency values stored in *parameter 4-62 Bypass Speed To [RPM]* are higher than the values in *parameter 4-60 Bypass Speed From [RPM]*, or if they do not have the same numbers of registrations for the Bypass From and Bypass To.

5.6 Parameter Group 5-** Digital In/Out

5.6.1 5-0* Digital I/O Mode

Parameters for configuring the input and output using NPN and PNP.

Parameter 5-00 Digital I/O Mode

Table 209: Parameter 5-00 Digital I/O Mode

5-00 Digital I/O Mode		
Default value: [0] PNP	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

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.

Parameter 5-01 Terminal 27 Mode

Table 210: Parameter 5-01 Terminal 27 Mode

5-01 Terminal 27 Mode		
Default value: [0] Input	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

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

Parameter 5-02 Terminal 29 Mode

Table 211: Parameter 5-02 Terminal 29 Mode

5-02 Terminal 29 Mode		
Default value: [0] Input	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Input	Defines terminal 29 as a digital input.
[1]	Output	Defines terminal 29 as a digital output.

5.6.2 5-1* Digital Inputs

The digital inputs are used for selecting various functions in the drive. Refer to Table 212 for functions which can be assigned to digital inputs.
Functions in function group 1 have higher priority than functions in function group 2.

Table 212: 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 213: Digital Input Functions and Terminals

Digital input function	Select	Terminal
No operation	[0]	All, terminal 32, 33
Reset	[1]	All
Coast inverse	[2]	All, terminal 27
Coast and reset inverse	[3]	All
DC brake inverse	[5]	All
Stop inverse	[6]	All
External interlock	[7]	All
Start	[8]	All, terminal 18
Latched start	[9]	All
Reversing	[10]	All
Start reversing	[11]	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
Pulse input	[32]	Terminal 29, 33
Ramp bit 0	[34]	All
Mains failure inverse	[36]	All

Digital input function	Select	Terminal
Fire mode	[37]	All
Run permissive	[52]	All
Hand start	[53]	All
Auto Start	[54]	All
DigiPot increase	[55]	All
DigiPot decrease	[56]	All
DigiPot clear	[57]	All
Counter A (up)	[60]	Terminal 29, 33
Counter A (down)	[61]	Terminal 29, 33
Reset Counter A	[62]	All
Counter B (up)	[63]	Terminal 29, 33
Counter B (down)	[64]	Terminal 29, 33
Reset Counter B	[65]	All
Sleep mode	[66]	All
Timed actions disabled	[68]	
Constant OFF actions	[69]	
Constant ON actions	[70]	
MCO specific	[75]	
Reset maint. word	[78]	All
PTC card 1	[80]	All
Lead pump start	[120]	All
Lead pump alternation	[121]	All
Pump 1 interlock	[130]	All
Pump 2 interlock	[131]	All
Pump 3 interlock	[132]	All
Fire mode ref bit 0	[190]	All
Fire mode ref bit 1	[191]	All
Fire mode ref bit 2	[192]	All
Firemode setup bit 0	[193]	All
Firemode setup bit 1	[194]	All
Test fire mode	[195]	All
Reset fire mode	[196]	All

All = Terminals 18, 19, 27, 29, 32, 33, X30/2, X30/3, X30/4. X30/ are the terminals on VLT® General Purpose I/O MCB 101.
Functions dedicated to only 1 digital input are stated in the associated parameter.
All digital inputs can be programmed to these functions:

Table 214: 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.
[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*. **NOTICE** When the drive is at the torque limit and has received a stop command, it may not stop by itself. To ensure that the drive stops, configure a digital output to *[27] Torque limit and stop*. Connect this digital output to a digital input that is configured as coast.
[7]	External interlock	Same function as coasting inverse and stop inverse, but this option generates the alarm message *External fault* on the display when the terminal programmed for coast inverse has signal 0. The alarm message is also active via digital outputs and relay outputs if programmed for external interlock. When the external interlock is removed, the alarm can be reset using a digital input or the [Reset] key. A delay can be programmed in *parameter 22-00 External Interlock Delay*. After applying a signal to the input, the reaction described above is delayed with the time set in *parameter 22-00 External Interlock Delay*.
[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*.
[11]	Start reversing	Used for start/stop and for reversing on the same wire. Signals on start are not allowed at the same time.
[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.

Option		Function
[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 215.
[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 215: 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 216: Digital Inputs, Function Descriptions - 2

Option		Function
[19]	Freeze ref	Freezes the actual reference, which is now the point of enable/condition to be used for *[21] Speed up* and *[22] Speed down*. If speed up/speed down is used, the speed change always follows ramp 2 (*parameter 3-51 Ramp 2 Ramp Up Time* and *parameter 3-52 Ramp 2 Ramp Down Time*) in the range 0–*parameter 3-03 Maximum Reference*.
[20]	Freeze output	Freezes the actual motor frequency (Hz), which is now the point of enable/condition to be used for *[21] Speed up* and *[22] Speed down*. If speed up/speed down is used, the speed change always follows ramp 2 (*parameter 3-51 Ramp 2 Ramp Up Time* and *parameter 3-52 Ramp 2 Ramp Down Time*) in the range 0–*parameter 1-23 Motor Frequency*. **NOTICE** When freeze output is active, the drive cannot be stopped via a low *[8] Start signal*. Stop the drive via a terminal programmed for *[2] Coasting inverse* or *[3] Coast and reset inverse*.
[21]	Speed up	Select *[21] Speed* up and *[22] Speed down* for digital control of the up/down speed (motor potentiometer). Activate this function by selecting either *[19] Freeze ref* or *[20] Freeze output*. When speed up/speed down is activated for less than 400 ms, the resulting reference is increased/decreased by 0.1%. If speed up/speed down is activated for more than 400 ms, the resulting reference follows the setting in ramping up/down parameters 3-x1/3-x2.

Table 217: 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 218: 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*.
[30]	Counter input	
[32]	Pulse input	Select this option when using a pulse sequence as either reference or feedback. Scaling is done in *parameter group 5-5* Pulse Input*.
[34]	Ramp bit 0	Enables a selection between 1 of the 4 ramps available, according to Table 219.
[36]	Mains failure inverse	Activates the function selected in *parameter 14-10 Mains Failure*. Mains failure is active in the logic 0 situation.

Table 219: 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 220: Digital Inputs, Function Descriptions - 4

Option		Function
[37]	Fire mode	A signal applied puts the drive into fire mode and the preset ref bits 0–2 define the operation mode of fire mode where all other commands are disregarded. See *parameter group 24-0* Fire Mode* and *parameter group 24-2* Fire Mode 2*.
[52]	Run permissive	The input terminal, for which the run permissive has been programmed, must be logic 1 before a start command can be accepted. Run permissive has a logic AND function related to the terminal, which is programmed for *[8] Start*, *[14] Jog*, or *[20] Freeze Output*. To start running the motor, both conditions must be fulfilled. If run permissive is programmed on multiple terminals, *[52] Run permissive* needs only be logic 1 on 1 of the terminals to carry out the function. The digital output signal for run request (*[8] Start*, *[14] Jog*, or *[20] Freeze output*) programmed in *parameter group 5-3* Digital Outputs* or *parameter group 5-4* Relays* is not affected by run permissive.

Option		Function
		NOTICE If no run permissive signal is applied, but either run, jog, or freeze commands are activated, the status line in the display shows either *Run Requested*, *Jog Requested*, or *Freeze Requested*.
[53]	Hand start	A signal applied puts the drive into hand-on mode as if [Hand On] was pressed on the LCP and a normal stop command is overridden. If disconnecting the signal, the motor stops. To make any other start commands valid, another digital input must be assigned to *[54] Auto Start*, and a signal applied to this. The [Hand On] and [Auto On] keys on the LCP have no impact. The [Off] key on the LCP overrides *[53] Hand start* and *[54] Auto start*. Press either [Hand On] or [Auto On] to make *[53] Hand start* and *[54] Auto start* active again. If there is no signal on neither *[53] Hand start* nor *[54] Auto start*, the motor stops regardless of any normal start command applied. If signals are applied to both *[53] Hand start* and *[54] Auto start*, the function is auto start. If pressing [Off] on the LCP, the motor stops regardless of the signal on *[53] Hand start* and *[54] Auto start*.
[54]	Auto start	This selection puts the drive into auto mode as if [Auto On] has been pressed. The function is similar to *[53] Hand start*.
[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*.
[60]	Counter A (up)	(Terminal 29 or 33 only). Input for increment counting in the SLC counter.
[61]	Counter A (down)	(Terminal 29 or 33 only). Input for decrement counting in the SLC counter.
[62]	Reset Counter A	Input for reset of counter A.
[63]	Counter B (up)	(Terminal 29 or 33 only). Input for increment counting in the SLC counter.
[64]	Counter B (down)	(Terminal 29 or 33 only). Input for decrement counting in the SLC counter.
[65]	Reset Counter B	Input for reset of counter B.
[66]	Sleep mode	Forces the drive into sleep mode (see *parameter group 22-4* Sleep Mode*.
[68]	Timed actions disabled	Timed actions are disabled. See *parameter group 23-0* Timed Actions*.
[69]	Constant OFF	Timed actions are set for constant OFF. See *parameter group 23-0* Timed Actions*.
[70]	Constant ON	Timed actions are set for constant ON. See *parameter group 23-0* Timed Actions*.
[75]	MCO specific	
[78]	Preset main. word	Resets all data in *parameter 16-96 Maintenance Word* to 0.
[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.
[120]	Lead pump start	
[121]	Lead pump alternation	

Option		Function
[130]	Pump 1 interlock	
[131]	Pump 2 interlock	
[132]	Pump 3 interlock	
[190]	Fire mode ref bit 0	Enables a choice between 1 of the 8 preset references according to Table 215.
[191]	Fire mode ref bit 1	Enables a choice between 1 of the 8 preset references according to Table 215.
[192]	Fire mode ref bit 2	Enables a choice between 1 of the 8 preset references according to Table 215.
[193]	Fire mode setup bit 0	Switch between fire mode setup 1 to 4 in *parameter group 24-0* Fire Mode* and *parameter group 24-4* Fire Mode 2* without changing starting setup mode for the rest of the parameters.
[194]	Fire mode setup bit 1	Switch between fire mode setup 1 to 4 in *parameter group 24-0* Fire Mode* and *parameter group 24-4* Fire Mode 2* without changing starting setup mode for the rest of the parameters.
[195]	Test fire mode	Activation of fire mode via *parameter 24-09 Fire 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 Time-out for Fire Mode Test*, and countdown starts when the test signal is active.
[196]	Reset fire mode	When operating in fire mode with impulse signals (*parameter 24-43 Fire Mode Signal Operation*, option *[2] Impulse, set-reset*), the reset signal stops the fire mode operation.

Parameter 5-10 Terminal 18 Digital Input

Table 221: Parameter 5-10 Terminal 18 Digital Input

5-10 Terminal 18 Digital Input		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the function from the available digital input range. All functions are described in Table 214, Table 216, Table 218, and Table 220.

Option	Name	Description
[0]	No operation	
[1]	Reset	
[2]	Coast inverse	
[3]	Coast and reset inv	
[5]	DC-brake inverse	
[6]	Stop inverse	
[7]	External interlock	
[8]	Start	
[9]	Latched	
[10]	Reversing	

Option	Name	Description
[11]	Start reversing	
[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	
[34]	Ramp bit 0	
[36]	Mains failure inverse	
[37]	Fire mode	
[52]	Run permissive	
[53]	Hand start	
[54]	Auto start	
[55]	DigiPot increase	
[56]	DigiPot decrease	
[57]	DigiPot clear	
[62]	Reset counter A	
[65]	Reset counter B	
[66]	Sleep mode	
[68]	Timed actions disabled	
[69]	Constant OFF	
[70]	Constant ON	
[75]	MCO specific	
[78]	Reset maint. word	
[80]	PTC card 1	
[120]	Lead pump start	
[121]	Lead pump alternation	

Option	Name	Description
[130]	Pump 1 interlock	
[131]	Pump 2 interlock	
[132]	Pump 3 interlock	
[190]	Fire mode ref bit 0	
[191]	Fire mode ref bit 1	
[192]	Fire mode ref bit 2	
[193]	Fire mode setup bit 0	
[194]	Fire mode setup bit 1	
[195]	Test fire mode	
[196]	Reset fire mode	

Parameter 5-11 Terminal 19 Digital Input

Table 222: Parameter 5-11 Terminal 19 Digital Input

5-11 Terminal 19 Digital Input		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-10 Terminal 18 Digital Input*.

Parameter 5-12 Terminal 27 Digital Input

Table 223: Parameter 5-12 Terminal 27 Digital Input

5-12 Terminal 27 Digital Input		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-10 Terminal 18 Digital Input*.

Parameter 5-13 Terminal 29 Digital Input

Table 224: Parameter 5-13 Terminal 29 Digital Input

5-13 Terminal 29 Digital Input		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

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 214, Table 216, Table 218, and Table 220.

Option	Name	Description
[0]	No operation	
[1]	Reset	
[2]	Coast inverse	

Option	Name	Description
[3]	Coast and reset inv	
[5]	DC-brake inverse	
[6]	Stop inverse	
[7]	External interlock	
[8]	Start	
[9]	Latched	
[10]	Reversing	
[11]	Start reversing	
[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	
[30]	Counter input	
[32]	Pulse input	
[34]	Ramp bit 0	
[36]	Mains failure inverse	
[37]	Fire mode	
[52]	Run permissive	
[53]	Hand start	
[54]	Auto start	
[55]	DigiPot increase	
[56]	DigiPot decrease	
[57]	DigiPot clear	
[60]	Counter A (up)	
[61]	Counter A (down)	

Option	Name	Description
[62]	Reset counter A	
[63]	Counter B (up)	
[64]	Counter B (down)	
[65]	Reset counter B	
[66]	Sleep mode	
[68]	Timed actions disabled	
[69]	Constant OFF	
[70]	Constant ON	
[75]	MCO specific	
[78]	Reset maint. word	
[80]	PTC card 1	
[120]	Lead pump start	
[121]	Lead pump alternation	
[130]	Pump 1 interlock	
[131]	Pump 2 interlock	
[132]	Pump 3 interlock	
[190]	Fire mode ref bit 0	
[191]	Fire mode ref bit 1	
[192]	Fire mode ref bit 2	
[193]	Fire mode setup bit 0	
[194]	Fire mode setup bit 1	
[195]	Test fire mode	
[196]	Reset fire mode	

Parameter 5-14 Terminal 32 Digital Input

Table 225: Parameter 5-14 Terminal 32 Digital Input

5-14 Terminal 32 Digital Input		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-10 Terminal 18 Digital Input*.

Parameter 5-15 Terminal 33 Digital Inputs

Table 226: Parameter 5-15 Terminal 33 Digital Input

5-15 Terminal 33 Digital Input		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-13 Terminal 29 Digital Input*.

Parameter 5-16 Terminal X30/2 Digital Input

Table 227: Parameter 5-16 Terminal X30/2 Digital Input

5-16 Terminal X30/2 Digital Input		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-10 Terminal 18 Digital Input*.

Parameter 5-17 Terminal X30/3 Digital Input

Table 228: Parameter 5-17 Terminal X30/3 Digital Input

5-17 Terminal X30/3 Digital Input		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-10 Terminal 18 Digital Input*.

Parameter 5-18 Terminal X30/4 Digital Input

Table 229: Parameter 5-18 Terminal X30/4 Digital Input

5-18 Terminal X30/4 Digital Input		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-10 Terminal 18 Digital Input*.

Parameter 5-19 Terminal 37 Safe Stop

Table 230: Parameter 5-19 Terminal 37 Safe Stop

5-19 Terminal 37 Safe Stop		
Default value: Size related	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

N O T I C E

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.

N O T I C E

Selecting Auto Reset/Warning enables automatic restart of the drive.

Use this parameter to configure the Safe Torque Off functionality. A warning message makes the drive coast the motor and enables the automatic restart. An alarm message makes the drive coast the motor and requires a manual restart (via a fieldbus, Digital I/O, or by pressing [RESET] on the LCP). When the VLT® PTC Thermistor Card MCB 112 is mounted, configure the PTC options to get the full benefit from the alarm handling.

Option	Name	Description
[1]	Safe stop alarm	Coasts the drive when Safe Torque Off is activated. Manual reset from LCP, digital input, or fieldbus.
[3]	Safe stop warning	Coasts the drive when Safe Torque Off is activated (terminal 37 off). When the Safe Torque Off circuit is re-established, the drive continues without manual reset.
[4]	PTC 1 alarm	Coasts the drive when Safe Torque Off is activated. Manual reset from LCP, digital input, or fieldbus.
[5]	PTC 1 warning	Coasts the drive when Safe Torque Off is activated (terminal 37 off). When the Safe Torque Off circuit is re-established, the drive continues without manual reset, unless a digital input set to *[80] PTC Card 1* is still enabled.
[6]	PTC 1 & Relay A	This option is used when the VLT® PTC Thermistor Card MCB 112 gates with a stop key through a safety relay to terminal 37. Coasts the drive when Safe Torque Off is activated. Manual reset from LCP, digital input, or fieldbus.
[7]	PTC 1 & Relay W	This option is used when the VLT® PTC Thermistor Card MCB 112 gates with a stop key through a safety relay to terminal 37. Coasts the drive when Safe Torque Off is activated (terminal 37 off). When the Safe Torque Off circuit is re-established, the drive continues without manual reset, unless a digital input set to *[80] PTC Card 1* is still enabled.
[8]	PTC 1 & Relay A/W	This option enables using a combination of alarm and warning.
[9]	PTC 1 & Relay W/A	This option enables using a combination of warning and alarm.

Table 231: Overview of Functions, Alarms, and Warnings

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

Parameter 5-20 Terminal X46/1 Digital Input

Table 232: Parameter 5-20 Terminal X46/1 Digital Input

5-20 Terminal X46/1 Digital Input		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

All functions are described in Table 214, Table 216, Table 218, and Table 220.

Option	Name	Description
[0]*	No operation	
[1]	Reset	
[2]	Coast inverse	
[3]	Coast and reset inv	
[5]	DC-brake inverse	
[6]	Stop inverse	
[7]	External interlock	
[8]	Start	
[9]	Latched	
[10]	Reversing	
[11]	Start reversing	
[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	
[34]	Ramp bit 0	
[36]	Mains failure inverse	
[37]	Fire mode	
[51]	External interlock	
[52]	Run permissive	
[53]	Hand start	
[54]	Auto start	
[55]	DigiPot increase	
[56]	DigiPot decrease	
[57]	DigiPot clear	

Option	Name	Description
[62]	Reset counter A	
[65]	Reset counter B	
[66]	Sleep mode	
[68]	Timed actions disabled	
[69]	Constant OFF actions	
[70]	Constant ON actions	
[75]	MCO specific	
[78]	Reset maint. word	
[80]	PTC card 1	
[120]	Lead pump start	
[121]	Lead pump alternation	
[130]	Pump 1 interlock	
[131]	Pump 2 interlock	
[132]	Pump 3 interlock	
[190]	Fire mode ref bit 0	
[191]	Fire mode ref bit 1	
[192]	Fire mode ref bit 2	
[195]	Test fire mode	
[196]	Reset fire mode	

Parameter 5-21 Terminal X46/3 Digital Input

Table 233: Parameter 5-21 Terminal X46/3 Digital Input

5-21 Terminal X46/3 Digital Input		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-20 Terminal X46/1 Digital Input*.

Parameter 5-22 Terminal X46/5 Digital Input

Table 234: Parameter 5-22 Terminal X46/5 Digital Input

5-22 Terminal X46/5 Digital Input		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-20 Terminal X46/1 Digital Input*.

Parameter 5-23 Terminal X46/7 Digital Input

Table 235: Parameter 5-23 Terminal X46/7 Digital Input

5-23 Terminal X46/7 Digital Input		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as for those lited for *parameter 5-20 Terminal X46/1 Digital Input*.

Parameter 5-24 Terminal X46/9 Digital Input

Table 236: Parameter 5-24 Terminal X46/9 Digital Input

5-24 Terminal X46/9 Digital Input		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-20 Terminal X46/1 Digital Input*.

Parameter 5-25 Terminal X46/11 Digital Input

Table 237: Parameter 5-25 Terminal X46/11 Digital Input

5-25 Terminal X46/11 Digital Input		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-20 Terminal X46/1 Digital Input*.

Parameter 5-26 Terminal X46/13 Digital Input

Table 238: Parameter 5-26 Terminal X46/13 Digital Input

5-26 Terminal X46/13 Digital Input		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-20 Terminal X46/1 Digital Input*.

5.6.3 5-3* Digital Outputs

The 2 solid-state digital outputs are common for terminals 27 and 29. Set the I/O function for terminal 27 in *parameter 5-01 Terminal 27 Mode*, and set the I/O function for terminal 29 in *parameter 5-02 Terminal 29 Mode*.

N O T I C E

These parameters cannot be adjusted while the motor is running.

Table 239: Digital Outputs, Function Descriptions

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.

Option		Function
[4]	Standby/no warning	The drive is ready for operation. No start or stop command is given (start/disable). There are no warnings.
[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.
[8]	Run on ref/no warn	The motor runs at reference speed. There are no warnings.
[9]	Alarm	An alarm activates the output. There are no warnings.
[10]	Alarm or warning	An alarm or warning activates the output.
[11]	At torque limit	The torque limit set in *parameter 4-16 Torque Limit Motor Mode* or *parameter 4-17 Torque Limit Generator Mode* has been exceeded.
[12]	Out of current range	The motor current is outside the range set in *parameter 4-18 Current Limit*.
[13]	Below current, low	The motor current is lower than set in *parameter 4-50 Warning Curent Low*.
[14]	Above current, high	The motor current is higher than set in *parameter 4-51 Warning Current High*.
[15]	Out of speed range	The output frequency is outside the frequency range set in *parameter 4-52 Warning Speed Low* and *parameter 4-53 Warning Speed High*.
[16]	Below speed, low	Output speed is lower than the setting in *parameter 4-52 Warning Speed Low*.
[17]	Above speed, high	The output speed is higher than the setting in *parameter 4-53 Warning Speed High*.
[18]	Out of feedb. range	Feedback is below the limit set in *parameter 4-56 Warning Feedback Low* and *parameter 4-57 Warning Feedback High*.
[19]	Below feedback, low	Feedback is below the limit set in *parameter 4-56 Warning Feedback Low*.
[20]	Above feedback, high	Feedback is above the limit set in *parameter 4-57 Warning Feedback High*.
[21]	Thermal warning	The thermal warning turns on when the temperature exceeds the limit in the motor, the drive, the brake resistor, or the thermistor.
[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.
[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.

Option		Function
[31]	Relay 123	Relay is activated when *[0] Control Word* is selected in *parameter group 8-** Communications and Options*.
[33]	Safe stop active	Indicates that the Safe Torque Off on terminal 37 is activated.
[35]	External interlock	
[40]	Out of ref range	Active when the actual speed is outside settings in *parameter 4-52 Warning Speed Low* in *parameter 4-55 Warning Reference High*.
[41]	Below reference, low	Active when the actual speed is below speed reference setting.
[42]	Above ref, high	Active when the actual speed is above speed reference setting.
[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 time-out	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 time-out	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]	Remote, enable, no TW	
[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.
[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.

Option		Function
[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.
[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*).
[151]	ATEX ETR cur. alarm	Selectable if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *Alarm 164 ATEX ETR cur.lim.alarm* is active, the output is 1.

Option		Function
[152]	ATEX ETR freq. alarm	Selectable if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *Alarm 166, ATEX ETR freq.lim.alarm* is active, the output is 1.
[153]	ATEX ETR cur. warning	Selectable if *parameter 1-90 Motor Thermal Protection* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *Warning 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.
[160]	No alarm	The output is high when no alarm is present.
[161]	Running reverse	The output is high when the drive is running counterclockwise (the logical product of the status bits running AND reverse).
[163]	Pressure sensor	
[165]	Local ref active	The output is high when *parameter 3-13 Reference Site* is set to *[2] Local* or when *parameter 3-13 Reference Site* is set to *[0] Linked to hand/auto* at the same time as the LCP is in hand-on mode.
[166]	Remote ref active	The output is high when *parameter 3-13 Reference Site* is set to *[1] Remote* or *[0] Linked to hand/auto* while the LCP is in auto-on mode.
[167]	Start command active	The output is high when there is an active start command (via digital input, bus connection, [Hand On], or [Auto On], and no stop command is active.
[168]	Hand/Off	The output is high when the drive is in hand-on mode (as indicated by the LED light above [Hand On].
[169]	Auto mode	The output is high when the drive is in auto-on mode (as indicated by the LED light above [Auto On].
[173]	10Wh counter pulse	
[178]	RS flipflop 8	
[179]	RS flipflop 9	
[180]	Clock fault	The clock function has been reset to default (2000-01-01) because of a power failure.
[181]	Prev. maintenance	One or more of the preventive maintenance events programmed in *parameter 23-10 Maintenance Item* has passed the time for the specified action is *parameter 23-11 Maintenance Action*.
[188]	AHF capacitor connect	The capacitors are turned on at 20% (hysteresis of 50% gives an interval of 10– 30%). The capacitors are disconnected below 10%. The off delay is 10 s and restarts if the nominal power goes above 10% during the delay. *Parameter 5-80 AHF Cap Reconnect Delay* is used to guarantee a minimum off time for the capacitors.
[189]	External fan control	The internal logics for the internal fan control is transferred to this output to make it possible to control an external fan (relevant for hp duct cooling).
[190]	No-flow	
[191]	Dry pump	
[192]	End of curve	
[193]	Sleep mode	The drive/system has entered sleep mode. See *parameter group 22-4* Sleep Mode*.
[194]	Broken belt	A broken-belt condition has been detected. This function must be enabled in *parameter 22-60 Broken Belt Function*.

Option		Function
[195]	Bypass valve control	
[196]	Fire mode	The drive operates in fire mode. See *parameter group 24-0* Fire Mode*.
[197]	Fire mode was act.	The drive has been operating in fire mode. In software version 7.3x, this output is only active 1 min after fire mode is stopped. See *parameter group 24-0* Fire Mode*.
[198]	Drive bypass	To be used as signal for activating an external electromechanical bypass, switching the motor direct on line. See *parameter group 24-1* Drive Bypass*. **N O T I C E** **LOSS OF CERTIFICATION** If enabling the drive bypass function, the drive is no longer certified for using the Safe Torque Off in versions where included.
[200]	Full capacity	All pumps running at full speed.
[201]	Pump 1 running	One or more pumps controlled by the cascade controller are running. The function also depends on *parameter 25-06 Number of Pumps*. If set to *[0] No*, pump 1 refers to the pump controlled by relay 1, and so on. If set to *[1] Yes*, pump 1 refers to the pump controlled by the drive only (without any of the built-in relays involved), and pump 2 refers to the pump controlled by relay 1.
[202]	Pump 2 running	See *[201] Pump 1 Running*.
[203]	Pump 3 running	See *[201] Pump 1 Running*.
[234]	PE power off	
[236]	Ext. CL 1 on ref	
[237]	Ext. CL 2 on ref	
[238]	Ext. CL 3 on ref	
[240]	RS flipflop 0	See *parameter group 13-1* Comparators*.
[241]	RS flipflop 1	See *parameter group 13-1* Comparators*.
[242]	RS flipflop 2	See *parameter group 13-1* Comparators*.
[243]	RS flipflop 3	See *parameter group 13-1* Comparators*.
[244]	RS flipflop 4	See *parameter group 13-1* Comparators*.
[245]	RS flipflop 5	See *parameter group 13-1* Comparators*.
[246]	RS flipflop 6	See *parameter group 13-1* Comparators*.
[247]	RS flipflop 7	See *parameter group 13-1* Comparators*.
[249]	Fire M. OPR. unexpected	Fire mode input or safe stop is not operating as expected, for example, live zero monitoring on an analog input is activated.
[250]	Fire mode limits	During fire mode operation, 1 of the critical alarms has been activated and suppressed by fire mode. This may lead to reduced drive performance and expected operation lifetime before service is required.
[254]	Testing fire mode	Fire mode is activated in a special test mode where the drive stops on all alarms.

Table 240: Pump Settings

Setting in *parameter group 5-3* Digital Outputs*	**Setting in** *parameter 25-06 Number of Pumps*	
	[0] No	*[1] Yes*
[200] Pump 1 running	Controlled by relay 1.	Controlled by drive.
[201] Pump 2 running	Controlled by relay 2.	Controlled by relay 1.
[202] Pump 3 running	Controlled by relay 3.	Controlled by relay 2.

Parameter 5-30 Terminal 27 Digital Output

Table 241: Parameter 5-30 Terminal 27 Digital Output

5-30 Terminal 27 Digital Output		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the function from the available digital output range. All functions are described in Table 239.

Option	Name	Description
[0]	No operation	
[1]	Control ready	
[2]	Drive ready	
[3]	Coast and reset inv	
[4]	Standby/no warning	
[5]	Running	
[6]	Running/no warning	
[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	

Option	Name	Description
[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	
[33]	Safe stop active	
[35]	External interlock	
[40]	Out of ref range	
[41]	Below reference, low	
[42]	Above ref, high	
[45]	Bus ctrl.	
[46]	Bus ctrl, 1 if timeout	
[47]	Bus ctrl, 0 if timeout	
[51]	MCO controlled	
[55]	Pulse output	
[59]	Remote,enable,no TW	
[60]	Comparator 0	
[61]	Comparator 1	
[62]	Comparator 2	
[63]	Comparator 3	
[64]	Comparator 4	
[65]	Comparator 5	
[66]	Comparator 6	
[67]	Comparator 7	
[68]	Comparator 8	
[69]	Comparator 9	
[70]	Logic rule 0	
[71]	Logic rule 1	
[72]	Logic rule 2	
[73]	Logic rule 3	

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 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	
[151]	ATEX ETR cur. alarm	
[152]	ATEX ETR freq. alarm	
[153]	ATEX ETR cur. warning	
[154]	ATEX ETR freq. warning	
[160]	No alarm	
[161]	Running reverse	
[163]	Pressure sensor	
[165]	Local ref active	
[166]	Remote ref active	
[167]	Start command activ	
[168]	Hand/Off	
[169]	Auto mode	
[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	

Option	Name	Description
[190]	No-flow	
[191]	Dry pump	
[192]	End of curve	
[193]	Sleep mode	
[194]	Broken belt	
[195]	Bypass valve control	
[196]	Fire mode	
[197]	Fire mode was act.	
[198]	Drive bypass	
[200]	Full capacity	
[201]	Pump 1 running	
[202]	Pump 2 running	
[203]	Pump 3 running	
[234]	PE power off	
[236]	Ext. CL 1 on ref	
[237]	Ext. CL 2 on ref	
[238]	Ext. CL 3 on ref	
[240]	RS flipflop 0	
[241]	RS flipflop 1	
[242]	RS flipflop 2	
[243]	RS flipflop 3	
[244]	RS flipflop 4	
[245]	RS flipflop 5	
[246]	RS flipflop 6	
[247]	RS flipflop 7	
[249]	Fire m. OPR unexpected	
[250]	Fire mode limits	
[254]	Testing fire mode	

Parameter 5-31 Terminal 29 Digital Output

Table 242: Parameter 5-31 Terminal 29 Digital Output

5-31 Terminal 29 Digital Output		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The options for this parameter are the same as those listed for *parameter 5-30 Terminal 27 Digital Output*.

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

Table 243: Parameter 5-32 Term X30/6 Digi Out (MCB 101)

5-32 Term X30/6 Digi Out (MCB 101)		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter is active when option module VLT® General Purpose I/O MCB 101 is mounted in the drive. The options for this parameter are the same as those listed for *parameter 5-30 Terminal 27 Digital Output*.

Table 244: Parameter 5-33 Term X30/7 Digi Out (MCB 101)

5-33 Term X30/7 Digi Out (MCB 101)		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter is active when option module VLT® General Purpose I/O MCB 101 is mounted in the drive. The options for this parameter are the same as those listed for *parameter 5-30 Terminal 27 Digital Output*.

5.6.4 5-4* Relays

Parameters for configuring the timing and the output functions for the relays.

Parameter 5-40 Function Relay

Table 245: Parameter 5-40 Function Relay

5-40 Function Relay		
Default value: Size related	Parameter type: Option, Array [9]	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select options to define the function of the relays. Standard: 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]	Standby/no warning	The drive is ready for operation. No start or stop command is given (start/disable). There are no warnings.
[5]	Running	The motor is running, and shaft torque is present.

Option	Name	Description
[6]	Running/no warn-ing	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.
[8]	Run on ref/no warn	The motor runs at reference speed. No warnings.
[9]	Alarm	An alarm activates the output. No warnings.
[10]	Alarm or warning	An alarm or a warning activates the output.
[11]	At torque limit	The torque limit set in *parameter 4-16 Torque Limit Motor Mode* or *parameter 4-17 Torque Limit Generator Mode* has been exceeded.
[12]	Out of current range	The motor current is outside the range set in *parameter 4-18 Current Limit*.
[13]	Below current, low	The motor current is lower than set in *parameter 4-50 Warning Current Low*.
[14]	Above current, high	The motor current is higher than set in *parameter 4-51 Warning Current High*.
[15]	Out of speed range	Output speed/frequency is outside the frequency range set in *parameter 4-52 Warning Speed Low* and *parameter 4-53 Warning Speed High*.
[16]	Below speed, low	Output speed is lower than the setting in *parameter 4-52 Warning Speed Low*.
[17]	Above speed, high	Output speed is higher than the setting in *parameter 4-53 Warning Speed High*.
[18]	Out of feedb. range	Feedback is outside the range set in *parameter 4-56 Warning Feedback Low* and *parameter 4-57 Warning Feedback High*.
[19]	Below feedback, low	Feedback is below the limit set in *parameter 4-56 Warning Feedback Low*.
[20]	Above feedback, high	Feedback is above the limit set in *parameter 4-57 Warning Feedback High*.
[21]	Thermal warning	Thermal warning turns on when the temperature exceeds the limit either in motor, drive, brake resistor, or connected thermistor.
[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*.
[33]	Safe stop active	Indicates that the Safe Torque Off on terminal 37 has been activated.
[35]	External interlock	The external interlock function has been activated via 1 of the digital inputs.

Option	Name	Description
[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.
[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.
[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 a 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 *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.
[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.

Option	Name	Description
[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]*.
[81]	SL digital output B	See *parameter 13-52 SL Controller Action*. Output B is low on smart logic action *[33] Set digital out B low*. Output B is high on smart logic action *[39]*.
[82]	SL digital output C	See *parameter 13-52 SL Controller Action*. Output C is low on smart logic action *[34] Set digital out C low*. Output C is high on smart logic action *[40]*.
[83]	SL digital output D	See *parameter 13-52 SL Controller 1 Action*. Output D is low on smart logic action *[35] Set digital out D low*. Output D is high on smart logic action *[41]*.
[84]	SL digital output E	See *parameter 13-52 SL Controller Action*. Output E is low on smart logic action *[36] Set digital out E low*. Output E is high on smart logic action *[42]*.
[85]	SL digital output F	See *parameter 13-52 SL Controller Action*. Output F is low on smart logic action *[37] Set digital out F low*. Output F is high on smart logic action *[43]*.
[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.
[160]	No alarm	The output is high when no alarm is present.
[161]	Running reverse	The output is high when the drive is running counterclockwise (the logical product of the status bits running AND reverse).

Option	Name	Description
[163]	Pressure sensor	
[165]	Local ref active	The output is high when *parameter 3-13 Reference Site* is set to *[2] Local* or when *parameter 3-13 Reference Site* is set to *[0] Linked to hand/auto* at the same time as the LCP is in hand-on mode.
[166]	Remote ref active	The output is high when *parameter 3-13 Reference Site* is set to *[1] Remote* or *[0] Linked to hand/ auto* while the LCP is in auto-on mode.
[167]	Start command ac-tiv	The output is high when there is an active start command (via digital input, bus connection, [Hand On], or [Auto On]), and no stop command is active.
[168]	Hand/Off	The output is high when the drive is in hand-on mode (as indicated by the LED light above [Hand On]).
[169]	Auto mode	The output is high when the drive is in auto-on mode (as indicated by the LED light above [Auto On]).
[173]	10Wh counter pulse	
[178]	RS flipflop 8	
[179]	RS flipflop 9	
[180]	Clock fault	The clock function has been reset to default (2000-01-01) because of a power failure.
[181]	Prev. maintenance	One or more of the preventive maintenance events programmed in *parameter 23-10 Maintenance Item* has passed the time for the specified action in *parameter 23-22 Maintenance Action*.
[188]	AHF capacitor con-nect	
[189]	External fan control	The internal logics for internal fan control is transferred to this output to make it possible to control an external fan (relevant for hp duct cooling).
[190]	No-flow	
[191]	Dry pump	
[192]	End of curve	
[193]	Sleep mode	The drive/system has entered sleep mode. See *parameter group 22-4* Sleep Mode*.
[194]	Broken belt	A broken-belt condition has been detected. Enable this function in *parameter 22-60 Broken Belt Function*.
[195]	Bypass valve con-trol	
[196]	Fire mode	The drive operates in fire mode. See *parameter group 24-0* Fire Mode*.
[197]	Fire mode was act.	The drive has been operating in fire mode. In software version 7.2X, this output is only active 1 min after fire mode is stopped. See *parameter 24-0* Fire Mode*.
[198]	Drive bypass	To be used as signal for activating an external electromechanical bypass, switching the motor direct on line. See *parameter group 24-1* Drive Bypass*. **NOTICE** **LOSS OF CERTIFICATION** If enabling the drive bypass function, the drive is no longer certified for using the Safe Torque Off in versions where included.

Option	Name	Description
[211]	Cascade pump 1	
[212]	Cascade pump 2	
[213]	Cascade pump 3	
[234]	PE power off	
[236]	Ext. CL 1 on ref	
[237]	Ext. CL 2 on ref	
[238]	Ext. CL 3 on ref	
[240]	RS flipflop 0	See *parameter group 13-1* Comparators*.
[241]	RS flipflop 1	See *parameter group 13-1* Comparators*.
[242]	RS flipflop 2	See *parameter group 13-1* Comparators*.
[243]	RS flipflop 3	See *parameter group 13-1* Comparators*.
[244]	RS flipflop 4	See *parameter group 13-1* Comparators*.
[245]	RS flipflop 5	See *parameter group 13-1* Comparators*.
[246]	RS flipflop 6	See *parameter group 13-1* Comparators*.
[247]	RS flipflop 7	See *parameter group 13-1* Comparators*.
[249]	Fire m OPR unexpected	Fire mode input or safe stop is not operating as expected, for example, live zero monitoring on an analog input is activated.
[250]	Fire mode limits	During fire mode operation, 1 of the critical alarms has been activated and suppressed by fire mode. This may lead to reduced drive performance and expected operation lifetime before service is required.
[254]	Testing fire mode	Fire mode is activated in a special test mode where the drive stops on all alarms.

Parameter 5-41 On Delay, Relay

Table 246: Parameter 5-41 On Delay, Relay

5-41 On Delay, Relay		
Default value: 0.01 s	Parameter type: Range, 0.01 – 600 s, Array [9]	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

Enter the delay of the relay cut-in time. Select 1 of 2 internal mechanical relays in an array function. See *parameter 5-40 Function Relay* for details.

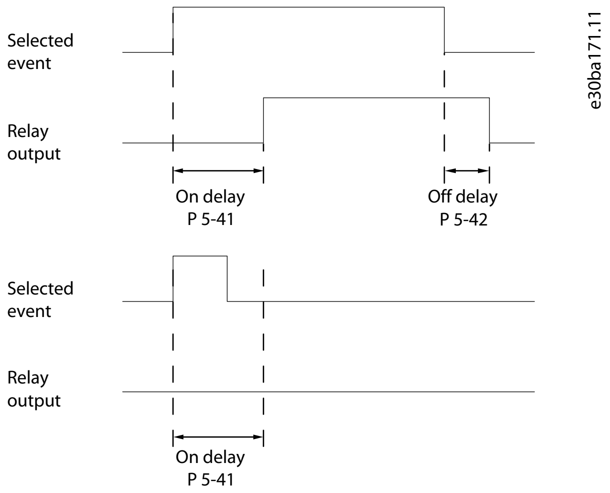


Illustration 49: On Delay, Relay

Parameter 5-42 Off Delay, Relay

Table 247: Parameter 5-42 Off Delay, Relay

5-42 Off Delay, Relay		
Default value: 0.01 s	Parameter type: Range, 0.01 – 600 s, Array [9]	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

Enter the delay of the relay cutout time. Select 1 of 2 internal mechanical relays in an array function. See *parameter 5-40 Function Relay* for details. If the selected event condition changes before a delay timer expires, the relay output is unaffected.

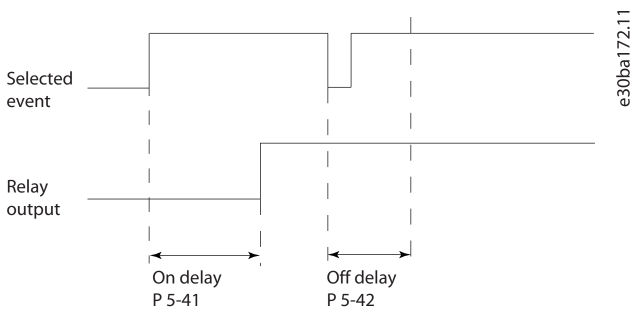


Illustration 50: Off Delay, Relay

If the selected recent condition changes before the on delay or off delay timer expires, the relay output is unaffected.

5.6.5 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 as an input, set *parameter 5-01 Terminal 27 Mode* to *[0] Input*.

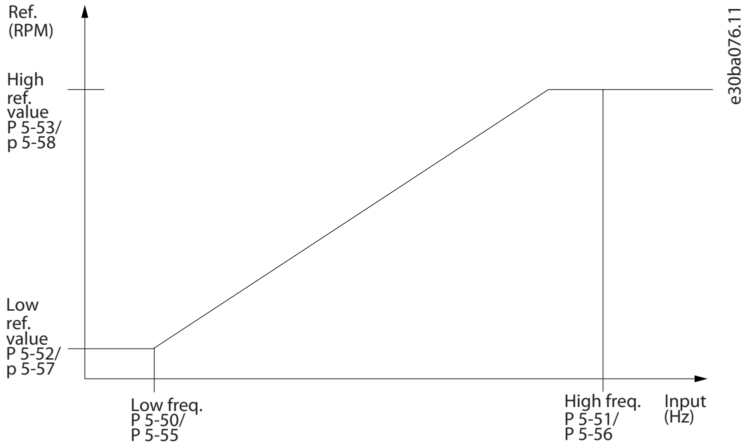


Illustration 51: Pulse Input

Parameter 5-50 Term. 29 Low Frequency

Table 248: Parameter 5-50 Term. 29 Low Frequency

5-50 Term. 29 Low Frequency		
Default value: 100 Hz	Parameter type: Range, 0 – 110000 Hz	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Enter the low frequency limit corresponding to the low motor shaft speed (that is low reference value) in *parameter 5-52 Term. 29 Low Ref./Feedb. Value*. Refer to Illustration 51.

Parameter 5-51 Term. 29 High Frequency

Table 249: Parameter 5-51 Term. 29 High Frequency

5-51 Term. 29 High 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 high frequency limit corresponding to the high motor shaft speed (that is high reference value) in *parameter 5-53 Term. 29 High Ref./Feedb. Value*.

Parameter 5-52 Term. 29 Low Ref./Feedb. Value

Table 250: Parameter 5-52 Term. 29 Low Ref./Feedb. Value

5-52 Term. 29 Low Ref./Feedb. Value		
Default value: 0 ReferenceFeedbackUnit	Parameter type: Range, -999999.999 - 999999.999 Reference- FeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the low reference value limit for the motor shaft speed [RPM]. This is also the lowest feedback value, see also *parameter 5-57 Term. 33 Low Ref./Feedb. Value*. Set terminal 29 to digital input (*parameter 5-02 Terminal 29 Mode = [0] Input* (default) and *parameter 5-13 Terminal 29 Digital Input* = applicable value).

Parameter 5-53 Term. 29 High Ref./Feedb. Value

Table 251: Parameter 5-53 Term. 29 High Ref./Feedb. Value

5-53 Term. 29 High Ref./Feedb. Value		
Default value: 100 ReferenceFeedbackUnit	Parameter type: Range, -999999.999 - 999999.999 Reference- FeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the high reference value [RPM] for the motor shaft speed and the high feedback value, see also *parameter 5-58 Term. 33 High Ref./Feedb. Value*. Select terminal 29 as a digital input (*parameter 5-02 Terminal 29 Mode = [0] Input* (default) and *parameter 5-13 Terminal 29 Digital Input* = applicable value).

Parameter 5-54 Pulse Filter Time Constant #29

Table 252: Parameter 5-54 Pulse Filter Time Constant #29

5-54 Pulse Filter Time Constant #29		
Default value: 100 ms	Parameter type: Range, 5 - 1000 ms	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: False

Enter the pulse filter time constant. The pulse filter dampens oscillations of the feedback signal. If there is much noise in the system this is an advantage. A high time constant value results in better dampening but also increases the time delay through the filter.

Parameter 5-55 Term. 33 Low Frequency

Table 253: Parameter 5-55 Term. 33 Low Frequency

5-55 Term. 33 Low Frequency		
Default value: 100 Hz	Parameter type: Range, 0 - 110000 Hz	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Enter the low frequency corresponding to the low motor shaft speed (that is low reference value) in *parameter 5-57 Term. 33 Low Ref./Feedb. Value*.

Parameter 5-56 Term. 33 High Frequency

Table 254: Parameter 5-56 Term. 33 High Frequency

5-56 Term. 33 High 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 high frequency corresponding to the high motor shaft speed (that is high reference value) in *parameter 5-58 Term. 33 High Ref./Feedb. Value*.

Parameter 5-57 Term. 33 Low Ref./Feedb. Value

Table 255: Parameter 5-57 Term. 33 Low Ref./Feedb. Value

5-57 Term. 33 Low Ref./Feedb. Value		
Default value: 0 ReferenceFeedbackUnit	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the low reference value [RPM] for the motor shaft speed. This is also the low feedback value, see also *parameter 5-52 Term. 29 Low Ref./Feedb. Value*.

Parameter 5-58 Term. 33 High Ref./Feedb. Value

Table 256: Parameter 5-58 Term. 33 High Ref./Feedb. Value

5-58 Term. 33 High Ref./Feedb. Value		
Default value: 100 ReferenceFeedbackUnit	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the high reference value [RPM] for the motor shaft speed. See also *parameter 5-53 Term. 29 High Ref./Feedb. Value*.

Parameter 5-59 Pulse Filter Time Constant #33

Table 257: Parameter 5-59 Pulse Filter Time Constant #33

5-59 Pulse Filter Time Constant #33		
Default value: 100 ms	Parameter type: Range, 5 - 1000 ms	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

Enter the pulse filter time constant. The low-pass filter reduces the influence and dampens oscillations on the feedback signal from the control. This is an advantage if there is a lot of noise in the system.

5.6.6 5-6* Pulse Outputs

N O T I C E

These parameters cannot be adjusted while the motor is running.

These parameters configure pulse outputs with their functions and scaling. Terminals 27 and 29 are allocated to pulse output via *parameter 5-01 Terminal 27 Mode* and *parameter 5-02 Terminal 29 Mode*, respectively.

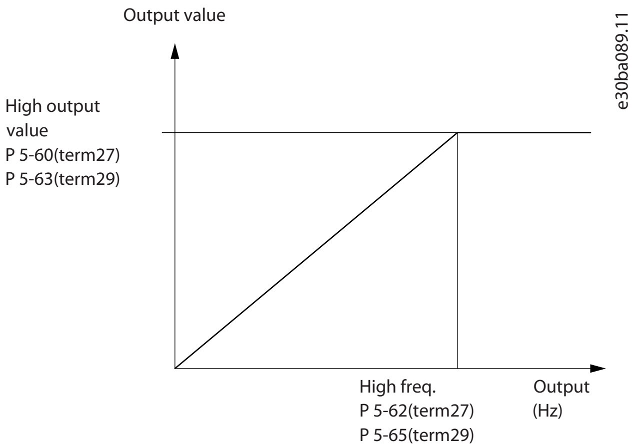


Illustration 52: Configuration of Pulse Outputs

Table 258: Options for Readout Output Variables

Option	Name	Description
		Parameters for configuring the scaling and output functions of pulse outputs. The pulse outputs are designated to terminals 27 or 29. Select terminal 27 output in *parameter 5-01 Terminal 27 Mode* and terminal 29 output in *parameter 5-02 Terminal 29 Mode*.
[0]	No operation	
[45]	Bus control	
[48]	Bus control timeout	
[51]	MCO-controlled	
[100]	Output frequency	
[101]	Reference	
[102]	Feedback	
[103]	Motor current	
[104]	Torque relative to limit	
[105]	Torque relative to rated	
[106]	Power	
[107]	Speed	
[113]	Ext. closed loop 1	
[114]	Ext. closed loop 2	
[115]	Ext. closed loop 3	

Parameter 5-60 Terminal 27 Pulse Output Variable

Table 259: Parameter 5-60 Terminal 27 Pulse Output Variable

5-60 Terminal 27 Pulse Output Variable		
Default value: [0]No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No operation	Select the display output for terminal 27.
[45]	Bus ctrl.	
[48]	Bus ctrl., timeout	
[51]	MCO controlled	
[86]	Pressure sensor 1	
[88]	Pressure sensor 2	
[93]	Pressure sensor 3	
[100]	Output freq. 0–100	

Option	Name	Description
[101]	Reference min–max	
[102]	Feedback ±200%	
[103]	Motor cur. 0–I_{MAX}	
[104]	Torque 0–T_{lim}	
[105]	Torque 0–T_{nom}	
[106]	Power 0–P_{nom}	
[107]	Speed 0–HighLim	
[113]	Ext. closed loop 1	
[114]	Ext. closed loop 2	
[115]	Ext. closed loop 3	
[186]	Pressure sensor 4	

Parameter 5-62 Pulse Output Max Freq #27

Table 260: Parameter 5-62 Pulse Output Max Freq #27

5-62 Pulse Output Max Freq #27		
Default value: 5000 Hz	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*.

Parameter 5-63 Terminal 29 Pulse Output Variable

Table 261: Parameter 5-63 Terminal 29 Pulse Output Variable

5-63 Terminal 29 Pulse Output Variable		
Default value: [0]No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No operation	Select the display output for terminal 27.
[45]	Bus ctrl.	
[48]	Bus ctrl., timeout	
[51]	MCO controlled	
[86]	Pressure sensor 1	
[88]	Pressure sensor 2	
[93]	Pressure sensor 3	
[100]	Output freq. 0–100	
[101]	Reference min–max	

Option	Name	Description
[102]	Feedback ±200%	
[103]	Motor cur. 0–I_{MAX}	
[104]	Torque 0–T_{lim}	
[105]	Torque 0–T_{nom}	
[106]	Power 0–P_{nom}	
[107]	Speed 0–HighLim	
[113]	Ext. closed loop 1	
[114]	Ext. closed loop 2	
[115]	Ext. closed loop 3	
[186]	Pressure sensor 4	

Parameter 5-65 Pulse Output Max Freq #29

Table 262: Parameter 5-65 Pulse Output Max Freq #29

5-65 Pulse Output Max Freq #29		
Default value: 5000 Hz	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*.

Parameter 5-66 Terminal X30/6 Pulse Output Variable

Table 263: Parameter 5-66 Terminal X30/6 Pulse Output Variable

5-66 Terminal X30/6 Pulse Output Variable		
Default value: [0]No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	No operation	Select the display output for terminal 27.
[45]	Bus ctrl.	
[48]	Bus ctrl., timeout	
[51]	MCO controlled	
[86]	Pressure sensor 1	
[88]	Pressure sensor 2	
[93]	Pressure sensor 3	
[100]	Output freq. 0–100	
[101]	Reference min–max	
[102]	Feedback ±200%	

Option	Name	Description
[103]	Motor cur. 0–I_{MAX}	
[104]	Torque 0–T_{lim}	
[105]	Torque 0–T_{nom}	
[106]	Power 0–P_{nom}	
[107]	Speed 0–HighLim	
[113]	Ext. closed loop 1	
[114]	Ext. closed loop 2	
[115]	Ext. closed loop 3	
[186]	Pressure sensor 4	

Parameter 5-68 Pulse Output Max Freq #30/6

Table 264: Parameter 5-68 Pulse Output Max Freq #X30/6

5-68 Pulse Output Max Freq #X30/6		
Default value: 5000 Hz	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*.

5.6.7 5-8* I/O Options

Parameter 5-80 AHF Cap Reconnect Delay

Table 265: Parameter 5-80 AHF Cap Reconnect Delay

5-80 AHF Cap Reconnect Delay		
Default value: 25 s	Parameter type: Range, 1 - 120 s	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Guarantees a minimum off-time for the capacitors. The timer starts once the AHF capacitor disconnects and has to expire before the output is allowed to be on again. It only turns on again if the drive power is 20–30%.

5.6.8 5-9* Bus-controlled

This parameter group selects digital and relay outputs via a fieldbus setting.

Parameter 5-90 Digital & Relay Bus Control

Table 266: Parameter 5-90 Digital & Relay Bus Control

5-90 Digital & Relay Bus Control		
Default value: 0	Parameter type: Range, 0 - 0xFFFFFFFF	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter holds the state of the digital outputs and relays that is controlled by bus. A logical 1 indicates that the output is high or active. A logical 0 indicates that the output is low or inactive.

Table 267: Bus-controlled Digital Outputs and Relays

Bit	Output/Relay
0	Digital output terminal 27
1	Digital output terminal 29
2	Digital output terminal X30/6
3	Digital output terminal X30/7
4	Relay 1 output terminal
5	Relay 2 output terminal
6	Option B relay 1 output terminal
7	Option B relay 2 output terminal
8	Option B relay 3 output terminal
9-15	Reserved for future terminals
16	Option C relay 1 output terminal
17	Option C relay 2 output terminal
18	Option C relay 3 output terminal
19	Option C relay 4 output terminal
20	Option C realy 5 output terminal
21	Option C relay 6 output terminal
22	Option C relay 7 output terminal
23	Option C relay 8 output terminal
21–31	Reserved for future terminals

Parameter 5-93 Pulse Out #27 Bus Control

Table 268: Parameter 5-93 Pulse Out #27 Bus Control

5-93 Pulse Out #27 Bus Control		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -2	Data type: N2	Change during operation: True

Set the output frequency transferred to output terminal 27 when the terminal is configured as *[45] Bus Controlled* in *parameter 5-60 Terminal 27 Pulse Output Variable*.

Parameter 5-94 Pulse Out #27 Timeout Preset

Table 269: Parameter 5-94 Pulse Out #27 Timeout Preset

5-94 Pulse Out #27 Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: -2	Data type: Uint16	Change during operation: True

Set the output frequency transferred to output terminal 27 when the terminal is configured as *[48] Bus Ctrl Timeout* in *parameter 5-60 Terminal 27 Pulse Output Variable* and a timeout is detected.

Parameter 5-95 Pulse Out #29 Bus Control

Table 270: Parameter 5-95 Pulse Out #29 Bus Control

5-95 Pulse Out #29 Bus Control		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -2	Data type: N2	Change during operation: True

Set the output frequency transferred to output terminal 29 when the terminal is configured as *[45] Bus Controlled* in *parameter 5-63 Terminal 29 Pulse Output Variable*.

Parameter 5-96 Pulse Out #29 Timeout Preset

Table 271: Parameter 5-96 Pulse Out #29 Timeout Preset

5-96 Pulse Out #29 Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: -2	Data type: Uint16	Change during operation: True

Set the output frequency transferred to output terminal 29 when the terminal is configured as *[48] Bus Ctrl Timeout* in *parameter 5-63 Terminal 29 Pulse Output Variable* and a timeout is detected.

Parameter 5-97 Pulse Out #X30/6 Bus Control

Table 272: Parameter 5-97 Pulse Out #30/6 Bus Control

5-97 Pulse Out #30/6 Bus Control		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -2	Data type: N2	Change during operation: True

Set the output frequency transferred to output terminal X30/6 when the terminal is configured as *[45] Bus ctrl.* in *parameter 5-66 Terminal X30/6 Pulse Output Variable*.

Parameter 5-98 Pulse Out #X30/6 Timeout Preset

Table 273: Parameter 5-98 Pulse Out #30/6 Timeout Preset

5-98 Pulse Out #30/6 Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: -2	Data type: Uint16	Change during operation: True

Set the output frequency transferred to output terminal X30/6 when the terminal is configured as *[48] Bus Ctrl Timeout* in *parameter 5-66 Terminal X30/6 Pulse Output Variable* and a timeout is detected.

5.7 Parameter Group 6-** Analog In/Out

5.7.1 6-0* Analog I/O Mode

The analog inputs can be allocated to be either voltage (FC 102: 0–10 V, : 0 to ±10 V) or current input (0/4–20 mA).

N O T I C E
Thermistors may be connected to either an analog or a digital input.

Parameter 6-00 Live Zero Timeout Time

Table 274: Parameter 6-00 Live Zero Timeout Time

6-00 Live Zero Timeout Time		
Default value: 10 s	Parameter type: Range, 1 - 99 s	Setup: All setup
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.

Parameter 6-01 Live Zero Timeout Function

Table 275: Parameter 6-01 Live Zero Timeout Function

6-01 Live Zero Timeout Function		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the timeout function. If the input signal on terminal 53 or 54 is below 50% of the value in

- *Parameter 6-10 Terminal 53 Low Voltage*
- *Parameter 6-12 Terminal 53 Low Current*
- *Parameter 6-20 Terminal 54 Low Voltage*
- *Parameter 6-22 Terminal 54 Low Current*

for a time period defined in *parameter 6-00 Live Zero Timeout Time*, then the function set in *parameter 6-01 Live Zero Timeout Function* is activated. If several timeouts occur simultaneously, the drive prioritizes the timeout functions as follows:

- *Parameter 6-01 Live Zero Timeout Function*
- *Parameter 8-04 Control Word Timeout Function*

Option	Name	Description
[0]*	Off	
[1]	Freeze output	Frozen at the present value.
[2]	Stop	Overruled to stop.
[3]	Jogging	Overruled to jog speed.
[4]	Max. speed	Overruled to maximum speed.
[5]	Stop and trip	Overruled to stop with subsequent trip.

Parameter 6-02 Fire Mode Live Zero Timeout Function

Table 276: Parameter 6-02 Fire Mode Live Zero Timeout Function

6-02 Fire 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 fire mode is active. The function set in this parameter is activated if the input signal on analog inputs is below 50% of the low value for a period defined in *parameter 6-00 Live Zero Timeout Time*.

Option	Name	Description
[0]*	Off	
[1]	Freeze output	Frozen at the present value.
[2]	Stop	Overruled to stop.
[3]	Jogging	Overruled to jog speed.
[4]	Max. speed	Overruled to maximum speed.

5.7.2 6-1* Analog Input 1

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

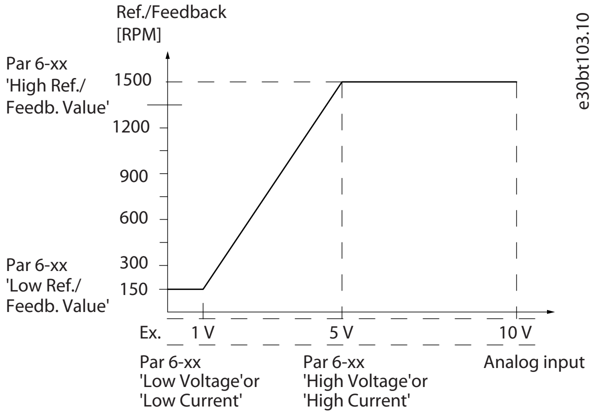


Illustration 53: Analog Input 1

Parameter 6-10 Terminal 53 Low Voltage

Table 277: Parameter 6-10 Terminal 53 Low Voltage

6-10 Terminal 53 Low Voltage		
Default value: 0.07 v	Parameter type: Range, 0 - par. 6-11 V	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Enter the low voltage value. This analog input scaling value should correspond to the minimum reference value set in *parameter 6-14 Terminal 53 Low Ref./Feedb. Value*.

Parameter 6-11 Terminal 53 High Voltage

Table 278: Parameter 6-11 Terminal 53 High Voltage

6-11 Terminal 53 High Voltage		
Default value: 10 V	Parameter type: Range, par. 6-10 V - 10 V	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Enter the high voltage value. This analog input scaling value should correspond to the high reference feedback value set in *parameter 6-15 Terminal 53 High Ref./Feedb. Value*.

Parameter 6-12 Terminal 53 Low Current

Table 279: Parameter 6-12 Terminal 53 Low Current

6-12 Terminal 53 Low Current		
Default value: 4 mA	Parameter type: Range, par. 0 - par. 6-13 mA	Setup: All setups
Conversion index: -5	Data type: Int16	Change during operation: True

Enter the low current value. This reference signal should correspond to the minimum reference value, set in *parameter 3-02 Minimum Reference*. Set the value to exceed 2 mA to activate the live zero timeout function in *parameter 6-01 Live Zero Timeout Function*.

Parameter 6-13 Terminal 53 High Current

Table 280: Parameter 6-13 Terminal 53 High Current

6-13 Terminal 53 High Current		
Default value: 20 mA	Parameter type: Range, par. par. 6-12 mA - 20 mA	Setup: All setups
Conversion index: -5	Data type: Int16	Change during operation: True

Enter the high current value corresponding to the high reference/feedback set in *parameter 6-15 Terminal 53 High Ref./Feedb. Value*.

Parameter 6-14 Terminal 53 Low Ref./Feedb. Value

Table 281: Parameter 6-14 Terminal 53 Low Ref./Feedb. Value

6-14 Terminal 53 Low Ref./Feedb. Value		
Default value: Size related	Parameter type: Range, -999999.999 - 999999.999	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the analog input scaling value that corresponds to the low voltage/low current set in *parameter 6-10 Terminal 53 Low Voltage* and *parameter 6-12 Terminal 53 Low Current*.

Parameter 6-15 Terminal 53 High Ref./Feedb. Value

Table 282: Parameter 6-15 Terminal 53 High Ref./Feedb. Value

6-15 Terminal 53 High Ref./Feedb. Value		
Default value: Size related	Parameter type: Range, -999999.999 - 999999.999	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the analog input scaling value that corresponds to the maximum reference feedback value set in *parameter 6-11 Terminal 53 High Voltage* and *parameter 6-13 Terminal 53 High Current*.

Parameter 6-16 Terminal 53 Filter Time Constant

Table 283: Parameter 6-16 Terminal 53 Filter Time Constant

6-16 Terminal 53 Filter Time Constant		
Default value: 0.005 s	Parameter type: Range, 0.005 - 10 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

NOTICE

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.

Parameter 6-17 Terminal 53 Live Zero

Table 284: Parameter 6-17 Terminal 53 Live Zero

6-17 Terminal 53 Live Zero		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Disables the live zero monitoring, for example, if the analog outputs are used as part of a decentral I/O system (if these are uesd to feed a building management system with data, and not as part of any control functions related to the drive).

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

5.7.3 6-2* Analog Input 2

Parameters for configuring the scaling and limits for analog input 2 (terminal 54).

Parameter 6-20 Terminal 54 Low Voltage

Table 285: Parameter 6-20 Terminal 54 Low Voltage

6-20 Terminal 54 Low Voltage		
Default value: 0.07 V	Parameter type: Range, 0 - par. 6-21 V	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Enter the low voltage value. This analog input scaling value should correspond to the minimum reference value set in *parameter 3-02 Minimum Reference*.

Parameter 6-21 Terminal 54 High Voltage

Table 286: Parameter 6-21 Terminal 54 High Voltage

6-21 Terminal 54 High Voltage		
Default value: 10 V	Parameter type: Range, par. 6-20 V - 10 V	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Enter the high voltage value. This analog input scaling value should correspond to the high reference feedback value set in *parameter 6-25 Terminal 54 High Ref./Feedb. Value*.

Parameter 6-22 Terminal 54 Low Current

Table 287: Parameter 6-22 Terminal 54 Low Current

6-22 Terminal 54 Low Current		
Default value: 4 mA	Parameter type: Range, par. 0 - par. 6-23 mA	Setup: All setups
Conversion index: -5	Data type: Int16	Change during operation: True

Enter the low current value. This reference signal should correspond to the minimum reference value, set in *parameter 3-02 Minimum Reference*. Enter the value that exceeds 2 mA to activate the live zero timeout function in *parameter 6-01 Live Zero Timeout Function*.

Parameter 6-23 Terminal 54 High Current

Table 288: Parameter 6-23 Terminal 54 High Current

6-23 Terminal 54 High Current		
Default value: 20 mA	Parameter type: Range, par. par. 6-22 mA - 20 mA	Setup: All setups
Conversion index: -5	Data type: Int16	Change during operation: True

Enter the high current value corresponding to the high reference feedback value set in *parameter 6-25 Terminal 54 High Ref./Feedb. Value*.

Parameter 6-24 Terminal 54 Low Ref./Feedb. Value

Table 289: Parameter 6-24 Terminal 54 Low Ref./Feedb. Value

6-24 Terminal 54 Low Ref./Feedb. Value		
Default value: 0	Parameter type: Range, -999999.999 - 999999.999	Setup: All setup
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the analog input scaling value that corresponds to the minimum reference feedback value set in *parameter 3-02 Minimum Reference*.

Parameter 6-25 Terminal 54 High Ref./Feedb. Value

Table 290: Parameter 6-25 Terminal 54 High Ref./Feedb. Value

6-25 Terminal 54 High Ref./Feedb. Value		
Default value: 100	Parameter type: Range, -999999.999 - 999999.999	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the analog input scaling value that corresponds to the maximum reference feedback value set in *parameter 3-03 Maximum Reference*.

Parameter 6-26 Terminal 54 Filter Time Constant

Table 291: Parameter 6-26 Terminal 54 Filter Time Constant

6-26 Terminal 54 Filter Time Constant		
Default value: 0.005 s	Parameter type: Range, 0.005 - 10 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

NOTICE

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.

Parameter 6-27 Terminal 54 Live Zero

Table 292: Parameter 6-27 Terminal 54 Live Zero

6-27 Terminal 54 Live Zero		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Disables the live zero monitoring, for example, if the analog outputs are used as part of a decentral I/O system (if these are uesd to feed a building management system with data, and not as part of any control functions related to the drive).

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

5.7.4 6-3* Analog Input 3 General Purpose I/O MCB 101

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

Parameter 6-30 Terminal X30/11 Low Voltage

Table 293: Parameter 6-30 Terminal X30/11 Low Voltage

6-30 Terminal X30/11 Low Voltage		
Default value: 0.07 V	Parameter type: Range,0 - par. 6-31 V	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Sets the analog input scaling value to correspond to the low reference feedback value (set in *parameter 6-34 Term. X30/11 Low Ref./Feedb. Value*).

Parameter 6-31 Terminal X30/11 High Voltage

Table 294: Parameter 6-31 Terminal X30/11 High Voltage

6-31 Terminal X30/11 High Voltage		
Default value: 10 V	Parameter type: Range, par. 6-30 V - 10 V	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Sets the analog input scaling value to correspond to the high reference feedback value (set in *parameter 6-35 Term. X30/11 High Ref./Feedb. Value*).

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

Table 295: Parameter 6-34 Term. X30/11 Low Ref./Feedb. Value

6-34 Term. X30/11 Low Ref./Feedb. Value		
Default value: 0	Parameter type: Range, -999999.999 - 999999.999	Setup: All setup
Conversion index: -3	Data type: Int32	Change during operation: True

Sets the analog input scaling value to correspond to the low voltage value (set in *parameter 6-30 Terminal X30/11 Low Voltage*).

Parameter 6-35 Term. X30/11 High Ref./Feedb. Value

Table 296: Parameter 6-35 Term. X30/11 High Ref./Feedb. Value

6-35 Term. X30/11 High Ref./Feedb. Value		
Default value: 100	Parameter type: Range, -999999.999 - 999999.999	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Sets the analog input scaling value to correspond to the high-voltage value (set in *parameter 6-31 Terminal X30/11 High Voltage*).

Parameter 6-36 Term. X30/11 Filter Time Constant

Table 297: Parameter 6-36 Term. X30/11 Filter Time Constant

6-36 Term. X30/11 Filter Time Constant		
Default value: 0.005 s	Parameter type: Range, 0.005 - 10 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

NOTICE

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.

Parameter 6-37 Term. X30/11 Filter Time Constant

Table 298: Parameter 6-37 Terminal X30/11 Live Zero

6-37 Terminal X30/11 Live Zero		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Disables the live zero monitoring, for example, if the analog outputs are used as part of a decentral I/O system (when an analog output does not fulfil any control function, but feeds a data storage device).

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

5.7.5 6-4* Analog Input X30/12

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

Parameter 6-40 Terminal X30/12 Low Voltage

Table 299: Parameter 6-40 Terminal X30/12 Low Voltage

6-40 Terminal X30/12 Low Voltage		
Default value: 0.07 V	Parameter type: Range, 0 - par. 6-41 V	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Sets the analog input scaling value to correspond to the low reference feedback value set in *parameter 6-44 Term. X30/12 Low Ref./ Feedb. Value*.

Parameter 6-41 Terminal X30/12 High Voltage

Table 300: Parameter 6-41 Terminal X30/12 High Voltage

6-41 Terminal X30/12 High Voltage		
Default value: 10 V	Parameter type: Range, par. 6-40 V - 10 V	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Sets the analog input scaling value to correspond to the high reference feedback value set in *parameter 6-45 Term. X30/12 High Ref./ Feedb. Value*.

Parameter 6-44 Term. X30/12 Low Ref./Feedb. Value

Table 301: Parameter 6-44 Term. X30/12 Low Ref./Feedb. Value

6-44 Term. X30/12 Low Ref./Feedb. Value		
Default value: 0	Parameter type: Range, -999999.999 - 999999.999	Setup: All setup
Conversion index: -3	Data type: Int32	Change during operation: True

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

Parameter 6-45 Term. X30/12 High Ref./Feedb. Value

Table 302: Parameter 6-45 Term. X30/12 High Ref./Feedb. Value

6-45 Term. X30/12 High Ref./Feedb. Value		
Default value: 100	Parameter type: Range, -999999.999 - 999999.999	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Sets the analog input scaling value to correspond to the high voltage value set in *parameter 6-41 Terminal X30/12 High Voltage*.

Parameter 6-46 Term. X30/12 Filter Time Constant

Table 303: Parameter 6-46 Term. X30/12 Filter Time Constant

6-46 Term. X30/12 Filter Time Constant		
Default value: 0.005 s	Parameter type: Range, 0.005 - 10 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

N O T I C E

This parameter cannot be adjusted while the motor is running.

Enter the filter time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal X30/12. Increasing the value improves dampening but also increases the time delay through the filter.

Parameter 6-47 Terminal X30/12 Live Zero

Table 304: Parameter 6-47 Terminal X30/12 Live Zero

6-47 Terminal X30/12 Live Zero		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Disables the live zero monitoring, for example, if the analog outputs are used as part of a decentral I/O system (when an analog output does not fulfil any control function, but feeds a data storage device).

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

5.7.6 6-5* Analog Output 1

Parameters for configuring the scaling and limits for analog output 1, that is terminal 42. Analog outputs are current outputs of 0/4–20 mA. Common terminal (terminal 39) is the same terminal and has the same electrical potential for analog common and digital common connection. The resolution on analog output is 12 bit.

Parameter 6-50 Terminal 42 Output

Table 305: Parameter 6-50 Terminal 42 Output

6-50 Terminal 42 Output		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

NOTICE

Values for setting the minimum reference are found in open loop *parameter 3-02 Minimum Reference* and in closed loop *parameter 20-13 Minimumm Reference/Feedb*. Values for maximum reference for open loop are in *parameter 3-03 Maximum Reference* and for closed loop *parameter 20-12 Maximum Reference/Feedb*.

Select the function of terminal 42 as an analog current output. Depending on the selection, the output is either a 0–20 mA or 4–20 mA output. The current value can be read out in the LCP in *parameter 16-65 Analog Output 42 [mA]*.

Option	Name	Description
[0]	No operation	Indicates no signal on the analog output.
[52]	MCO	
[53]	MCO 4–20mA	
[86]	Pressure sensor 1	
[87]	Pressure sensor 1 (4–20 mA)	
[88]	Pressure sensor 2	
[89]	Pressure sensor 2 (4–20 mA)	
[93]	Pressure sensor 3	
[94]	Pressure sensor 3 (4–20 mA)	
[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	-200% to +200% of *parameter 20-14 Maximum Reference/Feedb.*, (0–20 mA).
[103]	Motor cur. 0–I_{MAX}	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. **Example:** Inverter normal current (11 kW) is 24 A. 160 %=38.4 A. Motor normal current is 22 A, the readout is 11.46 mA. $\frac{20\text{ mA} \times 22\text{ A}}{38.4\text{ A}} = 11.46\text{ mA}$ When the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{VLT,MAX} \times 100}{I_{Motor,Nom}} = \frac{38.4 \times 100}{22} = 175\%$
[104]	Torque 0–T_{lim}	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.

Option	Name	Description
[105]	Torque 0–T_{nom}	The torque is related to the motor torque setting.
[106]	Power 0–P_{nom}	Taken from *parameter 1-20 Motor Power [kW]*.
[107]	Speed 0–$High_{Lim}$	Taken from *parameter 3-03 Maximum Reference*. 20 mA equals the value in *parameter 3-03 Maximum Reference*.
[113]	Ext. closed loop 1	0–100% (0–20 mA)
[114]	Ext. closed loop 2	0–100% (0–20 mA)
[115]	Ext. closed loop 3	0–100% (0–20 mA)
[117]	Shaft power	
[118]	Shaft power 4–20 mA	
[121]	Air pres. to flow	
[122]	Air pres. to flow	
[130]	Out frq. 0–100 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	-200% to +200% of *parameter 20-14 Maximum Reference/Feedb.*
[133]	Motor cur. 4–20mA	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 16 mA. Example: Inverter normal current (11 kW) is 24 A. 160% = 38.4 A. Motor normal current is 22 A, the readout is 13.17 mA. $\frac{16\ \text{mA} \times 22\ \text{A}}{38.4\ \text{A}} = 13.17\ \text{mA}$ If the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{VLT,\,MAX} \times 100}{I_{Motor,\,Nom}} = \frac{38.4 \times 100}{22} = 175\,\%$
[134]	Torq.0-lim 4–20mA	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[135]	Torq.0-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*.
[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 t.o.4-20mA	*Parameter 4-54 Warning Reference Low* defines the behavior of the analog output in case of fieldbus timeout.

Option	Name	Description
[143]	Ext. CL 1 4–20mA	0–100%
[144]	Ext. CL 2 4–20mA	0–100%
[145]	Ext. CL 3 4–20mA	0–100%
[184]	Mirror AI53 mA	
[185]	Mirror AI54 mA	
[186]	Pressure sensor 4	
[187]	Pressure sensor 4 (4–20 mA)	
[210]	Sensorless signal	

Parameter 6-51 Terminal 42 Output Min Scale

Table 306: Parameter 6-51 Terminal 42 Output Min Scale

6-51 Terminal 42 Output Min Scale		
Default value: 0%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Scale for the minimum output (0 mA or 4 mA) of the analog signal at terminal 42. Set the value to be the percentage of the full range of the variable selected in *parameter 6-50 Terminal 42 Output*.

Parameter 6-52 Terminal 42 Output Max Scale

Table 307: Parameter 6-52 Terminal 42 Output Max Scale

6-52 Terminal 42 Output Max Scale		
Default value: 100%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Scale the maximum output of the selected analog signal at terminal 42. Set the value to the maximum value of the current signal output. Scale the output to give a current lower than 20 mA at full scale; or 20 mA at an output below 100% of the maximum signal value. If 20 mA is the required output current at a value 0–100% of the full-scale output, program the percentage value in the parameter, that is 50% = 20 mA. If a current 4–20 mA is required at maximum output (100%), calculate the percentage value as follows: 20 mA/desired maximum current x 100%

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

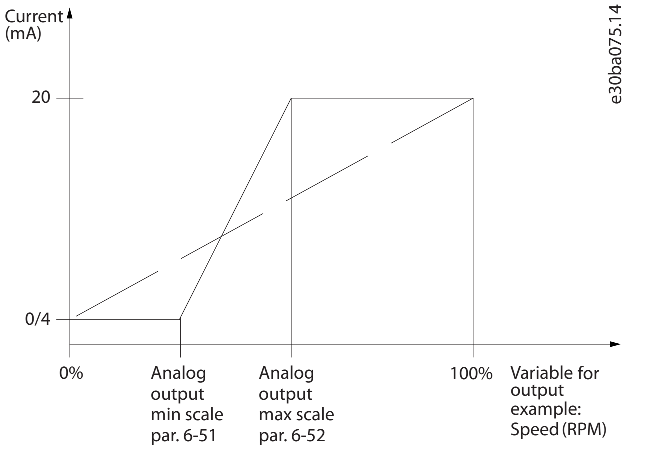


Illustration 54: Output Maximum Scale

Example 1:

Variable value = output frequency, range = 0–100 Hz. Range needed for output = 0–50 Hz. Output signal 0 mA or 4 mA is needed at 0 Hz (0% of range). Set *parameter 6-51 Terminal 42 Output Min Scale* to 0%. Output signal 20 mA is needed at 50 Hz (50% of range). Set *parameter 6-52 Terminal 42 Output Max Scale* to 50%.

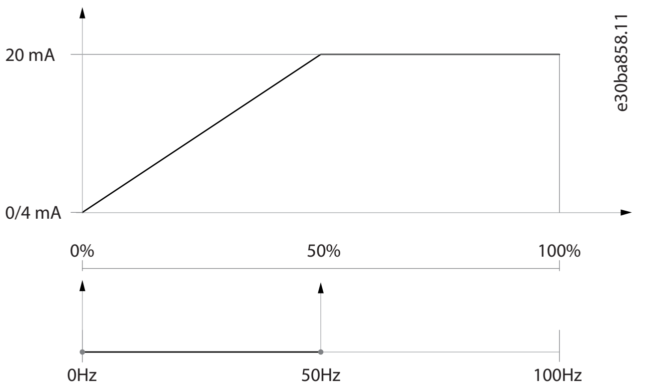


Illustration 55: Example 1, Terminal 52 Output Max Scale

Example 2:

Variable = feedback, range = -200% to +200%. Range needed for output = 0–100%. Output signal 0 mA or 4 mA is needed at 0% (50% of range). Set *parameter 6-51 Terminal 42 Output Min Scale* to 50%. Output signal 20 mA is needed at 100% (75% of range). Set *parameter 6-52 Terminal 42 Output Max Scale* to 75%.

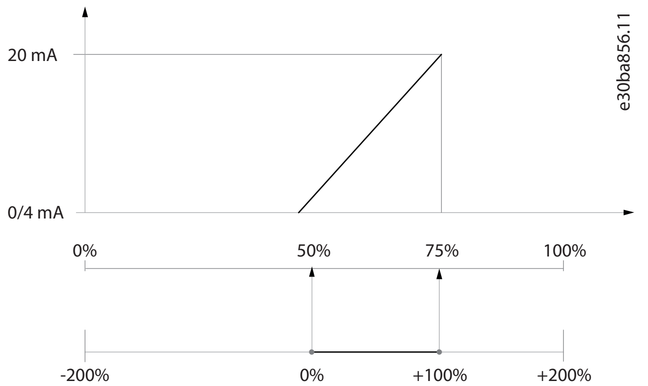


Illustration 56: Example 2, Terminal 52 Output Max Scale

Example 3:

Variable value = reference, range = minimum reference–maximum. Range needed for output = minimum reference (0%)–maximum reference (100%), 0–10 mA. Output signal 0 mA is needed at maximum reference (100% range). Set *parameter 6-52 Terminal 42 Output Max Scale* to 200% (20 mA/10 mA x 100%=200%).

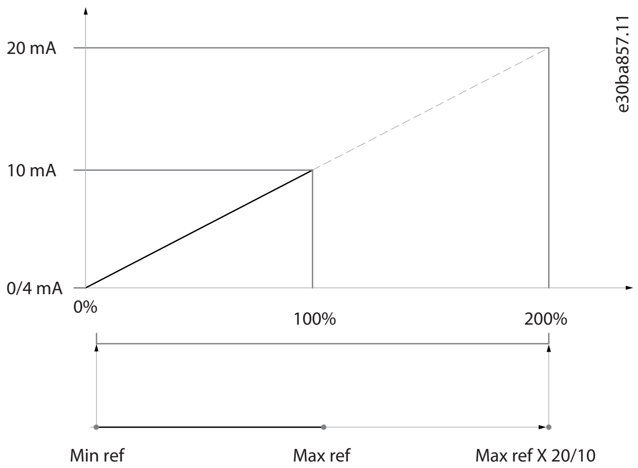


Illustration 57: Example 3, Terminal 52 Output Max Scale

Parameter 6-53 Term 42 Output Bus Ctrl

Table 308: Parameter 6-53 Term 42 Output Bus Ctrl

6-53 Term 42 Output Bus Ctrl		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -2	Data type: N2	Change during operation: True

Holds the level of output 42 if controlled by bus.

Parameter 6-54 Term 42 Output Timeout Preset

Table 309: Parameter 6-54 Term 42 Output Timeout Preset

6-54 Term 42 Output Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: -2	Data type: Uint16	Change during operation: True

Holds the preset level of output 42. If a timeout function is selected in *parameter 6-50 Terminal 42 Output*, the output is preset to this level if a fieldbus timeout occurs.

Parameter 6-55 Analog Output Filter

Table 310: Parameter 6-55 Analog Output Filter

6-55 Analog Output Filter		
Default value: [0] Off	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

The following readout parameters from selection in *parameter 6-50 Terminal 42 Output* have a filter selected when *parameter 6-55 Analog Output Filter* is on.

Table 311: Readout Parameters

Selection	0–20 mA	4–20 mA
Motor current (I_{max})	[103]	[133]
Torque limit (0–T_{lim})	[104]	[134]

Selection	0–20 mA	4–20 mA
Rated torque (0–T_{nom})	[105]	[135]
Power (0–P_{nom})	[106]	[136]
Speed (0–$Speed_{max}$)	[107]	[137]

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

5.7.7 6-6* Analog Output 2 MCB 101

Analog outputs are current outputs: 0/4–20 mA. Common terminal (terminal X30/8) is the same terminal and electrical potential for analog common communication. Resolution on analog output is 12 bit.

Parameter 6-60 Terminal X30/8 Output

Table 312: Parameter 6-60 Terminal X30/8 Output

6-60 Terminal X30/8 Output		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the function of terminal X30/8 as an analog current output.

Option	Name	Description
[0]	No operation	Indicates no signal on the analog output.
[52]	MCO	
[53]	MCO 4–20mA	
[86]	Pressure sensor 1	
[87]	Pressure sensor 1 (4–20 mA)	
[88]	Pressure sensor 2	
[89]	Pressure sensor 2 (4–20 mA)	
[93]	Pressure sensor 3	
[94]	Pressure sensor 3 (4–20 mA)	
[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	-200% to +200% of *parameter 20-14 Maximum Reference/Feedb.*, (0–20 mA).
[103]	Motor cur. 0–I_{MAX}	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. **Example:** Inverter normal current (11 kW) is 24 A. 160 %=38.4 A. Motor normal current is 22 A, the readout is 11.46 mA.

Option	Name	Description
		$\frac{20\text{ mA} \times 22\text{ A}}{38.4\text{ A}} = 11.46\text{ mA}$ When the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{VLT,MAX} \times 100}{I_{Motor,Nom}} = \frac{38.4 \times 100}{22} = 175\,\%$
[104]	Torque 0–T_{lim}	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[105]	Torque 0–T_{nom}	The torque is related to the motor torque setting.
[106]	Power 0–P_{nom}	Taken from *parameter 1-20 Motor Power [kW]*.
[107]	Speed 0–$High_{Lim}$	Taken from *parameter 3-03 Maximum Reference*. 20 mA equals the value in *parameter 3-03 Maximum Reference*.
[113]	Ext. closed loop 1	0–100% (0–20 mA)
[114]	Ext. closed loop 2	0–100% (0–20 mA)
[115]	Ext. closed loop 3	0–100% (0–20 mA)
[117]	Shaft power	
[118]	Shaft power 4–20 mA	
[121]	Air pres. to flow	
[122]	Air pres. to flow	
[130]	Out frq. 0–100 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	-200% to +200% of *parameter 20-14 Maximum Reference/Feedb.*
[133]	Motor cur. 4–20mA	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 16 mA. Example: Inverter normal current (11 kW) is 24 A. 160% = 38.4 A. Motor normal current is 22 A, the readout is 13.17 mA. $\frac{16\text{ mA} \times 22\text{ A}}{38.4\text{ A}} = 13.17\text{ mA}$ If the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{VLT,MAX} \times 100}{I_{Motor,Nom}} = \frac{38.4 \times 100}{22} = 175\,\%$
[134]	Torq.0-lim 4–20mA	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[135]	Torq.0-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*.

Option	Name	Description
[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 t.o.4-20mA	*Parameter 4-54 Warning Reference Low* defines the behavior of the analog output in case of fieldbus timeout.
[143]	Ext. CL 1 4–20mA	0–100%
[144]	Ext. CL 2 4–20mA	0–100%
[145]	Ext. CL 3 4–20mA	0–100%
[184]	Mirror AI53 mA	
[185]	Mirror AI54 mA	
[186]	Pressure sensor 4	
[187]	Pressure sensor 4 (4–20 mA)	
[210]	Sensorless signal	

Parameter 6-61 Terminal X30/8 Min. Scale

Table 313: Parameter 6-61 Terminal X30/8 Min. Scale

6-61 Terminal X30/8 Min. Scale		
Default value: 0%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Scales the minimum output of the selected analog signal on terminal X30/8. Scale the minimum value as a percentage of the maximum signal value. For example, enter the value 25% if the output should be 0 mA at 25% of the maximum output value. The value can never exceed the corresponding setting in *parameter 6-62 Terminal X30/8 Max. Scale* if the value is below 100%. This parameter is active when VLT® General Purpose I/O MCB 101 is mounted in the drive.

Parameter 6-62 Terminal X30/8 Max. Scale

Table 314: Parameter 6-62 Terminal X30/8 Max. Scale

6-62 Terminal X30/8 Max. Scale		
Default value: 100%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Scales the maximum output of the selected analog signal on terminal X30/8. Scale the value to the required maximum value of the current signal output. Scale the output to give a lower current than 20 mA at full scale or 20 mA at an output below 100% of the maximum signal value. If 20 mA is the required output current at a value between 0–100% of the fullscale output, program the percentage value in the parameter, that is 50%=20 mA. If a current 4–20 mA is required at maximum output (100%), calculate the percentage value as follows: 20 mA/desired maximum current x 100%

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

Parameter 6-63 Terminal X30/8 Bus Control

Table 315: Parameter 6-63 Terminal X30/8 Bus Control

6-63 Terminal X30/8 Bus Control		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -2	Data type: N2	Change during operation: True

Holds the level of output X30/8 if controlled by bus.

Parameter 6-64 Terminal X30/8 Output Timeout Preset

Table 316: Parameter 6-64 Terminal X30/8 Output Timeout Preset

6-64 Terminal X30/8 Output Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: -2	Data type: Uint16	Change during operation: True

Holds the preset level of output X30/8. If a timeout function is selected in *parameter 6-60 Terminal X30/8 Output*, the output is preset to this level if a fieldbus timeout occurs.

5.7.8 6-7* Analog Output 3 MCB 113

Parameters for configuring the scaling and limits for analog output 3, terminals X45/1, and X45/2. Analog outputs are current outputs: 0/4–20 mA. Resolution on analog output is 11 bit.

Parameter 6-70 Terminal X45/1 Output

Table 317: Parameter 6-70 Terminal X45/1 Output

6-70 Terminal X45/1 Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the function of terminal X45/1 as an analog current output.

Option	Name	Description
[0]*	No operation	Indicates no signal on the analog output.
[52]	MCO	
[53]	MCO 4–20mA	
[86]	Pressure sensor 1	
[87]	Pressure sensor 1 (4–20 mA)	
[88]	Pressure sensor 2	
[89]	Pressure sensor 2 (4–20 mA)	
[93]	Pressure sensor 3	
[94]	Pressure sensor 3 (4–20 mA)	
[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

Option	Name	Description
		Parameter 3-00 Reference Range [-Max - Max] -100% = 0 mA; 0% = 10 mA; +100% = 20 mA.
[102]	Feedback	-200% to +200% of *parameter 20-14 Maximum Reference/Feedb.*, (0–20 mA).
[103]	Motor cur. 0–I_{MAX}	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. **Example:** Inverter normal current (11 kW) is 24 A. 160 %=38.4 A. Motor normal current is 22 A, the readout is 11.46 mA. $\frac{20\ \text{mA} \times 22\ \text{A}}{38.4\ \text{A}} = 11.46\ \text{mA}$ When the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{\text{VLT, MAX}} \times 100}{I_{\text{Motor, Nom}}} = \frac{38.4 \times 100}{22} = 175\,\%$
[104]	Torque 0–T_{lim}	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[105]	Torque 0–T_{nom}	The torque is related to the motor torque setting.
[106]	Power 0–P_{nom}	Taken from *parameter 1-20 Motor Power [kW]*.
[107]	Speed 0–$High_{Lim}$	Taken from *parameter 3-03 Maximum Reference*. 20 mA equals the value in *parameter 3-03 Maximum Reference*.
[113]	Ext. closed loop 1	0–100% (0–20 mA)
[114]	Ext. closed loop 2	0–100% (0–20 mA)
[115]	Ext. closed loop 3	0–100% (0–20 mA)
[117]	Shaft power	
[118]	Shaft power 4–20 mA	
[121]	Air pres. to flow	
[122]	Air pres. to flow	
[130]	Out frq. 0–100 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	-200% to +200% of *parameter 20-14 Maximum Reference/Feedb.*
[133]	Motor cur. 4–20mA	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 16 mA. Example: Inverter normal current (11 kW) is 24 A. 160% = 38.4 A. Motor normal current is 22 A, the readout is 13.17 mA. $\frac{16\ \text{mA} \times 22\ \text{A}}{38.4\ \text{A}} = 13.17\ \text{mA}$ If the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{\text{VLT, MAX}} \times 100}{I_{\text{Motor, Nom}}} = \frac{38.4 \times 100}{22} = 175\,\%$

Option	Name	Description
[134]	Torq.0-lim 4–20mA	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[135]	Torq.0-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*.
[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 t.o.4-20mA	*Parameter 4-54 Warning Reference Low* defines the behavior of the analog output in case of fieldbus timeout.
[143]	Ext. CL 1 4–20mA	0–100%
[144]	Ext. CL 2 4–20mA	0–100%
[145]	Ext. CL 3 4–20mA	0–100%
[184]	Mirror AI53 mA	
[185]	Mirror AI54 mA	
[186]	Pressure sensor 4	
[187]	Pressure sensor 4 (4–20 mA)	
[210]	Sensorless signal	

Parameter 6-71 Terminal X45/1 Min. Scale

Table 318: Parameter 6-71 Terminal X45/1 Min. Scale

6-71 Terminal X45/1 Min. Scale		
Default value: 0%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Scale the minimum output of the selected analog signal at terminal X45/1 as a percentage of the maximum signal value. For example, if 0 mA (or 0 Hz) is required at 25% of the maximum output value, then program 25%. Scaling values up to 100% can never exceed the corresponding setting in *parameter 6-72 Terminal X45/1 Max. Scale*.

Parameter 6-72 Terminal X45/1 Max. Scale

Table 319: 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):

$$\frac{I_{RANGE}\,[\text{mA}]}{I_{DESIRED\ MAX}\,[\text{mA}]} \times 100\,\%$$

=

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

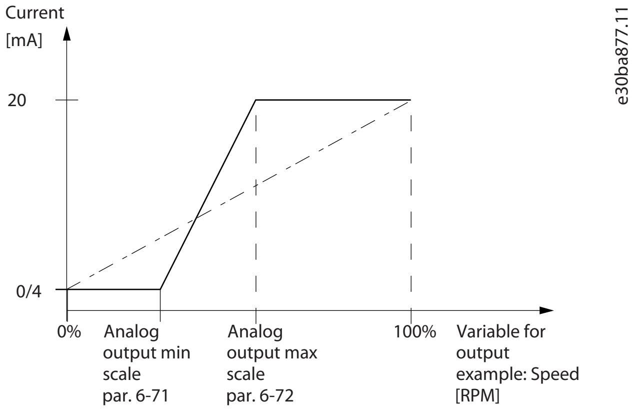


Illustration 58: Output Maximum Scale

Parameter 6-73 Terminal X45/1 Bus Control

Table 320: Parameter 6-73 Terminal X45/1 Bus Control

6-73 Terminal X45/1 Bus Control		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -2	Data type: N2	Change during operation: True

Holds the level of analog output 3 (terminal X45/1) if controlled by bus.

Parameter 6-74 Terminal X45/1 Output Timeout Preset

Table 321: Parameter 6-74 Terminal X45/1 Output Timeout Preset

6-74 Terminal X45/1 Output Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: -2	Data type: Uint16	Change during operation: True

Holds the preset level of analog output 3 (terminal X45/1). If there is a fieldbus timeout and a timeout function is selected in *parameter 6-70 Terminal X45/1 Output*, the output is preset to this level.

5.7.9 6-8* Analog Output 4 MCB 113

Parameters for configuring the scaling and limits for analog output 4, terminals X45/3 and X45/4. Analog outputs are current outputs: 0/4–20 mA. Resolution on analog output is 11 bit.

Parameter 6-80 Terminal X45/3 Output

Table 322: Parameter 6-80 Terminal X45/3 Output

6-80 Terminal X45/3 Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the function of terminal X45/3 as an analog current output.

Option	Name	Description
[0]*	No operation	Indicates no signal on the analog output.
[52]	MCO	
[53]	MCO 4–20mA	
[86]	Pressure sensor 1	
[87]	Pressure sensor 1 (4–20 mA)	
[88]	Pressure sensor 2	
[89]	Pressure sensor 2 (4–20 mA)	
[93]	Pressure sensor 3	
[94]	Pressure sensor 3 (4–20 mA)	
[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	-200% to +200% of *parameter 20-14 Maximum Reference/Feedb.*, (0–20 mA).
[103]	Motor cur. 0–I_{MAX}	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. **Example:** Inverter normal current (11 kW) is 24 A. 160 %=38.4 A. Motor normal current is 22 A, the readout is 11.46 mA. $\frac{20\ \text{mA} \times 22\ \text{A}}{38.4\ \text{A}} = 11.46\ \text{mA}$ When the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{VLT, MAX} \times 100}{I_{Motor, Nom}} = \frac{38.4 \times 100}{22} = 175\,\%$
[104]	Torque 0–T_{lim}	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[105]	Torque 0–T_{nom}	The torque is related to the motor torque setting.
[106]	Power 0–P_{nom}	Taken from *parameter 1-20 Motor Power [kW]*.
[107]	Speed 0–$High_{Lim}$	Taken from *parameter 3-03 Maximum Reference*. 20 mA equals the value in *parameter 3-03 Maximum Reference*.
[113]	Ext. closed loop 1	0–100% (0–20 mA)
[114]	Ext. closed loop 2	0–100% (0–20 mA)
[115]	Ext. closed loop 3	0–100% (0–20 mA)
[117]	Shaft power	
[118]	Shaft power 4–20 mA	

Option	Name	Description
[121]	Air pres. to flow	
[122]	Air pres. to flow	
[130]	Out frq. 0–100 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	-200% to +200% of *parameter 20-14 Maximum Reference/Feedb.*
[133]	Motor cur. 4–20mA	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 16 mA. Example: Inverter normal current (11 kW) is 24 A. 160% = 38.4 A. Motor normal current is 22 A, the readout is 13.17 mA. $\frac{16\ \text{mA} \times 22\ \text{A}}{38.4\ \text{A}} = 13.17\ \text{mA}$ If the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{VLT,MAX} \times 100}{I_{Motor,Nom}} = \frac{38.4 \times 100}{22} = 175\,\%$
[134]	Torq.0-lim 4–20mA	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[135]	Torq.0-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*.
[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 t.o.4-20mA	*Parameter 4-54 Warning Reference Low* defines the behavior of the analog output in case of fieldbus timeout.
[143]	Ext. CL 1 4–20mA	0–100%
[144]	Ext. CL 2 4–20mA	0–100%
[145]	Ext. CL 3 4–20mA	0–100%
[184]	Mirror AI53 mA	
[185]	Mirror AI54 mA	
[186]	Pressure sensor 4	
[187]	Pressure sensor 4 (4–20 mA)	
[210]	Sensorless signal	

Parameter 6-81 Terminal X45/3 Min. Scale

Table 323: Parameter 6-81 Terminal X45/3 Min. Scale

6-81 Terminal X45/3 Min. Scale		
Default value: 0%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Scales the minimum output of the selected analog signal on terminal X45/3. Scale the minimum value as a percentage of the maximum signal value, for example, 0 mA (or 0 Hz) is required at 25% of the maximum output value and 25% is programmed. The value can never exceed the corresponding setting in *parameter 6-82 Terminal X45/3 Max. Scale* if the value is below 100%. This parameter is active when VLT® Extended Relay Card MCB 113 is mounted in the drive.

Parameter 6-82 Terminal X45/3 Max. Scale

Table 324: Parameter 6-82 Terminal X45/3 Max. Scale

6-82 Terminal X45/3 Max. Scale		
Default value: 100%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Scale the maximum output of the selected analog signal at terminal X45/3. Set the value to the maximum value of the current signal output. Scale the output to give a current lower than 20 mA at full scale, or 20 mA at an output below 100% of the maximum signal value. If 20 mA is the required output current at a value between 0–100% of the full-scale output, program the percentage value in the parameter, for example 50% = 20 mA. If a current 4–20 mA is required at maximum output (100%), calculate the percentage value as follows (example where required maximum output is 10 mA):

$$\frac{I_{RANGE}\ [\text{mA}]}{I_{DESIRED\ MAX}\ [\text{mA}]} \times 100\,\%$$

=

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

Parameter 6-83 Terminal X45/3 Bus Control

Table 325: Parameter 6-83 Terminal X45/3 Bus Control

6-83 Terminal X45/3 Bus Control		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -2	Data type: N2	Change during operation: True

Holds the level of analog output 4 (terminal X45/3) if controlled by bus.

Parameter 6-84 Terminal X45/3 Output Timeout Preset

Table 326: Parameter 6-84 Terminal X45/3 Output Timeout Preset

6-84 Terminal X45/3 Output Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: -2	Data type: Uint16	Change during operation: True

Holds the preset level of output 4 (X45/3). If there is a fieldbus timeout and a timeout function is selected in *parameter 6-80 Terminal X45/3 Output*, the output is preset to this level.

5.8 Parameter Group 7-** Controllers

5.8.1 Speed PID Droop

This feature implements precise torque sharing between multiple motors on a common mechanical shaft. Speed PID droop is useful for marine and mining applications where redundancy and higher dynamics are required. Speed PID droop allows to reduce inertia by utilizing multiple small motors instead of 1 large motor.

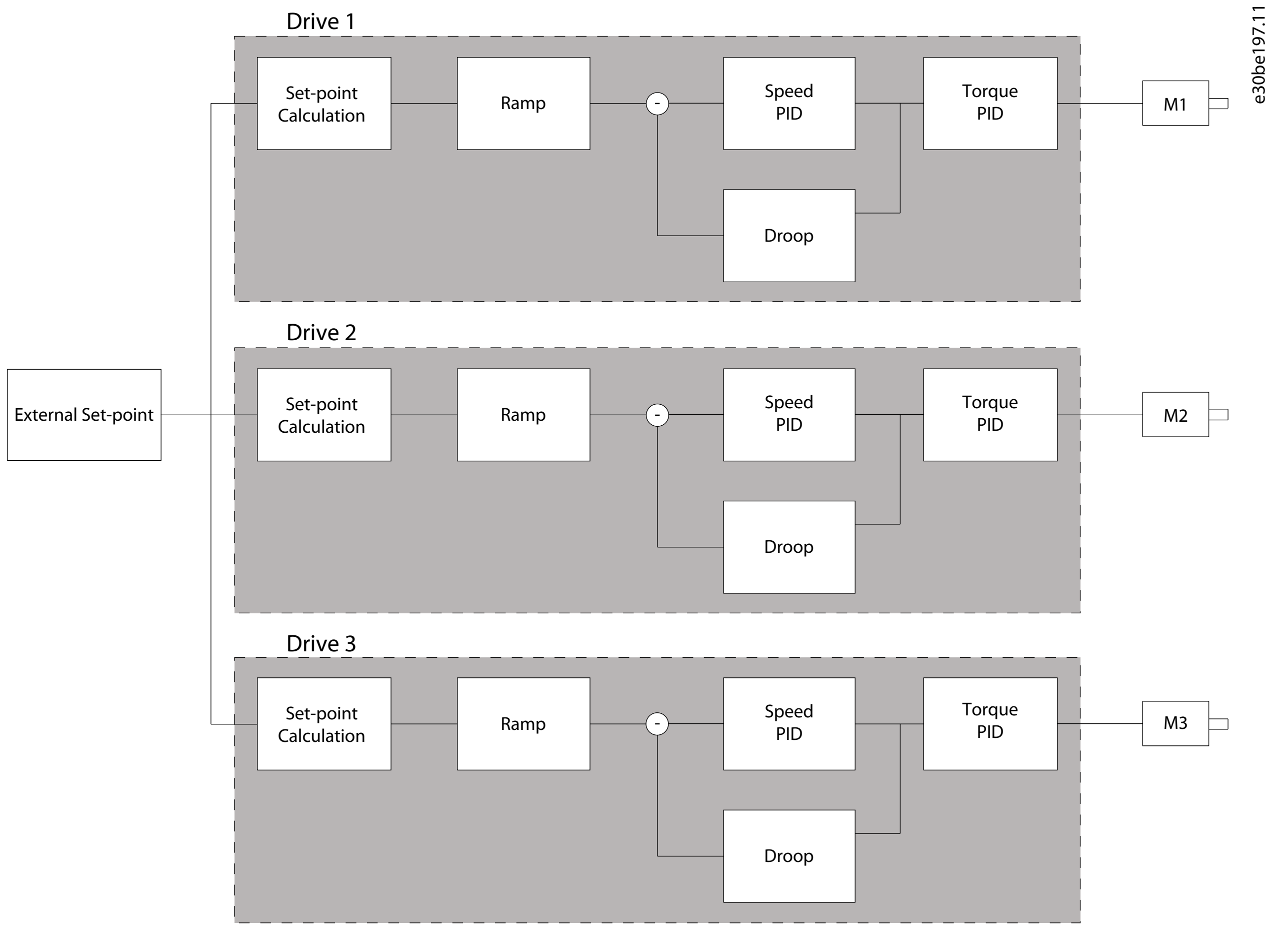


Illustration 59: Concept of Speed PID Droop

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*.

NOTICE

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

NOTICE

If the speed reference is lower than the value in *parameter 7-01 Speed PID Droop*, the drive makes the PID droop factor equal to the speed reference.

5.8.2 Speed Trim

The speed trim function is an add-on to the speed PID droop. The speed trim provides torque sharing with precise speed down to 0 RPM. The function requires wiring of analog signals.

In speed trim, the master drive runs normal speed PID without droop. The follower drives use the speed PID droop, but instead of reacting on their own load, they compare their own load to the load of other drives in the system. The follower drives then use that data as input for the speed PID droop. A setup with a single source, where the master drive sends information about torque to all followers, is limited by the number of available analog outputs on the master drive. It is possible to use a cascade principle which overcomes this limitation, but makes the control slower and less accurate. The master drive operates in speed mode. The follower drives operate in speed mode with the speed trim. The trim function uses torque data from all drives in the system.

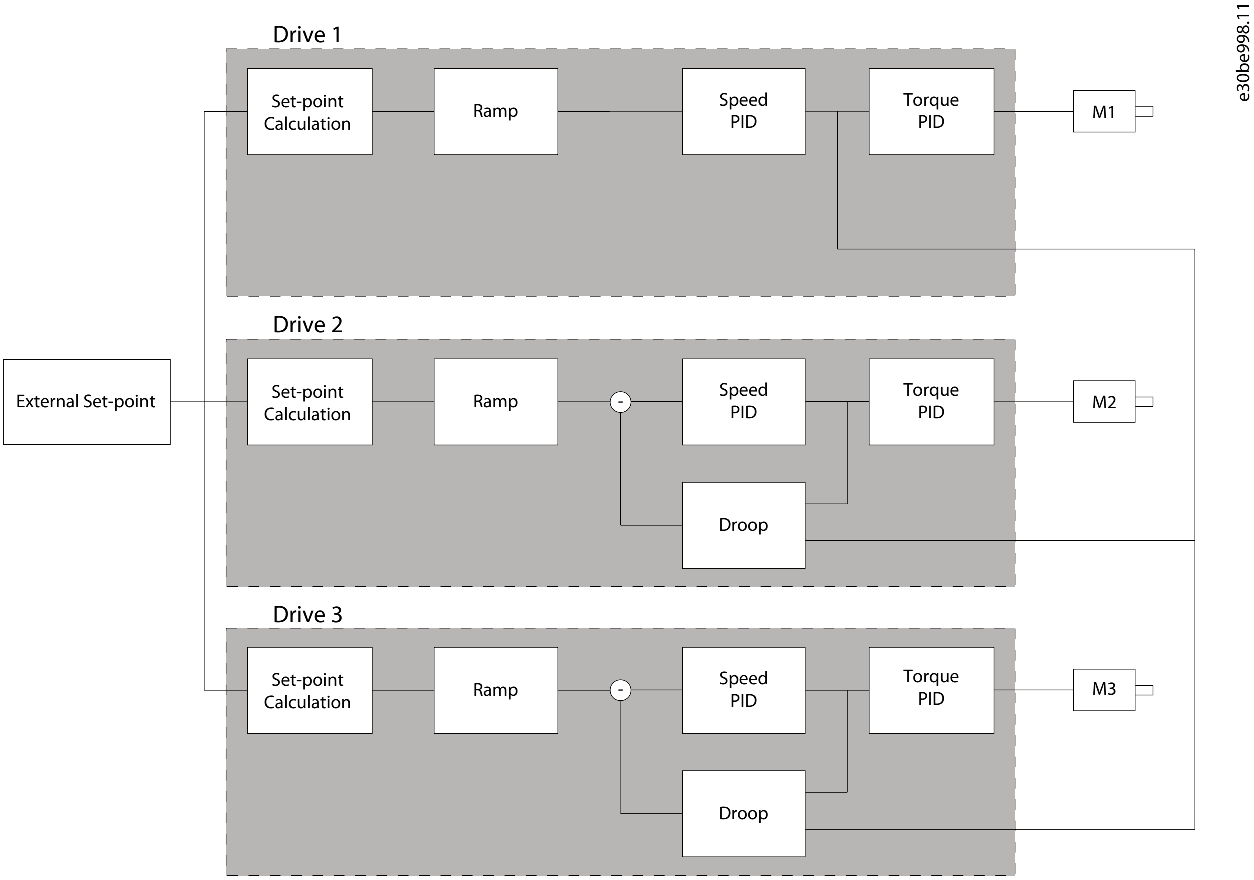


Illustration 60: Speed Trim

The drawing shows a single-source setup where the master sends the torque signal to all followers. The number of available analog outputs on the master limits this setup. To overcome the limitation of the number of analog outputs, use a cascade principle. The cascade principle makes the control slower and less accurate compared with the setup using analog outputs.

5.8.3 7-0* Speed PID Ctrl.

N O T I C E

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

Parameter 7-02 Speed PID Proportional Gain

Table 327: Parameter 7-02 Speed PID Proportional Gain

7-02 Speed PID Proportional Gain		
Default value: Size related	Parameter type: Range, 0 - 1	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

Enter the speed controller proportional gain. The proportional gain amplifies the error (that is the deviation between the feedback signal and the setpoint). This parameter is used with *parameter 1-00 Configuration Mode [0] Speed open loop* and *[1] Speed closed loop control*. Quick control is obtained at high amplification. Increasing amplification makes the process less stable. For values with 4 decimals, use *parameter 30-83 Speed PID Proportional Gain*.

Parameter 7-03 Speed PID Integral Time

Table 328: Parameter 7-03 Speed PID Integral Time

7-03 Speed PID Integral Time		
Default value: Size related	Parameter type: Range, 1.0 - 20000 ms	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: True

Enter the speed controller integral time, which determines the time the internal PID control takes to correct errors. The greater the error, the more quickly the gain increases. The integral time causes a delay of the signal and therefore a dampening effect and can be used to eliminate steady-state speed error. Obtain quick control through a short integral time, though if the integral time is too short, the process becomes unstable. An excessively long integral time disables the integral action, leading to major deviations from the required reference, since the process regulator takes too long to regulate errors. This parameter is used with *[0] Speed open loop* and *[1] Speed closed loop control*, set in *parameter 1-00 Configuration Mode*.

Parameter 7-04 Speed PID Differentiation Time

Table 329: Parameter 7-04 Speed PID Differentiation Time

7-04 Speed PID Differentiation Time		
Default value: Size related	Parameter type: Range, 0 - 200 ms	Setup: All setups
Conversion index: -4	Data type: Uint16	Change during operation: True

Enter the speed controller differentiation time. The differentiator does not react to constant error. It provides gain proportional to the rate of change of the speed feedback. The quicker the error changes, the stronger the gain from the differentiator. The gain is proportional with the speed at which errors change. Setting this parameter to 0 disables the differentiator. This parameter is used with *parameter 1-00 Configuration Mode*, *[1] Speed closed loop control*.

Parameter 7-05 Speed PID Diff. Gain Limit

Table 330: Parameter 7-05 Speed PID Diff. Gain Limit

7-05 Speed PID Diff. Gain Limit		
Default value: 5	Parameter type: Range, 1 - 20	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Set a limit for the gain provided by the differentiator. Consider limiting the gain at higher frequencies. For example, set up a pure D-link at low frequencies and a constant D-link at higher frequencies. This parameter is used with *parameter 1-00 Configuration Mode*, *[1] Speed closed loop control*.

Parameter 7-06 Speed PID Lowpass Filter Time

Table 331: Parameter 7-06 Speed PID Lowpass Filter Time

7-06 Speed PID Lowpass Filter Time		
Default value: Size related	Parameter type: Range, 0.1 - 100 ms	Setup: All setups
Conversion index: -4	Data type: Uint16	Change during operation: True

N O T I C E

Severe filtering can be detrimental to dynamic performance. This parameter is used with *parameter 1-00 Configuration Mode*, *[1] Speed closed loop* and *[2] Torque control*. Adjust the filter time in flux sensorless to 3–5 ms.

Set a time constant for the speed control low-pass filter. The low-pass filter improves steady-state performance and dampens oscillations on the feedback signal. This is an advantage if there is a great amount of noise in the system. For example, if a time constant (τ) of 100 ms is programmed, the cut-off frequency for the low-pass filter is 1/0.1 = 10 RAD/s, corresponding to (10/2 x π) = 1.6 Hz. The PID regulator only regulates a feedback signal that varies by a frequency of less than 1.6 Hz. If the feedback signal varies by a higher frequency than 1.6 Hz, the PID regulator does not react. Practical settings of *parameter 7-06 Speed PID Lowpass Filter Time* taken from the number of pulses per revolutions from encoder:

Table 332: Speed PID Low-pass Filter Time

Encoder PPR	*Parameter 7-06 Speed PID Lowpass Filter Time* [ms]
512	10
1024	5
2048	2
4096	1

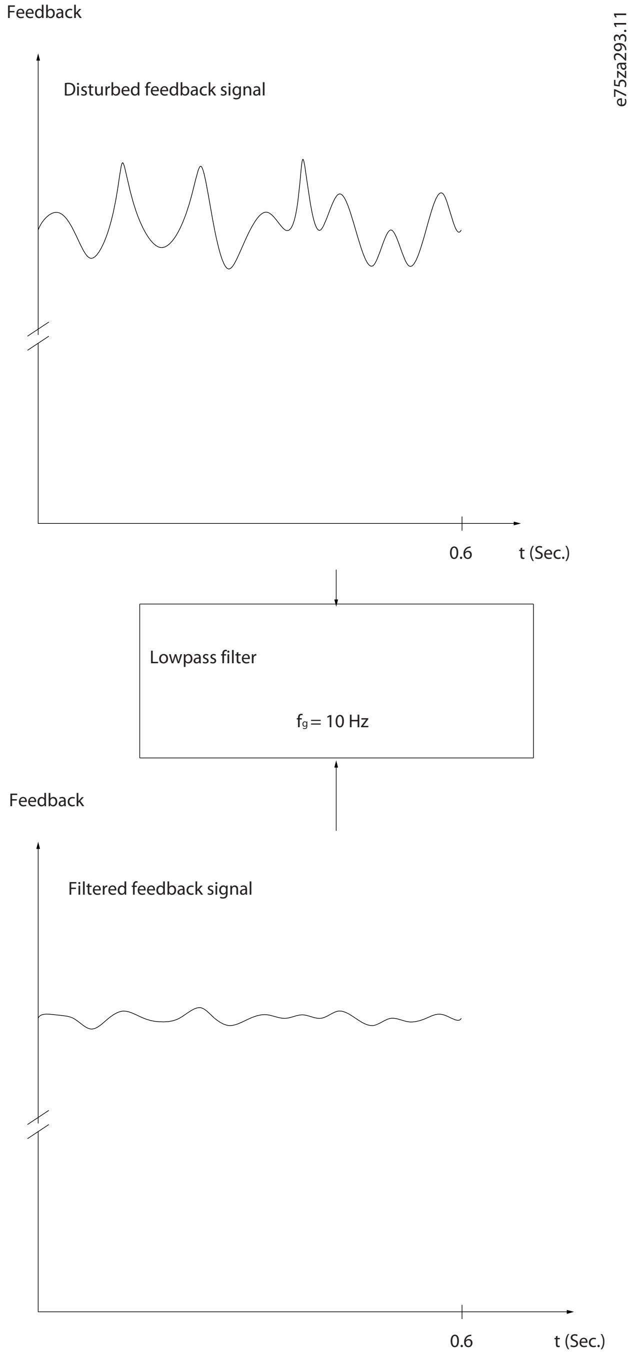


Illustration 61: Feedback Signal

Parameter 7-08 Speed PID Feed Forward Factor

Table 333: Parameter 7-08 Speed PID Feed Forward Factor

7-08 Speed PID Feed Forward Factor		
Default value: 0%	Parameter type: Range, 0 - 500%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

The reference signal bypasses the speed controller by the amount specified. This feature increases the dynamic performance of the speed control loop.

5.9 Parameter Group 8-** Communications and Options

5.9.1 8-0* General Settings

Parameter 8-01 Control Site

Table 334: Parameter 8-01 Control Site

8-01 Control Site		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

The setting in this parameter overrides the settings in *parameter 8-50 Coasting Select* to *parameter 8-56 Preset Reference Select*.

Option	Name	Description
[0]*	Digital and ctrl.word	Use both digital input and control word.
[1]	Digital only	Use digital inputs only.
[2]	Controlword only	Use control word only.

Parameter 8-02 Control Word Source

Table 335: Parameter 8-02 Control Word Source

8-02 Control Word Source		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

NOTICE

This parameter cannot be adjusted while the motor is running.

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 port*, and trips. If an option is installed after initial power-up, the setting of *parameter 8-02 Control Word Source* does not change, but the drive trips and shows: *Alarm 67, Option Changed*. When retrofitting a bus option into a drive that did not have a bus option installed earlier, change the control to bus-based. This change is required for safety reasons to avoid an unintended change.

Option	Name	Description
[0]	None	
[1]	FC port	
[2]	USB port	
[3]	Option A	
[4]	Option B	
[5]	Option C0	
[6]	Option C1	
[30]	External can	

Parameter 8-03 Control Word Timeout Time

Table 336: 8-03 Control Word Timeout Time

8-03 Control Word Timeout Time		
Default value: Size related	Parameter type: Range, 0.5 - 18000 s	Setup: 1 setup
Conversion index: -1	Data type: Uint32	Change during operation: True

Enter the maximum time expected to pass between the reception of 2 consecutive telegrams. If this time is exceeded, it indicates that the serial communication has stopped. The function selected in *parameter 8-04 Control Word Timeout Function* is then carried out. A valid control word triggers the timeout counter.

Parameter 8-04 Control Word Timeout Function

Table 337: Parameter 8-04 Control Word Timeout Function

8-04 Control Word Timeout Function		
Default value: [0] Off	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 and reference fails to be updated within the time period specified in *parameter 8-03 Control Word Timeout Time*.

N O T I C E

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.
[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*.

Option	Name	Description
[10]	Select setup 4	See *[7] Select set-up 1*.
[20]	N2 Override release	
[27]	Forced stop and trip	

Parameter 8-05 End-of-Timeout Function

Table 338: Parameter 8-05 End-of-Timeout Function

8-05 End-of-Timeout Function		
Default value: [1] Resume set-up	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Select the action after receiving a valid control word following a timeout. This parameter is active only when *parameter 8-04 Control Word Timeout Function* is set to:

- *[7] Setup 1*
- *[8] Setup 2*
- *[9] Setup 3*
- *[10] Setup 4*

Option	Name	Description
[0]	Hold set-up	Retains the setup selected in *parameter 8-04 Control Word Timeout Function* and shows a warning until *parameter 8-06 Reset Control Word Timeout* toggles. Then the drive resumes its original setup.
[1]*	Resume setup	Resumes the setup that was active before the timeout.

Parameter 8-06 Reset Control Word Timeout

Table 339: Parameter 8-06 Reset Control Word Timeout

8-06 Reset Control Word Timeout		
Default value: [0] Do not reset	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter is active only when *[0] Hold set-up* has been selected in *parameter 8-05 End-of-Timeout Function*.

Option	Name	Description
[0]*	Do not reset	Retains the setup specified in *parameter 8-04 Control Word Timeout Function*, following a control word timeout.
[1]	Do reset	Restores the drive to the original setup following a control word timeout. The drive resets and then immediately reverts to the *[0] Do not reset* setting.

Parameter 8-07 Diagnosis Trigger

Table 340: Parameter 8-07 Diagnosis Trigger

8-07 Diagnosis Trigger		
Default value: [0] Disable	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter has no function for DeviceNet.

Option	Name	Description
[0]*	Disable	
[1]	Trigger on alarms	
[2]	Trigger alarm/warn.	

Parameter 8-08 Readout Filtering

Table 341: Parameter 8-08 Readout Filtering

8-08 Readout Filtering		
Default value: Size related	Parameter type: Option, Array [1]	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Use this function if the speed feedback value readouts on the fieldbus fluctuate. Select *[1] Motor Data LP-Filter* if the function is required. A power cycle is required for changes to take effect.

Option	Name	Description
[0]	Motor data Std-Filt.	Normal fieldbus readouts.
[1]	Motor data LP-Filter	Filtered fieldbus readouts of the following parameters: • *Parameter 16-10 Power [kW]* • *Parameter 16-11 Power [hp]* • *Parameter 16-12 Motor Voltage* • *Parameter 16-14 Motor current* • *Parameter 16-16 Torque [Nm]* • *Parameter 16-17 Speed [RPM]* • *Parameter 16-22 Torque [%]* • *Parameter 16-25 Torque [Nm] High*

Parameter 8-09 Communication Charset

Table 342: Parameter 8-09 Communication Charset

8-09 Communication Charset		
Default value: Size related	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the communication character set to be supported.

Option	Name	Description
[0]	ISO 8859-1	
[1]	ANSI X3.4	
[2]	UTF-8	

5.9.2 8-1* Ctrl. Word Settings

Parameter 8-10 Control Word Profile

Table 343: Parameter 8-10 Control Word Profile

8-10 Control Word Profile		
Default value: [0] FC profile	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	Available only with VLT® DeviceNet MCA 104 and VLT® EtherNet/IP MCA 121.
[7]	CANopen DSP 402	
[22]	PROFIdrive v4_2 profile	

Parameter 8-13 Configurable Status Word STW

Table 344: Parameter 8–13 Configurable Status Word STW

8–13 Configurable Status Word STW		
Default value: [1] Profile default	Parameter type: Option, Array [16]	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the interpretation of the control and status words corresponding to the installed fieldbus. Only the selections valid for the fieldbus installed in slot A are visible in the LCP display. For more guidelines in the selection of *[1] PROFIdrive profile*, refer to the Installation Guide for the installed fieldbus.

Option	Name	Description
[0]	No function	The input is always low.
[1]	Profile default	Dependent on the profile set in *parameter 8–10 Control Profile*.
[2]	Alarm 68 Only	The input goes high whenever *Alarm 68 Safe Stop Activated* is active and goes low whenever *Alarm 68 Safe Stop Activated* is not activated.
[3]	Trip excl Alarm 68	Set if a trip occurs, unless alarm 68, Safe Torque Off is set to execute the trip.
[10]	T18DI status	The bit indicates the status of terminal 18. 0 indicates that the terminal is low. 1 indicates that the terminal is high.
[11]	T19DI status	The bit indicates the status of terminal 19. 0 indicates that the terminal is low. 1 indicates that the terminal is high.
[12]	T27DI status	The bit indicates the status of terminal 27. 0 indicates that the terminal is low. 1 indicates that the terminal is high.
[13]	T29DI status	The bit indicates the status of terminal 29. 0 indicates that the terminal is low. 1 indicates that the terminal is high.

Option	Name	Description
[14]	T32DI status	The bit indicates the status of terminal 32. 0 indicates that the terminal is low. 1 indicates that the terminal is high.
[15]	T33DI status	The bit indicates the status of terminal 33. 0 indicates that the terminal is low. 1 indicates that the terminal is high.
[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	
[21]	Thermal warning	The thermal warning turns on when the temperature exceeds the limit in the motor, drive, brake resistor, or thermistor.
[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. Use the output/ relay to cut out the main voltage from the drive.
[40]	Out of ref range	
[49]	Derate active	
[54]	Running	
[59]	On reference	
[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.
[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.

Option	Name	Description
[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 8 is evaluated as true, the output goes high. Otherwise, it is low.
[80]	SL digital out A	See *parameter group 13-52 SL Controller Action*. The output goes high whenever the smart logic action *[38] Set digital out A high* is executed. The output goes low whenever the smart logic action *[32] Set digital out A low* is executed.
[81]	SL digital out B	See *parameter group 13-52 SL Controller Action*. The output goes high whenever the smart logic action *[39] Set digital out B high* is executed. The output goes low whenever the smart logic action *[33] Set digital out B low* is executed.
[82]	SL digital out C	See *parameter group 13-52 SL Controller Action*. The output goes high whenever the smart logic action *[40] Set digital out C high* is executed. The output goes low whenever the smart logic action *[34] Set digital out C low* is executed.
[83]	SL digital out D	See *parameter group 13-52 SL Controller Action*. The output goes high whenever the smart logic action *[41] Set digital out D high* is executed. The output goes low whenever the smart logic action *[35] Set digital out D* low is executed.
[84]	SL digital out E	See *parameter group 13-52 SL Controller Action*. The output goes high whenever the smart logic action *[42] Set digital out E high* is executed. The output goes low whenever the smart logic action *[36] Set digital out E low* is executed.
[85]	SL digital out F	See *parameter group 13-52 SL Controller Action*. The output goes high whenever the smart logic action *[43] Set digital out F high* is executed. The output goes low whenever the smart logic action *[37] Set digital out F* low is executed.
[86]	ATEX ETR cur. alarm	
[87]	ATEX ETR freq. alarm	
[88]	ATEX ETR cur. warning	
[89]	ATEX ETR freq. warning	
[181]	Prev. maintenance	

Option	Name	Description
[190]	No-flow	
[191]	Dry pump	
[192]	End of curve	
[193]	Sleep mode	
[194]	Broken belt	
[196]	Fire mode	
[197]	Fire mode was active	
[198]	Fire mode limits	
[200]	User defined alerts	
[234]	Fire M. OPR unexpec-ted	
[254]	Testing fire mode	

Parameter 8-14 Configurable Control Word CTW

Table 345: Parameter 8-14 Configurable Control Word CTW

8-14 Configurable Control Word CTW		
Default value: [1] Profile default	Parameter type: Option, Array [16]	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This is an array parameter with 16 elements, 1 element for each bit in range 0–15. Each of the bits can be configured to any of the following options.

Option	Name	Description
[0]	None	The drive ignores the information in this bit.
[1]*	Profile default	Dependent on the profile set in *parameter group 8-10 Control Profile*.
[2]	CTW valid, active low	If set to 1, the drive ignores the remaining bits of the control word.
[7]	External interlock	
[15]	Relay 1	Control relay 1.
[16]	Relay 2	Control relay 1.
[22]	Digital out 27	
[23]	Digital out 29	
[24]	Digital out X30/6	
[25]	Digital out X30/7	
[33]	Bit 10 = 0 > CTW TO always	
[66]	Sleep mode	
[78]	Reset preventive maintenance word	

Option	Name	Description
[189]	Fire mode	
[190]	Fire mode ref bit 0	Enables a choice between 1 of the 8 preset references.
[191]	Fire mode ref bit 1	Enables a choice between 1 of the 8 preset references.
[192]	Fire mode ref bit 2	Enables a choice between 1 of the 8 preset references.
[193]	Fire mode setup bit 0	
[194]	Fire mode setup bit 1	
[195]	Test fire mode	Fire mode is activated in a special test mode where the drive stops on all alarms.
[235]	Setup bit 0	
[236]	Setup bit 1	

Parameter 8-19 Product Code

Table 346: Parameter 8-19 Product Code

8-19 Product Code		
Default value: Size related	Parameter type: Range, 0 - 2147483647, Array [2]	Setup: 1 setup
Conversion index: 0	Data type: Uint32	Change during operation: True

Select 0 to read out the actual fieldbus product code according to the mounted fieldbus option. Select 1 to read out the actual vendor ID.

5.9.3 8-3* FC Port Settings

Parameter 8-30 Protocol

Table 347: Parameter 8-30 Protocol

8-30 Protocol		
Default value: Size related	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	Communication according to the FC Protocol as described in the VLT® HVAC Drive FC 102 Design Guide, RS485 Installation and setup.
[1]	FC MC	Same as [0] FC but to be used when downloading SW to the drive or uploading a DLL file (covering information regarding parameters available in the drive and their inter-dependencies) to MCT 10 Setup software.
[2]	Modbus RTU	Communication according to the Modbus RTU protocol as described in the VLT® HVAC Drive FC 102 Design Guide, RS485 Installation and setup.
[3]	Metasys N2	Communication protocol. The N2 software protocol is general in nature to accommodate the unique properties each device may have. See VLT® HVAC Drive Metasys Operating Instructions.
[4]	FLN	Communication according to the Apogee FLN P1 protocol.

Op-tion	Name	Description
[5]	BACnet	Communication according to an open data communications protocol (building automation and control network), American National Standard (ANSI/ASHRAE 135-1995).
[9]	FC option	To be used when a gateway is connected to the integrated RS485 port, for example the BACnet gateway. The following changes take place: • Address for the FC port is set to 1, and *parameter 8-31 Address* is now used to set the address for the gateway on the network, for example BACnet. See VLT® HVAC Drive BACnet Operating Instruction. • Baud rate for the FC port is set to a fixed value (115.200 Baud), and *parameter 8-32 Baud Rate* is now used to set the baud rate for the network port (for example BACnet) on the gateway.
[20]	LEN	

Parameter 8-31 Address

Table 348: Parameter 8-31 Address

8-31 Address		
Default value: Size related	Parameter type: Range, 1 - 255	Setup: 1 setup
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the address for the drive (standard) port. Valid range: Depends on the selected protocol.

Parameter 8-32 FC Port Baud Rate

Table 349: Parameter 8-32 FC Port Baud Rate

8-32 FC Port Baud Rate		
Default value: Size related	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	2400 Baud	Baud rate selection for the FC (standard) port.
[1]	4800 Baud	
[2]	9600 Baud	
[3]	19200 Baud	
[4]	38400 Baud	
[5]	57600 Baud	
[6]	76800 Baud	
[7]	115200 Baud	

Parameter 8-33 Parity/Stop Bits

Table 350: Parameter 8-33 Parity/Stop Bits

8-33 Parity/Stop Bits		
Default value: Size related	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Even parity, 1 stop bit	
[1]	Odd parity, 1 stop bit	
[2]	No parity, 1 stop bit	
[3]	No parity, 2 stop bits	

Parameter 8-34 Estimated Cycle Time

Table 351: Parameter 8-34 Estimated Cycle Time

8-34 Estimated Cycle Time		
Default value: 0 ms	Parameter type: Range, 0 - 1000000 ms	Setup: 2 setups
Conversion index: -3	Data type: Uint32	Change during operation: True

In noisy environments, the interface may be blocked due to overload or bad frames. This parameter specifies the time between 2 consecutive frames on the network. If the interface does not detect valid frames in that time, it flushes the receive buffer.

Parameter 8-35 Minimum Response Delay

Table 352: Parameter 8-35 Minimum Response Delay

8-35 Minimum Response Delay		
Default value: Size related	Parameter type: Range, 5 - 10000 ms	Setup: 1 setup
Conversion index: -3	Data type: Uint16	Change during operation: True

Specify the minimum delay time between receiving a request and transmitting a response. This is used for overcoming modem turnaround delays.

Parameter 8-36 Max Response Delay

Table 353: Parameter 8-36 Max Response Delay

8-36 Max Response Delay		
Default value: Size related	Parameter type: Range, 11 - 10001 ms	Setup: 1 setup
Conversion index: -3	Data type: Uint16	Change during operation: True

Specify the maximum allowed delay time between transmitting a request and receiving a response. If a response from the drive exceeds the time setting, then it is discarded.

Parameter 8-37 Max Inter-Char Delay

Table 354: Parameter 8-37 Max Inter-Char Delay

8-37 Max Inter-Char Delay		
Default value: Size related	Parameter type: Range, 0.00 - 35.00 ms	Setup: 1 setup
Conversion index: -5	Data type: Uint16	Change during operation: True

Specify the maximum allowed time interval between receipt of 2 bytes. This parameter activates timeout if transmission is interrupted. This parameter is active only when *parameter 8-30 Protocol* is set to *[1] FC MC protocol*.

Parameter 8-39 Protocol/Profile Firmware Version

Table 355: Parameter 8-39 Protocol/Profile Firmware Version

8-39 Protocol/Profile Firmware Version		
Default value: 0	Parameter type: Range, 0 - 10, Array [8]	Setup: All setups
Conversion index: 0	Data type: VisibleString [10]	Change during operation: False

This parameter shows the firmware revision as follows:

- Index [0] = FC
- Index [1] = Modbus
- Index [2] = Metasys N2
- Index [3] = FLN
- Index [4] = BACnet
- Index [5] = Future native protocol
- Index [6] = PROFIdrive profile
- Index [7] = DS402 profile

5.9.4 8-4* FC MC Protocol Set

Parameter 8-40 Telegram Selection

Table 356: Parameter 8-40 Telegram Selection

8-40 Telegram Selection		
Default value: [1] Standard telegram 1	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[1]*	Standard telegram 1	Enables use of freely configurable telegrams or standard telegrams for the FC port.
[100]	None	
[101]	PPO 1	
[102]	PPO 2	
[103]	PPO 3	
[104]	PPO 4	
[105]	PPO 5	
[106]	PPO 6	
[107]	PPO 7	
[108]	PPO 8	
[200]	Custom telegram 1	Enables use of freely configurable telegrams or standard telegrams for the FC port.

Parameter 8-42 PCD Write Configuration

Table 357: Parameter 8-42 PCD Write Configuration

8-42 PCD Write Configuration		
Default value: Size related	Parameter type: Range, 0 - 9999, Array [64]	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Select the parameters to be assigned to the telegrams of the PCD. The number of available PCDs depends on the telegram type. The values in the PCDs are then written to the selected parameters as data values.

Parameter 8-43 PCD Read Configuration

Table 358: Parameter 8-43 PCD Read Configuration

8-43 PCD Read Configuration		
Default value: Size related	Parameter type: Range, 0 - 9999, Array [64]	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Select the parameters to be assigned to the PCDs of the telegrams. The number of available PCDs depends on the telegram type. PCDs contain the actual data values of the selected parameters.

Block Transfer Mode (BTM)

When Block Transfer Mode (BTM) is enabled, the parameters are written into a temporary buffer in the drive via the fieldbus. After wiring all the required parameters to the drive in BTM mode, a Commit command is sent to the drive. The drive ensures correct adaptation of the parameters.

5.9.5 8-5* Digital/Bus

Parameters for configuring the control word merging.

N O T I C E
These parameters are only active when *parameter 8-01 Control Site* is set to *[0] Digital and control word*.

Parameter 8-50 Coasting Select

Table 359: Parameter 8-50 Coasting Select

8-50 Coasting Select		
Default value: [3] Logic OR	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the trigger for the coasting function.

Option	Name	Description
[0]	Digital input	A digital input triggers the coasting function.
[1]	Bus	A serial communication port or the fieldbus triggers the coasting function.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the coasting function.
[3]*	Logic OR	The fieldbus/serial communication port or a digital input triggers the coasting function.

Parameter 8-52 DC Brake Select

Table 360: Parameter 8-52 DC Brake Select

8-52 DC Brake Select		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select control of the DC brake via the terminals (digital input) and/or via the fieldbus.

NOTICE

When *parameter 1-10 Motor Construction* is set to *[1] PM non-salient SPM*, only selection *[0] Digital input* is available.

Option	Name	Description
[0]	Digital input	Activate a start command via a digital input.
[1]	Bus	Activate a start command via a serial communication port or fieldbus option.
[2]	Logic AND	Activate a start command via the fieldbus/serial communication port and also via 1 of the digital inputs.
[3]	Logic OR	Activate a start command via the fieldbus/serial communication port or via 1 of the digital inputs.

Parameter 8-53 Start Select

Table 361: Parameter 8-53 Start Select

8-53 Start Select		
Default value: [3] Logic OR	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the trigger for the start function.

Option	Name	Description
[0]	Digital input	A digital input triggers the start function.
[1]	Bus	A serial communication port or the fieldbus triggers the start function.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the start function.
[3]*	Logic OR	The fieldbus/serial communication port or a digital input triggers the start function.

Parameter 8-54 Reversing Select

Table 362: Parameter 8-54 Reversing Select

8-54 Reversing Select		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the trigger for the reversing function.

Option	Name	Description
[0]	Digital input	A digital input triggers the reversing function.
[1]	Bus	A serial communication port or the fieldbus triggers the reversing function.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the reversing function.
[3]	Logic OR	The fieldbus/serial communication port or a digital input triggers the reversing function.

Parameter 8-55 Set-up Select

Table 363: Parameter 8-55 Set-up Select

8-55 Set-up Select		
Default value: [3] Logic OR	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the trigger for the setup selection.

Option	Name	Description
[0]	Digital input	A digital input triggers the setup selection.
[1]	Bus	A serial communication port or the fieldbus triggers the setup selection.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the setup selection.
[3]*	Logic OR	The fieldbus/serial communication port or a digital input triggers the setup selection.

Parameter 8-56 Preset Reference Select

Table 364: Parameter 8-56 Preset Reference Select

8-56 Preset Reference Select		
Default value: [3] Logic OR	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the trigger for the preset reference selection.

Option	Name	Description
[0]	Digital input	A digital input triggers the preset reference selection.
[1]	Bus	A serial communication port or the fieldbus triggers the preset reference selection.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the preset reference selection.
[3]*	Logic OR	The fieldbus/serial communication port or a digital input triggers the preset reference selection.

5.9.6 8-7* BACnet

Parameter 8-70 BACnet Device Instance

Table 365: Parameter 8-70 BACnet Device Instance

8-70 BACnet Device Instance		
Default value: 1	Parameter type: Range, 0 - 4194302	Setup: 1 setup
Conversion index: 0	Data type: Uint32	Change during operation: True

NOTICE

This parameter is active only when *parameter 8-30 Protocol* is set to *[5] BACnet. or [9] FC Option*.

Enter a unique ID number for the BACnet device.

Parameter 8-72 MS/TP Max Masters

Table 366: Parameter 8-72 MS/TP Max Masters

8-72 MS/TP Max Masters		
Default value: 127	Parameter type: Range, 1 - 127	Setup: 1 setup
Conversion index: 0	Data type: Uint8	Change during operation: True

NOTICE

This parameter is active only when *parameter 8-30 Protocol* is set to *[5] BACnet. or [9] FC Option*.

Define the address of the master which holds the highest address in this network. Decreasing this value optimizes polling for the token.

Parameter 8-73 MS/TP Max Info Frames

Table 367: Parameter 8-73 MS/TP Max Info Frames

8-73 MS/TP Max Info Frames		
Default value: 1	Parameter type: Range, 1 - 65534	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

NOTICE

This parameter is active only when *parameter 8-30 Protocol* is set to *[5] BACnet. or [9] FC Option*.

Define how many info/data frames the device is allowed to send while holding the token.

Parameter 8-74 "I-Am" Service

Table 368: Parameter 8-74 "I-Am" Service

8-74 "I-Am" Service		
Default value: [0] Send at power-up	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

NOTICE

This parameter is active only when *parameter 8-30 Protocol* is set to *[5] BACnet. or [9] FC Option*.

Choose whether the device should send the "I-Am" service message only at power-up or continuously with an interval of approximatley 1 minute.

Option	Name	Description
*[0]	Send at power-up	
[1]	Continuously	

Parameter 8-75 Initialisation Password

Table 369: Parameter 8-75 Initialisation Password

8-75 Initialisation Password		
Default value: Size related	Parameter type: Range, 1 - 20	Setup: 1 setup
Conversion index: 0	Data type: VisibleString [20]	Change during operation: True

N O T I C E

This parameter is active only when *parameter 8-30 Protocol* is set to *[5] BACnet. or [9] FC Option*.

Enter the password needed for execution of Drive Re-initialisation from BACnet.

Parameter 8-76 VFD Fault Code Mapping New

Table 370: Parameter 8-76 VFD Fault Code Mapping New

8-76 VFD Fault Code Mapping New		
Default value: [0] Off	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: False

N O T I C E

This parameter is active only when *parameter 8-30 Protocol* is set to *[5] BACnet. or [9] FC Option*.

If enabled a new mapping method of the p-VFD fault codes according to the ASHRAE BACnet standard is used.

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

5.9.7 8-8* FC Port Diagnostics

These parameters are used for monitoring the bus communication via the drive RS485 port terminals 68–69.

Parameter 8-80 Bus Message Count

Table 371: Parameter 8-80 Bus Message Count

8-80 Bus Message Count		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter shows the number of valid telegrams detected on the bus.

Parameter 8-81 Bus Error Count

Table 372: Parameter 8-81 Bus Error Count

8-81 Bus Error Count		
Default value: 0	Parameter type: Range, 0 - 0, Array [6]	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter shows the number of telegrams with faults (for example, CRC fault) detected on the bus.

Parameter 8-82 Slave Messages Rcvd

Table 373: Parameter 8-82 Slave Messages Rcvd

8-82 Slave Messages Rcvd		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter shows the number of valid telegrams addressed to the slave sent by the drive.

Parameter 8-83 Slave Error Count

Table 374: Parameter 8-83 Slave Error Count

8-83 Slave Error Count		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter shows the number of error telegrams which are not executed by the drive.

Parameter 8-84 Slave Message Sent

Table 375: Parameter 8-84 Slave Messages Sent

8-84 Slave Messages Sent		
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 messages sent from this drive.

Parameter 8-85 Slave Timeout Errors

Table 376: Parameter 8-85 Slave Timeout Errors

8-85 Slave Timeout Errors		
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 messages suppressed due to timeout.

Parameter 8-89 Diagnostics Count

Table 377: Parameter 8-89 Diagnostics Count

8-89 Diagnostics Count		
Default value: 0	Parameter type: Range, 2147483648–2147483647, Array [10]	Setup: 1 setup
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter shows the number of messages detected on the bus.

5.9.8 8-9* Bus Jog

Parameter 8-90 Bus Jog 1 Speed

Table 378: Parameter 8-90 Bus Jog 1 Speed

8-90 Bus Jog 1 Speed		
Default value: 100 RPM	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. This is a fixed jog speed activated via the serial port or fieldbus option.

Parameter 8-91 Bus Jog 2 Speed

Table 379: Parameter 8-91 Bus Jog 2 Speed

8-91 Bus Jog 2 Speed		
Default value: 200 RPM	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. This is a fixed jog speed activated via the serial port or fieldbus option.

Parameter 8-94 Bus Feedback 1

Table 380: Parameter 8-94 Bus Feedback 1

8-94 Bus Feedback 1		
Default value: 0	Parameter type: Range, -200 - 200	Setup: 1 setup
Conversion index: 0	Data type: N2	Change during operation: True

This parameter allows setting of a bus feedback value via the serial communication port or options. The feedback value forms part of the feedback handling. Bus feedback may be selected as feedback source.

Parameter 8-95 Bus Feedback 2

Table 381: Parameter 8-95 Bus Feedback 2

8-95 Bus Feedback 2		
Default value: 0	Parameter type: Range, -200 - 200	Setup: 1 setup
Conversion index: 0	Data type: N2	Change during operation: True

This parameter allows setting of a bus feedback value via the serial communication port or options. The feedback value forms part of the feedback handling. Bus feedback may be selected as feedback source.

Parameter 8-96 Bus Feedback 3

Table 382: Parameter 8-96 Bus Feedback 3

8-96 Bus Feedback 3		
Default value: 0	Parameter type: Range, -200 - 200	Setup: 1 setup
Conversion index: 0	Data type: N2	Change during operation: True

This parameter allows setting of a bus feedback value via the serial communication port or options. The feedback value forms part of the feedback handling. Bus feedback may be selected as feedback source.

5.10 Parameter Group 9-** PROFIBUS

Parameter 9-00 Setpoint

Table 383: Parameter 9-00 Setpoint

9-00 Setpoint		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation:

This parameter receives cyclic references from a master class 2. If the control priority is set to master class 2, the reference for the drive is taken from this parameter, whereas the cyclic reference is ignored.

Parameter 9-07 Actual Value

Table 384: Parameter 9-07 Actual Value

9-07 Actual Value		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation:

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

Parameter 9-15 PCD Write Configuration

Table 385: Parameter 9-15 PCD Write Configuration

9-15 PCD Write Configuration		
Default value: Size related	Parameter type: Option, Array [10]	Setup: 2 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	
[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 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	
[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]	Terminal 42 output bus control	
[663]	Terminal X30/8 output bus control	
[673]	Terminal X45/1 bus control	
[683]	Terminal X45/3 bus control	
[890]	Bus jog 1 speed	
[891]	Bus jog 2 speed	
[894]	Bus feedback 1	
[895]	Bus feedback 2	
[896]	Bus feedback 3	
[1680]	Fieldbus CTW 1	
[1682]	Fieldbus REF 1	
[1685]	FC port CTW 1	
[1686]	FC port REF 1	

Parameter 9-16 PCD Read Configuration

Table 386: Parameter 9-16 PCD Read Configuration

9-16 PCD Read Configuration		
Default value: Size related	Parameter type: Option, Array 10	Setup: 2 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	
[894]	Bus feedback 1	
[895]	Bus feedback 2	
[896]	Bus feedback 3	
[1397]	Alert alarm word	
[1398]	Alert warning word	
[1399]	Alert status word	

Option	Name	Description
[1500]	Operating hours	
[1501]	Running hours	
[1502]	kWh counter	
[1600]	Control word	
[1601]	Reference [unit]	
[1602]	Reference %	
[1603]	Status word	
[1605]	Main actual value [%]	
[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	
[1622]	Torque [%]	
[1623]	Motor shaft power [kW]	
[1624]	Calibrated stator resistance	
[1626]	Power filtered [kW]	
[1627]	Power filtered [hp]	
[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.	

Option	Name	Description
[1642]	Service log counter	
[1645]	Motor phase U current	
[1646]	Motor phase V current	
[1647]	Motor phase W current	
[1650]	External reference	
[1652]	Feedback[Unit]	
[1653]	Digi pot reference	
[1654]	Feedback 1 [unit]	
[1655]	Feedback 2 [unit]	
[1656]	Feedback 3 [unit]	
[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	
[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	
[1685]	FC Port CTW 1	
[1687]	Bus readout alarm/warning	

Option	Name	Description
[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	
[1830]	Analog input X42/1	
[1831]	Analog input X42/3	
[1832]	Analog input X42/5	
[1833]	Analog out X42/7 [V]	
[1834]	Analog out X42/9 [V]	
[1835]	Analog out X42/11 [V]	
[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]	
[1850]	Sensorless readout [unit]	
[1860]	Digital input 2	

Parameter 9-18 Node Address

Table 387: Parameter 9-18 Node Address

9-18 Node Address		
Default value: 126	Parameter type: Range, 1 - size related	Setup: 1 setup
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the station address in this parameter or, alternatively, in the hardware switch. To adjust the station address in this parameter, set the hardware switch to 126 or 127 (that is all switches set to ON). Otherwise, this parameter shows the actual setting of the switch.

Parameter 9-22 Telegram Selection

Table 388: Parameter 9-22 Telegram Selection

9-22 Telegram Selection		
Default value: [100] None	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Select a standard PROFIBUS telegram configuration for the drive as an alternative to the freely configurable telegrams in *parameter 9-15 PCD Write Configuration* and *parameter 9-16 PCD Read Configuration*.

Option	Name	Description
[1]	Standard telegram 1	
[100]*	None	
[101]	PPO 1	
[102]	PPO 2	
[103]	PPO 3	
[104]	PPO 4	
[105]	PPO 5	
[106]	PPO 6	
[107]	PPO 7	
[108]	PPO 8	

Parameter 9-23 Parameters for Signals

Table 389: Parameter 9-23 Parameters for Signals

9-23 Parameters for Signals		
Default value: [0] None	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint16	Change during operation: True

This parameter contains a list of signals available for selection in *parameter 9-15 PCD Write Configuration* and *parameter 9-16 PCD Read Configuration*.

Option	Name	Description
[0]*	None	
[15]	Readout: actual setup	

Option	Name	Description
[302]	Minimum reference	
[303]	Maximum reference	
[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	
[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	
[890]	Bus jog 1 speed	
[891]	Bus jog 2 speed	
[894]	Bus feedback 1	
[895]	Bus feedback 2	
[896]	Bus feedback 3	
[1397]	Alert alarm word	

Option	Name	Description
[1398]	Alert warning word	
[1399]	Alert status word	
[1500]	Operating hours	
[1501]	Running hours	
[1502]	kWh counter	
[1600]	Control word	
[1601]	Reference [unit]	
[1602]	Reference %	
[1603]	Status word	
[1605]	Main actual value [%]	
[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	
[1622]	Torque [%]	
[1623]	Motor shaft power [kW]	
[1624]	Calibrated stator resistance	
[1626]	Power filtered [kW]	
[1627]	Power filtered [hp]	
[1630]	DC link voltage	
[1632]	Brake energy /s	
[1633]	Brake energy average	
[1634]	Heatsink temp.	
[1635]	Inverter thermal	

Option	Name	Description
[1638]	SL controller state	
[1639]	Control card temp.	
[1642]	Service log counter	
[1645]	Motor phase U current	
[1646]	Motor phase V current	
[1647]	Motor phase W current	
[1650]	External reference	
[1652]	Feedback[unit]	
[1653]	Digi pot reference	
[1654]	Feedback 1 [unit]	
[1655]	Feedback 2 [unit]	
[1656]	Feedback 3 [unit]	
[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	
[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	

Option	Name	Description
[1682]	Fieldbus REF 1	
[1684]	Comm. option STW	
[1685]	FC port CTW 1	
[1686]	FC port REF 1	
[1687]	Bus readout alarm/warning	
[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	
[1830]	Analog input X42/1	
[1831]	Analog input X42/3	
[1832]	Analog input X42/5	
[1833]	Analog out X42/7 [V]	
[1834]	Analog out X42/9 [V]	
[1835]	Analog out X42/11 [V]	
[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]	
[1850]	Sensorless readout [unit]	

Option	Name	Description
[1860]	Digital input 2	
[2013]	Minimum reference/feedb.	
[2014]	Maximum reference/feedb.	
[2021]	Setpoint 1	
[2022]	Setpoint 2	
[2023]	Setpoint 3	
[2643]	Terminal X42/7 bus control	
[2653]	Terminal X42/9 bus control	
[2663]	Terminal X42/11 bus control	
[3126]	Pressure sensor 1	
[3127]	Pressure sensor 2	
[3128]	Pressure sensor 3	
[3129]	Pressure sensor 4	
[3130]	Press sens cmp state	
[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	

Option	Name	Description
[3429]	PCD 9 read from MCO	
[3430]	PCD 10 read from MCO	
[3644]	Terminal X49/7 bus control	
[3654]	Terminal X49/9 bus control	
[3664]	Terminal X49/11 bus control	
[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]	

Parameter 9-27 Parameter Edit

Table 390: Parameter 9-27 Parameter Edit

9-27 Parameter Edit		
Default value: [1] Enabled	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint16	Change during operation: False

Parameters can be edited via:

- PROFIBUS
- The standard RS485 interface
- The LCP

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

Parameter 9-28 Process Control

Table 391: Parameter 9-28 Process Control

9-28 Process Control		
Default value: [1] Enable cyclic master	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: False

Process control (setting of control word, speed reference, and process data) is possible via either PROFIBUS or standard fieldbus, but not both simultaneously. Local control is always possible via the LCP. Control via process control is possible via either terminals or fieldbus depending on the settings in *parameter 8-50 Coasting Select* to *parameter 8-56 Preset Reference Select*.

Option	Name	Description
[0]	Disable	
[1]*	Enable cyclic master	

Parameter 9-44 Fault Message Counter

Table 392: Parameter 9-44 Fault Message Counter

9-44 Fault Message Counter		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation:

Indicates the number of fault events presently stored in *parameter 9-45 Fault Code*. The buffer capacity is maximum 8 error events. The buffer and counter are set to 0 by reset or power-up.

Parameter 9-45 Fault Code

Table 393: Parameter 9-45 Fault Code

9-45 Fault Code		
Default value: 0	Parameter type: Range, N/A	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation:

This buffer contains the alarm word for all alarms and warnings that have occurred since the last reset or power-up. The buffer capacity is maximum 8 error events.

Parameter 9-47 Fault Number

Table 394: Parameter 9-47 Fault Number

9-47 Fault Number		
Default value: 0	Parameter type: Range, N/A	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation:

This buffer contains the alarm word for all alarms and warnings that have occurred since the last reset or power-up. The buffer capacity is maximum 8 error events.

Parameter 9-52 Fault Situation Counter

Table 395: Parameter 9-52 Fault Situation Counter

9-52 Fault Situation Counter		
Default value: 0	Parameter type: Range, 0 - 1000	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation:

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

Parameter 9-53 PROFIBUS Warning Word

Table 396: Parameter 9-53 PROFIBUS Warning Word

9-53 PROFIBUS Warning Word		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: V2	Change during operation: True

This parameter shows PROFIBUS communication warnings.

Table 397: 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.

Parameter 9-63 Actual Baud Rate

Table 398: Parameter 9-63 Actual Baud Rate

9-63 Actual Baud Rate		
Default value: [255] No baud rate found	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter shows the actual PROFIBUS baud rate. The PROFIBUS master automatically sets the baud rate.

Option	Name	Description
[0]	9,6 kbit/s	
[1]	19,2 kbit/s	

Option	Name	Description
[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	

Parameter 9-64 Device Identification

Table 399: Parameter 9-64 Device Identification

9-64 Device Identification		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation:

NOTICE

This parameter is not visible via LCP.

The device identification parameter. The data type is array [n] of unsigned16. The assignment of the 1st subindexes is defined and shown in the following table.

Index	Content	Value
[0]	Manufacturer	128 (for Danfoss)
[1]	Device type	1
[2]	Version	xxyy
[3]	Firmware date year	yyyy
[4]	Firmware date month	ddmm
[5]	No. of axes	Variable
[6]	Vendor specific: PB version	xxyy
[7]	Vendor specific: Database version	xxyy
[8]	Vendor specific: AOC version	xxyy
[9]	Vendor specific: MOC version	xxyy

Parameter 9-65 Profile Number

Table 400: Parameter 9-65 Profile Number

9-65 Profile Number		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: OctetString	Change during operation:

NOTICE

This parameter is not visible via LCP.

This parameter contains the profile identification. Byte 1 contains the profile number. Byte 2 contains the number of the profile.

Parameter 9-67 Control Word 1

Table 401: Parameter 9-67 Control Word 1

9-67 Control Word 1		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: V2	Change during operation:

This parameter accepts the control word from a master class 2 in the same format as PCD 1.

Parameter 9-68 Status Word 1

Table 402: Parameter 9-68 Status Word 1

9-68 Status Word 1		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: V2	Change during operation:

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

Parameter 9-70 Programming Set-up

Table 403: Parameter 9-70 Programming Set-up

9-70 Programming Set-up		
Default value: [9] Active set-up 1	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the setup to be programmed during operation.

Option	Name	Description
[0]	Factory setup	
[1]	Set-up 1	
[2]	Set-up 2	
[3]	Set-up 3	
[4]	Set-up 4	
[9]*Con	Active set-up	

Parameter 9-71 PROFIBUS Save Data Values

Table 404: Parameter 9-71 PROFIBUS Save Data Values

9-71 PROFIBUS Save Data Values		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Parameter values changed via RS485 are not automatically stored in a non-volatile memory. Use this parameter to activate a function that stores parameter values in the EEPROM non-volatile memory, so changed parameter values are retained at power-down.

Option	Name	Description
[0]*	Off	
[1]	Store all setups	
[2]	Store all setups	

Parameter 9-72 PROFIBUSDriveReset

Table 405: Parameter 9-72 PROFIBUSDriveReset

9-72 PROFIBUSDriveReset		
Default value: [0] No action	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: False

N O T I C E

Resets the VLT® PROFIBUS DP-V1 MCA 101 option only.

Option	Name	Description
[0]*	No action	
[1]	Power-on reset	
[3]	Comm option reset	

Parameter 9-80 Defined Parameters (1)

Table 406: Parameter 9-80 Defined Parameters (1)

9-80 Defined Parameters (1)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

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

Parameter 9-81 Defined Parameters (2)

Table 407: Parameter 9-81 Defined Parameters (2)

9-81 Defined Parameters (2)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

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

Parameter 9-82 Defined Parameters (3)

Table 408: Parameter 9-82 Defined Parameters (3)

9-82 Defined Parameters (3)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

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

Parameter 9-83 Defined Parameters (4)

Table 409: Parameter 9-83 Defined Parameters (4)

9-83 Defined Parameters (4)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

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

Parameter 9-84 Defined Parameters (5)

Table 410: Parameter 9-84 Defined Parameters (5)

9-84 Defined Parameters (5)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

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

Parameter 9-85 Defined Parameters (6)

Table 411: Parameter 9-85 Defined Parameters (6)

9-85 Defined Parameters (6)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

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

Parameter 9-90 Changed Parameters (1)

Table 412: Parameter 9-90 Changed Parameters (1)

9-90 Changed Parameters (1)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

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

Parameter 9-91 Changed Parameters (2)

Table 413: Parameter 9-91 Changed Parameters (2)

9-91 Changed Parameters (2)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

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

Parameter 9-92 Changed Parameters (3)

Table 414: Parameter 9-92 Changed Parameters (3)

9-92 Changed Parameters (3)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

This parameters shows a list of all the drive parameters deviating from default setting.
Parameter 9-93 Changed Parameters (4)

Table 415: Parameter 9-93 Changed Parameters (4)

9-93 Changed Parameters (4)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

This parameters shows a list of all the drive parameters deviating from default setting.
Parameter 9-94 Changed Parameters (5)

Table 416: Parameter 9-94 Changed Parameters (5)

9-94 Changed Parameters (5)		
Default value: 0	Parameter type: Range, 0 - 9999	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

This parameters shows a list of all the drive parameters deviating from default setting.
Parameter 9-99 PROFIBUS Revision Counter

Table 417: Parameter 9-99 PROFIBUS Revision Counter

9-99 PROFIBUS Revision Counter		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation:

Readout of revision count.

5.11 Parameter Group 10-** CAN Fieldbus

5.11.1 10-0* Common Settings

Parameter 10-00 CAN Protocol

Table 418: Parameter 10-00 CAN Protocol

10-00 CAN Protocol		
Default value: [1] DeviceNet	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: False

View the active CAN protocol.

Option	Name	Description
[1]*	DeviceNet	

Parameter 10-01 Baud Rate Select

Table 419: Parameter 10-01 Baud Rate Select

10-01 Baud Rate Select		
Default value: Size related	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the fieldbus transmission speed. The selection must correspond to the transmission speed of the master and of the other fieldbus nodes.

Option	Name	Description
[16]	10 Kbps	
[17]	20 Kbps	
[18]	50 Kbps	
[19]	100 Kbps	
[20]	125 Kbps	
[21]	250 Kbps	
[22]	500 Kbps	

Parameter 10-02 MAC ID

Table 420: Parameter 10-02 MAC ID

10-02 MAC ID		
Default value: Size related	Parameter type: Range, [N/A]	Setup: 2 setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Select the station address. Every station connected to the same network must have an unambiguous address.

Parameter 10-05 Readout Transmit Error Counter

Table 421: Parameter 10-05 Readout Transmit Error Counter

10-05 Readout Transmit Error Counter		
Default value: 0	Parameter type: Range, 0 - 255	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

View the number of CAN control transmission errors since the last power-up.

Parameter 10-06 Readout Receive Error Counter

Table 422: Parameter 10-06 Readout Receive Error Counter

10-06 Readout Receive Error Counter		
Default value: 0	Parameter type: Range, 0 - 255	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

View the number of CAN control receipt errors since the last power-up.

Parameter 10-07 Readout Bus Off Counter

Table 423: Parameter 10-07 Readout Bus Off Counter

10-07 Readout Bus Off Counter		
Default value: 0	Parameter type: Range, 0 - 255	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

5.11.2 10-1* DeviceNet

Parameter 10-10 Process Data Type Selection

Table 424: Parameter 10-10 Process Data Type Selection

10-10 Process Data Type Selection		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the instance (telegram) for data transmission. The instances available depend on the setting of *parameter 8-10 Control Word Profile*. When *parameter 8-10 Control Word Profile* is set to *[0] FC Profile*, options *[0] INSTANCE 100/150* and *[1] INSTANCE 101/151* in this parameter are available. When *parameter 8-10 Control Word Profile* is set to *[5] ODVA*, options *[2] INSTANCE 20/70* and *[3] INSTANCE 21/71* in this parameter are available. Instances 100/150 and 101/151 are Danfoss specific. Instances 20/70 and 21/71 are ODVA-specific AC motor profiles. For guidelines in telegram selection, refer to the VLT® DeciveNet MCA 104 Installation Guide.

N O T I C E

A change to this parameter is executed immediately.

Option	Name	Description
[0]	Instance 100/150	
[1]	Instance 101/151	
[2]	Instance 20/70	

Parameter 10-11 Process Data Config Write

Table 425: Parameter 10-11 Process Data Config Write

10-11 Process Data Config Write		
Default value: Size related	Parameter type: Option, Array 4	Setup: 2 setups
Conversion index: –	Data type: Uint16	Change during operation: True

Select the process write data for I/O Assembly Instances 101/151. Elements [2] and [3] of this array can be selected. Elements [0] and [1] of the array are fixed.

Option	Name	Description
[0]	None	
[302]	Minimum reference	
[303]	Maximum reference	
[341]	Ramp 1 ramp up time	
[342]	Ramp 1 ramp down time	
[351]	Ramp 2 ramp up time	

Option	Name	Description
[352]	Ramp 2 ramp down time	
[380]	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	
[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]	Terminal 42 output bus control	
[663]	Terminal X30/8 output bus control	
[673]	Terminal X45/1 bus control	
[683]	Terminal X45/3 bus control	
[890]	Bus jog 1 speed	
[891]	Bus jog 2 speed	
[894]	Bus feedback 1	
[895]	Bus feedback 2	
[896]	Bus feedback 3	
[1680]	Fieldbus CTW 1	
[1682]	Fieldbus REF 1	
[1685]	FC port CTW 1	
[1686]	FC port REF 1	

Parameter 10-12 Process Data Config Read

Table 426: Parameter 10-12 Process Data Config Read

10-12 Process Data Config Read		
Default value: Size related	Parameter type: Option, Array 4	Setup: 2 setups
Conversion index: –	Data type: Uint16	Change during operation: True

Select the process read data for I/O Assembly Instances 101/151. Elements [2] and [3] of this array can be selected. Elements [0] and [1] of the array are fixed.

Option	Name	Description
[0]	None	
[15]	Readout: actual setup	
[894]	Bus feedback 1	
[895]	Bus feedback 2	
[896]	Bus feedback 3	
[1397]	Alert alarm word	
[1398]	Alert warning word	
[1399]	Alert status word	
[1500]	Operating hours	
[1501]	Running hours	
[1502]	kWh counter	
[1600]	Control word	
[1601]	Reference [unit]	
[1602]	Reference %	
[1603]	Status word	
[1605]	Main actual value [%]	
[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	

Option	Name	Description
[1619]	Thermistor sensor temperature	
[1620]	Motor angle	
[1622]	Torque [%]	
[1623]	Motor shaft power [kW]	
[1624]	Calibrated stator resistance	
[1626]	Power filtered [kW]	
[1627]	Power filtered [hp]	
[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	
[1645]	Motor phase U current	
[1646]	Motor phase V current	
[1647]	Motor phase W current	
[1650]	External reference	
[1652]	Feedback[unit]	
[1653]	Digi pot reference	
[1654]	Feedback 1 [unit]	
[1655]	Feedback 2 [unit]	
[1656]	Feedback 3 [unit]	
[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	
[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	
[1685]	FC port CTW 1	
[1687]	Bus readout alarm/warning	
[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	
[1830]	Analog input X42/1	
[1831]	Analog input X42/3	
[1832]	Analog input X42/5	
[1833]	Analog out X42/7 [V]	
[1834]	Analog out X42/9 [V]	
[1835]	Analog out X42/11 [V]	
[1836]	Analog input X48/2[mA]	
[1837]	Temp. input X48/4	
[1838]	Temp. input X48/7	

Option	Name	Description
[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]	
[1850]	Sensorless readout [unit]	
[1860]	Digital input 2	
[3126]	Pressure sensor 1	
[3127]	Pressure sensor 2	
[3128]	Pressure sensor 3	
[3129]	Pressure sensor 4	
[3130]	Press sens cmp state	
[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	
[4521]	Status	
[4523]	Baseline failure	
[4590]	Stator [%]	
[4591]	Load [%]	
[4592]	Sensor 1 [%]	
[4593]	Sensor 1 [unit]	
[4594]	Sensor 2 [%]	

Option	Name	Description
[4595]	Sensor 3 [unit]	
[4596]	Sensor 3 [%]	
[4597]	Sensor 3 [unit]	
[4598]	Sensor 4 [%]	
[4599]	Sensor 4 [unit]	

Parameter 10-13 Warning Parameter

Table 427: Parameter 10-13 Warning Parameter

10-13 Warning Parameter		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

View a DeviceNet-specific warning word. One bit is assigned to every warning. Refer to the VLT® DeviceNet MCA 104 Installation Guide for further information.

Table 428: Warning Bits

Bit	Description
0	Bus not active
1	Explicit connection timeout
2	I/O connection
3	Retry limit reached
4	Actual is not updated
5	CAN bus off
6	I/O send error
7	Initialization error
8	No bus supply
9	Bus off
10	Error passive
11	Error warning
12	Duplicate MAC ID error
13	RX queue overrun
14	TX queue overrun
15	CAN overrun

Parameter 10-14 Net Reference

Table 429: Parameter 10-14 Net Reference

10-14 Net Reference		
Default value: [0] Off	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the reference source in instances 21/71 and 20/70.

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

Parameter 10-15 Net Control

Table 430: Parameter 10-15 Net Control

10-15 Net Control		
Default value: [0] Off	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the control source in instances 21/71 and 20/70.

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

5.11.3 10-2* COS Filters

Parameter 10-20 COS Filter 1

Table 431: Parameter 10-20 COS Filter 1

10-20 COS Filter 1		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Sets up the filter mask for the status word. When operating in COS (change-of-state), it is possible to filter out bits in the status word that should not be sent if they change.

Parameter 10-21 COS Filter 2

Table 432: Parameter 10-21 COS Filter 2

10-21 COS Filter 2		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Sets up the filter mask for the main actual value. When operating in COS (change-of-state), it is possible to filter out bits in the main actual value that should not be sent if they change.

Parameter 10-22 COS Filter 3

Table 433: Parameter 10-22 COS Filter 3

10-22 COS Filter 3		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Sets up the filter mask for PCD 3. When operating in COS (change-of-state), it is possible to filter out bits in PCD 3 that should not be sent if they change.

Parameter 10-23 COS Filter 4

Table 434: Parameter 10-23 COS Filter 4

10-23 COS Filter 4		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Sets up the filter mask for PCD 4. When operating in COS (change-of-state), it is possible to filter out bits in PCD 4 that should not be sent if they change.

5.11.4 10-3* Parameter Access

Parameter 10-30 Array Index

Table 435: Parameter 10-30 Array Index

10-30 Array Index		
Default value: 0	Parameter type: Range, 0 - 255	Setup: 2 setups
Conversion index: 0	Data type: Uint8	Change during operation: True

View array parameters. This parameter is only valid when a VLT® DeviceNet MCA 104 is installed.

Parameter 10-31 Store Data Values

Table 436: Parameter 10-31 Store Data Values

10-31 Store Data Values		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter is used to activate a function that stores all parameter values in the non-volatile memory, this retaining changed parameter values at power-down.

Option	Name	Description
[0]*	Off	
[1]	Store all setups	
[2]	Store all setups	

Parameter 10-32 Devicenet Revision

Table 437: Parameter 10-32 Devicenet Revision

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.

Parameter 10-33 Store Always

Table 438: Parameter 10-33 Store Always

10-33 Store Always		
Default value: [0] Off	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter is used to select whether parameter data received via the DeviceNet option should always be stored in non-volatile memory.

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

Parameter 10-34 DeviceNet Product Code

Table 439: Parameter 10-34 DeviceNet Product Code

10-34 DeviceNet Product Code		
Default value: 120	Parameter type: Range, 0 - 65535	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

Use this parameter for reading out the actual DeviceNet product code.

Parameter 10-39 Devicenet F Parameters

Table 440: Parameter 10-39 Devicenet F Parameters

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:

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

5.12 Parameter Group 11-** LonWorks

5.12.1 11-0* LonWorks ID

Parameter 11-00 Neuron ID

Table 441: Parameter 11-00 Neuron ID

11-00 Neuron ID		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: OctStr 6	Change during operation: True

View the Neuron chip's unique Neuron ID number.

5.12.2 11-1* LON Functions

Parameter 11-10 Drive Profile

Table 442: Parameter 11-10 Drive Profile

11-10 Drive Profile		
Default value: [0] VSD profile	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter allows selecting between LONMARK functional profiles.

Option	Name	Description
[0]*	VSD profile	The Danfoss Profile and the Node Object are common for all profiles.

Parameter 11-15 LON Warning Word

Table 443: Parameter 11-15 LON Warning Word

11-15 LON Warning Word		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint 16	Change during operation: True

This parameter contains the LON specific warnings.

Table 444: LON Warning Word

Bit	Status
0	Internal fault
1	Internal fault
2	Internal fault
3	Internal fault
4	Internal fault
5	Reserved
6	Reserved
7	Reserved
8	Reserved
9	Changeable types
10	Initialization error
11	Internal communication error
12	Software revision mismatch
13	Bus not active
14	Option not present
15	LON input (nvi/nci) exceeds limits

Parameter 11-17 XIF Revision

Table 445: Parameter 11-17 XIF Revision

11-17 XIF Revision		
Default value: 0	Parameter type: Range, 0 - 5	Setup: All setups
Conversion index: 0	Data type: VisStr 5	Change during operation: True

This parameter contains the version of the external interface file on the Neuron C chip on the LON option.

Parameter 11-18 LonWorks Revision

Table 446: Parameter 11-18 LonWorks Revision

11-18 LonWorks Revision		
Default value: 0	Parameter type: Range, 0 - 5	Setup: All setups
Conversion index: 0	Data type: VisStr 5	Change during operation: True

This parameter contains the software version of the application program on the Neuron C chip on the LON option.

5.12.3 11-2* LON Param. Access

Parameter 11-21 Store Data Values

Table 447: Parameter 11-21 Store Data Values

11-21 Store Data Values		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Use this parameter to activate storing of data in the volatile memory.

Option	Name	Description
[0]*	Off	The storing function is not activated.
[2]	Store all setups	All setups are stored in the volatile memory.

5.13 Parameter Group 12-** Ethernet

5.13.1 12-0* IP Settings

Parameter 12-00 IP Address Assignment

Table 448: Parameter 12-00 IP Address Assignment

12-00 IP Address Assignment		
Default value: Size related	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.

Option	Name	Description
[3]	Disable	
[10]	DCP	Assign the IP address via DCP server.
[20]	From node ID	

Parameter 12-01 IP Address

Table 449: Parameter 12-01 IP Address

12-01 IP Address		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: 1 setup
Conversion index: 0	Data type: 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.

Parameter 12-02 Subnet Mask

Table 450: Parameter 12-02 Subnet Mask

12-02 Subnet Mask		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: 1 setup
Conversion index: 0	Data type: 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*.

Parameter 12-03 Default Gateway

Table 451: Parameter 12-03 Default Gateway

12-03 Default Gateway		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: 1 setup
Conversion index: 0	Data type: 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.

Parameter 12-04 DHCP Server

Table 452: Parameter 12-04 DHCP Server

12-04 DHCP Server		
Default value: 0	Parameter type: Range, 0 - 2147483647	Setup: 2 setups
Conversion index: 0	Data type: OctStr [4]	Change during operation: True

N O T I C E

A power cycle is necessary after setting the IP parameters manually.

This parameter is read-only. It shows the IP address of the found DHCP or BOOTP server.

Parameter 12-05 Lease Expires

Table 453: Parameter 12-05 Lease Expires

12-05 Lease Expires		
Default value: Size related	Parameter type: Range, Size related	Setup: All setups
Conversion index: 0	Data type: TimeDifferenceWithDateIndication	Change during operation: True

This parameter is read-only. It shows the lease time for the current DHCP-assigned IP address.

Parameter 12-06 Name Servers

Table 454: Parameter 12-06 Name Servers

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.

Parameter 12-07 Domain Name

Table 455: Parameter 12-07 Domain Name

12-07 Domain Name		
Default value: 0	Parameter type: Range, 0 - 48	Setup: 1 setup
Conversion index: 0	Data type: VisStr 48	Change during operation: True

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

Parameter 12-08 Host Name

Table 456: Parameter 12-08 Host Name

12-08 Host Name		
Default value: 0	Parameter type: Range, 0 - 48	Setup: 1 setup
Conversion index: 0	Data type: VisStr 48	Change during operation: True

Logical (given) name of the option.

NOTICE

The display of the drive only shows the 1st 19 characters, but the remaining characters are stored in the drive. If hardware switches are different from all ON or all OFF, the switches have priority.

Parameter 12-09 Physical Address

Table 457: Parameter 12-09 Physical Address

12-09 Physical Address		
Default value: 0	Parameter type: Range, 0 - 17	Setup: 1 setup
Conversion index: 0	Data type: VisStr 17	Change during operation: True

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

5.13.2 12-1* Ethernet Link Parameters

Parameter 12-10 Link Status

Table 458: Parameter 12-10 Link Status

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	

Parameter 12-11 Link Duration

Table 459: Parameter 12-11 Link Duration

12-11 Link Duration		
Default value: Size related	Parameter type: Range, Size related, 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.

Parameter 12-12 Auto Negotiation

Table 460: Parameter 12-12 Auto Negotiation

12-12 Auto Negotiation		
Default value: [1] On	Parameter type: Option, Array 2	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Configures auto negotiation of Ethernet link parameters, for each port: ON or OFF. Link Speed and Link Duplex can be configured in *parameter 12-13 Link Speed* and *parameter 12-14 Link Duplex*.

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

Parameter 12-13 Link Speed

Table 461: Parameter 12-13 Link Speed

12-13 Link Speed		
Default value: [0] None	Parameter type: Option, Array 2	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Forces the link speed for each prot in 10 Mbps or 100 Mbps. If *parameter 12-12 Auto Negotiation* is set to *[0] On*, this parameter is read-only and shows the actual link speed. If no link is present, None is shown.

Option	Name	Description
[0]*	None	
[1]	10 Mbps	
[2]	100 Mbps	

Parameter 12-14 Link Duplex

Table 462: Parameter 12-14 Link Duplex

12-14 Link Duplex		
Default value: [1] Full duplex	Parameter type: Option, Array 2	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Forces the duplex for each port to full or half duplex. If *parameter 12-12 Auto Negotiation* is set to *[1] On*, this parameter is read-only.

Option	Name	Description
[0]	Half duplex	
[1]*	Full duplex	

Parameter 12-18 Supervisor MAC

Table 463: Parameter 12-18 Supervisor MAC

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.

Parameter 12-19 Supervisor IP Addr.

Table 464: Parameter 12-19 Supervisor IP Addr.

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.

5.13.3 12-2* Process Data

Parameter 12-20 Control Instance

Table 465: Parameter 12-20 Control Instance

12-20 Control Instance		
Default value: Size related	Parameter type: Range, 0 - 255	Setup: 1 setup
Conversion index: 0	Data type: Uint8	Change during operation: True

This parameter is read-only. It shows the connection to the master.

- In Ethernet/IP: If no CIP connection is present, None is shown.
- In EtherCAT: If no connection is active, None is shown, otherwise it shows the active PDO.

Parameter 12-21 Process Data Config Write

Table 466: Parameter 12-21 Process Data Config Write

12-21 Process Data Config Write		
Default value: Size related	Parameter type: Option, Array [20]	Setup: All setups
Conversion index: –	Data type: Uint16	Change during operation: True

Option	Name	Description
[0]	None	
[302]	Minimum reference	
[303]	Maximum reference	
[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	
[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	
[890]	Bus jog 1 speed	

Option	Name	Description
[891]	Bus jog 2 speed	
[894]	Bus feedback 1	
[895]	Bus feedback 2	
[896]	Bus feedback 3	
[1680]	Fieldbus CTW 1	
[1682]	Fieldbus REF 1	
[1685]	FC port CTW 1	
[1686]	FC port REF 1	

Parameter 12-22 Process Data Config Read

Table 467: Parameter 12-22 Process Data Config Read

12-22 Process Data Config Read		
Default value: Size related	Parameter type: Option, Array 20	Setup: All setups
Conversion index: –	Data type: Uint16	Change during operation: True

Option	Name	Description
[0]	None	
[15]	Readout: actual setup	
[894]	Bus feedback 1	
[895]	Bus feedback 2	
[896]	Bus feedback 3	
[1397]	Alert alarm word	
[1398]	Alert warning word	
[1399]	Alert status word	
[1500]	Operating hours	
[1501]	Running hours	
[1502]	kWh counter	
[1600]	Control word	
[1601]	Reference [unit]	
[1602]	Reference %	
[1603]	Status word	
[1605]	Main actual value [%]	
[1609]	Custom readout	
[1610]	Power [kW]	

Option	Name	Description
[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	
[1622]	Torque [%]	
[1623]	Motor shaft power [kW]	
[1624]	Calibrated stator resistance	
[1626]	Power filtered [kW]	
[1627]	Power filtered [hp]	
[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	
[1645]	Motor phase U current	
[1646]	Motor phase V current	
[1647]	Motor phase W current	
[1650]	External reference	
[1652]	Feedback[unit]	
[1653]	Digi pot reference	
[1654]	Feedback 1 [unit]	
[1655]	Feedback 2 [unit]	
[1656]	Feedback 3 [unit]	

Option	Name	Description
[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	
[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	
[1685]	FC port CTW 1	
[1687]	Bus readout alarm/warning	
[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	
[1830]	Analog input X42/1	

Option	Name	Description
[1831]	Analog input X42/3	
[1832]	Analog input X42/5	
[1833]	Analog out X42/7 [V]	
[1834]	Analog out X42/9 [V]	
[1835]	Analog out X42/11 [V]	
[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]	
[1850]	Sensorless readout [unit]	
[1860]	Digital input 2	

Parameter 12-27 Primary Master

Table 468: Parameter 12-27 Primary Master

12-27 Primary Master		
Default value: 0	Parameter type: Range, 0 - 4294967295, Array 2	Setup: 1 setup
Conversion index: 0	Data type: OctStr 4	Change during operation: True

Parameter 12-28 Store Data Values

Table 469: Parameter 12-28 Store Data Values

12-28 Store Data Values		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter activates a function that stores all parameter values in the non-volatile memory (EEPROM) thus retaining parameter values at power-down. The parameter returns to *[0] Off*.

Option	Name	Description
[0]*	Off	
[1]	Store all setups	
[2]	Store all setups	

Parameter 12-29 Store Always

Table 470: Parameter 12-29 Store Always

12-29 Store Always		
Default value: [0] Off	Parameter type: Option	Setup: 1 setup
Conversion index: –	Data type: Uint8	Change during operation: True

Activates a function that always stores received parameter data in the non-volatile memory (EEPROM).

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

5.13.4 12-3* EtherNet/IP

Parameter 12-30 Warning Parameter

Table 471: Parameter 12-30 Warning Parameter

12-30 Warning Parameter		
Default value: 0	Parameter type: Range, 0 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter is read-only. It shows the EthetNet/IP-specific 16-bit status word.

Table 472: 16-Bit Status Word, EtherNet/IP

Bit	Description
0	Owned
1	Not used
2	Configured
3	Not used
4	Not used
5	Not used
6	Not used
7	Not used
8	Minor recoverable fault
9	Minor unrecoverable fault
10	Major recoverable fault

Bit	Description
11	Major unrecoverable fault
12	Not used
13	Not used
14	Not used
15	Not used

Parameter 12-31 Net Reference

Table 473: Parameter 12-31 Net Reference

12-31 Net Reference		
Default value: [0] Off	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Shows the reference source in instance 21/71.

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

Parameter 12-32 Net Control

Table 474: Parameter 12-32 Net Control

12-32 Net Control		
Default value: [0] Off	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Shows the control source in instance 21/71.

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

Parameter 12-33 CIP Revision

Table 475: Parameter 12-33 CIP Revision

12-33 CIP Revision		
Default value: Size related	Parameter type: Range, 0 - 65535	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

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

Parameter 12-34 CIP Product Code

Table 476: Parameter 12-34 CIP Product Code

12-34 CIP Product Code		
Default value: Size related	Parameter type: Range, 0 - 65535	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter is read-only. It shows the CIP product code.

Parameter 12-35 EDS Parameter

Table 477: Parameter 12-35 EDS Parameter

12-35 EDS Parameter		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation:

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

Parameter 12-37 COS Inhibit Timer

Table 478: Parameter 12-37 COS Inhibit Timer

12-37 COS Inhibit Timer		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Read-only change-of-state inhibit timer. If the option is configured for COS operation, this inhibit timer can be configured in the forward open telegram to prevent that continuously changing PCD data generates extensive network traffic. The inhibit time is in ms. 0 = disabled.

Parameter 12-38 COS Filter

Table 479: Parameter 12-38 COS Filter

12-38 COS Filter		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Change-of-state PCD filters. Sets up a filter mask for each word of process data when operating in COS mode. Single bits in the PCDs can be filtered in/out.

5.13.5 12-4* Modbus TCP

Parameter 12-40 Status Parameter

Table 480: Parameter 12-40 Status Parameter

12-40 Status Parameter		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter is read-only. It shows the Modbus TCP-specific 16-bit status word.

Table 481: 16-Bit Status Word, Modbus TCP

Bit	Description	Bit = [0]	Bit = [1]
0	Link status port 1	Disconnected	Connected
1	Link status port 2	Disconnected	Connected
2	Link speed	0/10 Mbps	100 Mbps
3	Link duplex	Half	Full
4	Port 502 communication	No	Yes
5	UNUSED	–	–
6	Valid IP address	No	Yes
7	Modbus timeout (30 s)	No	Yes
8	Duplicate IP	No	Yes
9	Register 7 error	No	Yes
10	FTP server	Disabled	Enabled
11	HTTP server	Disabled	Enabled
12	SMTP server	Disabled	Enabled
13	Cable diagnosis	Disabled	Enabled
14	Auto crossover	Disabled	Enabled
15	IPMG	Disabled	Enabled

Parameter 12-41 Slave Message Count

Table 482: Parameter 12-41 Slave Message Count

12-41 Slave Message Count		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter is read-only. It shows the number of Modbus messages received and processed by the follower drive.

Parameter 12-42 Slave Exception Message Count

Table 483: Parameter 12-42 Slave Exception Message Count

12-42 Slave Exception Message Count		
Default value: 0	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter is read-only. It shows the number of Modbus messages for which the follower has sent an exception response.

5.13.6 12-4* Fieldbus Extension

Parameter 12-49 Ethernet Extended Status

Table 484: Parameter 12-49 Ethernet Extended Status

12-49 Ethernet Extended Status		
Default value: 0	Parameter type: Range, 0 - 0xFFFFFFFF	Setup: 1 setup
Conversion index: 0	Data type: Uint32	Change during operation: True

5.13.7 12-8* Other Ethernet Services

Parameter 12-80 FTP Server

Table 485: Parameter 12-80 FTP Server

12-80 FTP Server		
Default value: [0] Disabled	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Enables/disables the built-in FTP server.

Option	Name	Description
[0]*	Disabled	Disable the built-in FTP server.
[1]	Enabled	Enable the built-in FTP server.
[2]	Enabled with TLS	

Parameter 12-81 HTTP Server

Table 486: Parameter 12-81 HTTP Server

12-81 HTTP Server		
Default value: [0] Disabled	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Enables/disables the built-in HTTP (web) server.

Option	Name	Description
[0]*	Disabled	Disable the built-in HTTP (web) server.
[1]	Enabled	Enable the built-in HTTP (web) server.

Parameter 12-82 SMTP Service

Table 487: Parameter 12-82 SMTP Service

12-82 SMTP Service		
Default value: [0] Disabled	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Enables/disables the built-in SMTP (e-mail) service on the option.

Option	Name	Description
[0]*	Disabled	Disable the SMTP (e-mail) service on the option.
[1]	Enabled	Enable the SMTP (e-mail) service on the option.

Parameter 12-83 SNMP Agent

Table 488: Parameter 12-83 SNMP Agent

12-83 SNMP Agent		
Default value: [1] Enabled	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Use this parameter to either enable or disable the SNMP agent.

Option	Name	Description
[0]	Disabled	Disable the SNMP agent.
[1]*	Enabled	Enable the SNMP agent.

Parameter 12-84 Address Conflict Detection

Table 489: Parameter 12-84 Address Conflict Detection

12-84 Address Conflict Detection		
Default value: [1] Enabled	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Use this parameter to detect and resolve IP address conflict.

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

Parameter 12-85 ACD Last Conflict

Table 490: Parameter 12-85 ACD Last Conflict

12-85 ACD Last Conflict		
Default value: 0	Parameter type: Range, 0 - 2147483647	Setup: 2 setups
Conversion index: 0	Data type: OctStr 35	Change during operation: True

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

Parameter 12-89 Transparent Socket Channel Port

Table 491: Parameter 12-89 Transparent Socket Channel Port

12-89 Transparent Socket Channel Port		
Default value: Size related	Parameter type: Range, size related	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Configures the TCP port number for the transient socket channel. This enables FC telegrams to be sent transiently on Ethernet via TCP. The default value of 4000.0 indicates disabled.

5.13.8 12-9* Advanced Ethernet Services

Parameter 12-90 Cable Diagnostic

Table 492: Parameter 12-90 Cable Diagnostic

12-90 Cable Diagnostic		
Default value: [0] Disabled	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Enables/disables advanced cable diagnosis function. If enabled, the distance to cable errors can be read out in *parameter 12-93 Cable Error Length*. The parameter resumes to the default setting *[0] Disable* after the diagnostics have finished.

NOTICE

The cable diagnostics function is only issued on ports where there is no link (see *parameter 12-10 Link Status*).

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

12-91 Auto Cross Over

Table 493: Parameter 12-91 Auto Cross Over

12-91 Auto Cross Over		
Default value: [1] Enabled	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

NOTICE

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

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

Parameter 12-92 IGMP Snooping

Table 494: Parameter 12-92 IGMP Snooping

12-92 IGMP Snooping		
Default value: [1] Enabled	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

This function presents flooding of the Ethernet protocol stack by only forwarding multicast packets to ports that are a member of the multicast group.

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

Parameter 12-93 Cable Error Length

Table 495: Parameter 12-93 Cable Error Length

12-93 Cable Error Length		
Default value: 0	Parameter type: Range, 0 - 65535	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.

Parameter 12-94 Broadcast Storm Protection

Table 496: Parameter 12-94 Broadcast Storm Protection

12-94 Broadcast Storm Protection		
Default value: -1	Parameter type: Range, -1 - 20%	Setup: 2 setups
Conversion index: 0	Data type: Int8	Change during operation: True

The built-in switch is capable of protecting the switch system from receiving too many broadcast packages, which can use up network resources. The value indicates a percentage of the total bandwidth that is allowed for broadcast messages. Example: OFF means that the filter is disabled - all broadcast messages are passed through. The value 0% means that no broadcast messages are passed through. A value of 10% means that 10% of the total bandwidth is allowed for broadcast messages. If the amount of broadcast messages exceeds the 10% threshold, they are blocked.

Parameter 12-95 Inactivity Timeout

Table 497: Parameter 12-95 Inactivity Timeout

12-95 Inactivity Timeout		
Default value: 120	Parameter type: Range, 0 - 3600	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Applies to *parameter 12-94 Broadcast Storm Protection*, if the broadcast storm protection also includes multicast telegrams.

Parameter 12-96 Port Config

Table 498: Parameter 12-96 Port Config

12-96 Port Config		
Default value: Size related	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Enable or disable the port-mirroring function. The function is used for troubleshooting with a network analyzer tool.

Option	Name	Description
[0]	Normal	
[1]	Mirror port 1 to 2	
[2]	Mirror port 2 to 1	
[10]	Port 1 disabled	

Option	Name	Description
[11]	Port 2 disabled	
[254]	Mirror int. port to 1	
[255]	Mirror int. port to 2	

Parameter 12-97 QoS Priority

Table 499: Parameter 12-97 QoS Priority

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.

Parameter 12-98 Interface Counters

Table 500: Parameter 12-98 Interface Counters

12-98 Interface Counters		
Default value: 0	Parameter type: Range, 0 - 4294967296	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter is read-only. Advanced interface counters from a built-in switch can be used for low-level troubleshooting. The parameter shows a sum of port 1 + port 2.

Parameter 12-99 Media Counters

Table 501: Parameter 12-99 Media Counters

12-99 Media Counters		
Default value: 0	Parameter type: Range, 0 - 4294967296	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter is read-only. Advanced interface counters from a built-in switch can be used for low-level troubleshooting. The parameter shows a sum of port 1 + port 2.

5.14 Parameter Group 13-** Smart Logic Control

Smart logic control (SLC) is a sequence of user-defined actions (see *parameter 13-52 SL Controller 1 Action*) executed by the SLC when the associated user-defined event (see *parameter 13-51 SL Controller 1 Event*) is evaluated as true by the SLC. The condition for an event can be a particular status, or that the output from a logic rule or a comparator operand becomes true. That leads to an associated action as illustrated:

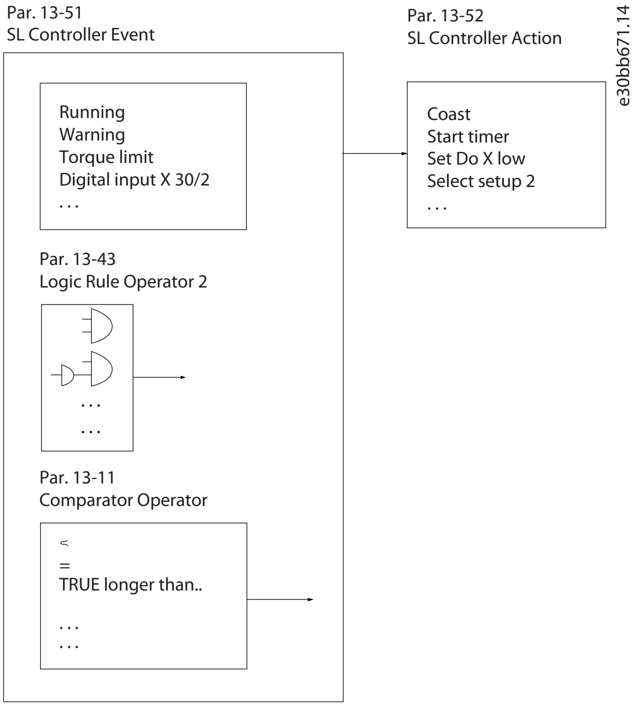


Illustration 62: Smart Logic Control (SLC)

Events and actions are each numbered and linked in pairs (states). This means that when the 1st event is fulfilled (becomes true), the 1st action is executed. After this, the conditions of the 2nd event are evaluated and if evaluated true, the 2nd action is executed, and so on. Only 1 event is evaluated at any time. If an event is evaluated as false, nothing happens (in the SLC) during the current scan interval and no other events are evaluated. This means that when the SLC starts, it evaluates the 1st event (and only the 1st event) in each scan interval. Only when the 1st event is evaluated as true, the SLC executes the 1st action and starts evaluating the 2nd event. It is possible to program 1–20 events and actions. When the last event/action has been executed, the sequence starts over again from the 1st event/action.

Four concurring sequences can be defined with each up to 20 event and action pairs. The sequences are executed at the same time but operate separately. For example, sequence 1 may have executed 3 actions, while sequence 2 still waits for its 1st event to occur. In this example, *parameter 13-00 SL Controller Mode [0]*, *parameter 13-01 Start Event [1]*, and *parameter 13-02 Stop Event [2]* correspond to sequence 1, sequence 2, sequence 3, and the like.

N O T I C E

Comparators Flip-Flops, timers, and logic rules are shared between sequences.

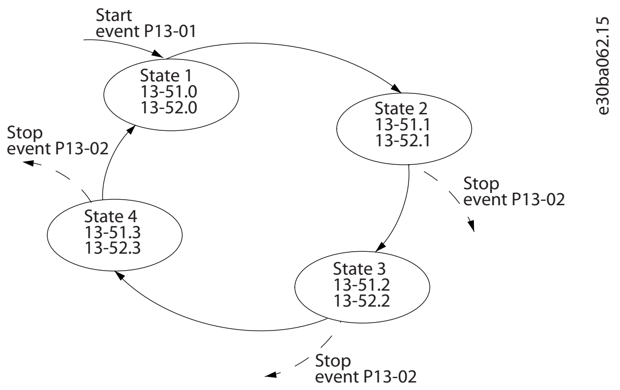


Illustration 63: Example of Events and Actions

Starting and stopping the SLC

Start and stop the SLC by selecting *[1] On* or *[0] Off* in *parameter 13-00 SL Controller Mode*. The SLC always starts in state 0 (where it evaluates event [0]). The SLC starts when the start event (defined in *parameter 13-01 Start Event*) is evaluated as true (provided that

[1] On is selected in *parameter 13-00 SL Controller Mode*). The SLC stops when the stop event (*parameter 13-02 Stop Event*) is true. *Parameter 13-03 Reset SLC* resets all SLC parameters and starts programming from scratch.

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

5.14.1 13-0* SLC Settings

Use the SLC settings to activate, deactivate, and reset the smart logic control sequence. The logic functions and comparators are always running in the background, which opens for separate control of digital inputs and outputs.

Parameter 13-00 SL Controller Mode

Table 502: Parameter 13-00 SL Controller Mode

13-00 SL Controller Mode		
Default value: Size related	Parameter type: Option, Array [4]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

An array with 4 elements [0]–[3] is shown in the display.

Option	Name	Description
[0]	Off	Disables the smart logic controller.
[1]	On	Enables the smart logic controller.

Parameter 13-01 Start Event

Table 503: Parameter 13-01 Start Event

13-01 Start Event		
Default value: Size related	Parameter type: Option, Array [4]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the boolean (true or false) input to activate smart logic control.

Option	Name	Description
[0]	False	Select the boolean (true or false) input to activate smart logic control. Enters the fixed value *False*.
[1]	True	Enters the fixed value *True*.
[2]	Running	The motor runs.
[3]	In range	The motor runs within the programmed current and speed ranges set in *parameter 4-50 Warning Current Low* to *parameter 4-53 Warning Speed High*.
[4]	On reference	The motor runs on reference.
[5]	Torque limit	The torque limit set in *parameter 4-16 Torque Limit Motor Mode* or *parameter 4-17 Torque Limit Generator Mode* is exceeded.
[6]	Current limit	The motor current limit set in *parameter 4-18 Current Limit* is exceeded.
[7]	Out of current range	The motor current is outside the range set in *parameter 4-18 Current Limit*.
[8]	Below I_{low}	The motor current is lower than set in *parameter 4-50 Warning Current Low*.
[9]	Above I_{high}	The motor current is higher than set in *parameter 4-51 Warning Current High*.

Option	Name	Description
[10]	Out of speed range	The speed is outside the range set in *parameter 4-52 Warning Speed Low* and *parameter 4-53 Warning Speed High*.
[11]	Below speed low	The output speed is lower than the setting in *parameter 4-52 Warning Speed Low*.
[12]	Above speed high	The output speed is higher than the setting in *parameter 4-53 Warning Speed High*.
[13]	Out of feedb. range	The feedback is outside the range set in *parameter 4-56 Warning Feedback Low* and *parameter 4-57 Warning Feedback High*.
[14]	Below feedb. low	The feedback is below the limit set in *parameter 4-56 Warning Feedback Low*.
[15]	Above feedb. high	The feedback is above the limit set in *parameter 4-57 Warning Feedback High*.
[16]	Thermal warning	The thermal warning turns on when the temperature exceeds the limit in the motor, the drive, the brake resistor, or the thermistor.
[17]	Mains out of range	The mains voltage is outside the specified voltage range.
[18]	Reversing	The output is high when the drive is running counterclockwise (the logical product of the status bits running AND reverse).
[19]	Warning	A warning is active.
[20]	Alarm (trip)	A (trip) alarm is active.
[21]	Alarm (trip lock)	A (trip lock) alarm is active.
[22]	Comparator 0	Use the result of comparator 0.
[23]	Comparator 1	Use the result of comparator 1.
[24]	Comparator 2	Use the result of comparator 2.
[25]	Comparator 3	Use the result of comparator 3.
[26]	Logic rule 0	Use the result of logic rule 0.
[27]	Logic rule 1	Use the result of logic rule 1.
[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.

Option	Name	Description
[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).
[90]	ECB drive mode	
[91]	ECB bypass mode	
[92]	ECB test mode	
[93]	Fire mode	
[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*.
[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.

Option	Name	Description
[235]	Logic rule 9	Use the result of logic rule 9.
[238]	RS flipflop 8	See *parameter group 13-1* Comparators*.
[239]	RS flipflop 9	See *parameter group 13-1* Comparators*.

Parameter 13-02 Stop Event

Table 504: Parameter 13-02 Stop Event

13-02 Stop Event		
Default value: Size related	Parameter type: Option, Array [4]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the boolean (true or false) input to deactivate smart logic control.

Option	Name	Description
[0]	False	Enter the fixed value of false in the logic rule.
[1]	True	Enter the fixed value of true in the logic rule.
[2]	Running	See *parameter group 5-3* Digital Outputs* for further description.
[3]	In range	See *parameter group 5-3* Digital Outputs* for further description.
[4]	On reference	See *parameter group 5-3* Digital Outputs* for further description.
[5]	Torque limit	See *parameter group 5-3* Digital Outputs* for further description.
[6]	Current limit	See *parameter group 5-3* Digital Outputs* for further description.
[7]	Out of current range	See *parameter group 5-3* Digital Outputs* for further description.
[8]	Below I_{low}	See *parameter group 5-3* Digital Outputs* for further description.
[9]	Above I_{high}	See *parameter group 5-3* Digital Outputs* for further description.
[10]	Out of speed range	
[11]	Below speed low	See *parameter group 5-3* Digital Outputs* for further description.
[12]	Above speed high	See *parameter group 5-3* Digital Outputs* for further description.
[13]	Out of feedb. range	See *parameter group 5-3* Digital Outputs* for further description.
[14]	Below feedb. low	See *parameter group 5-3* Digital Outputs* for further description.
[15]	Above feedb. high	See *parameter group 5-3* Digital Outputs* for further description.
[16]	Thermal warning	See *parameter group 5-3* Digital Outputs* for further description.
[17]	Mains out of range	See *parameter group 5-3* Digital Outputs* for further description.
[18]	Reversing	See *parameter group 5-3* Digital Outputs* for further description.
[19]	Warning	See *parameter group 5-3* Digital Outputs* for further description.
[20]	Alarm (trip)	See *parameter group 5-3* Digital Outputs* for further description.
[21]	Alarm (trip lock)	See *parameter group 5-3* Digital Outputs* for further description.

Option	Name	Description
[22]	Comparator 0	Use the result of comparator 0 in the logic rule.
[23]	Comparator 1	Use the result of comparator 1 in the logic rule.
[24]	Comparator 2	Use the result of comparator 2 in the logic rule.
[25]	Comparator 3	Use the result of comparator 3 in the logic rule.
[26]	Logic rule 0	Use the result of logic rule 0 in the logic rule.
[27]	Logic rule 1	Use the result of logic rule 1 in the logic rule.
[28]	Logic rule 2	Use the result of logic rule 2 in the logic rule.
[29]	Logic rule 3	Use the result of logic rule 3 in the logic rule.
[30]	SL time-out 0	Use the result of timer 0 in the logic rule.
[31]	SL time-out 1	Use the result of timer 1 in the logic rule.
[32]	SL timeout 2	Use the result of timer 2 in the logic rule.
[33]	Digital input DI18	Use the value of DI18 in the logic rule (high=true).
[34]	Digital input DI19	Use the value of DI19 in the logic rule (high=true).
[35]	Digital input DI27	Use the value of DI27 in the logic rule (high=true).
[36]	Digital input DI29	Use the value of DI29 in the logic rule (high=true).
[37]	Digital input DI32	Use the value of DI32 in the logic rule (high=true).
[38]	Digital input DI33	Use the value of DI33 in the logic rule (high=true).
[39]	Start command	This event is true if the drive is started (either via digital input, fieldbus, or other).
[40]	Drive stopped	This event is true if the drive is stopped or coasted (either via digial input, fieldbus, or other).
[41]	Reset trip	This event is true if the drive is tripped (but not trip locked) and [Reset] is pressed.
[42]	Auto-reset trip	This event is true if the drive is tripped (but not trip locked) and an automatic reset is issued.
[43]	OK key	This event is true if [OK] is pressed.
[44]	Reset key	This event is true if [Reset] is pressed.
[45]	Left key	This event is true [◂]
[46]	Right key	[▸]
[47]	Up key	[▴]
[48]	Down key	[▾]
[50]	Comparator 4	Use the result of comparator 4 in the logic rule.
[51]	Comparator 5	Use the result of comparator 5 in the logic rule.
[60]	Logic rule 4	Use the result of logic rule 4 in the logic rule.
[61]	Logic rule 5	Use the result of logic rule 5 in the logic rule.
[70]	SL time-out 3	Smart logic controller time 3 is timed out.

Option	Name	Description
[71]	SL time-out 4	Smart logic controller time 4 is timed out.
[72]	SL time-out 5	Smart logic controller time 5 is timed out.
[73]	SL time-out 6	Smart logic controller time 6 is timed out.
[74]	SL time-out 7	Smart logic controller time 7 is timed out.
[75]	Start command given	
[76]	Digital input X30/2	
[77]	Digital input X30/3	
[78]	Digital input X30/4	
[80]	No flow	
[81]	Dry pump	
[82]	End of curve	
[83]	Broken belt	
[90]	ECB drive mode	
[91]	ECB bypass mode	
[92]	ECB test mode	
[93]	Fire mode	
[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*.
[103]	Relay 1	
[104]	Relay 2	
[109]	Relay 7	X34/VLT® Relay Card MCB 105.
[110]	Relay 8	X34/VLT® Relay Card MCB 105.
[111]	Relay 9	X34/VLT® Relay Card MCB 105.
[140]	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.
[141]	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.

Option	Name	Description
[142]	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.
[143]	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.
[144]	Pressure 1 low	
[145]	Pressure 2 low	
[146]	Pressure 3 low	
[147]	Pressure 4 low	
[148]	Pressure 1 high	
[149]	Pressure 2 high	
[150]	Pressure 3 high	
[151]	Pressure 4 high	
[228]	Comparator 6	Use the result of comparator 6 in the logic rule.
[229]	Comparator 7	Use the result of comparator 7 in the logic rule.
[230]	Comparator 8	Use the result of comparator 8 in the logic rule.
[231]	Comparator 9	Use the result of comparator 9 in the logic rule.
[232]	Logic rule 6	Use the result of logic rule 6 in the logic rule.
[233]	Logic rule 7	Use the result of logic rule 7 in the logic rule.
[234]	Logic rule 8	Use the result of logic rule 8 in the logic rule.
[235]	Logic rule 9	Use the result of logic rule 9 in the logic rule.
[236]	SL time-out 8	Smart logic controller time 8 is timed out.
[237]	SL time-out 9	Smart logic controller time 9 is timed out.
[238]	RS flipflop 8	See *parameter group 13-1* Comparators*.
[239]	RS flipflop 9	See *parameter group 13-1* Comparators*.
[240]	SL digital output A	
[241]	SL digital output B	
[242]	SL digital output C	
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

Parameter 13-03 Reset SLC

Table 505: Parameter 13-03 Reset SLC

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*

5.14.2 13-1* Comparators

Comparators are used for comparing continuous variables (that is output frequency, output current, analog input, and so on) to fixed preset values.

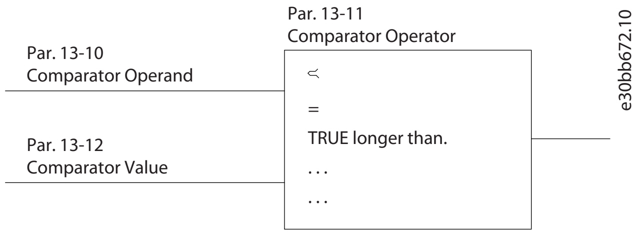


Illustration 64: Comparators

There are digital values that are compared to fixed time values. See the explanation in *parameter 13-10 Comparator Operand*. Comparators are evaluated once in each scan interval. Use the result (true or false) directly. All parameters in this parameter group are array parameters with index 0–9. Select index 0 to program comparator 0, select index 1 to program comparator 1, and so on.

Parameter 13-10 Comparator Operand

Table 506: Parameter 13-10 Comparator Operand

13-10 Comparator Operand		
Default value: Size related	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Options *[1] Reference %* to *[31] Counter B* are variables, which are compared based on their values. Options *[50] FALSE* to *[186] Drive in auto mode* are digital values (true/false) where the comparison is based on the amount of time during which they are set to true or false. See *parameter 13-11 Comparator Operator*.

Option	Name	Description
[0]	DISABLED	The comparator is disabled.
[1]	Reference %	The resulting remote reference in %.
[2]	Feedback %	[RPM] or [Hz], as set in *parameter 0-02 Motor Speed Unit*.
[3]	Motor speed	[RPM] or [Hz], as set in *parameter 0-02 Motor Speed Unit*.
[4]	Motor current	
[5]	Motor torque	
[6]	Motor power	
[7]	Motor voltage	

Option	Name	Description
[8]	DC-link voltage	
[9]	Motor thermal	The value is in %.
[10]	Drive thermal	The value is in %.
[11]	Heat sink temp.	The value is in %.
[12]	Analog input AI53	The value is in %.
[13]	Analog input AI54	The value is in %.
[14]	Analog input AIFB10	AIFB10 is internal 10 V supply.
[15]	Analog input AIS24V	AIS24V is a 24 V switch mode power supply.
[17]	Analog input AICCT	Value is in [°]. 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. **NOTICE** With this selection, it is not possible to use < and > as comparator operators. **NOTICE** Several alarms/warnings can be present at the same time. As the alarm/warning numbers are not grouped in a predefined order, defining a range is not relevant.
[21]	Warning number	Shows the actual warning number. **NOTICE** With this selection, it is not possible to use < and > as comparator operators. **NOTICE** Several alarms/warnings can be present at the same time. As the alarm/warning numbers are not grouped in a predefined order, defining a range is not relevant.
[22]	Analog input X30/11	
[23]	Analog input X30/12	
[24]	Sensorless flow	
[25]	Sensorless pressure	
[29]	Number of pump running	
[30]	Counter A	
[31]	Counter B	
[34]	Analog input X48/2	

Option	Name	Description
[35]	Temp input X48/4	
[36]	Temp input X48/7	
[37]	Temp input X48/10	
[40]	Analog input X42/1	
[41]	Analog input X42/3	
[42]	Analog input X42/5	
[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.
[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*.

Option	Name	Description
[76]	Below feedback low	The feedback is lower than the limit set in *parameter 4-56 Warning Feedback Low*.
[77]	Above feedback high	The feedback exceeds the limit set in *parameter 4-57 Warning Feedback High*.
[80]	Thermal warning	This operand becomes true when the drive detects any thermal warning, for instance when the temperature exceeds the limit in the motor, the drive, the brake resistor, or thermistor.
[82]	Mains out of range	The mains voltage is outside the specified voltage range.
[85]	Warning	If a warning is triggered, this operand gets the warning number.
[86]	Alarm (trip)	A trip alarm is active.
[87]	Alarm (trip lock)	A trip lock alarm is active.
[90]	Bus OK	Active communication (no timeout) via the serial communication port.
[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.

Option	Name	Description
[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.
[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.

Option	Name	Description
[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.
[180]	Local reference active	Active when *parameter 3-13 Reference Site* is *[2] Local* or when *parameter 3-13 Reference Site* is *[0] Linked to hand/auto*, at the same time as the LCP is in hand-on mode.
[181]	Remote reference active	Active when *parameter 3-13 Reference Site* is *[1] Remote* or *[0] Linked to hand/auto*, while the LCP is in auto-on mode.
[182]	Start command	Active when there is an active start command and no stop command.
[183]	Drive stopped	A stop command (jog, stop, qstop, coast) is issued – and not from the SLC itself.
[185]	Drive in hand mode	Active when the drive is in hand-on mode.
[186]	Drive in auto mode	Active when the drive is in auto-on mode.
[187]	Start command given	
[190]	Digital input X30/2	
[191]	Digital input X30/3	
[192]	Digital input X30/4	
[205]	No flow	
[206]	Dry pump	
[207]	End of curve	
[208]	Broken belt	
[209]	ECB drive mode	
[210]	ECB bypass mode	
[211]	ECB test mode	
[212]	Fire mode	
[249]	Therm. sensor temp.	
[250]	Pressure 3	
[251]	Pressure 4	
[252]	Pressure 1	
[253]	Pressure 2	

Parameter 13-11 Comparator Operator

Table 507: Parameter 13-11 Comparator Operator

13-11 Comparator Operator		
Default value: Size related	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the operator to be used in the comparison. This is an array parameter containing comparator operators 0–5.

Option	Name	Description
[0]	<	**NOTICE** If *[20] Alarm number* or *[21] Warning number* is selected in *parameter 3-10 Comparator Operand*, *[0] <* cannot be selected in this parameter. The result of the evaluation is true when the variable selected in *parameter 13-10 Comparator Operand* is smaller than the fixed value in *parameter 13-12 Comparator Value*. The result is false if the variable selected in *parameter 13-10 Comparator Operand* is greater than the fixed value in *parameter 13-12 Comparator Value*.
[1]	≈ (equal)	The result of the evaluation is true when the variable selected in *parameter 13-10 Comparator Operand* is approximately equal to the fixed value in *parameter 13-12 Comparator Value*.
[2]	>	**NOTICE** If *[20] Alarm number* or *[21] Warning number* is selected in *parameter 3-10 Comparator Operand*, *[2] >* cannot be selected in this parameter. Inverse logic of option *[0] <*.
[5]	TRUE longer than..	
[6]	FALSE longer-than..	
[7]	TRUE shorter than..	
[8]	FALSE shorter than..	

Parameter 13-12 Comparator Value

Table 508: Parameter 13-12 Comparator Value

13-12 Comparator Value		
Default value: Size related	Parameter type: Range, -100000.000 - 100000, Array [10]	Setup: 2 setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the trigger level for the variable that is monitored by this comparator. This is an array parameter containing comparator values 0–9.

5.14.2.1 RS FlipFlops

The reset/set flipflops hold the signal until set/reset.

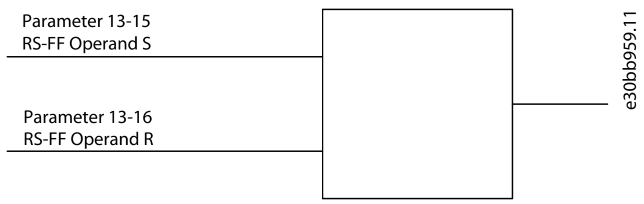


Illustration 65: Reset/Set Flipflops

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

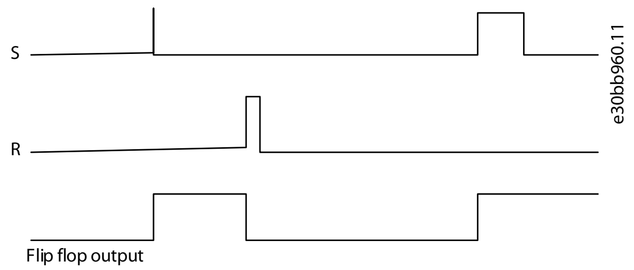


Illustration 66: Flipflop Outputs

The 2 operators can be selected from a long list. As a special case, the same digital input can be used as both set and reset, making it possible to use the same digital input as start/stop. The following settings can be used to set up the same digital input (for example, DI32) as start/stop.

Table 509: Operators

Parameter	Setting	Notes
Parameter 13-00 SL Controller Mode	*[1] On*	–
Parameter 13-01 Start Event [0]	*True*	–
Parameter 13-02 Stop Event [0]	*False*	–
Parameter 13-40 Logic Rule Boolean 1 [0]	*[37] Digital input DI32*	–
Parameter 13-42 Logic Rule Boolean 2 [0]	*[2] Running*	–
Parameter 13-41 Logic Rule Operator 1 [0]	*[3] AND NOT*	–
Parameter 13-40 Logic Rule Boolean 1 [1]	*[37] Digital input DI32*	–
Parameter 13-42 Logic Rule Boolean 2 [1]	*[2] Running*	–
Parameter 13-41 Logic Rule Operator 1 [1]	*[1] AND*	–
Parameter 13-15 RS-FF Operand S [0]	*[26] Logic rule 0*	Output from *parameter 13-41 Log ic Rule Operator 1* [0].
Parameter 13-16 RS-FF Operand R [0]	*[27] Logic rule 1*	Output from *parameter 13-41 Log ic Rule Operator 1* [1].
Parameter 13-51 SL Controller 1 Event [0]	*[94] RS Flipflop 0*	Output from *parameter 13-15 RSFF Operand S* and *parameter 13-16 RSFF Operand R*.
Parameter 13-52 SL Controller 1 Action [0]	*[22] Run*	–

Parameter	Setting	Notes
Parameter 13-51 SL Controller 1 Event [1]	*[27] Logic rule 1*	–
Parameter 13-52 SL Controller 1 Action [1]	*[24] Stop*	–

Parameter 13-15 RS-FF Operand S

Table 510: Parameter 13-15 RS-FF Operand S

13-15 RS-FF Operand S		
Default value: Size related	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the boolean (true or false) input to deactivate smart logic control.

Option	Name	Description
[0]	False	Enter the fixed value of false in the logic rule.
[1]	True	Enter the fixed value of true in the logic rule.
[2]	Running	See *parameter group 5-3* Digital Outputs* for further description.
[3]	In range	See *parameter group 5-3* Digital Outputs* for further description.
[4]	On reference	See *parameter group 5-3* Digital Outputs* for further description.
[5]	Torque limit	See *parameter group 5-3* Digital Outputs* for further description.
[6]	Current limit	See *parameter group 5-3* Digital Outputs* for further description.
[7]	Out of current range	See *parameter group 5-3* Digital Outputs* for further description.
[8]	Below I_{low}	See *parameter group 5-3* Digital Outputs* for further description.
[9]	Above I_{high}	See *parameter group 5-3* Digital Outputs* for further description.
[10]	Out of speed range	
[11]	Below speed low	See *parameter group 5-3* Digital Outputs* for further description.
[12]	Above speed high	See *parameter group 5-3* Digital Outputs* for further description.
[13]	Out of feedb. range	See *parameter group 5-3* Digital Outputs* for further description.
[14]	Below feedb. low	See *parameter group 5-3* Digital Outputs* for further description.
[15]	Above feedb. high	See *parameter group 5-3* Digital Outputs* for further description.
[16]	Thermal warning	See *parameter group 5-3* Digital Outputs* for further description.
[17]	Mains out of range	See *parameter group 5-3* Digital Outputs* for further description.
[18]	Reversing	See *parameter group 5-3* Digital Outputs* for further description.
[19]	Warning	See *parameter group 5-3* Digital Outputs* for further description.
[20]	Alarm (trip)	See *parameter group 5-3* Digital Outputs* for further description.
[21]	Alarm (trip lock)	See *parameter group 5-3* Digital Outputs* for further description.

Option	Name	Description
[22]	Comparator 0	Use the result of comparator 0 in the logic rule.
[23]	Comparator 1	Use the result of comparator 1 in the logic rule.
[24]	Comparator 2	Use the result of comparator 2 in the logic rule.
[25]	Comparator 3	Use the result of comparator 3 in the logic rule.
[26]	Logic rule 0	Use the result of logic rule 0 in the logic rule.
[27]	Logic rule 1	Use the result of logic rule 1 in the logic rule.
[28]	Logic rule 2	Use the result of logic rule 2 in the logic rule.
[29]	Logic rule 3	Use the result of logic rule 3 in the logic rule.
[30]	SL time-out 0	Use the result of timer 0 in the logic rule.
[31]	SL time-out 1	Use the result of timer 1 in the logic rule.
[32]	SL timeout 2	Use the result of timer 2 in the logic rule.
[33]	Digital input DI18	Use the value of DI18 in the logic rule (high=true).
[34]	Digital input DI19	Use the value of DI19 in the logic rule (high=true).
[35]	Digital input DI27	Use the value of DI27 in the logic rule (high=true).
[36]	Digital input DI29	Use the value of DI29 in the logic rule (high=true).
[37]	Digital input DI32	Use the value of DI32 in the logic rule (high=true).
[38]	Digital input DI33	Use the value of DI33 in the logic rule (high=true).
[39]	Start command	This event is true if the drive is started (either via digital input, fieldbus, or other).
[40]	Drive stopped	This event is true if the drive is stopped or coasted (either via digial input, fieldbus, or other).
[41]	Reset trip	This event is true if the drive is tripped (but not trip locked) and [Reset] is pressed.
[42]	Auto-reset trip	This event is true if the drive is tripped (but not trip locked) and an automatic reset is issued.
[43]	OK key	This event is true if [OK] is pressed.
[44]	Reset key	This event is true if [Reset] is pressed.
[45]	Left key	This event is true [◂]
[46]	Right key	[▸]
[47]	Up key	[▴]
[48]	Down key	[▾]
[50]	Comparator 4	Use the result of comparator 4 in the logic rule.
[51]	Comparator 5	Use the result of comparator 5 in the logic rule.
[60]	Logic rule 4	Use the result of logic rule 4 in the logic rule.
[61]	Logic rule 5	Use the result of logic rule 5 in the logic rule.
[70]	SL time-out 3	Smart logic controller time 3 is timed out.

Option	Name	Description
[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.
[76]	Digital input X30/2	
[77]	Digital input X30/3	
[78]	Digital input X30/4	
[80]	No flow	
[81]	Dry pump	
[82]	End of curve	
[83]	Broken belt	
[90]	ECB drive mode	
[91]	ECB bypass mode	
[92]	ECB test mode	
[93]	Fire mode	
[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*.
[103]	Relay 1	
[104]	Relay 2	
[109]	Relay 7	X34/VLT® Relay Card MCB 105.
[110]	Relay 8	X34/VLT® Relay Card MCB 105.
[111]	Relay 9	X34/VLT® Relay Card MCB 105.
[140]	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.
[141]	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.

Option	Name	Description
[142]	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.
[143]	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.
[144]	Pressure 1 low	
[145]	Pressure 2 low	
[146]	Pressure 3 low	
[147]	Pressure 4 low	
[148]	Pressure 1 high	
[149]	Pressure 2 high	
[150]	Pressure 3 high	
[151]	Pressure 4 high	
[228]	Comparator 6	Use the result of comparator 6 in the logic rule.
[229]	Comparator 7	Use the result of comparator 7 in the logic rule.
[230]	Comparator 8	Use the result of comparator 8 in the logic rule.
[231]	Comparator 9	Use the result of comparator 9 in the logic rule.
[232]	Logic rule 6	Use the result of logic rule 6 in the logic rule.
[233]	Logic rule 7	Use the result of logic rule 7 in the logic rule.
[234]	Logic rule 8	Use the result of logic rule 8 in the logic rule.
[235]	Logic rule 9	Use the result of logic rule 9 in the logic rule.
[236]	SL time-out 8	Smart logic controller time 8 is timed out.
[237]	SL time-out 9	Smart logic controller time 9 is timed out.
[238]	RS flipflop 8	See *parameter group 13-1* Comparators*.
[239]	RS flipflop 9	See *parameter group 13-1* Comparators*.
[240]	SL digital output A	
[241]	SL digital output B	
[242]	SL digital output C	
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

Parameter 13-16 RS-FF Operand R

Table 511: Parameter 13-16 RS-FF Operand R

13-16 RS-FF Operand R		
Default value: Size related	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the boolean (true or false) input to deactivate smart logic control. The Operand R inputs have priority over the Operand S inputs.

Option	Name	Description
[0]	False	Enter the fixed value of false in the logic rule.
[1]	True	Enter the fixed value of true in the logic rule.
[2]	Running	See *parameter group 5-3* Digital Outputs* for further description.
[3]	In range	See *parameter group 5-3* Digital Outputs* for further description.
[4]	On reference	See *parameter group 5-3* Digital Outputs* for further description.
[5]	Torque limit	See *parameter group 5-3* Digital Outputs* for further description.
[6]	Current limit	See *parameter group 5-3* Digital Outputs* for further description.
[7]	Out of current range	See *parameter group 5-3* Digital Outputs* for further description.
[8]	Below I_{low}	See *parameter group 5-3* Digital Outputs* for further description.
[9]	Above I_{high}	See *parameter group 5-3* Digital Outputs* for further description.
[10]	Out of speed range	
[11]	Below speed low	See *parameter group 5-3* Digital Outputs* for further description.
[12]	Above speed high	See *parameter group 5-3* Digital Outputs* for further description.
[13]	Out of feedb. range	See *parameter group 5-3* Digital Outputs* for further description.
[14]	Below feedb. low	See *parameter group 5-3* Digital Outputs* for further description.
[15]	Above feedb. high	See *parameter group 5-3* Digital Outputs* for further description.
[16]	Thermal warning	See *parameter group 5-3* Digital Outputs* for further description.
[17]	Mains out of range	See *parameter group 5-3* Digital Outputs* for further description.
[18]	Reversing	See *parameter group 5-3* Digital Outputs* for further description.
[19]	Warning	See *parameter group 5-3* Digital Outputs* for further description.
[20]	Alarm (trip)	See *parameter group 5-3* Digital Outputs* for further description.
[21]	Alarm (trip lock)	See *parameter group 5-3* Digital Outputs* for further description.
[22]	Comparator 0	Use the result of comparator 0 in the logic rule.
[23]	Comparator 1	Use the result of comparator 1 in the logic rule.
[24]	Comparator 2	Use the result of comparator 2 in the logic rule.
[25]	Comparator 3	Use the result of comparator 3 in the logic rule.

Option	Name	Description
[26]	Logic rule 0	Use the result of logic rule 0 in the logic rule.
[27]	Logic rule 1	Use the result of logic rule 1 in the logic rule.
[28]	Logic rule 2	Use the result of logic rule 2 in the logic rule.
[29]	Logic rule 3	Use the result of logic rule 3 in the logic rule.
[30]	SL time-out 0	Use the result of timer 0 in the logic rule.
[31]	SL time-out 1	Use the result of timer 1 in the logic rule.
[32]	SL timeout 2	Use the result of timer 2 in the logic rule.
[33]	Digital input DI18	Use the value of DI18 in the logic rule (high=true).
[34]	Digital input DI19	Use the value of DI19 in the logic rule (high=true).
[35]	Digital input DI27	Use the value of DI27 in the logic rule (high=true).
[36]	Digital input DI29	Use the value of DI29 in the logic rule (high=true).
[37]	Digital input DI32	Use the value of DI32 in the logic rule (high=true).
[38]	Digital input DI33	Use the value of DI33 in the logic rule (high=true).
[39]	Start command	This event is true if the drive is started (either via digital input, fieldbus, or other).
[40]	Drive stopped	This event is true if the drive is stopped or coasted (either via digial input, fieldbus, or other).
[41]	Reset trip	This event is true if the drive is tripped (but not trip locked) and [Reset] is pressed.
[42]	Auto-reset trip	This event is true if the drive is tripped (but not trip locked) and an automatic reset is issued.
[43]	OK key	This event is true if [OK] is pressed.
[44]	Reset key	This event is true if [Reset] is pressed.
[45]	Left key	This event is true [◂]
[46]	Right key	[▸]
[47]	Up key	[▵]
[48]	Down key	[▿]
[50]	Comparator 4	Use the result of comparator 4 in the logic rule.
[51]	Comparator 5	Use the result of comparator 5 in the logic rule.
[60]	Logic rule 4	Use the result of logic rule 4 in the logic rule.
[61]	Logic rule 5	Use the result of logic rule 5 in the logic rule.
[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.

Option	Name	Description
[76]	Digital input X30/2	
[77]	Digital input X30/3	
[78]	Digital input X30/4	
[80]	No flow	
[81]	Dry pump	
[82]	End of curve	
[83]	Broken belt	
[90]	ECB drive mode	
[91]	ECB bypass mode	
[92]	ECB test mode	
[93]	Fire mode	
[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*.
[103]	Relay 1	
[104]	Relay 2	
[109]	Relay 7	X34/VLT® Relay Card MCB 105.
[110]	Relay 8	X34/VLT® Relay Card MCB 105.
[111]	Relay 9	X34/VLT® Relay Card MCB 105.
[140]	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.
[141]	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.
[142]	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.
[143]	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.
[144]	Pressure 1 low	
[145]	Pressure 2 low	

Option	Name	Description
[146]	Pressure 3 low	
[147]	Pressure 4 low	
[148]	Pressure 1 high	
[149]	Pressure 2 high	
[150]	Pressure 3 high	
[151]	Pressure 4 high	
[228]	Comparator 6	Use the result of comparator 6 in the logic rule.
[229]	Comparator 7	Use the result of comparator 7 in the logic rule.
[230]	Comparator 8	Use the result of comparator 8 in the logic rule.
[231]	Comparator 9	Use the result of comparator 9 in the logic rule.
[232]	Logic rule 6	Use the result of logic rule 6 in the logic rule.
[233]	Logic rule 7	Use the result of logic rule 7 in the logic rule.
[234]	Logic rule 8	Use the result of logic rule 8 in the logic rule.
[235]	Logic rule 9	Use the result of logic rule 9 in the logic rule.
[236]	SL time-out 8	Smart logic controller time 8 is timed out.
[237]	SL time-out 9	Smart logic controller time 9 is timed out.
[238]	RS flipflop 8	See *parameter group 13-1* Comparators*.
[239]	RS flipflop 9	See *parameter group 13-1* Comparators*.
[240]	SL digital output A	
[241]	SL digital output B	
[242]	SL digital output C	
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

5.14.3 13-2* Timers

Use the result (true or false) from timers directly to define an event (see *parameter 13-51 SL Controller Event*), or as boolean input in a logic rule (see *parameter 13-40 Logic Rule Boolean 1*, *parameter 13-42 Logic Rule Boolean 2*, or *parameter 13-44 Logic Rule Boolean 3*). A timer is only false when started by an action (for example *[29] Start timer 1*) until the timer value entered in this parameter has elapsed. Then it becomes true again. All parameters in this parameter group are array parameters with index 0–9. Select index 0 to program timer 0, select index 1 to program timer 1, and so on.

Parameter 13-20 SL Controller Time

Table 512: Parameter 13-20 SL Controller Timer

13-20 SL Controller Timer		
Default value: Size related	Parameter type: Range, 0 - 0, Array [10]	Setup: 1 setup
Conversion index: -3	Data type: Timediff w/o DateID	Change during operation: True

Enter the value to define the duration of the false output from the programmed timer. A timer is only false if it is started by an action (that is *[29] Start timer 1*) and until the given timer value has elapsed.

5.14.4 13-4* Logic Rules

Combine up to 3 boolean inputs (true/false inputs) from timers, comparators, digital inputs, status bits, and events using the logical operators AND, OR, and NOT. Select boolean inputs for the calculation in *parameter 13-40 Logic Rule Boolean 1*, *parameter 13-42 Logic Rule Boolean 2*, and *parameter 13-44 Logic Rule Boolean 3*. Define the operators used to logically combine the selected inputs in *parameter 13-41 Logic Rule Operator 1* and *parameter 13-43 Logic Rule Operator 2*.

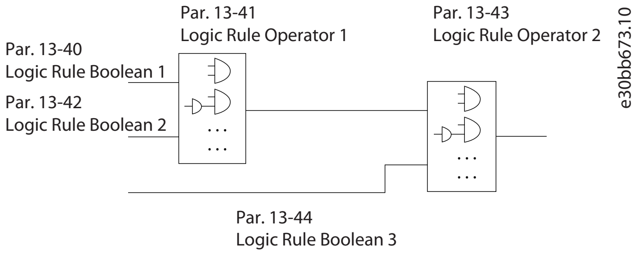


Illustration 67: Logic Rules

Priority of calculation

The results of *parameter 13-40 Logic Rule Boolean 1*, *parameter 13-41 Logic Rule Operator 1*, and *parameter 13-42 Logic Rule Boolean 2* are calculated first. The outcome (true/false) of this calculation is combined with the settings of *parameter 13-43 Logic Rule Operator 2* and *parameter 13-44 Logic Rule Boolean 3*, yielding the final result (true/false) of the logic rule.

Parameter 13-40 Logic Rule Boolean 1

Table 513: Parameter 13-40 Logic Rule Boolean 1

13-40 Logic Rule Boolean 1		
Default value: Size related	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data Type: Uint8	Change during operation: True

Option	Name	Description
[0]	False	Select the 1st boolean (true or false) input for the selected logic rule. See *parameter 13-01 Start Event* and *parameter 13-02 Stop Event* for more information.
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	

Option	Name	Description
[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.

Option	Name	Description
[46]	Right key	[▹] is pressed. Only available on the graphical LCP.
[47]	Up key	[▵] is pressed. Only available on the graphical LCP.
[48]	Down key	[▿] is pressed. Only available on the graphical LCP.
[50]	Comparator 4	Use the result of comparator 4.
[51]	Comparator 5	Use the result of comparator 5.
[60]	Logic rule 4	Use the result of logic rule 4.
[61]	Logic rule 5	Use the result of logic rule 5.
[70]	SL time-out 3	
[71]	SL time-out 4	
[72]	SL time-out 5	
[73]	SL time-out 6	
[74]	SL time-out 7	
[76]	Digital input X30/2	
[77]	Digital input X30/3	
[78]	Digital input X30/4	
[80]	No flow	
[81]	Dry pump	
[82]	End of curve	
[83]	Broken belt	
[90]	ECB drive mode	
[91]	ECB bypass mode	
[92]	ECB test mode	
[93]	Fire mode	
[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*.
[103]	Relay 1	

Option	Name	Description
[104]	Relay 2	
[109]	Relay 7	X34/VLT® Relay Card MCB 105.
[110]	Relay 8	X34/VLT® Relay Card MCB 105.
[111]	Relay 9	X34/VLT® Relay Card MCB 105.
[140]	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.
[141]	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.
[142]	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.
[143]	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.
[144]	Pressure 1 low	
[145]	Pressure 2 low	
[146]	Pressure 3 low	
[147]	Pressure 4 low	
[148]	Pressure 1 high	
[149]	Pressure 2 high	
[150]	Pressure 3 high	
[151]	Pressure 4 high	
[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	

Option	Name	Description
[242]	SL digital output C	
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

Parameter 13-41 Logic Rule Operator 1

Table 514: Parameter 13-41 Logic Rule Operator 1

13-41 Logic Rule Operator 1		
Default value: Size related	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the 1st logical operator to use on the boolean inputs from *parameter 13-40 Logic Rule Boolean 1* and *parameter 13-42 Logic Rule Boolean 2*. Parameter numbers in square brackets stand for the boolean inputs of parameters in *parameter group 13-** Smart Logic Control*.

Option	Name	Description
[0]	DISABLED	Ignores • *Parameter 13-42 Logic Rule Boolean 2.* • *Parameter 13-43 Logic Rule Operator 2.* • *Parameter 13-44 Logic Rule Boolean 3.*
[1]	AND	Evaluates the expression [13-40] AND [13-42].
[2]	OR	Evaluates the expression [13-40] OR [13-42].
[3]	AND NOT	Evaluates the expression [13-40] AND NOT [13-42].
[4]	OR NOT	Evaluates the expression [13-40] OR NOT [13-42].
[5]	NOT AND	Evaluates the expression NOT [13-40] AND [13-42].
[6]	NOT OR	Evaluates the expression NOT [13-40] OR [13-42].
[7]	NOT AND NOT	Evaluates the expression NOT [13-40] AND NOT [13-42].
[8]	NOT OR NOT	Evaluates the expression NOT [13-40] OR NOT [13-42].

Parameter 13-42: Logic Rule Boolean 2

Table 515: Parameter 13-42 Logic Rule Boolean 2

13-42 Logic Rule Boolean 2		
Default value: Size related	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data Type: Uint8	Change during operation: True

Option	Name	Description
[0]	False	Select the 2nd boolean (true or false) input for the selected logic rule. See *parameter 13-01 Start Event* and *parameter 13-02 Stop Event* for more information.
[1]	True	

Option	Name	Description
[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	

Option	Name	Description
[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	
[76]	Digital input X30/2	
[77]	Digital input X30/3	
[78]	Digital input X30/4	
[80]	No flow	
[81]	Dry pump	
[82]	End of curve	
[83]	Broken belt	
[90]	ECB drive mode	

Option	Name	Description
[91]	ECB bypass mode	
[92]	ECB test mode	
[93]	Fire mode	
[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*.
[103]	Relay 1	
[104]	Relay 2	
[109]	Relay 7	X34/VLT® Relay Card MCB 105.
[110]	Relay 8	X34/VLT® Relay Card MCB 105.
[111]	Relay 9	X34/VLT® Relay Card MCB 105.
[140]	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.
[141]	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.
[142]	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.
[143]	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.
[144]	Pressure 1 low	
[145]	Pressure 2 low	
[146]	Pressure 3 low	
[147]	Pressure 4 low	
[148]	Pressure 1 high	
[149]	Pressure 2 high	
[150]	Pressure 3 high	
[151]	Pressure 4 high	
[228]	Comparator 6	
[229]	Comparator 7	

Option	Name	Description
[230]	Comparator 8	
[231]	Comparator 9	
[232]	Logic rule 6	
[233]	Logic rule 7	
[234]	Logic rule 8	
[235]	Logic rule 9	
[236]	SL time-out 8	
[237]	SL time-out 9	
[238]	RS flipflop 8	
[239]	RS flipflop 9	
[240]	SL digital output A	
[241]	SL digital output B	
[242]	SL digital output C	
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

Parameter 13-43 Logic Rule Operator 2

Table 516: Parameter 13-43 Logic Rule Operator 2

13-43 Logic Rule Operator 2		
Default value: Size related	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the 2nd logical operator to be used on the boolean input calculated in:

- *Parameter 13-40 Logic Rule Boolean 1.*
- *Parameter 13-41 Logic Rule Operator 1.*
- *Parameter 13-42 Logic Rule Boolean 2.*

[13-44] signifies the boolean input of *parameter 13-44 Logic Rule Boolean 3*. [13-40/13-42] signifies the boolean input calculated in:

- *Parameter 13-40 Logic Rule Boolean 1.*
- *Parameter 13-41 Logic Rule Operator 1.*
- *Parameter 13-42 Logic Rule Boolean 2.*

Option	Name	Description
[0]	DISABLED	
[1]	AND	
[2]	OR	
[3]	AND NOT	

Option	Name	Description
[4]	OR NOT	
[5]	NOT AND	
[6]	NOT OR	
[7]	NOT AND NOT	
[8]	NOT OR NOT	

Parameter 13-44 Logic Rule Boolean 3

Table 517: Parameter 13-44 Logic Rule Boolean 3

13-44 Logic Rule Boolean 3		
Default value: Size related	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data Type: Uint8	Change during operation: True

Option	Name	Description
[0]	False	Select the 3rd boolean (true or false) input for the selected logic rule. See *parameter 13-01 Start Event* and *parameter 13-02 Stop Event* for more information.
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	

Option	Name	Description
[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.

Option	Name	Description
[70]	SL time-out 3	
[71]	SL time-out 4	
[72]	SL time-out 5	
[73]	SL time-out 6	
[74]	SL time-out 7	
[76]	Digital input X30/2	
[77]	Digital input X30/3	
[78]	Digital input X30/4	
[80]	No flow	
[81]	Dry pump	
[82]	End of curve	
[83]	Broken belt	
[90]	ECB drive mode	
[91]	ECB bypass mode	
[92]	ECB test mode	
[93]	Fire mode	
[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*.
[103]	Relay 1	
[104]	Relay 2	
[109]	Relay 7	X34/VLT® Relay Card MCB 105.
[110]	Relay 8	X34/VLT® Relay Card MCB 105.
[111]	Relay 9	X34/VLT® Relay Card MCB 105.
[140]	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.
[141]	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.

Option	Name	Description
[142]	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.
[143]	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.
[144]	Pressure 1 low	
[145]	Pressure 2 low	
[146]	Pressure 3 low	
[147]	Pressure 4 low	
[148]	Pressure 1 high	
[149]	Pressure 2 high	
[150]	Pressure 3 high	
[151]	Pressure 4 high	
[228]	Comparator 6	
[229]	Comparator 7	
[230]	Comparator 8	
[231]	Comparator 9	
[232]	Logic rule 6	
[233]	Logic rule 7	
[234]	Logic rule 8	
[235]	Logic rule 9	
[236]	SL time-out 8	
[237]	SL time-out 9	
[238]	RS flipflop 8	
[239]	RS flipflop 9	
[240]	SL digital output A	
[241]	SL digital output B	
[242]	SL digital output C	
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

5.14.5 13-5* States

Parameter 13-51 SL Controller Event

Table 518: Parameter 13-51 SL Controller 1 Event

13-51 SL Controller 1 Event		
Default value: Size related	Parameter type: Option, Array [20]	Setup: 2 setups
Conversion index: -	Data Type: Uint8	Change during operation: True

Option	Name	Description
[0]	False	Select the boolean (true or false) input for the selected logic rule. See *parameter 13-02 Stop Event* for more information.
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	

Option	Name	Description
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[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	

Option	Name	Description
[76]	Digital input X30/2	
[77]	Digital input X30/3	
[78]	Digital input X30/4	
[80]	No flow	
[81]	Dry pump	
[82]	End of curve	
[83]	Broken belt	
[90]	ECB drive mode	
[91]	ECB bypass mode	
[92]	ECB test mode	
[93]	Fire mode	
[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*.
[103]	Relay 1	
[104]	Relay 2	
[109]	Relay 7	X34/VLT® Relay Card MCB 105.
[110]	Relay 8	X34/VLT® Relay Card MCB 105.
[111]	Relay 9	X34/VLT® Relay Card MCB 105.
[140]	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.
[141]	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.
[142]	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.
[143]	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.
[144]	Pressure 1 low	
[145]	Pressure 2 low	

Option	Name	Description
[146]	Pressure 3 low	
[147]	Pressure 4 low	
[148]	Pressure 1 high	
[149]	Pressure 2 high	
[150]	Pressure 3 high	
[151]	Pressure 4 high	
[228]	Comparator 6	
[229]	Comparator 7	
[230]	Comparator 8	
[231]	Comparator 9	
[232]	Logic rule 6	
[233]	Logic rule 7	
[234]	Logic rule 8	
[235]	Logic rule 9	
[236]	SL time-out 8	
[237]	SL time-out 9	
[238]	RS flipflop 8	
[239]	RS flipflop 9	
[240]	SL digital output A	
[241]	SL digital output B	
[242]	SL digital output C	
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

Parameter 13-52 SL Controller Action

Table 519: Parameter 13-52 SL Controller 1 Action

13-52 SL Controller 1 Action		
Default value: Size related	Parameter type: Option, Array [20]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the action corresponding to the SLC event. Actions are executed when the corresponding event (defined in *parameter 13-51 SL Controller 1 Event*) is evaluated as true. The following actions are available:

Option	Name	Description
[0]	Disabled	
[1]	No action	No action is taken if the SLC event is evaluated as true.
[2]	Select set-up 1	Changes the active setup to setup 1.
[3]	Select set-up 2	Changes the active setup to setup 2.
[4]	Select set-up 3	Changes the active setup to setup 3.
[5]	Select set-up 4	Changes the active setup to setup 4. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via fieldbus.
[10]	Select preset ref 0	Select preset reference 0.
[11]	Select preset ref 1	Select preset reference 1.
[12]	Select preset ref 2	Select preset reference 2.
[13]	Select preset ref 3	Select preset reference 3.
[14]	Select preset ref 4	Select preset reference 4.
[15]	Select preset ref 5	Select preset reference 5.
[16]	Select preset ref 6	Select preset reference 6.
[17]	Select preset ref 7	Select preset reference 7. If the active preset reference is changed, it merges with other preset reference commands coming from either digital inputs or via fieldbus.
[18]	Select ramp 1	The value is in %.
[19]	Select ramp 2	The value is in %.
[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.
[26]	DC brake	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	Start timer 0, see *parameter 13-20 SL Controller Timer* for further description.
[30]	Start timer 1	Start timer 1, see *parameter 13-20 SL Controller Timer* for further description.
[31]	Start timer 2	Start timer 2, see *parameter 13-20 SL Controller Timer* for further description.
[32]	Set digital out A low	Any output with digital output 1 selected is low (off)
[33]	Set digital out B low	Any output with digital output 2 selected is low (off)
[34]	Set digital out C low	Any output with digital output 3 selected is low (off)
[35]	Set digital out D low	Any output with digital output 4 selected is low (off)
[36]	Set digital out E low	Any output with digital output 5 selected is low (off)
[37]	Set digital out F low	Any output with digital output 6 selected is low (off)

Option	Name	Description
[38]	Set digital out A high	Any output with digital output 1 selected is high (closed).
[39]	Set digital out B high	Any output with digital output 2 selected is high (closed).
[40]	Set digital out C high	Any output with digital output 3 selected is high (closed).
[41]	Set digital out D high	Any output with digital output 4 selected is high (closed).
[42]	Set digital out E high	Any output with digital output 5 selected is high (closed).
[43]	Set digital out F high	Any output with digital output 6 selected is high (closed).
[60]	Reset counter A	Resets counter A to 0.
[61]	Reset counter B	Resets counter B to 0.
[62]	Counter A (up)	The motor runs at a reference which exceeds the value in *parameter 4-55 Warning Reference High*.
[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.
[80]	Sleep mode	Starts the sleep mode.
[90]	Set ECB bypass mode	
[91]	Set ECB drive mode	
[100]	Reset alarms	

Parameter 13-53 SL Controller 2 Event

Table 520: Parameter 13-53 SL Controller 2 Event

13-53 SL Controller 2 Event		
Default value: Size related	Parameter type: Option, Array [20]	Setup: 2 setups
Conversion index: -	Data Type: Uint8	Change during operation: True

Option	Name	Description
[0]	False	Select the boolean (true or false) input for the selected logic rule. See *parameter 13-02 Stop Event* for more information.
[1]	True	

Option	Name	Description
[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	

Option	Name	Description
[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	
[76]	Digital input X30/2	
[77]	Digital input X30/3	
[78]	Digital input X30/4	
[80]	No flow	
[81]	Dry pump	
[82]	End of curve	
[83]	Broken belt	
[90]	ECB drive mode	

Option	Name	Description
[91]	ECB bypass mode	
[92]	ECB test mode	
[93]	Fire mode	
[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*.
[103]	Relay 1	
[104]	Relay 2	
[109]	Relay 7	X34/VLT® Relay Card MCB 105.
[110]	Relay 8	X34/VLT® Relay Card MCB 105.
[111]	Relay 9	X34/VLT® Relay Card MCB 105.
[140]	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.
[141]	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.
[142]	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.
[143]	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.
[144]	Pressure 1 low	
[145]	Pressure 2 low	
[146]	Pressure 3 low	
[147]	Pressure 4 low	
[148]	Pressure 1 high	
[149]	Pressure 2 high	
[150]	Pressure 3 high	
[151]	Pressure 4 high	
[228]	Comparator 6	
[229]	Comparator 7	

Option	Name	Description
[230]	Comparator 8	
[231]	Comparator 9	
[232]	Logic rule 6	
[233]	Logic rule 7	
[234]	Logic rule 8	
[235]	Logic rule 9	
[236]	SL time-out 8	
[237]	SL time-out 9	
[238]	RS flipflop 8	
[239]	RS flipflop 9	
[240]	SL digital output A	
[241]	SL digital output B	
[242]	SL digital output C	
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

Parameter 13-54 SL Controller 2 Action

Table 521: Parameter 13-54 SL Controller 2 Action

13-54 SL Controller 2 Action		
Default value: Size related	Parameter type: Option, Array [20]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the action corresponding to the SLC event. Actions are executed when the corresponding event (defined in *parameter 13-53 SL Controller 2 Event*) is evaluated as true. The following actions are available:

Option	Name	Description
[0]	Disabled	
[1]	No action	No action is taken if the SLC event is evaluated as true.
[2]	Select set-up 1	Changes the active setup to setup 1.
[3]	Select set-up 2	Changes the active setup to setup 2.
[4]	Select set-up 3	Changes the active setup to setup 3.
[5]	Select set-up 4	Changes the active setup to setup 4. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via fieldbus.
[10]	Select preset ref 0	Select preset reference 0.
[11]	Select preset ref 1	Select preset reference 1.

Option	Name	Description
[12]	Select preset ref 2	Select preset reference 2.
[13]	Select preset ref 3	Select preset reference 3.
[14]	Select preset ref 4	Select preset reference 4.
[15]	Select preset ref 5	Select preset reference 5.
[16]	Select preset ref 6	Select preset reference 6.
[17]	Select preset ref 7	Select preset reference 7. If the active preset reference is changed, it merges with other preset reference commands coming from either digital inputs or via fieldbus.
[18]	Select ramp 1	The value is in %.
[19]	Select ramp 2	The value is in %.
[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.
[26]	DC brake	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	Start timer 0, see *parameter 13-20 SL Controller Timer* for further description.
[30]	Start timer 1	Start timer 1, see *parameter 13-20 SL Controller Timer* for further description.
[31]	Start timer 2	Start timer 2, see *parameter 13-20 SL Controller Timer* for further description.
[32]	Set digital out A low	Any output with digital output 1 selected is low (off)
[33]	Set digital out B low	Any output with digital output 2 selected is low (off)
[34]	Set digital out C low	Any output with digital output 3 selected is low (off)
[35]	Set digital out D low	Any output with digital output 4 selected is low (off)
[36]	Set digital out E low	Any output with digital output 5 selected is low (off)
[37]	Set digital out F low	Any output with digital output 6 selected is low (off)
[38]	Set digital out A high	Any output with digital output 1 selected is high (closed).
[39]	Set digital out B high	Any output with digital output 2 selected is high (closed).
[40]	Set digital out C high	Any output with digital output 3 selected is high (closed).
[41]	Set digital out D high	Any output with digital output 4 selected is high (closed).
[42]	Set digital out E high	Any output with digital output 5 selected is high (closed).
[43]	Set digital out F high	Any output with digital output 6 selected is high (closed).
[60]	Reset counter A	Resets counter A to 0.
[61]	Reset counter B	Resets counter B to 0.

Option	Name	Description
[62]	Counter A (up)	The motor runs at a reference which exceeds the value in *parameter 4-55 Warning Reference High*.
[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.
[80]	Sleep mode	Starts the sleep mode.
[90]	Set ECB bypass mode	
[91]	Set ECB drive mode	
[100]	Reset alarms	

Parameter 13-55 SL Controller 3 Event

Table 522: Parameter 13-55 SL Controller 3 Event

13-55 SL Controller 3 Event		
Default value: Size related	Parameter type: Option, Array [20]	Setup: 2 setups
Conversion index: -	Data Type: Uint8	Change during operation: True

Option	Name	Description
[0]	False	Select the boolean (true or false) input for the selected logic rule. See *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	

Option	Name	Description
[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	
[76]	Digital input X30/2	
[77]	Digital input X30/3	
[78]	Digital input X30/4	
[80]	No flow	
[81]	Dry pump	
[82]	End of curve	
[83]	Broken belt	
[90]	ECB drive mode	
[91]	ECB bypass mode	
[92]	ECB test mode	
[93]	Fire mode	
[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*.
[103]	Relay 1	
[104]	Relay 2	
[109]	Relay 7	X34/VLT® Relay Card MCB 105.
[110]	Relay 8	X34/VLT® Relay Card MCB 105.
[111]	Relay 9	X34/VLT® Relay Card MCB 105.
[140]	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.
[141]	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.
[142]	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.
[143]	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.
[144]	Pressure 1 low	
[145]	Pressure 2 low	
[146]	Pressure 3 low	
[147]	Pressure 4 low	
[148]	Pressure 1 high	
[149]	Pressure 2 high	
[150]	Pressure 3 high	
[151]	Pressure 4 high	
[228]	Comparator 6	
[229]	Comparator 7	
[230]	Comparator 8	
[231]	Comparator 9	
[232]	Logic rule 6	
[233]	Logic rule 7	
[234]	Logic rule 8	
[235]	Logic rule 9	
[236]	SL time-out 8	
[237]	SL time-out 9	

Option	Name	Description
[238]	RS flipflop 8	
[239]	RS flipflop 9	
[240]	SL digital output A	
[241]	SL digital output B	
[242]	SL digital output C	
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

Parameter 13-56 SL Controller 3 Action

Table 523: Parameter 13-56 SL Controller 3 Action

13-56 SL Controller 3 Action		
Default value: Size related	Parameter type: Option, Array [20]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the action corresponding to the SLC event. Actions are executed when the corresponding event (defined in *parameter 13-55 SL Controller 3 Event*) is evaluated as true. The following actions are available:

Option	Name	Description
[0]	Disabled	
[1]	No action	No action is taken if the SLC event is evaluated as true.
[2]	Select set-up 1	Changes the active setup to setup 1.
[3]	Select set-up 2	Changes the active setup to setup 2.
[4]	Select set-up 3	Changes the active setup to setup 3.
[5]	Select set-up 4	Changes the active setup to setup 4. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via fieldbus.
[10]	Select preset ref 0	Select preset reference 0.
[11]	Select preset ref 1	Select preset reference 1.
[12]	Select preset ref 2	Select preset reference 2.
[13]	Select preset ref 3	Select preset reference 3.
[14]	Select preset ref 4	Select preset reference 4.
[15]	Select preset ref 5	Select preset reference 5.
[16]	Select preset ref 6	Select preset reference 6.
[17]	Select preset ref 7	Select preset reference 7. If the active preset reference is changed, it merges with other preset reference commands coming from either digital inputs or via fieldbus.
[18]	Select ramp 1	The value is in %.
[19]	Select ramp 2	The value is in %.

Option	Name	Description
[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.
[26]	DC brake	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	Start timer 0, see *parameter 13-20 SL Controller Timer* for further description.
[30]	Start timer 1	Start timer 1, see *parameter 13-20 SL Controller Timer* for further description.
[31]	Start timer 2	Start timer 2, see *parameter 13-20 SL Controller Timer* for further description.
[32]	Set digital out A low	Any output with digital output 1 selected is low (off).
[33]	Set digital out B low	Any output with digital output 2 selected is low (off).
[34]	Set digital out C low	Any output with digital output 3 selected is low (off).
[35]	Set digital out D low	Any output with digital output 4 selected is low (off).
[36]	Set digital out E low	Any output with digital output 5 selected is low (off).
[37]	Set digital out F low	Any output with digital output 6 selected is low (off).
[38]	Set digital out A high	Any output with digital output 1 selected is high (closed).
[39]	Set digital out B high	Any output with digital output 2 selected is high (closed).
[40]	Set digital out C high	Any output with digital output 3 selected is high (closed).
[41]	Set digital out D high	Any output with digital output 4 selected is high (closed).
[42]	Set digital out E high	Any output with digital output 5 selected is high (closed).
[43]	Set digital out F high	Any output with digital output 6 selected is high (closed).
[60]	Reset counter A	Resets counter A to 0.
[61]	Reset counter B	Resets counter B to 0.
[62]	Counter A (up)	The motor runs at a reference which exceeds the value in *parameter 4-55 Warning Reference High*.
[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.

Option	Name	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.
[80]	Sleep mode	Starts the sleep mode.
[90]	Set ECB bypass mode	
[91]	Set ECB drive mode	
[100]	Reset alarms	

Parameter 13-57 SL Controller 4 Event

Table 524: Parameter 13-57 SL Controller 4 Event

13-57 SL Controller 4 Event		
Default value: Size related	Parameter type: Option, Array [20]	Setup: 2 setups
Conversion index: -	Data Type: Uint8	Change during operation: True

Option	Name	Description
[0]	False	Select the boolean (true or false) input for the selected logic rule. See *parameter 13-02 Stop Event* for more information.
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[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.

Option	Name	Description
[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	
[76]	Digital input X30/2	
[77]	Digital input X30/3	
[78]	Digital input X30/4	
[80]	No flow	
[81]	Dry pump	
[82]	End of curve	
[83]	Broken belt	
[90]	ECB drive mode	
[91]	ECB bypass mode	
[92]	ECB test mode	
[93]	Fire mode	
[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*.
[103]	Relay 1	
[104]	Relay 2	
[109]	Relay 7	X34/VLT® Relay Card MCB 105.
[110]	Relay 8	X34/VLT® Relay Card MCB 105.
[111]	Relay 9	X34/VLT® Relay Card MCB 105.
[140]	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
[141]	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.
[142]	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.
[143]	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.
[144]	Pressure 1 low	
[145]	Pressure 2 low	
[146]	Pressure 3 low	
[147]	Pressure 4 low	
[148]	Pressure 1 high	
[149]	Pressure 2 high	
[150]	Pressure 3 high	
[151]	Pressure 4 high	
[228]	Comparator 6	
[229]	Comparator 7	
[230]	Comparator 8	
[231]	Comparator 9	
[232]	Logic rule 6	
[233]	Logic rule 7	
[234]	Logic rule 8	
[235]	Logic rule 9	
[236]	SL time-out 8	
[237]	SL time-out 9	
[238]	RS flipflop 8	
[239]	RS flipflop 9	
[240]	SL digital output A	
[241]	SL digital output B	
[242]	SL digital output C	
[243]	SL digital output D	
[244]	SL digital output E	
[245]	SL digital output F	

Parameter 13-58 SL Controller 4 Action

Table 525: Parameter 13-58 SL Controller 4 Action

13-58 SL Controller 4 Action		
Default value: Size related	Parameter type: Option, Array [20]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the action corresponding to the SLC event. Actions are executed when the corresponding event (defined in *parameter 13-57 SL Controller 4 Event*) is evaluated as true. The following actions are available:

Option	Name	Description
[0]	Disabled	
[1]	No action	No action is taken if the SLC event is evaluated as true.
[2]	Select set-up 1	Changes the active setup to setup 1.
[3]	Select set-up 2	Changes the active setup to setup 2.
[4]	Select set-up 3	Changes the active setup to setup 3.
[5]	Select set-up 4	Changes the active setup to setup 4. If the setup is changed, it merges with other setup commands coming from either the digital inputs or via fieldbus.
[10]	Select preset ref 0	Select preset reference 0.
[11]	Select preset ref 1	Select preset reference 1.
[12]	Select preset ref 2	Select preset reference 2.
[13]	Select preset ref 3	Select preset reference 3.
[14]	Select preset ref 4	Select preset reference 4.
[15]	Select preset ref 5	Select preset reference 5.
[16]	Select preset ref 6	Select preset reference 6.
[17]	Select preset ref 7	Select preset reference 7. If the active preset reference is changed, it merges with other preset reference commands coming from either digital inputs or via fieldbus.
[18]	Select ramp 1	The value is in %.
[19]	Select ramp 2	The value is in %.
[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.
[26]	DC brake	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	Start timer 0, see *parameter 13-20 SL Controller Timer* for further description.
[30]	Start timer 1	Start timer 1, see *parameter 13-20 SL Controller Timer* for further description.
[31]	Start timer 2	Start timer 2, see *parameter 13-20 SL Controller Timer* for further description.

Option	Name	Description
[32]	Set digital out A low	Any output with digital output 1 selected is low (off).
[33]	Set digital out B low	Any output with digital output 2 selected is low (off).
[34]	Set digital out C low	Any output with digital output 3 selected is low (off).
[35]	Set digital out D low	Any output with digital output 4 selected is low (off).
[36]	Set digital out E low	Any output with digital output 5 selected is low (off).
[37]	Set digital out F low	Any output with digital output 6 selected is low (off).
[38]	Set digital out A high	Any output with digital output 1 selected is high (closed).
[39]	Set digital out B high	Any output with digital output 2 selected is high (closed).
[40]	Set digital out C high	Any output with digital output 3 selected is high (closed).
[41]	Set digital out D high	Any output with digital output 4 selected is high (closed).
[42]	Set digital out E high	Any output with digital output 5 selected is high (closed).
[43]	Set digital out F high	Any output with digital output 6 selected is high (closed).
[60]	Reset counter A	Resets counter A to 0.
[61]	Reset counter B	Resets counter B to 0.
[62]	Counter A (up)	The motor runs at a reference which exceeds the value in *parameter 4-55 Warning Reference High*.
[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.
[80]	Sleep mode	Starts the sleep mode.
[90]	Set ECB bypass mode	
[91]	Set ECB drive mode	
[100]	Reset alarms	

5.14.6 13-9* User-defined Alerts and Readouts

Parameters in this group allow the configuration of application-specific triggers for triggering the drive to perform a certain action, show the status on the LCP, and represent it accordingly in *parameter 13-97 Alert Alarm Word*, *parameter 13-98 Alert Warning Word*, and *parameter 13-99 Alert Status Word*. In *parameter 13-91 Alert Action*, it is possible to select drive functionalities such as *info only*, *stop*, *running to max*, and *force drive to trip*.

Use the following parameters to configure the drive to show a message and perform an action when a specific event occurs:

- *Parameter 13-90 Alert Trigger* – the event that triggers the user-defined action and message.
- *Parameter 13-91 Alert Action* – the action that the drive performs when the event defined in *parameter 13-90 Alert Trigger* occurs.
- *Parameter 13-92 Alert Text* – the text that the drive shows in the display when the event defined in *parameter 13-90 Alert Trigger* occurs.

For example, consider the following use case: If there is an active signal on digital input 32, the drive shows the message *Valve 5 open* and ramps down to a stop. To achieve this configuration, make the following settings:

- *Parameter 13-90 Alert Trigger = [37] Digital input DI32*.
- *Parameter 13-91 Alert Action = [5] Stop & warning*.
- *Parameter 13-92 Alert Text = Valve 5 open*.

Actions reflected in *parameter 16-03 Status Word* and alert parameters

When an action containing trip is selected and triggered, the drive trips, bit 3 in the basic status word is set, and the corresponding hex value is shown in *parameter 13-97 Alert Alarm Word*.

The alarm for *User Alert* is logged as alarm value = 124 in *parameter 15-30 Fault Log: Error Code*, index [0]–[9].

When an action containing warning info is selected and triggered, bit 7 in the basic status word is set, and the corresponding hex value is shown in *parameter 13-98 Alert Warning Word*.

Other actions selected are not indicated in the basic status word, but the corresponding hex value is shown in *parameter 13-99 Alert Status Word*.

Example of setting up digital inputs as triggers, actions, and readouts

Refer to the following table to understand the 3 examples in this section.

Table 526: 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

ID	Name	Setup 1
1391.7	Alert Action	[0] Info
1391.8	Alert Action	[12] Trip
1391.9	Alert Action	[0] Info
1392.0	Alert Text	Dig In 19
1392.1	Alert Text	Dig In 32
1392.2	Alert Text	User Alert
1392.3	Alert Text	User Alert
1392.4	Alert Text	User Alert
1392.5	Alert Text	User Alert
1392.6	Alert Text	User Alert
1392.7	Alert Text	User Alert
1392.8	Alert Text	Dig In 33
1392.9	Alert Text	User Alert

Example 1: In *parameter 13-90 Alert Trigger*, index [0], DI19 is selected as trigger. The digital value is 0000 0001. The corresponding action, Info, is set in *parameter 13-91 Alert Action*, index [0] and is shown as 1 hex in *parameter 13-99 Alert Status Word*.

Example 2: In *parameter 13-90 Alert Trigger*, index [1], DI32 is selected as trigger. The digital value is 0000 0010. The corresponding action, Warning, is set in *parameter 13-91 Alert Action*, index [1] and is shown as 2 hex in *parameter 13-98 Alert Warning Word*.

Example 3: In *parameter 13-90 Alert Trigger*, index [8], DI33 is selected as trigger. The digital value is 0001 0000 0000. The corresponding action, Trip, is set in *parameter 13-91 Alert Action*, index [8] and is shown as 100 hex in *parameter 13-97 Alert Alarm Word*.

When 1 of the 3 digital inputs shown in this example is activated, the text shown in the LCP is the one defined in *parameter 13-92 Alert Text*, index [0], [1], and [8].

N O T I C E

The action setting of an active trigger cannot be changed. For example, if DI19 is selected as trigger and the input is high, the action cannot be changed from *Stop* to *Jog*.

Parameter 13-90 Alert Trigger

Table 527: Parameter 13-90 Alert Trigger

13-90 Alert Trigger		
Default value: [0] False	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the event that triggers the user-defined action and message.

Option	Name	Description
[0]*	False	
[1]	True	
[18]	Reversing	
[22]	Comparator 0	

Option	Name	Description
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL time-out 0	
[31]	SL time-out 1	
[32]	SL time-out 2	
[33]	Digital input DI18	
[34]	Digital input DI19	
[35]	Digital input DI27	
[36]	Digital input DI29	
[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	

Option	Name	Description
[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	

Parameter 13-91 Alert Action

Table 528: Parameter 13-91 Alert Action

13-91 Alert Action		
Default value: [0] Info	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

N O T I C E

For safety reasons, this parameter cannot be changed when there is an active alarm.

Select the action that the drive performs when the event defined in *parameter 13-90 Alert Trigger* occurs.

Option	Name	Description
[0]*	Info	
[1]	Warning	
[2]	Freeze output	
[3]	Freeze output & warn	
[4]	Stop	
[5]	Stop & warning	
[6]	Jogging	
[7]	Jogging & warning	
[8]	Max speed	
[9]	Max speed & warn	

Option	Name	Description
[10]	Stop and trip	
[11]	Stop and trip w manual reset	
[12]	Trip	
[13]	Trip w manual reset	
[14]	Trip lock	

Parameter 13-92 Alert Text

Table 529: Parameter 13-92 Alert Text

13-92 Alert Text		
Default value: Size related	Parameter type: Range, 0 - 20, Array [10]	Setup: 2 setups
Conversion index: 0	Data type: VisStr 20	Change during operation: True

Enter the text that the drive shows in the display when the event is defined in *parameter 13-90 Alert Trigger* occurs.

Parameter 13-97 Alert Alarm Word

Table 530: Parameter 13-97 Alert Alarm Word

13-97 Alert Alarm Word		
Default value: 0	Parameter type: Range, 0 - 3FF hex	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Shows the alarm word of a user-defined alarm in hex code.

Parameter 13-98 Alert Warning Word

Table 531: Parameter 13-98 Alert Warning Word

13-98 Alert Warning Word		
Default value: 0	Parameter type: Range, 0 - 3FF hex	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Shows the warning word of a user-defined alarm in hex code.

Parameter 13-99 Alert Status Word

Table 532: Parameter 13-99 Alert Status Word

13-99 Alert Status Word		
Default value: 0	Parameter type: Range, 0 - 3FF hex	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Shows the status word of a user-defined alarm in hex code.

5.15 Parameter Group 14-** Special Functions

5.15.1 14-0* Inverter Switching

Parameter 14-00 Switching Pattern

Table 533: Parameter 14-00 Switching Pattern

14-00 Switching Pattern		
Size related	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the switching pattern: 60° AVM or SFAVM.

NOTICE

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

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

Parameter 14-01 Switching Frequency

Table 534: Parameter 14-01 Switching Frequency

14-01 Switching Frequency		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the drive switching frequency. Changing the switching frequency reduces acoustic noise from the motor. Default values depend on power size.

NOTICE

The output frequency value of the drive must never exceed 10% of the switching frequency. When the motor is running, adjust the switching frequency in *parameter 14-01 Switching Frequency* to minimize motor noise.

NOTICE

To avoid a trip, the drive can adjust the switching frequency automatically.

Option	Name	Description
[0]	1.0 kHz	
[1]	1.5 kHz	
[2]	2.0 kHz	
[3]	2.5 kHz	
[4]	3.0 kHz	
[5]	3.5 kHz	
[6]	4.0 kHz	

Option	Name	Description
[7]	5.0 kHz	
[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	

Parameter 14-02 Switching Pattern Shift Frequency

Table 535: Parameter 14-02 Switching Pattern Shift Frequency

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*.

Parameter 14-03 Overmodulation

Table 536: Parameter 14-03 Overmodulation

14-03 Overmodulation		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

NOTICE

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.
[1]	On	Select *[1] On* to enable the overmodulation function for the output voltage. This is the right option when it is required that the output voltage is higher than 95% of the input voltage (typically when running over-synchronously). The output voltage is increased according to the degree of overmodulation. Control in flux control principle provides an output current of up to 98% of the input current, regardless of *parameter 14-03 Overmodulation*.
[2]	User defined	Modulation index refers to the relation between motor voltage and DC-link voltage. High overmodulation increases the motor voltage and optimizes the motor torque and efficiency by reducing the motor current. A high modulation index increases the risk of torque ripple on the motor shaft. In applications where the torque ripple occur, it can be beneficial to disable the overmodulation. It is possible to configure the setup in the range defined in *parameter 40-55 Modulation Index*.

Parameter 14-04 Acoustic Noise Reduction

Table 537: Parameter 14-04 Acoustic Noise Reduction

14-04 Acoustic Noise Reduction		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Off	No change of the acoustic motor switching noise.
[1]	On	Select to reduce the acoustic noise from the motor.

Parameter 14-05 PWM Generation

Table 538: Parameter 14-05 PWM Generation

14-05 PWM Generation		
Default value: [0] Standard	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Use this parameter in VVC+ and U/f mode only. When running with low ratio between switch frequency and output frequency (especially close to or <10:1), it is possible to improve the resolution of the PWM modulation and optimize the output voltage.

Option	Name	Description
[0]*	Standard	Use this setting for standard motors.
[1]	Double update	Updates the PWM pattern twice per switch period. Select this option to achieve a more optimal sinus-wave and slight increase of the output voltage.

5.15.2 14-1* Mains On/Off

Parameters for configuring mains failure monitoring and handling. If a mains failure appears, the drive tries to continue in a controlled way until the power in the DC link is exhausted.

Parameter 14-10 Mains Failure

Table 539: Parameter 14-10 Mains Failure

14-10 Mains Failure		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

When *parameter 1-00 Configuration Mode* is set to *[2] Torque*, the following options are inactive:

- *[1] Ctrl. ramp-down*
- *[5] Kinetic back-up, trip*
- *[7] Kin. back-up, trip w recovery*

N O T I C E

This parameter cannot be changed while the motor is running.

Parameter 14-10 Mains Failure is typically used where short mains interruptions (voltage dips) are present. At 100% load and a short voltage interruption, the DC voltage on the main capacitors drops quickly. For larger drives, it only takes a few milliseconds before the DC level drops to about 373 V DC, and the IGBTs cut off and lose the control of the motor. When mains is restored, and the IGBTs start again, the output frequency and voltage vector do not correspond to the speed/frequency of the motor, and the result is normally an overvoltage or overcurrent, mostly resulting in a trip lock. *Parameter 14-10 Mains Failure* can be programmed to avoid this situation. Select the function according to which the drive must act when the threshold in *parameter 14-11 Mains Fault Voltage Level* is reached.

<table>
<tr><th>Option</th><th>Name</th><th>Description</th></tr>
<tr><td>[0]*</td><td>No function</td><td>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.</td></tr>
<tr><td>[1]</td><td>Ctrl. ramp-down</td><td>Control of the motor remains with the drive, and the drive performs a controlled ramp down from parameter 14-11 Mains Fault Voltage Level. If parameter 2-10 Brake Function is [0] Off or [2] AC brake, the ramp follows the overvoltage ramping. If parameter 2-10 Brake Function is [1] Resistor Brake, the ramp follows the setting in parameter 3-81 Quick Stop Ramp Time. This selection is useful in pump applications, where the inertia is low and the friction is high. When mains is restored, the output frequency ramps the motor up to the reference speed. If the mains interruption is prolonged, the controlled ramp down may bring the output frequency down to 0 RPM, and when the mains is restored, the application is ramped up from 0 RPM to the previous reference speed via the normal ramp-up. If the energy in the DC link disappears before the motor is ramped to 0, the motor is coasted. Limitation: See the introduction text in this parameter.</td></tr>
<tr><td>[3]</td><td>Coasting</td><td>The inverter turns off and the capacitor bank backs up the control card. Backing up the control card ensures a faster restart when mains is reconnected (at short power zags).</td></tr>
<tr><td>[4]</td><td>Kinetic back-up</td><td>Kinetic back-up ensures that the drive keeps running as long as there is energy in the system due to the inertia from motor and load. This is done by converting the mechanical energy to the DC link and maintaining control of the drive and motor. This can extend the controlled operation, depending on the inertia in the system. For fans, it is typically several seconds; for pumps up to 2 s; and for compressors only for a fraction of a second. Many industry applications can extend controlled operation for many seconds, which is often enough time for the mains to return.

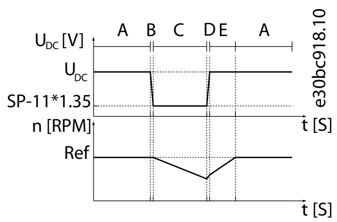


Illustration 68: Kinetic Back-up

<table>
<tr><td>A</td><td>Normal operation</td><td>D</td><td>Mains return</td></tr>
<tr><td>B</td><td>Mains failure</td><td>E</td><td>Normal operation: Ramping</td></tr>
<tr><td>C</td><td>Kinetic back-up</td><td></td><td></td></tr>
</table>

The DC level during [4] Kinetic backup equals parameter 14-11 Mains Fault Voltage Level x 1.35. If the mains does not return, U_{DC} is maintained as long as possible by ramping the speed down towards 0 RPM. Finally, the drive coasts. If the mains returns while in kinetic back-up mode, U_{DC} increases above parameter 14-11 Mains Fault Voltage Level x 1.35. This is detected in 1 of the following ways:

If U_{DC} > parameter 14-11 Mains Fault Voltage Level x 1.35 x 1.05.
If the speed is above the reference. This is relevant if the mains comes back at a lower level than before, for example parameter 14-11 Mains Fault Voltage Level x 1.35 x 1.02. This does not fulfill the criterion in point 1, and the drive tries to reduce U_{DC} to parameter 14-11 Mains Fault Voltage Level x 1.35 by increasing the speed. This cannot be done as the mains cannot be lowered.
If running mechanically. The same mechanism as in point 2 applies, but the inertia prevents the speed from going above the reference speed. This leads to the motor running mechanically until the speed is above the reference speed and the situation in point 2 occurs. Instead of waiting for that criterion, point 3 is introduced.
</td></tr>
</table>

<table>
<tr><th>Op-tion</th><th>Name</th><th>Description</th></tr>
<tr><td>[5]</td><td>Kinetic back-up, trip</td><td>

The difference between kinetic back-up with and without trip is that the latter always ramps down to 0 RPM and trips, regardless of whether mains returns or not. The function does not detect if mains returns. This is the reason for the relatively high level on the DC link during ramp-down.

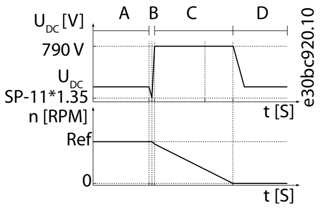


Illustration 69: Kinetic Back-up Trip

<table>
<tr><td>A</td><td>Normal operation</td><td>C</td><td>Kinetic back-up</td></tr>
<tr><td>B</td><td>Mains failure</td><td>D</td><td>Trip</td></tr>
</table>

</td></tr>
<tr><td>[6]</td><td>Alarm</td><td></td></tr>
<tr><td>[7]</td><td>Kin. back-up, trip w re-covery</td><td>

This option is valid in VVC+ only. Kinetic back-up with recovery combines the features of kinetic back-up and kinetic back-up with trip. This feature makes it possible to select between kinetic back-up and kinetic back-up with trip, based on a recovery speed, configurable in *parameter 14-15 Kin. Back-up Trip Recovery Level*. If mains does not return, the drive ramps down to 0 RPM and trips. If mains returns while in kinetic back-up at a speed above the value in *parameter 14-15 Kin. Back-up Trip Recovery Level*, normal operation is resumed. This is equal to *[4] Kinetic Back-up*. The DC level during *[7] Kin. back-up, trip w recovery* is *parameter 14-11 Mains Fault Voltage Level* x 1.35.

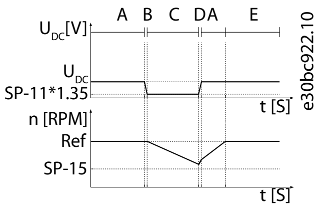


Illustration 70: Kinetic Back-up Trip w/Recovery, Mains Returns Above *Parameter 14-15 Kin. Back-up Trip Recovery Level*

<table>
<tr><td>A</td><td>Normal operation</td><td>D</td><td>Mains return</td></tr>
<tr><td>B</td><td>Mains Failure</td><td>E</td><td>Normal operation: Ramping</td></tr>
<tr><td>C</td><td>Kinetic back-up</td><td></td><td></td></tr>
</table>

If mains returns while in kinetic back-up at a speed below *parameter 14-15 Kin. Back-up Trip Recovery Level*, the drive ramps down to 0 RPM using the ramp and then trips. If the ramp is slower than the system ramping down on its own, the ramping is done mechanically and U_{DC} is at the normal level ($U_{DC,m}$ x 1.35).

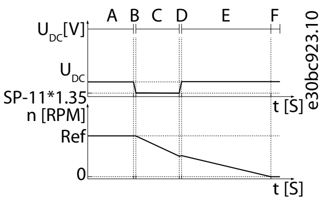


Illustration 71: Kinetic Back-up Trip w/Recovery, Slow Ramp, Mains Returns Below *Parameter 14-15 Kin. Back-up Trip Recovery Level*

</td></tr>
</table>

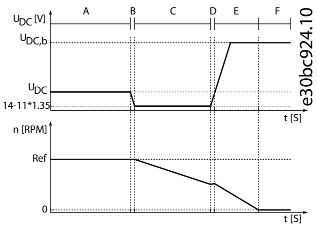
<table>
<tr><th>Option</th><th>Name</th><th>Description</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>A</td><td>Normal operation</td><td>D</td><td>Mains return</td></tr>
<tr><td>B</td><td>Mains failure</td><td>E</td><td>Kinetic back-up, ramping to trip</td></tr>
<tr><td>C</td><td>Kinetic back-up</td><td>F</td><td>Trip</td></tr>
</table>
If the ramp is quicker than the ramp-down speed of the application, the ramping generates current. This results in a higher U_{DC}, which is limited using the brake chopper/resistor brake.


Illustration 72: Kinetic Back-up Trip w/Recovery, Quick Ramp, Mains Returns Below Parameter 14-15 Kin. Back-up Trip Recovery Level
<table>
<tr><td>A</td><td>Normal operation</td><td>D</td><td>Mains return</td></tr>
<tr><td>B</td><td>Mains failure</td><td>E</td><td>Kinetic back-up ramping to trip</td></tr>
<tr><td>C</td><td>Kinetic back-up</td><td>F</td><td>Trip</td></tr>
</table>
</td></tr>
<tr><td>[9]</td><td>Kinetic back-up, coast</td><td>The purpose of this function is to avoid mains failure trips (Alarm 36), for example, where mains is weak or can be disturbed by other motors being started directly. When the drive detects mains failure, the drive ramps down the motor using kinetic back-up and coasts the drive. The drive remains coasted for the time set in parameter 40-14 Mains Loss Duration - the actual ramp-down time in KB. If mains returns after that time, the drive ramps up again. When parameter 40-14 Mains Loss Duration = 60, the drive immediately restarts the ramp up if the start command is still valid from PLC and mains voltage is back. When parameter 40-14 Mains Loss Duration = <60, the drive waits for the timer in parameter 40-14 Mains Loss Duration to expire before restarting ramp up. This delay prevents an unintentional restart if the drive detects that mains is back at an acceptable level, but not being consistently back.</td></tr>
</table>

Parameter 14-11 Mains Fault Voltage Level

Table 540: Parameter 14-11 Mains Fault Voltage Level

14-11 Mains Fault Voltage Level		
Default value: Size related	Parameter type: Range, 140 - 600 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).

Parameter 14-12 Response to Mains Imbalance

Table 541: Parameter 14-12 Response to Mains Imbalance

14-12 Response to Mains Imbalance		
Default value: [0] Trip lock	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

NOTICE
Make sure that the setting in *parameter 0-03 Regional Setting* matches the actual grid.

Operation under severe mains imbalance conditions reduces the lifetime of the motor. Conditions are considered severe if the motor is operated continuously near nominal load (for example, a pump or a fan running near full speed). Select the level of operation when mains imbalance conditions occur. Options *[5] Fast trip lock* to *[7] Fast warning* are based on a principle which enures detection of a missing mains phase within 2 s and responds according to the selection. See *parameter 14-17 Fast Mains Phase Loss* and *parameter 14-18 Fast Mains Phase Loss Min Power*. A minimum load on the drive of 2% nominal power is required for detection of missing mains phase.

Option	Name	Description
[0]*	Trip Lock	A trip lock is triggered upon a mains phase imbalance.
[1]	Warning	A warning is issued upon a mains phase imbalance.
[2]	Disabled	Mains failure detection is disabled.
[3]	Derate	The drive derates upon a mains phase imbalance.
[4]	Trip	The drive trips.
[5]	Fast Trip Lock	A trip lock occurs when a mains input phase is missing.
[6]	Fast Trip	The drive trips when a mains input phase is missing.
[7]	Fast Warning	A warning occurs when a mains input phase is missing.

Parameter 14-14 Kin. Back-up Time-up

Table 542: Parameter 14-14 Kin. Back-up Time-up

14-14 Kin. Back-up Time-up		
Default value: 60 s	Parameter type: Range, 0 - 60 s	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

This parameter defines the kinetic back-up timeout in flux mode when running on low voltage grids. If the supply voltage does not exceed the value defined in *parameter 14-11 Mains Fault Voltage Level* +5% within the specified time, the drive automatically runs a controlled ramp-down profile before stop.

Parameter 14-15 Kin. Back-up Trip Recovery Level

Table 543: Parameter 14-15 Kin. Back-up Trip Recovery Level

14-15 Kin. Back-up Trip Recovery Level		
Default value: Size related	Parameter type: Range, 0 - 60000.000 Reference- FeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Uint32	Change during operation: True

This parameter specifies the kinetic back-up trip recovery level. The unit is defined in *parameter 0-02 Motor Speed Unit*.

Parameter 14-16 Kin. Back-up Gain

Table 544: Parameter 14-16 Kin. Back-up Gain

14-16 Kin. Back-up Gain		
Default value: 100%	Parameter type: Range, 0 - 500%	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Enter the kinetic back-up gain value in percent.

Parameter 14-17 Fast Mains Phase Loss Level

Table 545: Parameter 14-17 Fast Mains Phase Loss Level

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.

N O T I C E

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

Parameter 14-18 Fast Mains Phase Loss Min Power

Table 546: Parameter 14-18 Fast Mains Phase Loss Min Power

14-18 Fast Mains Phase Loss Min Power		
Default value: 2	Parameter type: Range, 0 - 100	Setup: 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 Fst Mains Phase Loss Warning (see *parameter 14-12 Response to Mains Imbalance*) should be activated.

N O T I C E

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

5.15.3 14-2* Trip Reset

Parameters for configuring auto reset handling, special trip handling, and control card self-test or initialization.

Parameter 14-20 Reset Mode

Table 547: Parameter 14-20 Reset Mode

14-20 Reset Mode		
Default value: Size related	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.

N O T I C E

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	

Option	Name	Description
[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.

Parameter 14-21 Automatic Restart Time

Table 548: Parameter 14-21 Automatic Restart Time

14-21 Automatic Restart Time		
Default value: 10 s	Parameter type: Range, 0 - 600 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the time interval from trip to start of the automatic reset function. This parameter is active when *parameter 14-20 Reset Mode* is set to *[1]–[13] Automatic reset*.

Parameter 14-22 Operation Mode

Table 549: Parameter 14-22 Operation Mode

14-22 Operation Mode		
Default value: [0] Normal operation	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Use this parameter to specify normal operation, to perform tests, or to initialize all parameters except *parameter 15-03 Power Up's*, *parameter 15-04 Over Temp's*, and *parameter 15-05 Over Volt's*. This function is active only when the power is cycled to the drive. Select *[0] Normal operation* for normal operation of the drive with the motor in the selected application. Select *[1] Control card test* to test the analog and digital inputs and outputs and the +10 V control voltage. The test requires a test connector with internal connections. Use the following procedure for the control card test:

- Select *[1] Control card test*.
- Disconnect the mains supply and wait for the indicator light in the display to go out.
- Set switches S201 (A53) and S202 (A54) to ON/I.
- Insert the test plug.
- Connect to mains supply.
- Carry out various tests.
- The results are shown on the LCP and the drive moved into an infinite loop.
- *Parameter 14-22 Operation Mode* is automatically set to normal operation. Carry out a power cycle to start up in normal operation after a control card test.

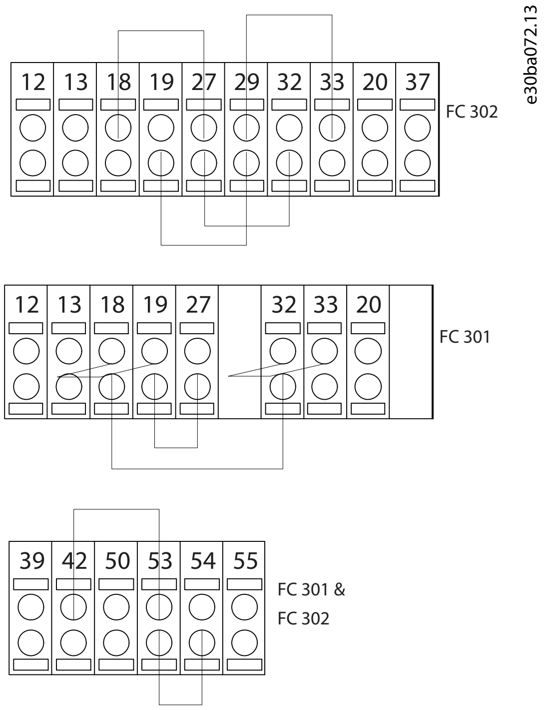
<table>
<tr><td>If the test is OK</td><td>LCP readout: Control card OK.
Disconnect the mains supply and remove the test plug. The green indicator light on the control card lights up.</td></tr>
<tr><td>If the test fails</td><td>LCP readout: Control card I/O failure.
Replace the drive or control card. The red indicator light on the control card is turned on. Test plugs (connect the following terminals to each other): 18 - 27 - 32; 19 - 29 - 33; 42 - 53 - 54.


Illustration 73: Test Plugs</td></tr>
</table>

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	Normal operation of the drive with the motor in the selected application.
[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. The drive resets during the next power-up. This option does not clear the service logs.
[3]	Boot mode	
[4]	Initialize all parameters	Select this option to reset all parameters (including bus and motor parameters) to default values.
[5]	Clear service logs	**NOTICE** Save the log information using MCT 10 Set-up Software before clearing the service logs. Select this option and perform a power cycle to clear the log.
[6]	Clear param. log	

Parameter 14-25 Trip Delay at Torque Limit

Table 550: Parameter 14-25 Trip Delay at Torque Limit

14-25 Trip Delay at Torque Limit		
Default value: 60 s	Parameter type: Range, 0 - 60 s	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the torque limit trip delay in s. When the output torque reaches the torque limits (*parameter 4-16 Torque Limit Motor Mode* and *parameter 4-17 Torque Limit Generator Mode*), a warning is triggered. When the torque limit warning has been continuously present for the period specified in this parameter, the drive trips. Disable the trip delay by setting the parameter to 60 s. Thermal monitoring of the drive remains active.

Parameter 14-26 Trip Delay at Inverter Fault

Table 551: Parameter 14-26 Trip Delay at Inverter Fault

14-26 Trip Delay at Inverter Fault		
Default value: Size related	Parameter type: Range, 0 - 35 s	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

When the drive detects an overvoltage in the set time, a trip is effected after the set time. If the value is 0, protection mode is disabled.

5.15.4 14-3* Current Limit Control

The drive features an integral current limit controller, which is activated when the motor current, and thus the torque, is higher than the torque limits set in *parameter 4-16 Torque Limit Motor Mode* and *parameter 4-17 Torque Limit Generator Mode*. When the current limit is reached during motor operation or regenerative operation, the drive tries to reduce torque below the preset torque limits as quickly as possible without losing control of the motor. While the current control is active, the drive can only be stopped by setting a digital input to *[2] Coast inverse* or *[3] Coast and reset inv*. Any signals on terminals 18–33 are not active until the drive is no longer near the current limit. By using a digital input set to *[2] Coast inverse* or *[3] Coast and reset inv.*, the motor does not use the ramp-down time, since the drive is coasted. If a quick stop is necessary, use the mechanical brake control function along with an external electro-mechanical brake attached to the application.

Parameter 14-30 Current Lim Ctrl, Proportional Gain

Table 552: Parameter 14-30 Current Lim Ctrl, Proportional Gain

14-30 Current Lim Ctrl, Proportional Gain		
Default value: 100%	Parameter type: Range, 0 - 500%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

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

Parameter 14-31 Current Lim Ctrl, Integration Time

Table 553: Parameter 14-31 Current Lim Ctrl, Integration Time

14-31 Current Lim Ctrl, Integration Time		
Default value: Size related	Parameter type: Range, 0.002 - 2 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: False

Controls the current limit control integration time. Setting it to a lower value makes it react faster. A setting too low leads to controller instability.

Parameter 14-32 Current Lim Ctrl, Filter Time

Table 554: Parameter 14-32 Current Lim Ctrl, Filter Time

14-32 Current Lim Ctrl, Filter Time		
Default value: Size related	Parameter type: Range, 1 - 100 ms	Setup: All setups
Conversion index: -4	Data type: Uint16	Change during operation: True

Controls the current limit control low-pass filter. This makes it possible to react to peak values or to average values. When selecting average values, it is sometimes possible to run with higher output current and instead trip on the hardware limit for current. However, the control reacts slower as it does not react on immediate values.

Parameter 14-35 Stall Protection

Table 555: Parameter 14-35 Stall Protection

14-35 Stall Protection		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

N O T I C E

This parameter is active in flux mode only.

Option	Name	Description
[0]	Disabled	Disables stall protection in field weakening flux mode and might cause the motor to be lost.
[1]*	Enabled	Enables stall protection in field weakening flux mode.

5.15.5 14-4* Energy Optimizing

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

Parameter 14-40 VT Level

Table 556: Parameter 14-40 VT Level

14-40 VT Level		
Default value: 66%	Parameter type: Range, 40 - 90%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

N O T I C E

This parameter cannot be adjusted while the motor is running.

N O T I C E

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

Enter the level of motor magnetization at low speed. Selection of a low value reduces energy loss in the motor but also reduces load capability.

Parameter 14-41 AEO Minimum Magnetisation

Table 557: Parameter 14-41 AEO Minimum Magnetisation

14-41 AEO Minimum Magnetisation		
Default value: Size related	Parameter type: Range, 40 - 200%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

NOTICE

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

Enter the minimum allowable magnetization for AEO. Selection of a low value reduces energy loss in the motor but can also reduce resistance to sudden load changes.

Parameter 14-42 Minimum AEO Frequency

Table 558: Parameter 14-42 Minimum AEO Frequency

14-42 Minimum AEO Frequency		
Default value: Size related	Parameter type: Range, 5 - 255 Hz	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

NOTICE

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

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

Parameter 14-43 Motor Cosphi

Table 559: Parameter 14-43 Motor Cosphi

14-43 Motor Cosphi		
Default value: Size related	Parameter type: Range, 0.40 - 0.95	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

The Cos(phi) setpoint is automatically set for optimum AEO performance. This parameter should normally not be altered. However, in some situations it may be necessary to enter a new value to fine-tune.

Parameter 14-44 d-axis Reference Gain

Table 560: Parameter 14-44 d-axis Reference Gain

14-44 d-axis Reference Gain		
Default value: 100%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Adjustment parameter for the d-axis current. 100% indicates maximum torque per ampere value based on motor parameters. Increasing the maximum torque can improve the power factor of the machine, which may increase the current consumption. The adjustment parameter allows to:

- Adjust minimum current consumption, allowing for tolerances in the motor parameters.
- Obtain the optimal balance between current consumption and power factor of the machine at a given point of operation.

Parameter 14-46 PROFIEnergy Times

Table 561: Parameter 14-46 PROFIEnergy Times

14-46 PROFIEnergy Times		
Default value: Size related	Parameter type: Range, 0 - 0x7ffffff, Array [3]	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Parameter with an array of 3. *[0] Time to pause*, *[1] Time min stay*, *[2] Time regular operate*.

Parameter 14-47 PROFIEnergy State

Table 562: Parameter 14-47 PROFIEnergy State

14-47 PROFIEnergy State		
Default value: [255] Ready to operate	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: False

Option	Name	Description
[1]	LCP off	
[4]	Internal fan off	
[7]	Gatedrive off	
[10]	Mains off	
[13]	External fan off	
[255]*	Ready to operate	

Parameter 14-48 PROFIEnergy Desired State

Table 563: Parameter 14-48 PROFIEnergy Desired State

14-48 PROFIEnergy Desired State		
Default value: [255] Ready to operate	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: False

Option	Name	Description
[1]	LCP off	
[4]	Internal fan off	
[7]	Gatedrive off	
[10]	Mains off	
[13]	External fan off	
[255]*	Ready to operate	

Parameter 14-49 PROFIEnergy Info

Table 564: Parameter 14-49 PROFIEnergy Info

14-49 PROFIEnergy Info		
Default value: 0	Parameter type: Range, 0 - 0x7ffffff, Array [115]	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Read-out information about PROFIEnergy.

5.15.6 14-5* Environment

AMA and Motor Filters

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

Table 565: Motor Filter Types

Motor construction	Filter type	
	MCC 102 dU/dt Filters	**MCC 101 Sine-wave Filters and MCC 201 All-mode Filters**
	Valid P1-29 AMA options	
ASM and SPM	*[1] Complete AMA*	*[2] Reduced AMA*
	[2] Reduced AMA	*[4] Enable reduced AMA II*
	[4] Enable reduced AMA II	–
IPM	*[1] Complete AMA*	*[2] Reduced AMA*
	[2] Reduced AMA	AMA II not available
	AMA II not available	–

N O T I C E

Perform a power cycle after changing any of the parameters in this parameter group.

Use these parameters when operating the drive under special environmental conditions.

Parameter 14-50 RFI Filter

Table 566: Parameter 14-50 RFI Filter

14-50 RFI Filter		
Default value: [1] On	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: False

Turn the RFI filter on or off. The RFI filter ensures that the drive complies with EMC standards. Select *[0] Off* only when the drive is connected to an isolated mains source (IT mains).

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

Parameter 14-51 DC-link Compensation

Table 567: Parameter 14-51 DC-link Compensation

14-51 DC-link Compensation		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

The rectified AC-DC voltage in the DC link of the drive is associated with voltage ripples. These ripples can increase in magnitude with increased load. These ripples are undesirable because they can generate current and torque ripples. A compensation method is used to reduce these voltage ripples in the DC link. In general, DC-link compensation is recommended for most applications, but pay attention when operating in field weakening as it can generate speed oscillations at the motor shaft. In field weakening, turn off DC-link compensation.

Option	Name	Description
[0]	Off	Disables DC-link compensation.
[1]	On	Enables DC-link compensation.
[2]	Advanced	Improved compensation of DC-link ripple caused by mains frequency and phase imbalance. **N O T I C E** *Parameter 0-03 Regional Setting* must be set correctly according to the actual mains grid.

Parameter 14-52 Fan Control

Table 568: Parameter 14-52 Fan Control

14-52 Fan Control		
Default value: [0] Auto	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the minimum speed of the main fan.

Option	Name	Description
[0]*	Auto	Select *[0] Auto* to run fan only when internal temperature in the drive is in the range 35 °C (95 °F) to approximately 55 °C (131 °F). The fan runs at low speed below 35 °C (95 °F), and at full speed at approximately 55 °C (131 °F).
[1]	On 50%	The fan always runs at 50% speed or above. The fan runs at 50% speed at 35 °C (95 °F), and at full speed at approximately 55 °C (131 °F).
[2]	On 75%	The fan always runs at 75% speed or above. The fan runs at 75% speed at 35 °C (95 °F), and at full speed at approximately 55 °C (131 °F).
[3]	On 100%	The fan always runs at 100% speed.
[4]	Auto (Low temp env.)	This option is the same as *[0] Auto*, but with special considerations around and below 0 °C (32 °F). In option *[0] Auto* there is a risk that the fan starts running around 0 °C as the drive detects a sensor fault and thus protects the drive while reporting *warning 66, Heat sink Temperature Low*. Option *[4] Auto (Low temp env.)* can be used in very cold environments and prevents the negative effects of this further cooling and avoids *warning 66, Heat sink Temperature Low*.

Parameter 14-53 Fan Monitor

Table 569: Parameter 14-53 Fan Monitor

14-53 Fan Monitor		
Default value: [1] Warning	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the drive action if a fan fault is detected.

Option	Name	Description
[0]	Disabled	
[1]*	Warning	
[2]	Trip	

Parameter 14-55 Output Filter

Table 570: Parameter 14-55 Output Filter

14-55 Output Filter		
Default value: [0] No filter	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

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.

NOTICE

This parameter cannot be adjusted while the motor is running.

NOTICE

Reset the drive after selecting *[2] Sine-wave filter fixed.*

Select the type of output filter connected.

<table>
<tr><th>Op-tion</th><th>Name</th><th>Description</th></tr>
<tr><td>[0]*</td><td>No filter</td><td>Set the parameter when VLT® MCC 102 dU/dt filters or VLT® MCC 105 high-frequency common-mode filters are connected to the drive.</td></tr>
<tr><td>[1]</td><td>Sine-wave filter</td><td>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.</td></tr>
<tr><td>[2]</td><td>Sine-Wave Filter Fixed</td><td>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.</td></tr>
<tr><td>[5]</td><td>All-mode Filter</td><td>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.</td></tr>
</table>

Parameter 14-56 Capacitance Output Filter

Table 571: Parameter 14-56 Capacitance Output Filter

14-56 Capacitance Output Filter		
Default value: Size related	Parameter type: Range, 0.1 - 6500 uF	Setup: All setups
Conversion index: -7	Data type: Uint16	Change during operation: False

Set the C_y (capacitance) value of the output filter in uF, when using VLT® MCC 101 Sine-wave filter and VLT® MCC 201 All-mode filter. See the filter product label for the capacitance value. The value is the equivalent star-connected capacitance of the filter. When the filters are installed in parallel, enter the combined capacitance value of the paralleled filter. The value is the equivalent star-connected capacitance (C_y) of the filter multiplied by the number of installed paralleled filters.

NOTICE

SETTING FOR VLT® MCC 101 SINE-WAVE FILTER AND VLT® MCC 201 ALL-MODE FILTER

Enables accurate flux compensation when option [2] Flux sensorless or option [3] Flux w/motor feedback is selected in *parameter 1-01 Motor Control Principle*.

- Enter the correct capacitance value of the connected filter.

Parameter 14-57 Inductance Output Filter

Table 572: Parameter 14-57 Inductance Output 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.

Parameter 14-59 Actual Number of Inverter Units

Table 573: Parameter 14-59 Actual Number of Inverter Units

14-59 Actual Number of Inverter Units		
Default value: Size related	Parameter type: Range, 1 - 1	Setup: 1 setups
Conversion index: 0	Data type: Uint8	Change during operation: False

Set the actual number of power units.

5.15.7 14-6* Auto Derate

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

Parameter 14-60 Function at Over Temperature

Table 574: Parameter 14-60 Function at Over Temperature

14-60 Function at Over Temperature		
Default value: [0] Trip	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

If either heat sink or control card temperature exceeds a factory-programmed temperature limit, a warning is activated. If the temperature increases further, select whether the drive should trip (trip lock) or derate the output current.

Option	Name	Description
[0]*	Trip	The drive trips (trip lock) and generates an alarm. Cycle power to reset the alarm. The motor restarts when the heat sink temperature has dropped below the alarm limit.
[1]	Derate	If the critical temperature is exceeded, the output current is reduced until the allowable temperature has been reached.

No trip at inverter overload

In some systems, the drive has not been sized properly to yield the current needed in all points of the operational flow-head characteristic. At these points, the motor needs a current higher than the rated current of the drive. The drive can yield 110% of the rated current continuously for 60 s. If still overloaded, the drive normally trips (causing the motor to stop by coasting) and issues an alarm.

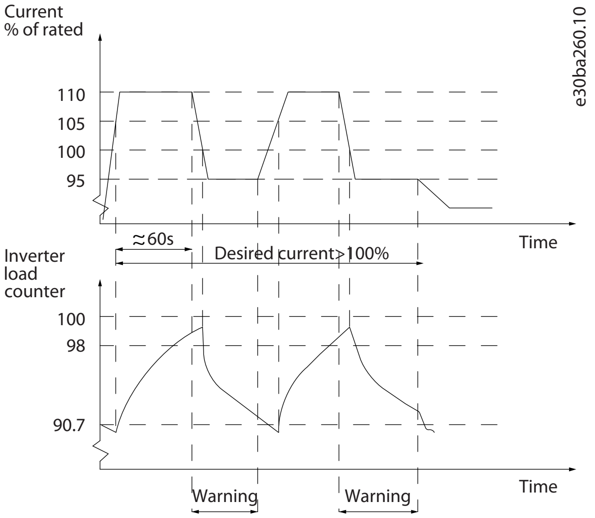


Illustration 74: Output Current in Overload Condition

If the motor is unable to run continuously with the demanded capacity, run it at reduced speed for a while.

Select *parameter 14-61 Function at Inverter Overload* to automatically reduce motor speed until the output current is below 100% of the rated current (set in *parameter 14-62 Inv. Overload Derate Current*). *Parameter 14-61 Function at Inverter Overload* is an alternative to letting the drive trip.

The drive estimates the load on the power section with an inverter load counter, which causes a warning at 98% and a reset of the warning at 90%. At the value 100%, the drive trips and issues an alarm. Status for the counter can be read in *parameter 16-35 Inverter Thermal*.

If *parameter 14-61 Function at Inverter Overload* is set to *[3] Derate*, the motor speed is reduced when the counter exceeds 98%, and stays reduced until the counter has dropped below 90.7%. If *parameter 14-62 Inv. Overload Derate Current* is set to for example 95%, a steady overload causes the pump speed to fluctuate between values corresponding to 110% and 95% of rated output current for the drive.

Parameter 14-61 Function at Inverter Overload

Table 575: Parameter 14-61 Function at Inverter Overload

14-61 Function at Inverter Overload		
Default value: [0] Trip	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Use if there is a steady overload beyond the thermal limits (110% for 60 s).

Option	Name	Description
[0]*	Trip	Select *[0] Trip* to make the drive trip and issue an alarm.
[1]	Derate	Reduces the motor speed to decrease the load on the power section and allowing it to cool down.

Parameter 14-62 Inv. Overload Derate Current

Table 576: Parameter 14-62 Inv. Overload Derate Current

14-62 Inv. Overload Derate Current		
Default value: 95%	Parameter type: Range, 50 - 100%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the current level (in % of rated output current for the drive) when running with reduced motor speed after load on the drive has exceeded the allowable limit (110% for 60 s).

5.15.8 14-8* Options

Parameter 14-80 Option Supplied by External 24VDC

Table 577: Parameter 14-80 Option Supplied by External 24VDC

14-80 Option Supplied by External 24VDC		
Default value: [1] Yes	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: False

N O T I C E

To make the parameter change function, perform a power cycle.

Option	Name	Description
[0]	No	Select this option to use the 24 V DC supply of the drive.
[1]*	Yes	Select this option if a 24 V DC external supply is used to power the option. Inputs/outputs are galvanically isolated from the drive when operated from an external supply.

Parameter 14-88 Option Data Storage

Table 578: Parameter 14-88 Option Data Storage

14-88 Option Data Storage		
Default value: 0	Parameter type: Range, 0 - 65535, Array [24]	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter stores information about options over a power cycle.

Parameter 14-89 Option Detection

Table 579: Parameter 14-89 Option Detection

14-89 Option Detection		
Default value: [0] Protect option config.	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

Selects the behavior of the drive when a change in the option configuration is detected.

Option	Name	Description
[0]*	Protect option config.	Freezes the current settings and prevents unwanted changes when missing or defective options are detected.
[1]	Enable option change	Changes drive settings and is used when modifying the system configuration. This parameter setting returns to *[0] Protect option config.* after an option change.

5.15.9 14-9* Fault Settings

Parameter 14-90 Fault Level

Table 580: Parameter 14-90 Fault Level

14-90 Fault Level		
Default value: Size related	Parameter type: Option, Array [28]	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

This is an array parameter with 26 elements. Each of the bits can be configured to any of the following options. Use this parameter to customize fault levels.

Option	Name	Description
[0]	Off	Use *[0] Off* with caution as it ignores all warnings and alarms for the selected source.
[1]	Warning	
[2]	Trip	Changing a fault level from default option *[3] Trip Lock* to *[2] Trip* leads to the automatic reset of the alarm. For alarms involving overcurrent, the drive has a hardware protection that issues a 3-minute recovery after 2 consecutive overcurrent incidents. This hardware protection cannot be overruled.
[3]	Trip lock	
[4]	Trip w. delayed reset	This option adds a delay between automatic resets, otherwise it is the same as option *[2] Trip*. The delay prevents a situation where reset is attempted repeatedly for an overcurrent situation. Hardware protection of the drive forces the 3-minute recovery time after 2 consecutive overcurrents (within a short time window).

Table 581: Selection of Action when Selected Alarm Appears

Failure	Alarm	Element in parameter 14-90 Fault Level	Off	Warning	Trip	Trip lock	Trip with delayed reset
10 V low	1	1490.0	–	D	–	–	–
24 V supply low	47	1490.1	X	–	–	D	–
1.2 V supply low	48	1490.2	–	–	–	D	–
Voltage limit	64	1490.3	–	D	–	–	–
Ground fault during ramping	14	1490.4	–	–	D	–	–
Ground fault 2 during continuous operation	45	1490.5	–	–	D	–	–
Torque limit	12	1490.6	–	D	–	–	–
Overcurrent	13	1490.7	–	–	–	D	X
Short circuit	16	1490.8	–	–	–	D	–
Heat sink temperature	29	1490.9	–	–	–	D	–

Failure	Alarm	Element in parameter 14-90 Fault Level	Off	Warning	Trip	Trip lock	Trip with delayed reset
Heat sink sensor	39	1490.10	–	–	–	D	–
Control card temperature	65	1490.11	–	–	–	D	–
Power card temperature	69	1490.12	–	(1)	–	D	–
Heat sink temperature(2)	244	1490.13	–	–	–	D	–
Heat sink sensor(2)	245	1490.14	–	–	–	D	–
Power card temperature(2)	247	1490.15	–	–	–	D	–
Motor phase U missing	30	1490.16	–	–	–	D	–
Motor phase V missing	31	1490.16	–	–	–	D	–
Motor phase W missing	32	1490.16	–	–	–	D	–
Derag limit fault	100	1490.17	–	–	D	–	–
Inverter overload	9	1490.18	X	D	–	–	–
Current limit(3)	59	1490.19	X	D	–	–	–
Locked rotor	99	1490.20	–	–	X	D	–
AIC earth fault	407	1490.21	–	–	–	D	–
DC-link voltage out of range	404	1490.22	–	–	–	D	–
Mains contactor fault	300	1490.23	–	–	–	D	–
Not used	x	1490.24	–	–	–	D	–
Fan contactor	431	1490.25	–	–	–	D	–
Inrush fault	33	1490.26	–	–	–	D	–
Fieldbus fault	34	1490.27	X	D	–	–	–

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

2 Only high-power drives.

3 Warning 59 is configured in 1490.19. The current limit warning can be disabled by choice. The alarm cannot be configured.

VLT® Motion Control Tool MCT 10 has the element numbers listed in the column ID. Use this table with MCT 10 to get information about specific fault levels.

5.16 Parameter Group 15-** Drive Information

5.16.1 15-0* Operating Data

Parameter 15-00 Operating Hours

Table 582: Parameter 15-00 Operating Hours

15-00 Operating Hours		
Default value: 0 h	Parameter type: Range, 0 - 2147483647 h	Setup: All setups
Conversion index: 74	Data type: Uint32	Change during operation: False

View for how many hours the drive has run. The value is saved when the drive is turned off.

Parameter 15-01 Running Hours

Table 583: Parameter 15-01 Running Hours

15-01 Running Hours		
Default value: 0 h	Parameter type: Range, 0 - 2147483647 h	Setup: All setups
Conversion index: 74	Data type: Uint32	Change during operation: False

View how many hours the motor has run. Reset the counter in *parameter 15-07 Reset Running Hours Counter*. The value is saved when the drive is turned off.

Parameter 15-02 kWh Counter

Table 584: Parameter 15-02 kWh Counter

15-02 kWh Counter		
Default value: 0 kWh	Parameter type: Range, 0 - 2147483647 kWh	Setup: All setups
Conversion index: 75	Data type: Uint32	Change during operation: False

Register the power consumption of the motor as an average value over 1 hour. Reset the counter in *parameter 15-06 Reset kWh Counter*.

Parameter 15-03 Power Up's

Table 585: Parameter 15-03 Power Up's

15-03 Power Up's		
Default value: 0	Parameter type: Range, 0 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

View the number of times the drive has been powered up.

Parameter 15-04 Over Temp's

Table 586: Parameter 15-04 Over Temp's

15-04 Over Temp's		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View the number of drive temperature faults.

Parameter 15-05 Over Volt's

Table 587: Parameter 15-05 Over Volt's

15-05 Over Volt's		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View the number of drive overvoltages.

Parameter 15-06 Reset kWh Counter

Table 588: Parameter 15-06 Reset kWh Counter

15-06 Reset kWh Counter		
Default value: [0] Do not reset	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Do not reset	No reset of the kWh counter is required.
[1]	Reset counter	Press [OK] to reset the kWh counter to 0 (see *parameter 15-02 kWh Counter*).

Parameter 15-07 Reset Running Hours Counter

Table 589: Parameter 15-07 Reset Running Hours Counter

15-07 Reset Running Hours Counter		
Default value: [0] Do not reset	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Do not reset	No reset of running hours and number of starts counter is required.
[1]	Reset counter	To reset the running hours and numbers of starts counter to 0, select *[1] Reset* and press [OK] (see *parameter 15-01 Running Hours* and *parameter 15-08 Number of starts*).

Parameter 15-08 Number of starts

Table 590: Parameter 15-08 Number of starts

15-08 Number of starts		
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 motor has been started. The counter can be reset in *parameter 15-07 Reset Running Hours Counter*. The value is saved when the drive is turned off.

5.16.2 15-1* Data Log Settings

The data log enables continuous logging of up to 4 data sources (*parameter 15-10 Logging Source*) at individual rates (*parameter 15-11 Logging Interval*). A trigger event (*parameter 15-12 Trigger Event*) and window (*parameter 15-14 Samples Before Trigger*) are used to start and stop the logging conditionally.

Parameter 15-10 Logging Source

Table 591: Parameter 15-10 Logging Source

15-10 Logging Source		
Default value: [0] None	Parameter type: Option, Array [4]	Setup: 2 setups
Conversion index: -	Data type: Uint16	Change during operation: True

Select the variables to be logged.

Option	Name	Description
[0]*	None	
[15]	Readout: Actual setup	
[17]	Active fire mode setup	
[1397]	Alert alarm word	
[1398]	Alert warning word	

Option	Name	Description
[1399]	Alert status word	
[1600]	Control word	
[1601]	Reference [Unit]	
[1602]	Reference [%]	
[1603]	Status word	
[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	
[1622]	Torque [%]	
[1624]	Calibrated Stator Resistance	
[1626]	Power filtered [kW]	
[1627]	Power filtered [hp]	
[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	
[1650]	External reference	
[1652]	Feedback[Unit]	
[1654]	Feedback 1 [Unit]	
[1655]	Feedback 2 [Unit]	
[1656]	Feedback 3 [Unit]	
[1659]	Adjusted setpoint	

Option	Name	Description
[1660]	Digital input	
[1662]	Analog input 53	
[1664]	Analog input 54	
[1665]	Analog output 42 [mA]	
[1666]	Digital output [bin]	
[1675]	Analog in X30/11	
[1676]	Analog in X30/12	
[1677]	Analog out X30/8 [mA]	
[1687]	Bus readout alarm/warning	
[1690]	Alarm word	
[1691]	Alarm word 2	
[1692]	Warning word	
[1693]	Warning word 2	
[1694]	Ext. status word	
[1695]	Ext. status word 2	
[1697]	Alarm word 3	
[1698]	Warning word 3	
[1830]	Analog input X42/1	
[1831]	Analog input X42/3	
[1832]	Analog input X42/5	
[1833]	Analog out X42/7 [V]	
[1834]	Analog out X42/9 [V]	
[1835]	Analog out X42/11 [V]	
[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]	

Option	Name	Description
[1850]	Sensorless readout [unit]	
[1860]	Digital input 2	
[3110]	Bypass status word	

Parameter 15-11 Logging Interval

Table 592: Parameter 15-11 Logging Interval

15-11 Logging Interval		
Default value: Size related	Parameter type: Range, 0.000 - 0.000, Array [4]	Setup: 2 setups
Conversion index: -3	Data type: Time diff wo DateID [4]	Change during operation: True

Enter the interval in ms between each sampling of the variables to be logged.

Parameter 15-12 Trigger Event

Table 593: Parameter 15-12 Trigger Event

15-12 Trigger Event		
Default value: [0] False	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

Select the trigger event. When the trigger event occurs, a window is applied to freeze the log. The log then retains a specified percentage of samples before the occurrence of the trigger event (*parameter 15-14 Samples Before Trigger*).

Option	Name	Description
[0]*	False	
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	

Option	Name	Description
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[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	

Parameter 15-13 Logging Mode

Table 594: Parameter 15-13 Logging Mode

15-13 Logging Mode		
Default value: [0] Log always	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Log always	Select *[0] Log always* for continuous logging.
[1]	Log once on trigger	Select *[1] Log once on trigger* to start and stop logging conditionally using *parameter 15-12 Trigger Event* and *parameter 15-14 Samples Before Trigger*.

Parameter 15-14 Samples Before Trigger

Table 595: Parameter 15-14 Samples Before Trigger

15-14 Samples Before Trigger		
Default value: 50	Parameter type: Range, 0 - 100	Setup: 2 setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Before a trigger event, enter the percentage of all samples which should be retained in the log. See also *parameter 15-12 Trigger Event* and *parameter 15-13 Logging Mode*.

Parameter 15-15 Info Message: "Service Log Full"

Table 596: Parameter 15-15 Info Message: "Service Log Full"

15-15 Info Message: "Service Log Full"		
Default value: [0] Disabled	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

See Service log. By enabling this parameter, a text message is shown in the drive when the service log runs full: *Clear logs, Service log full: 28 [M26]*. The message recommends to clear the log.

Option	Name	Description
[0]*	Disabled	
[1]	Enabled	Enable message.

Parameter 15-17 Service Log Trigger Alarm

Table 597: Parameter 15-17 Service Log Trigger Alarm

15-17 Service Log Trigger Alarm		
Default Value: 0	Parameter Type: Range, 0=Off - 9.999	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.

5.16.3 Service Log

The service log function saves detailed log information of a 5-second interval when alarms occur. Service technicians can analyze this information to troubleshoot and optimize the drive.

The drive can save up to 24 service log records in the flash memory. To receive a warning when the service log is full, set *parameter 15-15 Info Message: "Service Log Full"* to *[1] Enable*. To read the current number of records in the memory, check *parameter 16-42 Service Log Counter*.

Sampling rate

There are 2 periods with different sampling rates:

- Slow samples: 20 samples at a rate of 250 ms resulting in 5 s of history before the trip.
- Fast samples: 50 samples at a rate of 5 ms resulting in 250 ms of detailed history before the trip.

N O T I C E

To enable the real-time clock (RTC) stamp, use the real-time clock module. If real-time clock is not available, the operating time in *parameter 15-32 Fault Log: Time* is recorded.

Table 598: Logged Channels

Polling	Color	Name
CH 1	Light gray	Frequency
CH 2	Dark gray	Speed [RPM]
CH 3	Red	Reference [%]
CH 4	Orange	DC-link voltage
CH 5	Yellow	Motor current
CH 6	Khaki	Motor voltage
CH 7	Light green	Control word
CH 8	Light blue	Status word
CH 9	Dark blue	[20] Operating hours
CH 10	Purple	[21] Running hours
CH 11	Magenta	[22] kWh counter

Channels 1–8 are fixed channels with unfiltered signals and cannot be changed. Channels 9–11 are filtered and refer to *parameters 0–20* to *0–22*, which are reflected in the 3 upper lines in the LCP.

5.16.4 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.

5.16.5 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.

5.16.6 Reading the Service Log Information

See the VLT® Motion Control Tool MCT 10 to read the service log information.

Procedure

1. Open the MCT 10 software.
2. Select a drive.
3. Select the Service Log plug-in.

4. Click *Read from drive*.

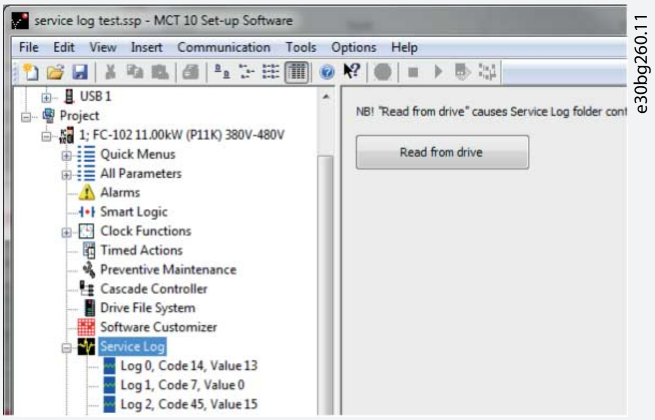


Illustration 75: MCT 10, Read From Drive

The service log view in MCT 10 looks as shown in Illustration 76. Use the cursor to view the detailed readings at a specific time.

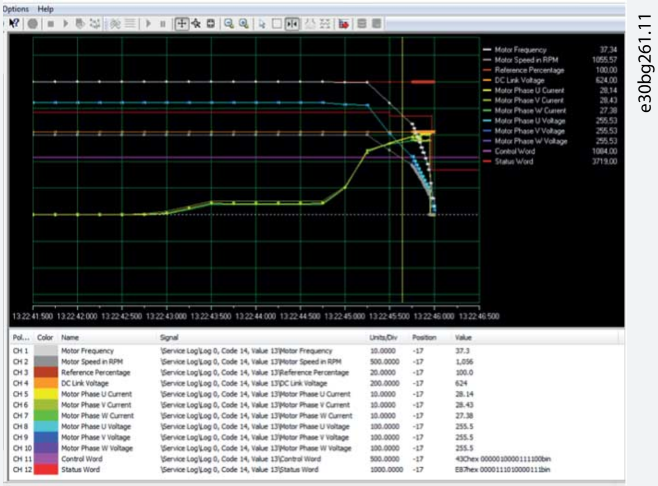


Illustration 76: Service Log View, 5 s

Use the zoom function to focus on the last 250 ms before the fault.

5.16.7 Alarms that Trigger a Service Log Record

Table 599: Alarms Triggering a Service Log Record

#	Alarm title
4	Mains phase loss
5	DC voltage high
6	DC voltage low
7	DC overvolt
8	DC undervolt
9	Inverter overld.
10	Motor ETR over
12	Torque limit

#	Alarm title
13	Over current
14	Earth (ground) fault
16	Short circuit
18	Start failed
25	Brake resistor
26	Brake overload
27	Brake IGBT
28	Brake check
30	U phase loss
31	V phase loss
32	W phase loss
36	Mains failure
37	Phase imbalance
44	Earth (ground) fault AL44
45	Earth (ground) fault 2
59	Current

NOTICE

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

5.16.8 15-2* Historic Log

View up to 50 logged data items via the array parameters in this parameter group. Data is logged every time an event occurs (not to be confused with SLC events). Events in this context are defined as a change in 1 of the following areas:

- Digital inputs
- Digital outputs
- Warning word
- Alarm word
- Status word
- Control word
- Extended status word

Events are logged with value and time stamp in ms. The time interval between 2 events depends on how often events occur (maximum once every scan time). Data logging is continuous, but if an alarm occurs, the log is saved and the values can be viewed on the display. This feature is useful, for example when carrying out service following a trip. View the historic log contained in this parameter via the serial communication port or via the display.

Parameter 15-20 Historic Log: Event

Table 600: Parameter 15-20 Historic Log: Event

15-20 Historic Log: Event		
Default value: 0	Parameter type: Range, 0 - 255, Array [50]	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

View the event type of the logged events.

Parameter 15-21 Historic Log: Value

Table 601: Parameter 15-21 Historic Log: Value

15-21 Historic Log: Value		
Default value: 0	Parameter type: Range, 0 - 2147483647, Array [50]	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

View the value of the logged event. Interpret the event values as below:

Digital input	Decimal value. See *parameter 16-60 Digital Input* for a description after converting to binary value.
Digital output (not monitored in this SW release)	Decimal value. See *parameter 16-66 Digital Output [bin]* for a description after converting to binary value.
Warning word	Decimal value. See *parameter 16-92 Warning Word* for a description.
Alarm word	Decimal value. See *parameter 16-90 Alarm Word* for a description.
Status word	Decimal value. See *parameter 16-03 Status Word* for a description after converting to binary value.
Control word	Decimal value. See *parameter 16-00 Control Word* for a description.
Extended status word	Decimal value. See *parameter 16-94 Ext. Status Word* for a description.

Parameter 15-22 Historic Log: Time

Table 602: Parameter 15-22 Historic log: Time

15-22 Historic log: Time		
Default value: 0 ms	Parameter type: Range, 0 - 2147483647 ms, Array [50]	Setup: All setups
Conversion index: -3	Data type: Uint32	Change during operation: False

View the time at which the logged event occurred. Time is measured in ms since drive start. This is an array parameter containing event times 0-49.

Parameter 15-23 Historic log: Date and Time

Table 603: Parameter 15-23 Historic log: Date and Time

15-23 Historic log: Date and Time		
Default value: Size related	Parameter type: Range, 0 - 0, Array [50]	Setup: All setups
Conversion index: 0	Data type: TimeOfDay	Change during operation: False

Array parameter; Date & Time 0 – 49. This parameter shows which time the logged event occurred.

5.16.9 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 stamp can be viewed for all logged data.

Parameter 15-30 Fault Log: Error Code

Table 604: Parameter 15-30 Alarm Log: Error Code

15-30 Alarm 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 6 Troubleshooting.

Parameter 15-31 Alarm Log: Value

Table 605: Parameter 15-31 Alarm Log: Value

15-31 Alarm Log: Value		
Default value: 0	Parameter type: Range, -32767 - 32767, Array [10]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View an extra description of the error. This parameter is mostly used with *alarm 38, internal fault*.

Parameter 15-32 Alarm Log: Time

Table 606: Parameter 15-32 Alarm Log: Time

15-32 Alarm Log: Time		
Default Value: 0 s	Parameter Type: Range, 0 - 2147483647, Array [10]	Setup: All setups
Conversion Index: 0	Data Type: Uint32	Change during operation: False

View the time when the logged event occurred. Time is measured in s from start-up of the drive.

Parameter 15-33 Alarm Log: Date and Time

Table 607: Parameter 15-33 Alarm Log: Date and Time

15-33 Alarm Log: Date and Time		
Default value: Size related	Parameter type: Range, 0 - 0, Array [10]	Setup: All setups
Conversion index: 0	Data type: TimeOfDay	Change during operation: False

Array parameter; Date & Time 0–9: This parameter shows when the logged event occurred.

5.16.10 15-4* Drive Identification

Parameters containing read-only information about the hardware and software configuration of the drive.

Parameter 15-40 FC Type

Table 608: Parameter 15-40 FC Type

15-40 FC Type		
Default value: 0	Parameter type: Range, 0 - 6	Setup: All setups
Conversion index: 0	Data type: VisStr[6]	Change during operation: False

View the drive type. The readout is identical to the drive power field of the type code definition, characters 1–6.

Parameter 15-41 Power Section

Table 609: Parameter 15-41 Power Section

15-41 Power Section		
Default value: 0	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

View the power section. The readout is identical to the drive power field of the type code definition, characters 7–10.

Parameter 15-42 Voltage

Table 610: Parameter 15-42 Voltage

15-42 Voltage		
Default value: 0	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

View the voltage. The readout is identical to the drive power field of the type code definition, characters 11-12.

Parameter 15-43 Software Version

Table 611: Parameter 15-43 Software Version

15-43 Software Version		
Default value: 0	Parameter type: Range, 0 - 5	Setup: All setups
Conversion index: 0	Data type: VisStr[5]	Change during operation: False

View the combined SW version (or package version) consisting of power SW and control SW.

Parameter 15-44 Ordered Typecode String

Table 612: Parameter 15-44 Ordered Typecode String

15-44 Ordered Typecode String		
Default value: 0	Parameter type: Range, 0 - 40	Setup: All setups
Conversion index: 0	Data type: VisStr[40]	Change during operation: False

View the type code string used for reordering the drive in its original configuration.

Parameter 15-45 Actual Typecode String

Table 613: Parameter 15-45 Actual Typecode String

15-45 Actual Typecode String		
Default value: 0	Parameter type: Range, 0 - 40	Setup: All setups
Conversion index: 0	Data type: VisStr[40]	Change during operation: False

View the actual type code string.

Parameter 15-46 Frequency Converter Ordering No

Table 614: Parameter 15-46 Frequency Converter Ordering No

15-46 Frequency Converter Ordering No		
Default value: 0	Parameter type: Range, 0 - 8	Setup: All setups
Conversion index: 0	Data type: VisStr[8]	Change during operation: False

View the 8-digit code number used for reordering the drive in its original configuration. To restore the order number after the power card exchange, see *parameter 14-29 Service Code*.

Parameter 15-47 Power Card Ordering No

Table 615: Parameter 15-47 Power Card Ordering No

15-47 Power Card Ordering No		
Default value: 0	Parameter type: Range, 0 - 8	Setup: All setups
Conversion index: 0	Data type: VisStr[8]	Change during operation: False

View the power card code number.

Parameter 15-48 LCP ID No

Table 616: Parameter 15-48 LCP ID No

15-48 LCP ID No		
Default value: 0	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

View the LCP ID number.

Parameter 15-49 SW ID Control Card

Table 617: Parameter 15-49 SW ID Control Card

15-49 SW ID Control Card		
Default value: 0	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

View the control card software version number.

Parameter 15-50 SW ID Power Card

Table 618: Parameter 15-50 SW ID Power Card

15-50 SW ID Power Card		
Default value: 0	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

View the power card software version number.

Parameter 15-51 Frequency Converter Serial Number

Table 619: Parameter 15-51 Frequency Converter Serial Number

15-51 Frequency Converter Serial Number		
Default value: 0	Parameter type: Range, 0 - 10	Setup: All setups
Conversion index: 0	Data type: VisStr[10]	Change during operation: False

View the drive serial number.

Parameter 15-53 Power Card Serial Number

Table 620: Parameter 15-53 Power Card Serial Number

15-53 Power Card Serial Number		
Default value: 0	Parameter type: Range, 0 - 19	Setup: All setups
Conversion index: 0	Data type: VisStr[19]	Change during operation: False

View the power card serial number.

Parameter 15-54 Config File Name

Table 621: Parameter 15-54 Config File Name

15-54 Config File Name		
Default value: Size related	Parameter type: Range, 0 - 16, Array [8]	Setup: All setups
Conversion index: 0	Data type: VisStr[16]	Change during operation: False

Shows the special configuration file names.

Parameter 15-55 Vendor URL

Table 622: Parameter 15-55 Vendor URL

15-55 Vendor URL		
Default value: 0	Parameter type: Range, 0 - 40	Setup: All setups
Conversion index: 0	Data type: VisStr[40]	Change during operation: False

Drive vendor URL.

Parameter 15-56 Vendor Name

Table 623: Parameter 15-56 Vendor Name

15-56 Vendor Name		
Default value: 0	Parameter type: Range, 0 - 40	Setup: All setups
Conversion index: 0	Data type: VisStr[40]	Change during operation: False

Drive vendor name.

Parameter 15-58 Smart Setup Filename

Table 624: Parameter 15-58 Smart Setup Filename

15-58 Smart Setup Filename		
Default value: Size related	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[16]	Change during operation: True

Shows the SmartStart file name.

Parameter 15-59 Filename

Table 625: Parameter 15-59 Filename

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.

5.16.11 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.

Parameter 15-60 Option Mounted

Table 626: Parameter 15-60 Option Mounted

15-60 Option Mounted		
Default value: 0	Parameter type: Range, 0 - 30, Array [8]	Setup: All setups
Conversion index: 0	Data type: VisStr[30]	Change during operation: False

Shows the type of installed option.

Parameter 15-61 Option SW Version

Table 627: Parameter 15-61 Option SW Version

15-61 Option SW Version		
Default value: 0	Parameter type: Range, 0 - 20, Array [8]	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

View the installed option software version.

Parameter 15-62 Option Ordering No

Table 628: Parameter 15-62 Option Ordering No

15-62 Option Ordering No		
Default value: 0	Parameter type: Range, 0 - 8, Array [8]	Setup: All setups
Conversion index: 0	Data type: VisStr[8]	Change during operation: False

Shows the code number for the installed options.

Parameter 15-63 Option Serial No

Table 629: Parameter 15-63 Option Serial No

15-63 Option Serial No		
Default value: 0	Parameter type: Range, 0 - 18, Array [8]	Setup: All setups
Conversion index: 0	Data type: VisStr[18]	Change during operation: False

View the installed option serial number.

Parameter 15-64 Application Version

Table 630: Parameter 15-64 Application Version

15-64 Application Version		
Default value: 0	Parameter type: Range, 0 - 30, Array [8]	Setup: All setups
Conversion index: 0	Data type: VisStr[30]	Change during operation: False

View application version that is running in options installed in slots A, B, C0, and C1.

Parameter 15-70 Option in Slot A

Table 631: Parameter 15-70 Option in Slot A

15-70 Option in Slot A		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: 0	Data type: VisStr[30]	Change during operation: False

View the type code string for the option installed in slot A and a translation of the type code string. For example, for type code string *AX*, the translation is *No option*.

Parameter 15-71 Slot A Option SW Version

Table 632: Parameter 15-71 Slot A Option SW Version

15-71 Slot A Option SW Version		
Default value: 0	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

View the software version for the option installed in slot A.

Parameter 15-72 Option in Slot B

Table 633: Parameter 15-72 Option in Slot B

15-72 Option in Slot B		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: 0	Data type: VisStr[30]	Change during operation: False

View the type code string for the option installed in slot B and a translation of the type code string. For example, for type code string *BX*, the translation is *No option*.

Parameter 15-73 Slot B SW Version

Table 634: Parameter 15-73 Slot B SW Version

15-73 Slot B SW Version		
Default value: 0	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

View the software version for the option installed in slot B.

Parameter 15-74 Option in Slot C0/E0

Table 635: Parameter 15-74 Option in Slot C0/E0

15-74 Option in Slot C0/E0		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: 0	Data type: VisStr[30]	Change during operation: False

View the type code string for the option installed in slot C and a translation of the type code string. For example, for type code string *CXXXX*, the translation is *No option*.

Parameter 15-75 Slot C0/E0 Option SW Version

Table 636: Parameter 15-75 Slot C0/E0 Option SW Version

15-75 Slot C0/E0 Option SW Version		
Default value: 0	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

View the software version for the option installed in slot C.

Parameter 15-76 Option in Slot C1/E1

Table 637: Parameter 15-76 Option in Slot C1/E1

15-76 Option in Slot C1/E1		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: 0	Data type: VisStr[30]	Change during operation: False

View the type code string for the option installed in slot C1 and a translation of the type code string. For example, for type code string CXXXX, the translation is *No option*.

Parameter 15-77 Slot C1/E1 Option SW Version

Table 638: Parameter 15-77 Slot C1/E1 Option SW Version

15-77 Slot C1/E1 Option SW Version		
Default value: 0	Parameter type: Range, 0 - 20	Setup: All setups
Conversion index: 0	Data type: VisStr[20]	Change during operation: False

Shows the software version for the installed option in option slot C.

5.16.12 15-8* Operating Data II

Parameter 15-80 Fan Running Hours

Table 639: Parameter 15-80 Fan Running Hours

15-80 Fan Running Hours		
Default value: 0 h	Parameter type: Range, 0 - 2147483647 h	Setup: All setups
Conversion index: 74	Data type: Uint32	Change during operation: True

View for how many hours the heat sink fan has run (increments for every hour). The value is saved when the drive is turned off.

Parameter 15-81 Preset Fan Running Hours

Table 640: Parameter 15-81 Preset Fan Running Hours

15-81 Preset Fan Running Hours		
Default value: 0 h	Parameter type: Range, 0 - 99999 h	Setup: All setups
Conversion index: 74	Data type: Uint32	Change during operation: True

Enter the preset fan running hours counter, see *parameter 15-80 Fan Running Hours*. This parameter cannot be selected via the serial port RS485.

Parameter 15-87 kWh Counter Hires

Table 641: Parameter 15-87 kWh Counter Hires

15-87 kWh Counter Hires		
Default value: 0 kWh	Parameter type: Range, 0 - 2147483647 kWh	Setup: All setups
Conversion index: 75	Data type: Uint32	Change during operation: False

Register the power consumption of the motor as an average value over 1 hour. Reset the counter in *parameter 15-06 Reset kWh Counter*. The decimal places are reset at power-up.

5.16.13 15-9* Parameter Info

Parameter 15-92 Defined Parameters

Table 642: Parameter 15-92 Defined Parameters

15-92 Defined Parameters		
Default value: 0	Parameter type: Range, 0 - 9999, Array [1000]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View a list of all defined parameters in the drive. The list ends with 0.

Parameter 15-93 Modified Parameters

Table 643: Parameter 15-93 Modified Parameters

15-93 Modified Parameters		
Default value: 0	Parameter type: Range, 0 - 9999, Array [1000]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View a list of the parameters that have been changed from their default setting. The list ends with 0. Changes may not be visible until up to 30 s after implementation.

Parameter 15-94 Extended Version

Table 644: Parameter 15-94 Extended Version

15-94 Extended Version		
Default value: Size related	Parameter type: Range, 0 - 65, Array [10]	Setup: All setups
Conversion index: 0	Data type: VisStr[65]	Change during operation: True

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

Parameter 15-98 Drive Identification

Table 645: Parameter 15-98 Drive Identification

15-98 Drive Identification		
Default value: 0	Parameter type: Range, 0 - 40	Setup: All setups
Conversion index: 0	Data type: VisStr[40]	Change during operation: False

This parameter contains data used by the VLT® Motion Control Tool MCT 10.

Parameter 15-99 Parameter Metadata

Table 646: Parameter 15-99 Parameter Metadata

15-99 Parameter Metadata		
Default value: 0	Parameter type: Range, 0 - 9999, Array [30]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

This parameter contains data used by the VLT® Motion Control Tool MCT 10.

5.17 Parameter Group 16-** Data Readouts

5.17.1 16-0* General Status

Parameter 16-00 Control Word

Table 647: Parameter 16-00 Control Word

16-00 Control Word		
Default Value: 0	Parameter Type: Range, 0 - 65535	Setup: All setups
Conversion Index: 0	Data Type: V2	Change during operation: False

View the control word sent to the drive via the serial communication port in hex code.

Parameter 16-01 Reference [Unit]

Table 648: Parameter 16-01 Reference [Unit]

16-01 Reference [Unit]		
Default value: 0 ReferenceFeedbackUnit	Parameter type: Range, -999999 ReferenceFeedbackUnit - 999999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

View the present reference value applied on impulse or analog basis in the unit resulting from the configuration selected in *parameter 1-00 Configuration Mode* (Hz, Nm, or RPM).

Parameter 16-02 Reference %

Table 649: Parameter 16-02 Reference %

16-02 Reference %		
Default value: 0%	Parameter type: Range, -200 - 200%	Setup: All setups
Conversion index: -1	Data type: Int16	Change during operation: False

View the total reference. The total reference is the sum of digital, analog, preset, bus, and freeze references plus catch up and slow down.

Parameter 16-03 Status Word

Table 650: Parameter 16-03 Status Word

16-03 Status Word		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: V2	Change during operation: False

View the status word sent from the drive via the serial communication port in hex code.

Parameter 16-05 Main Actual Value [%]

Table 651: Parameter 16-05 Main Actual Value [%]

16-05 Main Actual Value [%]		
Default value: 0%	Parameter type: Range, -100 - 100%	Setup: All setups
Conversion index: -2	Data type: N2	Change during operation: False

View the 2-byte word sent with the status word to the fieldbus master reporting the main actual value.

Parameter 16-09 Customer Readout

Table 652: Parameter 16-09 Customer Readout

16-09 Customer Readout		
Default value: 0 CustomReadoutUnit	Parameter type: Range, -999999.99 CustomReadoutUnit - 999999.99 CustomReadoutUnit	Setup: All setups
Conversion index: -2	Data type: Int32	Change during operation: False

View the value of custom readout from *parameter 0-30 Unit for Userdefined Readout* to *parameter 0-32 Custom Readout Max Value*.

5.17.2 16-1* Motor Status

Parameter 16-10 Power [kW]

Table 653: Parameter 16-10 Power [kW]

16-10 Power [kW]		
Default value: 0 kW	Parameter type: Range, 0 - 10000 kW	Setup: All setups
Conversion index: 1	Data type: Int32	Change during operation: False

Shows motor power in kW. The value shown is calculated based on the actual motor voltage and motor current. The value is filtered, and therefore approximately 1.3 s may pass from when an input value changes to when the data readout values change. The resolution of readout value on fieldbus is in 10-W steps. The base unit is in W.

Parameter 16-11 Power [hp]

Table 654: Parameter 16-11 Power [hp]

16-11 Power [hp]		
Default value: 0 hp	Parameter type: Range, 0 - 10000 hp	Setup: All setups
Conversion index: -2	Data type: Int32	Change during operation: False

Shows motor power in hp. The value shown is calculated based on the actual motor voltage and motor current. The value is filtered, and therefore approximately 1.3 ms may pass from when an input value changes to when the data readout values change.

Parameter 16-12 Motor Voltage

Table 655: Parameter 16-12 Motor Voltage

16-12 Motor Voltage		
Default value: 0 V	Parameter type: Range, 0 - 6000 V	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: False

View the motor voltage, a calculated value used for controlling the motor.

Parameter 16-13 Frequency

Table 656: Parameter 16-13 Frequency

16-13 Frequency		
Default value: 0 Hz	Parameter type: Range, 0 - 6500 Hz	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: False

View the motor frequency without resonance damping.

Parameter 16-14 Motor Current

Table 657: Parameter 16-14 Motor Current

16-14 Motor Current		
Default value: 0 A	Parameter type: Range, 0 - 10000 A	Setup: All setups
Conversion index: -2	Data type: Int32	Change during operation: False

View the motor current measured as an average value, I_{RMS}. The value is filtered, and thus approximately 1.3 s may pass from when an input value changes to when the data readout values change.

Parameter 16-15 Frequency [%]

Table 658: Parameter 16-15 Frequency [%]

16-15 Frequency [%]		
Default value: 0%	Parameter type: Range, -100 - 100%	Setup: All setups
Conversion index: -2	Data type: N2	Change during operation: False

View a 2-byte word reporting the actual motor frequency (without resonance damping) as a percentage (scale 0000–4000 hex) of *parameter 4-19 Max Output Frequency*. Set *parameter 9-16 PCD Read Configuration* index 1 to send it with the status word instead of the MAV.

Parameter 16-16 Torque [Nm]

Table 659: Parameter 16-16 Torque [Nm]

16-16 Torque [Nm]		
Default value: 0 Nm	Parameter type: Range, -30000 - 30000 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. Linearity is not exact between 160% motor current and torque in relation to the rated torque. Some motors supply more than 160% torque. Therefore, the minimum value and the maximum value depend on the maximum motor current and the motor used. The value is filtered, and thus approximately 30 ms may pass from when an input changes value to when the data readout values change. In flux control principle, this readout is compensated for in *parameter 1-68 Motor Inertia* for improved accuracy.

Parameter 16-17 Speed [RPM]

Table 660: Parameter 16-17 Speed [RPM]

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.

Parameter 16-18 Motor Thermal

Table 661: Parameter 16-18 Motor Thermal

16-18 Motor Thermal		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

View the calculated thermal load on the motor. The cutout limit is 100%. The basis for calculation is the ETR function selected in *parameter 1-90 Motor Thermal Protection*.

Parameter 16-19 Thermistor Sensor Temperature

Table 662: Parameter 16-19 Thermistor Sensor Temperature

16-19 Thermistor Sensor Temperature		
Default value: 0 °C	Parameter type: Range, 0 - 0 °C	Setup: All setups
Conversion index: 100	Data type: Int16	Change during operation: False

Returning the actual temperature on KTY sensor built into the motor. See *parameter group 1-9* Motor Temperature*.

Parameter 16-20 Motor Angle

Table 663: Parameter 16-20 Motor Angle

16-20 Motor Angle		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

View the current encoder/resolver angle offset relative to the index position. The value range of 0–65535 corresponds to 0–2xpi (radian).

Parameter 16-22 Torque [%]

Table 664: Parameter 16-22 Torque [%]

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.

Parameter 16-23 Motor Shaft Power [kW]

Table 665: Parameter 16-23 Motor Shaft Power [kW]

16-23 Motor Shaft Power [kW]		
Default value: 0 kW	Parameter type: Range, 0 - 10000 kW	Setup: All setups
Conversion index: 1	Data type: Int32	Change during operation: True

Readout of the mechanical power applied to the motor shaft. The base unit is in W.

Parameter 16-24 Calibrated Stator Resistance

Table 666: Parameter 16-24 Calibrated Stator Resistance

16-24 Calibrated Stator Resistance		
Default value: 0.0000 Ohm	Parameter type: Range, 0.0000 - 100.0000 Ohm	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: True

Shows the calibrated stator resistance.

Parameter 16-26 Power Filtered [kW]

Table 667: Parameter 16-26 Power Filtered [kW]

16-26 Power Filtered [kW]		
Default value: 0 kW	Parameter type: Range, 0 - 10000 kW	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: False

Shows the calibrated stator resistance.

Parameter 16-27 Power Filtered [hp]

Table 668: Parameter 16-27 Power Filtered [hp]

16-27 Power Filtered [hp]		
Default value: 0 hp	Parameter type: Range, 0 - 10000 hp	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

Shows the calibrated stator resistance.

5.17.3 16-3* Drive Status

Parameter 16-30 DC Link Voltage

Table 669: Parameter 16-30 DC Link Voltage

16-30 DC Link Voltage		
Default value: 0 V	Parameter type: Range, 0 - 10000 V	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View a measured value. The value is filtered with a 30 ms time constant.

Parameter 16-32 Brake Energy /s

Table 670: Parameter 16-32 Brake Energy /s

16-32 Brake Energy /s		
Default value: 0 kW	Parameter type: Range, 0 - 10000 kW	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

View the brake power transmitted to an external brake resistor, stated as an instant value.

Parameter 16-33 Brake Energy Average

Table 671: Parameter 16-33 Brake Energy Average

16-33 Brake Energy Average		
Default value: 0 kW	Parameter type: Range, 0 - 10000 kW	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

View the brake power transmitted to an external brake resistor. The mean power is calculated on an average level based on the selected time period within *parameter 2-13 Brake Power Monitoring*.

Parameter 16-34 Heatsink Temp.

Table 672: Parameter 16-34 Heatsink Temp.

16-34 Heatsink Temp.		
Default value: 0 °C	Parameter type: Range, 0 - 255 °C	Setup: All setups
Conversion index: 100	Data type: Uint8	Change during operation: False

View the drive heat sink temperature. The cutout limit is 90 ±5 °C (194 ±9 °F), and the motor cuts back in at 60 ±5 °C (140 ±9 °F).

Parameter 16-35 Inverter Thermal

Table 673: Parameter 16-35 Inverter Thermal

16-35 Inverter Thermal		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

View the percentage load on the inverter.

Parameter 16-36 Inv. Nom. Current

Table 674: Parameter 16-36 Inv. Nom. Current

16-36 Inv. Nom. Current		
Default value: Size related	Parameter type: Range, 0.01 - 10000 A	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: False

View the inverter nominal current, which must match the nameplate data on the connected motor. The data is used for calculation of torque, motor overload protection, and so on.

Parameter 16-37 Inv. Max. Current

Table 675: Parameter 16-37 Inv. Max. Current

16-37 Inv. Max. Current		
Default value: Size related	Parameter type: Range, 0.01 - 10000 A	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: False

View the inverter maximum current, which must match the nameplate data on the connected motor. The data is used for calculation of torque, motor overload protection, and so on.

Parameter 16-38 SL Controller State

Table 676: Parameter 16-38 SL Controller State

16-38 SL Controller State		
Default value: 0	Parameter type: Range, 0 - 100, Array [4]	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

View the state of the event under execution by the SL controller.

Parameter 16-39 Control Card Temp.

Table 677: Parameter 16-39 Control Card Temp.

16-39 Control Card Temp.		
Default value: 0 °C	Parameter type: Range, 0 - 100 °C	Setup: All setups
Conversion index: 100	Data type: Uint8	Change during operation: False

View the temperature on the control card, stated in °C.

Parameter 16-40 Logging Buffer Full

Table 678: Parameter 16-40 Logging Buffer Full

16-40 Logging Buffer Full		
Default value: [0] No	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

View whether the logging buffer is full (see *parameter group 15-1* Data Log Settings*). The logging buffer is never full when *parameter 15-13 Logging Mode* is set to *[0] Log always*.

Option	Name	Description
[0]*	No	
[1]	Yes	

Parameter 16-42 Service Log Counter

Table 679: Parameter 16-42 Service Log Counter

16-42 Service Log Counter		
Default value: 0	Parameter type: Range, 0 - 24	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Shows the number of service logs stored in the ServiceLog file. If the ServiceLog file is full, clear the logged data by selecting option *[5] Clear* service logs in *parameter 14-22 Operation Mode*. The logged data is deleted on the next power-up.

Parameter 16-43 Timed Actions Status

Table 680: Parameter 16-43 Timed Actions Status

16-43 Timed Actions Status		
Default value: [0] Timed actions auto	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the times actions view.

Option	Name	Description
[0]*	Timed actions auto	
[1]	Timed actions disabled	
[2]	Constant on action	
[3]	Constant off actions	

Parameter 16-45 Motor Phase U Current

Table 681: Parameter 16-45 Motor Phase U Current

16-45 Motor Phase U Current		
Default value: 0 A	Parameter type: Range, 0 - 10000 A	Setup: All setups
Conversion index: -2	Data type: Int32	Change during operation: True

Shows the motor phase U_{RMS} current. Facilitates monitoring of imbalance in the motor currents, detection of weak motor cables or imbalance in motor windings.

Parameter 16-46 Motor Phase V Current

Table 682: Parameter 16-46 Motor Phase V Current

16-46 Motor Phase V Current		
Default value: 0 A	Parameter type: Range, 0 - 10000 A	Setup: All setups
Conversion index: -2	Data type: Int32	Change during operation: True

Shows the motor phase V_{RMS} current. Facilitates monitoring of imbalance in the motor currents, detection of weak motor cables or imbalance in motor windings.

Parameter 16-47 Motor Phase W Current

Table 683: Parameter 16-47 Motor Phase W Current

16-47 Motor Phase W Current		
Default value: 0 A	Parameter type: Range, 0 - 10000 A	Setup: All setups
Conversion index: -2	Data type: Int32	Change during operation: True

Shows the motor phase W_{RMS} current. Facilitates monitoring of imbalance in the motor currents, detection of weak motor cables or imbalance in motor windings.

Parameter 16-49 Current Fault Source

Table 684: Parameter 16-49 Current Fault Source

16-49 Current Fault Source		
Default value: 0	Parameter type: Range, 0 - 8	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Value indicates source of current faults including short circuit, overcurrent, and imbalance of supply voltage (from left):

- 1–4 Inverter
- 5–8 Rectifier
- 0 No fault recorded

5.17.4 16-5* Ref. & Feedb.

Parameter 16-50 External Reference

Table 685: Parameter 16-50 External Reference

16-50 External Reference		
Default value: 0	Parameter type: Range, -200 - 200	Setup: All setups
Conversion index: -1	Data type: Int16	Change during operation: False

View the total reference, the sum of digital, analog, preset, fieldbus, and freeze references, plus catch up and slow down.

Parameter 16-52 Feedback[Unit]

Table 686: Parameter 16-52 Feedback[Unit]

16-52 Feedback[Unit]		
Default value: 0 ProcessCtrlUnit	Parameter type: Range, -999999.999 ProcessCtrlUnit - 999999.999 ProcessCtrlUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

View value of resulting feedback value after processing of feedback 1-3 in *parameter 3-00 Reference Range*, *parameter 16-54 Feedback 1 [Unit]*, *parameter 16-55 Feedback 2 [Unit]*, and *parameter 16-56 Feedback 3 [Unit]* in the feedback manager. See *parameter group 20-0* Feedback*. The value is limited by settings in *parameter 3-02 Minimum Reference* and *parameter 3-03 Maximum Reference*. Units are set in *parameter 20-12 Reference/Feedback Unit*.

Parameter 16-53 Digi Pot Reference

Table 687: Parameter 16-53 Digi Pot Reference

16-53 Digi Pot Reference		
Default Value: 0	Parameter Type: Range, -200 - 200	Setup: All setups
Conversion Index: -2	Data Type: Int16	Change during operation: False

View the contribution of the digital potentiometer to the actual reference.

Parameter 16-54 Feedback 1 [Unit]

Table 688: Parameter 16-54 Feedback 1 [Unit]

16-54 Feedback 1 [Unit]		
Default value: 0 ProcessCtrlUnit	Parameter type: Range, -999999.999 ProcessCtrlUnit - 999999.999 ProcessCtrlUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

View the value of feedback 1, see *parameter group 20-0* Feedback*. The value is limited by the settings in *parameter 20-13 Minimum Reference/Feedb.* and *parameter 20-14 Maximum Reference/Feedb.* Units are as set in *parameter 20-12 Reference/Feedback Unit*.

Parameter 16-55 Feedback 2 [Unit]

Table 689: Parameter 16-55 Feedback 2 [Unit]

16-55 Feedback 2 [Unit]		
Default value: 0 ProcessCtrlUnit	Parameter type: Range, -999999.999 ProcessCtrlUnit - 999999.999 ProcessCtrlUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

View the value of feedback 2, see *parameter group 20-0* Feedback*. The value is limited by the settings in *parameter 20-13 Minimum Reference/Feedb.* and *parameter 20-14 Maximum Reference/Feedb.* Units are as set in *parameter 20-12 Reference/Feedback Unit*.

Parameter 16-56 Feedback 3 [Unit]

Table 690: Parameter 16-56 Feedback 3 [Unit]

16-56 Feedback 3 [Unit]		
Default value: 0 ProcessCtrlUnit	Parameter type: Range, -999999.999 ProcessCtrlUnit - 999999.999 ProcessCtrlUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

View the value of feedback 3, see *parameter group 20-0* Feedback*. The value is limited by the settings in *parameter 20-13 Minimum Reference/Feedb.* and *parameter 20-14 Maximum Reference/Feedb.* Units are as set in *parameter 20-12 Reference/Feedback Unit*.

Parameter 16-58 PID Output [%]

Table 691: Parameter 16-58 PID Output [%]

16-58 PID Output [%]		
Default value: 0 %	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -1	Data type: Int16	Change during operation: True

This parameter returns the drive closed-looop PID controller output value in %.

Parameter 16-59 Adjusted Setpoint

Table 692: Parameter 16-59 Adjusted Setpoint

16-59 Adjusted Setpoint		
Default value: 0 ProcessCtrlUnit	Parameter type: Range, -999999.999 ProcessCtrlUnit - 999999.999 ProcessCtrlUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

This parameter shows the actual operating setpoint after it has been modified by flow compensation.

5.17.5 16-6* Inputs and Outputs

Parameter 16-60 Digital Input

Table 693: Parameter 16-60 Digital Input

16-60 Digital Input		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View the signal states from the active digital inputs. Example: Input 18 corresponds to bit number 5, 0 = no signal, 1 = connected signal. Bit 6 works in the opposite way, on = 0, off = 1 (Safe Torque Off input).

Table 694: Active Digital Inputs

Bit	Input
0	Digital input terminal 33.
1	Digital input terminal 32.
2	Digital input terminal 29.
3	Digital input terminal 27.
4	Digital input terminal 19.
5	Digital input terminal 18.
6	Digital input terminal 37.
7	Digital input VLT® General Purpose I/O MCB 101 terminal X30/4.
8	Digital input VLT® General Purpose I/O MCB 101 terminal X30/3.
9	Digital input VLT® General Purpose I/O MCB 101 terminal X30/2.
Bit 10–63	Reserved for future terminals.

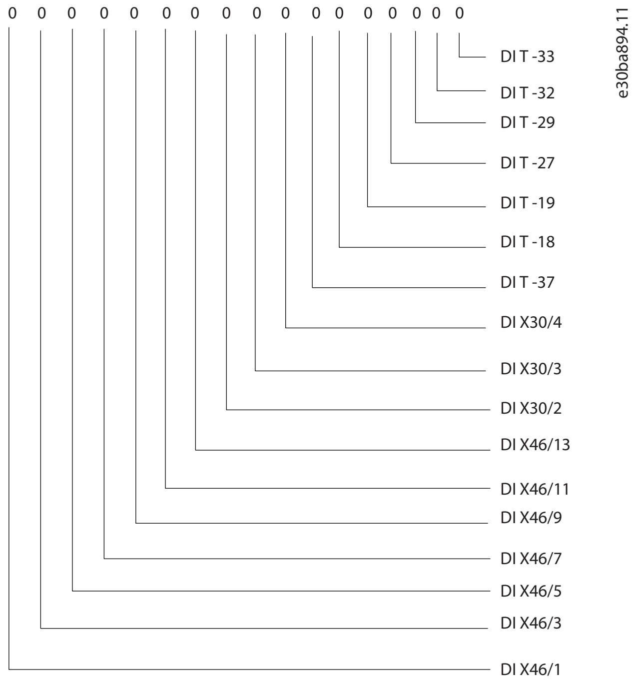


Illustration 77: Relay Settings

Parameter 16-61 Terminal 53 Switch Setting

Table 695: Parameter 16-61 Terminal 53 Switch Setting

16-61 Terminal 53 Switch Setting		
Default value: [0] Current	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

View the setting of input terminal 53.

Option	Name	Description
[0]*	Current	
[1]	Voltage	

Parameter 16-62 Analog Input 53

Table 696: Parameter 16-62 Analog Input 53

16-62 Analog Input 53		
Default value: 0	Parameter type: Range, -20 - 20	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

View the actual value at input 53.

Parameter 16-63 Terminal 54 Switch Setting

Table 697: Parameter 16-63 Terminal 54 Switch Setting

16-63 Terminal 54 Switch Setting		
Default value: [0] Current	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: False

View the setting of terminal 54.

Option	Name	Description
[0]*	Current	
[1]	Voltage	

Parameter 16-64 Analog Input 54

Table 698: Parameter 16-64 Analog Input 54

16-64 Analog Input 54		
Default value: 0	Parameter type: Range, -20 - 20	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

View the actual value at input 54.

Parameter 16-65 Analog Output 42 [mA]

Table 699: Parameter 16-65 Analog Output 42 [mA]

16-65 Analog Output 42 [mA]		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: False

View the actual value at output 42 in mA. The value shown reflects the selection in *parameter 6-50 Terminal 42 Output*.

Parameter 16-66 Digital Output [bin]

Table 700: Parameter 16-66 Digital Output [bin]

16-66 Digital Output [bin]		
Default value: 0	Parameter type: Range, 0 - 15	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: False

View the binary value of all digital outputs.

Parameter 16-67 Freq. Input #29 [Hz]

Table 701: Parameter 16-67 Freq. Input #29 [Hz]

16-67 Freq. Input #29 [Hz]		
Default value: 0	Parameter type: Range, 0 - 130000	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: False

View the actual frequency rate on terminal 29.

Parameter 16-68 Freq. Input #33 [Hz]

Table 702: Parameter 16-68 Freq. Input #33 [Hz]

16-68 Freq. Input #33 [Hz]		
Default value: 0	Parameter type: Range, 0 - 130000	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: False

View the actual value of the frequency applied at terminal 33 as an impulse input.

Parameter 16-69 Pulse Output #27 [Hz]

Table 703: Parameter 16-69 Pulse Output #27 [Hz]

16-69 Pulse Output #27 [Hz]		
Default value: 0	Parameter type: Range, 0 - 40000	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: False

View the actual value of pulses applied to terminal 27 in digital output mode.

Parameter 16-70 Pulse Output #29 [Hz]

Table 704: Parameter 16-70 Pulse Output #29 [Hz]

16-70 Pulse Output #29 [Hz]		
Default value: 0	Parameter type: Range, 0 - 40000	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: False

View the actual value of pulses at terminal 29 in digital output mode.

Parameter 16-71 Relay Output [bin]

Table 705: Parameter 16-71 Relay Output [bin]

16-71 Relay Output [bin]		
Default value: 0	Parameter type: Range, 0 - 511	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: False

View the settings of all relays.

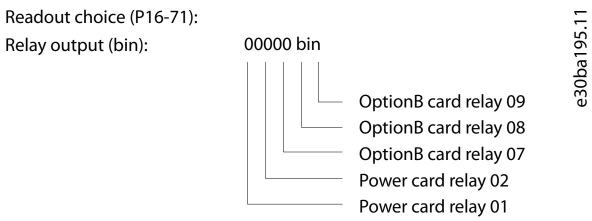


Illustration 78: Relay Settings

Parameter 16-72 Counter A

Table 706: Parameter 16-72 Counter A

16-72 Counter A		
Default value: 0	Parameter type: Range, -2147483648 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

View the present value of counter A. Counters are useful as comparator operands, see *parameter 13-10 Comparator Operand*. Reset or change the value either via digital inputs (*parameter group 5-1* Digital Inputs*) or by using an SLC action (*parameter 13-52 SL Controller Action*).

Parameter 16-73 Counter B

Table 707: Parameter 16-73 Counter B

16-73 Counter B		
Default value: 0	Parameter type: Range, -2147483648 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

View the present value of counter B. Counters are useful as comparator operands, see *parameter 13-10 Comparator Operand*. Reset or change the value either via digital inputs (*parameter group 5-1* Digital Inputs*) or by using an SLC action (*parameter 13-52 SL Controller Action*).

Parameter 16-75 Analog In X30/11

Table 708: Parameter 16-75 Analog In X30/11

16-75 Analog In X30/11		
Default value: 0	Parameter type: Range, -20 - 20	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

View the actual value at input X30/11 of VLT® General Purpose I/O MCB 101.

Parameter 16-76 Analog In X30/12

Table 709: Parameter 16-76 Analog In X30/12

16-76 Analog In X30/12		
Default value: 0	Parameter type: Range, -20 - 20	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

View the actual value at input X30/12 of VLT® General Purpose I/O MCB 101.

Parameter 16-77 Analog Out X30/8 [mA]

Table 710: Parameter 16-77 Analog Out X30/8 [mA]

16-77 Analog Out X30/8 [mA]		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: False

View the actual value at input X30/8 in mA.

Parameter 16-78 Analog Out X45/1 [mA]

Table 711: Parameter 16-78 Analog Out X45/1 [mA]

16-78 Analog Out X45/1 [mA]		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: False

Shows the actual output value at terminal X45/1. The value shown reflects the selection in *parameter 6-70 Terminal X45/1 Output*.

Parameter 16-79 Analog Out X45/3 [mA]

Table 712: Parameter 16-79 Analog Out X45/3 [mA]

16-79 Analog Out X45/3 [mA]		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: False

Shows the actual output value at terminal X45/3. The value shown reflects the selection in *parameter 6-80 Terminal X45/3 Output*.

5.17.6 16-8* Fieldbus & FC Port

Parameter 16-80 Fieldbus CTW 1

Table 713: Parameter 16-80 Fieldbus CTW 1

16-80 Fieldbus CTW 1		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: V2	Change during operation: False

View the 2-byte control word (CTW) received from the bus-master. Interpretation of the CTW depends on the fieldbus option installed and the CTW profile selected in *parameter 8-10 Control Word Profile*. For more information, refer to the relevant fieldbus manual.

Parameter 16-82 Fieldbus REF 1

Table 714: Parameter 16-82 Fieldbus REF 1

16-82 Fieldbus REF 1		
Default value: 0	Parameter type: Range, -200 - 200	Setup: All setups
Conversion index: 0	Data type: N2	Change during operation: False

View the 2-byte word sent with the control word form the bus-master to set the reference value. For more information, refer to the relevant fieldbus manual.

Parameter 16-84 Comm. Option STW

Table 715: Parameter 16-84 Comm. Option STW

16-84 Comm. Option STW		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: V2	Change during operation: False

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

Parameter 16-85 FC Port CTW 1

Table 716: Parameter 16-85 FC Port CTW 1

16-85 FC Port CTW 1		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: V2	Change during operation: False

View the 2-byte control word (CTW) received from the fieldbus master. Interpretation of the control word depends on the fieldbus option installed and the control word profile selected in *parameter 8-10 Control Word Profile*.

Parameter 16-86 FC Port REF 1

Table 717: Parameter 16-86 FC Port REF 1

16-86 FC Port REF 1		
Default value: 0	Parameter type: Range, -200 - 200	Setup: All setups
Conversion index: 0	Data type: N2	Change during operation: False

View the 2-byte status word (STW) sent to the fieldbus master. Interpretation of the status word depends on the fieldbus option installed and the control word profile selected in *parameter 8-10 Control Word Profile*.

Parameter 16-87 Bus Readout Alarm/Warning

Table 718: Parameter 16-87 Bus Readout Alarm/Warning

16-87 Bus Readout Alarm/Warning		
Default value: 0	Parameter type: Range, 0 - 65535, Array [3]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Alarm and warning numbers in hex as shown in the alarm log. The high byte contains the alarm, the low byte contains the warning. The alarm number is the 1st that occurred after the last reset.

5.17.7 16-9* Diagnosis Readouts

For details of bit descriptions, refer to Table 1231.

Parameter 16-90 Alarm Word

Table 719: Parameter 16-90 Alarm Word

16-90 Alarm Word		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

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

Parameter 16-91 Alarm Word 2

Table 720: Parameter 16-91 Alarm Word 2

16-91 Alarm Word 2		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

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

Parameter 16-92 Warning Word

Table 721: Parameter 16-92 Warning Word

16-92 Warning Word		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

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

Parameter 16-93 Warning Word 2

Table 722: Parameter 16-93 Warning Word 2

16-93 Warning Word 2		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

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

Parameter 16-94 Ext. Status Word

Table 723: Parameter 16-94 Ext. Status Word

16-94 Ext. Status Word		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Returns the extended status word sent via the serial communication port in hex code.

Parameter 16-95 Ext. Status Word 2

Table 724: Parameter 16-95 Ext. Status Word 2

16-95 Ext. Status Word 2		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

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

Parameter 16-96 Maintenance Word

Table 725: Parameter 16-96 Maintenane Word

16-96 Maintenane Word		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Readout of the preventive maintenance word. The bits reflect the status for the programmed preventive maintenance events in *parameter group 23-1* Maintenance*. 13 bits show combinations of all the possible items:

- Bit 0: Motor bearings
- Bit 1: Pump bearings
- Bit 2: Fan bearings
- Bit 3: Valve
- Bit 4: Pressure transmitter
- Bit 5: Flow transmitter
- Bit 6: Temperature transmitter

- Bit 7: Pump seals
- Bit 8: Fan belt
- Bit 9: Filter
- Bit 10: Drive cooling fan
- Bit 11: Drive system health check
- Bit 12: Warranty
- Bit 13: Maintenance text 0
- Bit 14: Maintenance text 1
- Bit 15: Maintenance text 2
- Bit 16: Maintenance text 3
- Bit 17: Maintenance text 4

The following table details the display of the maintenance word.

Table 726: 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.

Parameter 16-97 Alarm Word 3

Table 727: Parameter 16-97 Alarm Word 3

16-97 Alarm Word 3		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

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

Parameter 16-98 Warning Word 3

Table 728: Parameter 16-98 Warning Word 3

16-98 Warning Word 3		
Default value: 0	Parameter type: Range, 0 - 4294967295	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

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

5.18 Parameter Group 18-** Data Readouts 2

5.18.1 18-0* Maintenance Log

This group contains the last 10 preventive maintenance events. Maintenance log 0 is the latest and maintenance log 9 is the oldest. By selecting 1 of the logs and pressing [OK], the maintenance item, action, and time of the occurrence are shown in *parameter 18-00 Maintenance Log: Item – parameter 18-03 Maintenance Log: Date and Time*.

The alarm log key allows access to both alarm log and maintenance log.

Parameter 18-00 Maintenance Log: Item

Table 729: Parameter 18-00 Maintenance Log: Item

18-00 Maintenance Log: Item		
Default value: 0	Parameter type: Range, 0 - 255, Array [10]	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

Shows the fault code. See the different maintenance items in *parameter 23-10 Maintenance Item*.

Parameter 18-01 Maintenance Log: Action

Table 730: Parameter 18-01 Maintenance Log: Action

18-01 Maintenance Log: Action		
Default value: 0	Parameter type: Range, 0 - 255, Array [10]	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: False

Shows the fault code. See the different maintenance actions in *parameter 23-11 Maintenance Action*.

Parameter 18-02 Maintenance Log: Time

Table 731: Parameter 18-02 Maintenance Log: Time

18-02 Maintenance Log: Time		
Default value: 0 s	Parameter type: Range, 0 - 2147483647 s, Array [10]	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: False

Shows when the logged event occurred. Time is measured in s since last power-up.

Parameter 18-03 Maintenance Log: Date and Time

Table 732: Parameter 18-03 Maintenance Log: Date and Time

18-03 Maintenance Log: Date and Time		
Default value: Size related	Parameter type: Range, 0 - 0, Array [10]	Setup: All setups
Conversion index: 0	Data type: TimeOfDay	Change during operation: False

Shows when the logged event occurred.

NOTICE

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*.

NOTICE

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.

NOTICE

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

5.18.2 18-1* Fire Mode Log

The fire log covers operation of fire mode with start and stop activities and if critical alarms are suppressed during fire mode. The log contains the 10 latest activations of fire mode or the alarm number of the critical alarm that was suppressed as this affects the warranty of the drive. Suppressed alarm numbers are stored and can only be reset by a Danfoss service inspection.

Parameter 18-10 Fire Mode Log: Event

Table 733: Parameter 18-10 Fire Mode Log: Event

18-10 Fire Mode Log: Event		
Default Value: 0	Parameter Type: Range, 0 - 255, Array [10]	Setup: All setups
Conversion Index: 0	Data Type: Uint8	Change during operation: False

This parameter contains an array with 10 elements. The number read represents a fault code, which corresponds to a specific alarm. Refer to 6.1.2 Alarm/Warning Code List.

Parameter 18-11 Fire Mode Log: Time

Table 734: Parameter 18-11 Fire Mode Log: Time

18-11 Fire Mode Log: Time		
Default Value: 0 s	Parameter Type: Range, 0 - 2147483647 s, Array [10]	Setup: All setups
Conversion Index: 0	Data Type: Uint32	Change during operation: False

This parameter shows at which time the logged event occurred. Time is measured in seconds since the drive was started.

Parameter 18-12 Fire Mode Log: Date and Time

Table 735: Parameter 18-12 Fire Mode Log: Date and Time

18-12 Fire Mode Log: Date and Time		
Default Value: Size related	Parameter Type: Range, Size related, Array [10]	Setup: All setups
Conversion Index: 0	Data Type: TimeOfDay	Change during operation: False

This parameter shows at which date and time the logged event occurred. The date and time rely on the internal clock in *parameter group 0-7* Clock Settings*.

5.18.3 18-1* Parameter Log

Parameter 18-13 Parameter Number

Table 736: Parameter 18-13 Parameter Number

18-13 Parameter Number		
Default value: 0 N/A	Parameter type: Range, 0 - 0xFFFF N/A, Array [10]	4-setup: All set-ups
Conversion index: 0	Data type: Uint16	Change during operation: False

Shows the parameter which is most recently changed. Index 0 shows the latest change in the parameter.

Parameter 18-14 Parameter Index

Table 737: Parameter 18-14 Parameter Index

18-14 Parameter Index		
Default value: 0 N/A	Parameter type: Range, 0 - 0xFFFF N/A, Array [10]	4-setup: All set-ups
Conversion index: -	Data type: Uint16	Change during operation: False

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

Parameter 18-15 Change Time

Table 738: Parameter 18-15 Change Time

18-15 Change Time		
Default value: Size related	Parameter type: Range, 0 - 0, Array [10]	4-setup: All set-ups
Conversion index: 0	Data type: TimeOfDay	Change during operation: False

Shows the date and time stamp when a parameter was most recently changed. It is recommended to set the time and date in the drive to ensure the right time is logged.

Parameter 18-16 Operating Hours

Table 739: Parameter 18-16 Operating Hours

18-16 Operating Hours		
Default value: 0	Parameter type: Range, 0 - 2147483647, Array [10]	4-setup: All set-ups
Conversion index: 0	Data type: Uint32	Change during operation: False

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

Parameter 18-17 Running Hours

Table 740: Parameter 18-17 Running Hours

18-17 Running Hours		
Default value: 0	Parameter type: Range, 0 - 2147483647, Array [10]	4-setup: All set-ups
Conversion index: 0	Data type: Uint32	Change during operation: False

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

Parameter 18-18 Value Before Change as Integer

Table 741: Parameter 18-18 Value before change as Integer

18-18 Value before change as Integer		
Default value: 0	Parameter type: Range, -2147483648 - 2147483647, Array [10]	4-setup: All set-ups
Conversion index: 0	Data type: Int32	Change during operation: False

Shows the previous value of the parameter as integer, without scaling or unit conversion. The parameter only shows integer data.

Parameter 18-19 Value Before Change

Table 742: Parameter 18-19 Value Before Change

18-19 Value Before Change		
Default value: Size related	Parameter type: Range, 0-30, Array [10]	4-setup: All set-ups
Conversion index: 0	Data type: VisStr[30]	Change during operation: False

Shows the previous value of the parameter with units. Only applicable for integer values.

5.18.4 18-3* Inputs & Outputs

Parameters in this group show data related to analog inputs.

Parameter 18-30 Analog Input X42/1

Table 743: Parameter 18-30 Analog Input X42/1

18-30 Analog Input X42/1		
Default value: -3	Parameter type: Range, -20 - 20	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: False

Readout of the value of the signal applied to terminal X42/1 on the analog I/O card. The units of the value shown in the LCP correspond to the mode selected in *parameter 26-00 Terminal X42/1 Mode*.

Parameter 18-31 Analog Input X42/3

Table 744: Parameter 18-31 Analog Input X42/3

18-31 Analog Input X42/3		
Default value: 0	Parameter type: Range, -20 - 20	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

Readout of the value of the signal applied to terminal X42/3 on the analog I/O card. The units of the value shown in the LCP correspond to the mode selected in *parameter 26-01 Terminal X42/3 Mode*.

Parameter 18-32 Analog Input X42/5

Table 745: Parameter 18-32 Analog Input X42/5

18-32 Analog Input X42/5		
Default value: 0	Parameter type: Range, -20 - 20	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

Readout of the value of the signal applied to terminal X42/5 on the analog I/O card. The units of the value shown in the LCP correspond to the mode selected in *parameter 26-02 Terminal X42/5 Mode*.

Parameter 18-33 Analog Input X42/7 [V]

Table 746: Parameter 18-33 Analog Input X42/7 [V]

18-33 Analog Input X42/7 [V]		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: False

Readout of the value of the signal applied to terminal X42/7 on the analog I/O card. The value shown reflects the selection in *parameter 26-40 Terminal X42/7 Output*.

Parameter 18-34 Analog Input X42/9 [V]

Table 747: Parameter 18-34 Analog Input X42/9 [V]

18-34 Analog Input X42/9 [V]		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: False

Readout of the value of the signal applied to terminal X42/9 on the analog I/O card. The value reflects the selection in *parameter 26-50 Terminal X42/9 Output*.

Parameter 18-35 Analog Input X42/11 [V]

Table 748: Parameter 18-35 Analog Input X42/11 [V]

18-35 Analog Input X42/11 [V]		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: False

Readout of the value of the signal applied to terminal X42/11 on the analog I/O card. The value shown reflects the selection in *parameter 26-60 Terminal X42/11 Output*.

Parameter 18-36 Analog Input X48/2 [mA]

Table 749: Parameter 18-36 Analog Input X48/2 [mA]

18-36 Analog Input X48/2 [mA]		
Default value: 0	Parameter type: Range, -20 - 20	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

View the actual current measured at input X48/2.

Parameter 18-37 Temp. Input X48/4

Table 750: Parameter 18-37 Temp. Input X48/4

18-37 Temp. Input X48/4		
Default value: 0	Parameter type: Range, -500 - 500	Setup: All set-ups
Conversion index: 0	Data type: Int16	Change during operation: True

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

Parameter 18-38 Temp. Input X48/7

Table 751: Parameter 18-38 Temp. Input X48/7

18-38 Temp. Input X48/7		
Default value: 0	Parameter type: Range, -500 - 500	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

View the actual temperature measured at input X48/7. The temperature unit is based on the selection in *parameter 35-02 Term. X48/7 Temperature Unit*.

Parameter 18-39 Temp. Input X48/10

Table 752: Parameter 18-39 Temp. Input X48/10

18-39 Temp. Input X48/10		
Default value: 0	Parameter type: Range, -500 - 500	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

View the actual temperature measured at input X48/10. The temperature unit is based on the selection in *parameter 35-04 Term. X48/10 Temperature Unit*.

5.18.5 18-4* PGIO Data Readouts

Parameters for configuring the readout of VLT® Programmable I/O MCB 115.

Parameter 18-40 Analog Input X49/1

Table 753: Parameter 18-40 Analog Input X49/1

18-40 Analog Input X49/1		
Default value: 0	Parameter type: Range, -20 - 20	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

View the actual value at input X49/1 either as a voltage, current or a temperature value.

Parameter 18-41 Analog Input X49/3

Table 754: Parameter 18-41 Analog Input X49/3

18-41 Analog Input X49/3		
Default value: 0	Parameter type: Range, -20 - 20	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

View the actual value at input X49/3 either as a voltage, current, or a temperature value.

Parameter 18-42 Analog Input X49/5

Table 755: Parameter 18-42 Analog Input X49/5

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.

Parameter 18-43 Analog Input X49/7

Table 756: Parameter 18-43 Analog Input X49/7

18-43 Analog Input X49/7		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: False

Shows the actual value at output of terminal X49/7 in V or mA. The value reflects the selection in *parameter 36-40 Terminal X49/7 Analog Output*.

Parameter 18-44 Analog Input X49/9

Table 757: Parameter 18-44 Analog Input X49/9

18-44 Analog Input X49/9		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: False

Shows the actual value at output of terminal X49/9 in V or mA. The value reflects the selection in *parameter 36-50 Terminal X49/9 Analog Output*.

Parameter 18-45 Analog Input X49/11

Table 758: Parameter 18-45 Analog Input X49/11

18-45 Analog Input X49/11		
Default value: 0	Parameter type: Range, 0 - 30	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: False

Shows the actual value at output of terminal X49/11 in V or mA. The value reflects the selection in *parameter 36-60 Terminal X49/11 Analog Output*.

Parameter 18-46 X49 Digital Output [bin]

Table 759: Parameter 18-46 X49 Digital Output [bin]

18-46 X49 Digital Output [bin]		
Default value: 0	Parameter type: Range, 0 - 15	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: False

Shows the binary value of all programmable I/O digital outputs.

5.18.6 18-5* Active Alarms/Warnings

The parameters in this group report the reference and feedback inputs.

Parameter 18-50 Sensorless Readout [Unit]

Table 760: Parameter 18-50 Sensorless Readout [Unit]

18-50 Sensorless Readout [Unit]		
Default value: 0 SensorlessUnit	Parameter type: Range, -999999.999 - 999999.999 SensorlessUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: False

This parameter shows a readout of the pressure or flow based on the sensorless calculations. This value is not used for control and will only be updated if sensorless data supports both flow and pressure.

Parameter 18-55 Active Alarm Numbers

Table 761: Parameter 18-55 Active Alarm Numbers

18-55 Active Alarm Numbers		
Default value: 0	Parameter type: Range, 0 - 65535, Array [20]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter contains an array of up to 20 alarms that are currently active. The value 0 means no alarm.

Parameter 18-56 Active Warning Numbers

Table 762: Parameter 18-56 Active Warning Numbers

18-56 Active Warning Numbers		
Default value: 0	Parameter type: Range, 0 - 65535, Array [20]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter contains an array of up to 20 warnings that are currently active. The value 0 means no warning.

Parameter 18-57 Air Pressure to Flow Air Flow

Table 763: Parameter 18-57 Air Pressure to Flow Air Flow

18-57 Air Pressure to Flow Air Flow		
Default value: 0 AirPresToFlowUnit	Parameter type: Range, -999999.999 - 999999.999 AirPresToFlowUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

This parameter shows the airflow, which is calculated based on the pressure difference measured.

5.18.7 18-6* Inputs & Outputs 2

Parameter 18-60 Digital Input 2

Table 764: Parameter 18-60 Digital Input 2

18-60 Digital Input 2		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

Shows the signal states from the active digital inputs.

- 0 = No signal
- 1 = Connected signal

5.18.8 18-7* Rectifier Status

Parameter 18-70 Mains Voltage

Table 765: Parameter 18-70 Mains Voltage

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.

Parameter 18-71 Mains Frequency

Table 766: Parameter 18-71 Mains Frequency

18-71 Mains Frequency		
Default value: 0 Hz	Parameter type: Range, -100 - 100 Hz	Setup: All setups
Conversion index: -1	Data type: Int16	Change during operation: True

Shows the mains frequency.

Parameter 18-72 Mains Imbalance

Table 767: Parameter 18-72 Mains Imbalance

18-72 Mains Imbalance		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Shows the maximum imbalance for the 3 mains line-to-line measurements.

Parameter 18-73 Worst Inrush

Table 768: Parameter 18-73 Worst Inrush

18-73 Worst Inrush		
Default value: 0	Parameter type: Range, 0 - 10000	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter identifies which active inrush produces the data shown in *parameter 18-70 Mains Voltage*, *parameter 18-71 Mains Frequency*, *parameter 18-72 Mains Imbalance*, and *parameter 18-75 Rectifier DC Volt*. 1 = inrush 1, 2 = inrush 2, and so on.

Parameter 18-74 Inrush Mode

Table 769: Parameter 18-74 Inrush Mode

18-74 Inrush Mode		
Default value: 0	Parameter type: Range, 0 - 1000, Array [4]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter shows the reported mode of each inrush board. The values are:

- 0 = unknown
- 1 = inrush
- 2 = running

The indices are as follows:

- 0 = inrush1
- 1 = inrush2
- 2 = inrush3
- 3 = inrush4

Parameter 18-75 Rectifier DC Volt

Table 770: Parameter 18-75 Rectifier DC Volt

18-75 Rectifier DC Volt		
Default value: 0 V	Parameter type: Range, 0 - 10000 V	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the DC voltage measured on the rectifier module.

Parameter 18-76 Mains Voltage 2

Table 771: Parameter 18-76 Mains Voltage 2

18-76 Mains Voltage 2		
Default value: 0 V	Parameter type: Range, 0 - 1000 V, Array [16]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

View the mains line-to-line measurements. The values are RMS. The indices are as follows:

- 0 = inrush1 average
- 1 = inrush2 average
- 4 = inrush1 L1
- 5 = inrush2 L1
- 8 = inrush1 L2
- 9 = inrush2 L2
- = inrush1 L3
- = inrush2 L3

Parameter 18-77 Mains Frequency 2

Table 772: Parameter 18-77 Mains Frequency 2

18-77 Mains Frequency 2		
Default value: 0 Hz	Parameter type: Range, -100 - 100 Hz, Array [4]	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

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

- 0 = inrush1
- 1 = inrush2

Parameter 18-78 Mains Imbalance 2

Table 773: Parameter 18-78 Mains Imbalance 2

18-78 Mains Imbalance 2		
Default value: 0%	Parameter type: Range, 0 - 100%, Array [4]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

View the maximum measured imbalance for the 3 mains line-to-line measurements. The indices are as follows:

- 0 = inrush1
- 1 = inrush2

Parameter 18-79 Rectifier DC Volt. 2

Table 774: Parameter 18-79 Rectifier DC Volt. 2

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

5.19 Parameter Group 20-** Drive Closed Loop

This parameter group is used for configuring the closed-loop PID controller that controls the output frequency of the drive.

5.19.1 20-0* Feedback

This parameter group is used to configure the feedback signal for the closed-loop PID controller of the drive. Whether the drive is in closed-loop mode or open-loop mode, the feedback signals can also be shown on the drive display, be used to control a drive analog output, and be transmitted over various serial communication protocols.

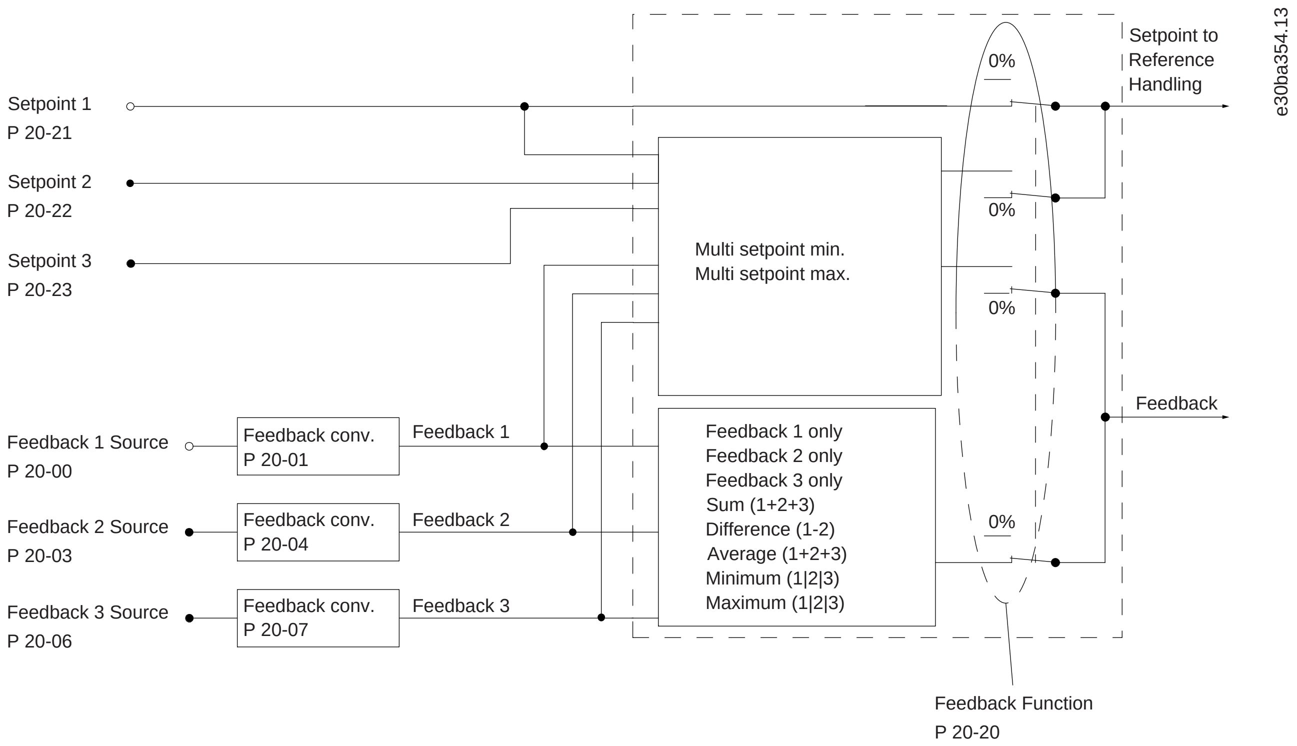


Illustration 79: Block Diagram Showing Feedback Signal Processing

Parameter 20-00 Feedback 1 Source

Table 775: Parameter 20-00 Feedback 1 Source

20-00 Feedback 1 Source		
Default value: [2] Analog Input 54	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

N O T I C E

If feedback is not used, set its source to *[0] No function*. *Parameter 20-20 Feedback Function* determines how the PID controller uses the 3 possible feedbacks.

Up to 3 different feedback signals can be used to provide the feedback signal for the PID controller of the drive. This parameter defines which input is used as the source of the 1st feedback signal. Analog input X30/11 and analog input X30/12 refer to inputs on VLT® General Purpose I/O MCB 101.

Option	Name	Description
[0]	No function	Use this selection if feedback is not used.
[1]	Analog input 53	
[2]*	Analog input 54	
[3]	Pulse input 29	
[4]	Pulse input 33	
[7]	Analog input X30/11	
[8]	Analog input X30/12	
[9]	Analog input X42/1	

Option	Name	Description
[10]	Analog input X42/3	
[11]	Analog input X42/5	
[15]	Analog input X48/2	
[16]	Analog input X49/1	
[17]	Analog input X49/3	
[18]	Analog input X49/5	
[19]	Pressure 3	
[20]	Pressure 4	
[99]	Normal feedback	
[100]	Bus feedback 1	
[101]	Bus feedback 2	
[102]	Bus feedback 3	
[104]	Sensorless flow	Requires setup by VLT® Motion Control Tool MCT 10 with sensorless plug-in.
[105]	Sensorless pressure	Requires setup by VLT® Motion Control Tool MCT 10 with sensorless plug-in.
[110]	Air Pres. to Flow	

Parameter 20-01 Feedback 1 Conversion

Table 776: Parameter 20-01 Feedback 1 Conversion

20-01 Feedback 1 Conversion		
Default value: [0] Linear	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

This parameter allows a conversion function to be applied to feedback 1.

Option	Name	Description
[0]*	Linear	No effect on the feedback.
[1]	Square root	Commonly used when a pressure sensor is used to provide flow feedback. (flow α $\sqrt{\text{pressure}}$)
[2]	Pressure to temperature	Used in compressor applications to provide temperature feedback using a pressure sensor. The temperature of the refrigerant is calculated using the following formula: $\text{Temperature} = \frac{A2}{(\ln(pe + 1) - A1)} - A3$ where A1, A2, and A3 are refrigerant-specific constants. Select the refrigerant in *parameter 20-30 Refrigerant*. *Parameter 20-21 Setpoint 1* through *parameter 20-23 Setpoint 3* allow the values of A1, A2, and A3 to be entered for a refrigerant that is not listed in *parameter 20-30 Refrigerant*.
[3]	Pressure to flow	Used in applications for controlling the air flow in a duct. A dynamic pressure measurement (pitot tube) represents the feedback signal.

Op-tion	Name	Description
		Flow = Duct area $\times \sqrt{\text{Dynamic pressure}} \times$ air density factor See also *parameter 20-34 Duct 1 Area [m2]* through *parameter 20-38 Air Density Factor [%]* for setting of duct area and air density.
[4]	Velocity to flow	Used in applications for controlling the air flow in a duct. An air velocity measurement represents the feed-back signal. Flow = Duct area × air velocity See also *parameter 20-34 Duct 1 Area [m2]* through *parameter 20-37 Duct 2 Area [in2]* for setting of duct area.

Parameter 20-02 Feedback 1 Source Unit

Table 777: Parameter 20-02 Feedback 1 Source Unit

20-02 Feedback 1 Source Unit		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

NOTICE

This parameter is only available when using pressure to temperature feedback conversion. If option *[0] Linear* is selected in *parameter 20-01 Feedback 1 Conversion*, the setting of any option in *parameter 20-02 Feedback 1 Source Unit* does not matter as a conversion is 1-to-1.

This parameter determines the unit that is used for this feedback source before applying the feedback conversion of *parameter 20-01 Feedback 1 Conversion*. This unit is not used by the PID controller.

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	

Option	Name	Description
[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	
[75]	mm Hg	
[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	

Option	Name	Description
[173]	ft WG	
[174]	in HG	
[180]	hp	

Parameter 20-03 Feedback 2 Source

Table 778: Parameter 20-03 Feedback 2 Source

20-03 Feedback 2 Source		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

N O T I C E

If feedback is not used, set its source to *[0] No function*. *Parameter 20-20 Feedback Function* determines how the PID controller uses the 3 possible feedbacks.

Up to 3 different feedback signals can be used to provide the feedback signal for the PID controller of the drive. This parameter defines which input is used as the source of the 1st feedback signal. Analog input X30/11 and analog input X30/12 refer to inputs on VLT® General Purpose I/O MCB 101.

Option	Name	Description
[0]*	No function	Use this selection if feedback is not used.
[1]	Analog input 53	
[2]	Analog input 54	
[3]	Pulse input 29	
[4]	Pulse input 33	
[7]	Analog input X30/11	
[8]	Analog input X30/12	
[9]	Analog input X42/1	
[10]	Analog input X42/3	
[11]	Analog input X42/5	
[15]	Analog input X48/2	
[16]	Analog input X49/1	
[17]	Analog input X49/3	
[18]	Analog input X49/5	
[19]	Pressure 3	
[20]	Pressure 4	
[99]	Normal feedback	
[100]	Bus feedback 1	

Option	Name	Description
[101]	Bus feedback 2	
[102]	Bus feedback 3	
[104]	Sensorless flow	Requires setup by VLT® Motion Control Tool MCT 10 with sensorless plug-in.
[105]	Sensorless pressure	Requires setup by VLT® Motion Control Tool MCT 10 with sensorless plug-in.
[110]	Air Pres. to Flow	

Parameter 20-04 Feedback 2 Conversion

Table 779: Parameter 20-04 Feedback 2 Conversion

20-04 Feedback 2 Conversion		
Default value: [0] Linear	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

This parameter allows a conversion function to be applied to feedback 2.

Option	Name	Description
[0]*	Linear	No effect on the feedback.
[1]	Square root	Commonly used when a pressure sensor is used to provide flow feedback. ((flow α $\sqrt{\text{pressure}}$))
[2]	Pressure to temperature	Used in compressor applications to provide temperature feedback using a pressure sensor. The temperature of the refrigerant is calculated using the following formula:
[3]	Pressure to flow	
[4]	Velocity to flow	

Parameter 20-05 Feedback 2 Source Unit

Table 780: Parameter 20-05 Feedback 2 Source Unit

20-05 Feedback 2 Source Unit		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

N O T I C E

This parameter is only available when using pressure to temperature feedback conversion. If option *[0] Linear* is selected in *parameter 20-04 Feedback 2 Conversion*, the setting of any option in *parameter 20-05 Feedback 2 Source Unit* does not matter as a conversion is 1-to-1.

This parameter determines the unit that is used for this feedback source before applying the feedback conversion of *parameter 20-04 Feedback 2 Conversion*. This unit is not used by the PID controller.

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

Option	Name	Description
[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	
[174]	in HG	
[180]	hp	

Parameter 20-06 Feedback 3 Source

Table 781: Parameter 20-06 Feedback 3 Source

20-06 Feedback 3 Source		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

N O T I C E

If feedback is not used, set its source to *[0] No function*. *Parameter 20-20 Feedback Function* determines how the PID controller uses the 3 possible feedbacks.

Up to 3 different feedback signals can be used to provide the feedback signal for the PID controller of the drive. This parameter defines which input is used as the source of the 1st feedback signal. Analog input X30/11 and analog input X30/12 refer to inputs on VLT® General Purpose I/O MCB 101.

Option	Name	Description
[0]*	No function	Use this selection if feedback is not used.
[1]	Analog input 53	
[2]	Analog input 54	
[3]	Pulse input 29	

Option	Name	Description
[4]	Pulse input 33	
[7]	Analog input X30/11	
[8]	Analog input X30/12	
[9]	Analog input X42/1	
[10]	Analog input X42/3	
[11]	Analog input X42/5	
[15]	Analog input X48/2	
[16]	Analog input X49/1	
[17]	Analog input X49/3	
[18]	Analog input X49/5	
[19]	Pressure 3	
[20]	Pressure 4	
[99]	Normal feedback	
[100]	Bus feedback 1	
[101]	Bus feedback 2	
[102]	Bus feedback 3	
[104]	Sensorless flow	Requires setup by VLT® Motion Control Tool MCT 10 with sensorless plug-in.
[105]	Sensorless pressure	Requires setup by VLT® Motion Control Tool MCT 10 with sensorless plug-in.
[110]	Air Pres. to Flow	

Parameter 20-07 Feedback 3 Conversion

Table 782: Parameter 20-07 Feedback 3 Conversion

20-07 Feedback 3 Conversion		
Default value: [0] Linear	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

This parameter allows a conversion function to be applied to feedback 3.

Option	Name	Description
[0]*	Linear	No effect on the feedback.
[1]	Square root	Commonly used when a pressure sensor is used to provide flow feedback. (flow α $\sqrt{\text{pressure}}$)
[2]	Pressure to temperature	Used in compressor applications to provide temperature feedback using a pressure sensor. The temperature of the refrigerant is calculated using the following formula:

Op-tion	Name	Description
		$\text{Temperature} = \frac{A2}{(\ln(pe + 1) - A1)} - A3$ where A1, A2, and A3 are refrigerant-specific constants. Select the refrigerant in *parameter 20-30 Refrigerant*. *Parameter 20-21 Setpoint 1* through *parameter 20-23 Setpoint 3* allow the values of A1, A2, and A3 to be entered for a refrigerant that is not listed in *parameter 20-30 Refrigerant*.
[3]	Pressure to flow	Used in applications for controlling the air flow in a duct. A dynamic pressure measurement (pitot tube) represents the feedback signal. $\text{Flow} = \text{Duct area} \times \sqrt{\text{Dynamic pressure}} \times \text{air density factor}$ See also *parameter 20-34 Duct 1 Area [m2]* through *parameter 20-38 Air Density Factor [%]* for setting of duct area and air density.
[4]	Velocity to flow	Used in applications for controlling the air flow in a duct. An air velocity measurement represents the feedback signal. $\text{Flow} = \text{Duct area} \times \text{air velocity}$ See also *parameter 20-34 Duct 1 Area [m2]* through *parameter 20-37 Duct 2 Area [in2]* for setting of duct area.

Parameter 20-08 Feedback 3 Source Unit

Table 783: Parameter 20-08 Feedback 3 Source Unit

20-08 Feedback 3 Source Unit		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

NOTICE

This parameter is only available when using pressure to temperature feedback conversion. If option *[0] Linear* is selected in *parameter 20-07 Feedback 3 Conversion*, the setting of any option in *parameter 20-08 Feedback 3 Source Unit* does not matter as a conversion is 1-to-1.

This parameter determines the unit that is used for this feedback source before applying the feedback conversion of *parameter 20-07 Feedback 3 Conversion*. This unit is not used by the PID controller.

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	

Option	Name	Description
[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	
[75]	mm Hg	
[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	

Option	Name	Description
[160]	°F	
[170]	psi	
[171]	lb/in^2	
[172]	in WG	
[173]	ft WG	
[174]	in HG	
[180]	hp	

Parameter 20-12 Reference/Feedback Unit

Table 784: Parameter 20-12 Reference/Feedback Unit

20-12 Reference/Feedback Unit		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter determines the unit that is used for references and feedback in closed-loop operation.

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	
[75]	mm Hg	
[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	
[174]	in HG	
[180]	hp	

Parameter 20-13 Minimum Reference/Feedb.

Table 785: Parameter 20-13 Minimum Reference/Feedb.

20-13 Minimum Reference/Feedb.		
Default value: 0 ProcessCtrlUnit	Parameter type: Range, -999999.999 - 999999.999 ProcessCtrlUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the desired minimum value for the remote reference when operating with *parameter 1-00 Configuration Mode* set for *[3] Closed Loop Operation*. Units are set in *parameter 20-12 Referene/Feedback Unit*. Minimum feedback is -200% of either the value set in *parameter 20-13 Minimum Reference/Feedb.* or in *parameter 20-14 Maximum Reference/Feedb.*, which ever numeric value is the highest.

Parameter 20-14 Maximum Reference/Feedb.

Table 786: Parameter 20-14 Maximum Reference/Feedb.

20-14 Maximum Reference/Feedb.		
Default value: 100 ProcessCtrlUnit	Parameter type: Range, -999999.999 - 999999.999 ProcessCtrlUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

N O T I C E

If operating with *parameter 1-00 Configuration Mode* set for *[0] Open Loop*, use *parameter 3-03 Maximum Reference*.

N O T I C E

The dynamics of the PID controller depend on the value set in this parameter. See also *parameter 20-93 PID Proportional Gain*. *Parameter 20-13 Minimum Reference/Feedb.* and *parameter 20-13 Maximum Referene/Feedb.* also determine the feedback range when using feedback for display readout with *parameter 1-00 Configuration Mode* set for *[0] Open Loop*.

Enter the maximum reference/feedback for closed-loop operation. The setting determines the highest value obtainable by summing all reference sources for closed-loop operation. The setting determines 100% feedback in open and closed loop (total feedback range: -200% to +200%).

5.19.2 20-2* Feedback/Setpoint

This parameter group is used to determine how the PID controller uses the 3 possible feedback signals to control the output frequency of the drive. This group is also used to store the 3 internal setpoint references.

Parameter 20-20 Feedback Function

Table 787: Parameter 20-20 Feedback Function

20-20 Feedback Function		
Default value: [3] Minimum	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter determines how the 3 possible forms of feedback are used to control the output frequency of the drive.

Option	Name	Description
[0]	Sum	Sets up the PID controller to use the sum of feedback 1, feedback 2, and feedback 3 as the feedback.

Option	Name	Description
		NOTICE Set any unused feedback to *[0] No function* in: – *Parameter 20-00 Feedback 1 Source* – *Parameter 20-02 Feedback 2 Source* – *Parameter 20-06 Feedback 3 Source* The sum of setpoint 1 and any other references that are enabled (see *parameter group 3-1* References*) are used as the PID controller's setpoint reference.
[1]	Difference	Sets up the PID controller to use the difference between feedback 1 and feedback 2 as the feedback. Feedback 3 is not used with this selection. Only setpoint 1 is used. The sum of setpoint 1 and any other references that are enabled are used as the PID controller's setpoint reference.
[2]	Average	Sets up the PID controller to use the average of feedback 1, feedback 2, and feedback 3 as the feedback. **NOTICE** Set any unused feedback to *[0] No function* in: – *Parameter 20-00 Feedback 1 Source* – *Parameter 20-02 Feedback 2 Source* – *Parameter 20-06 Feedback 3 Source* The sum of setpoint 1 and any other references that are enabled are used as the PID controller's setpoint reference.
[3]*	Minimum	Sets up the PID controller to compare feedback 1, feedback 2, and feedback 3. The PID controller uses the lowest value as the feedback. **NOTICE** Set any unused feedback to *[0] No function* in: – *Parameter 20-00 Feedback 1 Source* – *Parameter 20-02 Feedback 2 Source* – *Parameter 20-06 Feedback 3 Source* Only setpoint 1 is used. The sum of setpoint 1 and any other references that are enabled are used as the PID controller's reference.
[4]	Maximum	Sets up the PID controller to compare feedback 1, feedback 2, and feedback 3. The PID controller uses the highest value as the feedback. **NOTICE** Set any unused feedback to *[0] No function* in: – *Parameter 20-00 Feedback 1 Source* – *Parameter 20-02 Feedback 2 Source* – *Parameter 20-06 Feedback 3 Source*

<table>
<tr><th>Option</th><th>Name</th><th>Description</th></tr>
<tr><td></td><td></td><td>Only setpoint 1 is used. The sum of setpoint 1 and any other references that are enabled are used as the PID controller's setpoint reference.</td></tr>
<tr><td>[5]</td><td>Multi setpoint min</td><td>Sets up the PID controller to calculate the difference between feedback 1 and setpoint 1, feedback 2 and setpoint 2, and feedback 3 and setpoint 3. It uses the feedback/setpoint pair in which the feedback is the farthest below its corresponding setpoint reference. If all feedback signals are above their corresponding setpoints, the PID controller uses the feedback/setpoint pair with the least difference between the 2.

NOTICE
Set any unused feedback to [0] No function in:
– Parameter 20-00 Feedback 1 Source
– Parameter 20-02 Feedback 2 Source
– Parameter 20-06 Feedback 3 Source

Each setpoint reference is the sum of its respective parameter value and any other references that are enabled.</td></tr>
<tr><td>[6]</td><td>Multi setpoint max</td><td>Sets up the PID controller to calculate the difference between feedback 1 and setpoint 1, feedback 2 and setpoint 2, and feedback 3 and setpoint 3. It uses the feedback/setpoint pair in which the feedback is farthest above its corresponding setpoint reference. If all feedback signals are below their corresponding setpoints, the PID controller uses the feedback/setpoint pair with the least difference between the 2.

NOTICE
Set any unused feedback to [0] No function in:
– Parameter 20-00 Feedback 1 Source
– Parameter 20-02 Feedback 2 Source
– Parameter 20-06 Feedback 3 Source

Each setpoint reference is the sum of its respective parameter value and any other references that are enabled.</td></tr>
</table>

The PID controller uses the feedback resulting from the function selected in *parameter 20-20 Feedback Function* to control the output frequency of the drive. This feedback can also be:

- Shown on the display of the drive.
- Used to control an analog output of a drive.
- Transmitted over various serial communication protocols.

The drive can be configured to handle multi-zone applications. 2 different multi-zone applications are supported:

- Multi-zone, single setpoint
- Multi-zone, multi-setpoint

Examples 1 and 2 show the difference between the 2 applications.

Example 1 - Multi-zone, single setpoint

In an office building, a VAV (variable air volume) VLT® HVAC Drive system must ensure a minimum pressure at selected VAV boxes. Due to the varying pressure losses in each duct, the pressure at each VAV box cannot be assumed to be the same. The minimum pressure required is the same for all VAV boxes. This control method can be set up by setting *parameter 20-20 Feedback Function* to *[3] Minimum* and entering the desired pressure in *parameter 20-21 Setpoint 1*. If any feedback is below the setpoint, the PID controller increases the fan speed. If all feedbacks are above the setpoint, the PID controller decreases the fan speed.

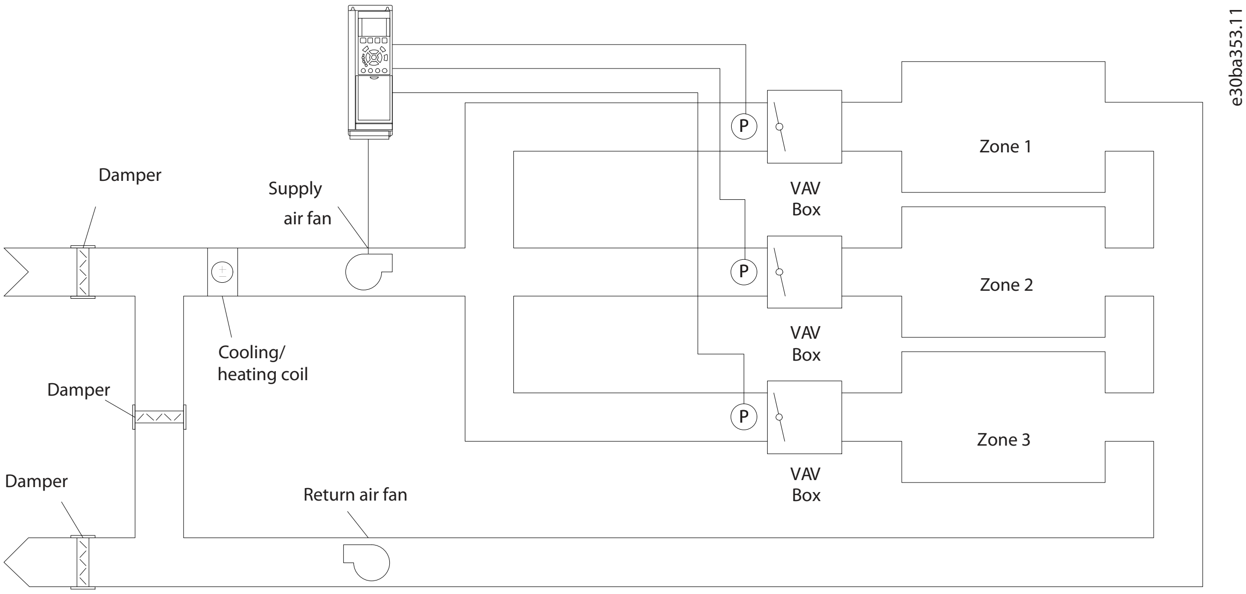


Illustration 80: Example, Multi-zone, Single Setpoint

Example 2, multi-zone, multi-setpoint

The previous example illustrates the use of multi-zone, single-setpoint control. If the zones require different pressures for each VAV box, each setpoint may be specified in

- *parameter 20-21 Setpoint 1*
- *parameter 20-22 Setpoint 2*
- *parameter 20-23 Setpoint 3*

By selecting *[5] Multi-setpoint minimum* in *parameter 20-20 Feedback Function*, the PID controller increases the fan speed if any of the feedbacks are below their setpoints. If all feedbacks are above their individual setpoints, the PID controller decreases the fan speed.

Parameter 20-21 Setpoint 1

Table 788: Parameter 20-21 Setpoint 1

20-21 Setpoint 1		
Default value: 0 ProcessCtrlUnit	Parameter type: Range, -999999.999 - 999999.999 ProcessCtrlUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

NOTICE

The setpoint entered in this parameter is added to any other references that are enabled.

Setpoint 1 is used in closed-loop mode to enter a setpoint reference that is used by the PID controller of the drive.

Parameter 20-22 Setpoint 2

Table 789: Parameter 20-22 Setpoint 2

20-22 Setpoint 2		
Default value: 0 ProcessCtrlUnit	Parameter type: Range, -999999.999 - 999999.999 ProcessCtrlUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

NOTICE

The setpoint entered in this parameter is added to any other references that are enabled.

Setpoint 2 is used in closed-loop mode to enter a setpoint reference that is used by the PID controller of the drive.

Parameter 20-23 Setpoint 3

Table 790: Parameter 20-23 Setpoint 3

20-23 Setpoint 3		
Default value: 0 ProcessCtrlUnit	Parameter type: Range, -999999.999 - 999999.999 ProcessCtrlUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

N O T I C E

The setpoint entered in this parameter is added to any other references that are enabled.

Setpoint 3 is used in closed-loop mode to enter a setpoint reference that is used by the PID controller of the drive.

5.19.3 20-3* Feedback Adv. Conversion

In air-conditioning compressor applications, it is often useful to control the system based on the temperature of the refrigerant. However, it is generally more convenient to directly measure its pressure. This parameter group allows the PID controller of the drive to convert refrigerant pressure measurements into temperature values.

Parameter 20-30 Refrigerant

Table 791: Parameter 20-30 Refrigerant

20-30 Refrigerant		
Default value: [0] R22	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the refrigerant used in the compressor application. This parameter must be specified correctly for the pressure to temperature conversion to be accurate. If the refrigerant used is not listed in options [0] through [6], select *[7] User defined*. Then, use *parameter 20-31 User Defined Refrigerant A1*, *parameter 20-32 User Defined Refrigerant A2*, and *parameter 20-33 User Defined Refrigerant A3* to provide A1, A2, and A3 for the formula below:

$$\text{Temperature} = \frac{A2}{(\ln(Pe + 1) - A1)} - A3$$

Option	Name	Description
[0]*	R22	
[1]	R134a	
[2]	R404A	
[3]	R407C	
[4]	R410A	
[5]	R502	
[6]	R744	
[7]	User defined	

Parameter 20-31 User Defined Refrigerant A1

Table 792: Parameter 20-31 User Defined Refrigerant A1

20-31 User Defined Refrigerant A1		
Default value: 10	Parameter type: Range, 8 - 12	Setup: All setups
Conversion index: -4	Data type: Uint32	Change during operation: True

Use this parameter to enter the value of coefficient A1 when *parameter 20-30 Refrigerant* is set to *[7] User defined*.

Parameter 20-32 User Defined Refrigerant A2

Table 793: Parameter 20-32 User Defined Refrigerant A2

20-32 User Defined Refrigerant A2		
Default value: -2250	Parameter type: Range, -3000 - -1500	Setup: All setups
Conversion index: -2	Data type: Int32	Change during operation: True

Use this parameter to enter the value of coefficient A2 when *parameter 20-30 Refrigerant* is set to *[7] User defined*.

Parameter 20-33 User Defined Refrigerant A3

Table 794: Parameter 20-33 User Defined Refrigerant A3

20-33 User Defined Refrigerant A3		
Default value: 250	Parameter type: Range, 200 - 300	Setup: All setups
Conversion index: -3	Data type: Uint32	Change during operation: True

Use this parameter to enter the value of coefficient A3 when *parameter 20-30 Refrigerant* is set to *[7] User defined*.

Parameter 20-34 Duct 1 Area [m^2]

Table 795: Parameter 20-34 Duct 1 Area [m^2]

20-34 Duct 1 Area [m^2]		
Default value: 0.500 m^2	Parameter type: Range, 0.001 - 10 m^2	Setup: All setups
Conversion index: -3	Data type: Uint32	Change during operation: True

Used for setting the area of the air ducts in connection with feedback conversion pressure/velocity to flow. The unit (m^2) is determined by the setting of *parameter 0-03 Regional Settings*. Fan 1 is used with feedback 1. In case of flow difference control, set *parameter 20-20 Feedback Function* to *[1] Difference* to control flow fan 1 – flow fan 2.

Parameter 20-35 Duct 1 Area [in^2]

Table 796: Parameter 20-35 Duct 1 Area [in^2]

20-35 Duct 1 Area [in^2]		
Default value: 750 in^2	Parameter type: Range, 1 - 15500 in^2	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Used for setting the area of the air ducts in connection with feedback conversion pressure/velocity to flow. The unit (in^2) is determined by the setting of *parameter 0-03 Regional Settings*. Fan 1 is used with feedback 1. In case of flow difference control, set *parameter 20-20 Feedback Function* to *[1] Difference* to control flow fan 1 – flow fan 2.

Parameter 20-36 Duct 2 Area [m2]

Table 797: Parameter 20-36 Duct 2 Area [m^2]

20-36 Duct 2 Area [m^2]		
Default value: 0.500 m^2	Parameter type: Range, 0.001 - 10 m^2	Setup: All setups
Conversion index: -3	Data type: Uint32	Change during operation: True

Used for setting the area of the air ducts in connection with feedback conversion pressure/velocity to flow. The unit (m^2) is determined by the setting of *parameter 0-03 Regional Settings*. Fan 2 is used with feedback 2. In case of flow difference control, set *parameter 20-20 Feedback Function* to *[1] Difference*, to control flow fan 1 – flow fan 2.

Parameter 20-37 Duct 2 Area [in2]

Table 798: Parameter 20-37 Duct 2 Area [in^2]

20-37 Duct 2 Area [in^2]		
Default value: 750 in^2	Parameter type: Range, 1 - 15500 in^2	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Used for setting the area of the air ducts in connection with feedback conversion pressure/velocity to flow. The unit (in^2) is determined by the setting of *parameter 0-03 Regional Settings*. Fan 2 is used with feedback 2. In case of flow difference control, set *parameter 20-20 Feedback Function* to *[1] Difference* to control flow fan 1 – flow fan 2.

Parameter 20-38 Air Density Factor [%]

Table 799: Parameter 20-38 Air Density Factor [%]

20-38 Air Density Factor [%]		
Default value: 100%	Parameter type: Range, 50 - 150%	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Set the air density factor for conversion from pressure to flow in % relative to the air density at sea level at 20 °C (68 °F) (100% ~ 1,200 kg/m^3 (75 lbs/ft^3)).

5.19.4 20-6* Sensorless

Parameters for sensorless. See also:

- *Parameter 20-00 Feedback 1 Source*
- *Parameter 18-50 Sensorless Readout [Unit]*
- *Parameter 16-26 Power Filtered [kW]*
- *Parameter 16-27 Power Filtered [hp]*

N O T I C E

Sensorless unit and sensorless information require setup by VLT® Motion Control Tool MCT 10 with sensorless-specific plug-in.

Parameter 20-60 Sensorless Unit

Table 800: Parameter 20-60 Sensorless Unit

20-60 Sensorless Unit		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the unit to be used with *parameter 18-50 Sensorless Readout [Unit]*.

Option	Name	Description
[20]	l/s	
[21]	l/min	
[22]	l/h	
[23]	m^3/s	
[24]	m^3/min	
[25]	m^3/h	
[70]	mbar	
[71]	bar	
[72]	Pa	
[73]	kPa	
[74]	m WG	
[75]	mm Hg	
[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	
[170]	psi	
[171]	lb/in^2	
[172]	in WG	
[173]	ft WG	
[174]	in Hg	

Parameter 20-69 Sensorless Information

Table 801: Parameter 20-69 Sensorless Information

20-69 Sensorless Information		
Default value: 0	Parameter type: Range, 0 - 25, Array [8]	Setup: All setups
Conversion index: 0	Data type: VisStr 25	Change during operation: True

View the information about the sensorless data.

5.19.5 20-7* Autotuning

PID autotuning

The closed-loop controller of the drive (*parameter group 20-** FC Closed Loop*) can be autotuned, which simplifies and saves time during commissioning, while ensuring accurate control adjustment. To use autotuning, configure the drive for closed loop in *parameter 1-00 Configuration Mode*.

Use a graphical local control panel (GLCP) to react to messages during the autotuning sequence.

Selecting either PID or SPC in *parameter 20-79 PID Autotuning* puts the drive in autotuning mode. The LCP then shows on-screen instructions.

To start the fan/pump, press [Auto On] and apply a start signal. The default control settings ensure that the setpoint is eventually reached. For PID autotuning, it is possible to adjust the speed manually by pressing [▵] or [▿] to a level where the feedback is around the system setpoint.

N O T I C E

If the feedback goes outside the specified limits (2073 and 2074) defined during autotune setup, the autotuning is discarded. The limits also serve as application protection during autotuning execution.

N O T I C E

It is not possible to run the motor at maximum or minimum speed when manually adjusting the motor speed due to the need of increasing or decreasing the motor speed during autotuning.

Autotuning introduces step changes while operating at a steady state and then monitors the feedback. For PID control, the autotuning feedback response defines the required values for *parameter 20-93 PID Proportional Gain*, and *parameter 20-94 PID Integral Time* is calculated. *Parameter 20-95 PID Differentiation Time* is set to value 0. *Parameter 20-81 PID Normal/Inverse Control* is determined during the tuning process.

These calculated values are presented in the LCP and can be either accepted or rejected. Once accepted, the values are written to the relevant parameters and autotuning mode is disabled in *parameter 20-79 PID Autotuning*. Depending on the system, the time required to carry out autotuning could be several minutes.

Before carrying out the autotuning, set the following parameters according to the load inertia:

- *Parameter 3-41 Ramp 1 Ramp Up Time*
- *Parameter 3-42 Ramp 1 Ramp Down Time*

or

- *Parameter 3-51 Ramp 2 Ramp Up Time*
- *Parameter 3-52 Ramp 2 Ramp Down Time*

If PID autotuning is carried out with slow ramp times, the autotuned parameters typically result in slow control. Before activating PID autotuning, remove excessive feedback sensor noise using the input filter (*parameter groups 6-** Analog In/Out*, *5-** Pulse Input*, and *26-** Analog I/O Option MCB 109*, *parameter 6-16 Terminal 53 Filter Time Constant*, *parameter 6-26 Terminal 54 Filter Time Constant*, *parameter 5-54 Pulse Filter Time Constant #29*, *parameter 5-59 Pulse Filter Time Constant #33*). To obtain the most accurate controller parameters, carry out PID autotuning when the application runs in typical operation with a typical load.

SPC autotuning

SPC initiates a tuning of DRC. If feedback from the system determines the system to be 2nd order, autotuning proceeds automatically with tuning of PID parameters. If SPC discards the DRC, it is shown by the process bar going to step 4.

DCR assumes that the target applications of the drive can be generically modeled as 1st order plus dead-time systems. DRC autotuning is providing the feedback for calculation.

- τ = time constant of process system K_p process system gain.
- θ = time delay between input and output DRC can only be set up by using SPC.

Parameter 20-70 Closed Loop Type

Table 802: Parameter 20-70 Closed Loop Type

20-70 Closed Loop Type		
Default value: [0] Auto	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the application response speed if it is known. The default setting is sufficient for most applications. A more precise value decreases the time needed for carrying out PID adaptation. The setting has no impact on values of parameters and only affects the auto-tuning speed.

Option	Name	Description
[0]*	Auto	Takes 30–120 s to complete.
[1]	Fast pressure	Takes 10–60 s to complete.
[2]	Slow pressure	Takes 30–120 s to complete
[3]	Fast temperature	Takes 10–20 minutes to complete.
[4]	Slow temperature	Takes 30–60 minutes to complete.

Parameter 20-71 PID Performance

Table 803: Parameter 20-71 PID Performance

20-71 PID Performance		
Default value: [0] Normal	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the application response speed if it is known. The default setting is sufficient for most applications. A more precise value decreases the time needed for carrying out PID adaptation. The setting has no impact on values of parameters and only affects the auto-tuning speed.

Option	Name	Description
[0]*	Normal	Normal setting of this parameter is suitable for pressure control in fan systems.
[1]	Fast	Fast setting is used in pumping systems where a faster control response is wanted.

Parameter 20-72 PID Output Change

Table 804: Parameter 20-72 PID Output Change

20-72 PID Output Change		
Default value: 0.10	Parameter type: Range, 0.01 - 0.5	Setup: 2 setups
Conversion index: -2	Data type: Uint 16	Change during operation: True

This parameter sets the magnitude of step change during auto tuning. The value is a percentage of full speed. That is, if maximum output frequency in *parameter 4-13 Motor Speed High Limit [RPM]*/*parameter 4-14 Motor Speed High Limit [Hz]* is set to 40 Hz, 0.10 is 10% of 50 Hz, which is 5 Hz. Set this parameter to a value resulting in feedback changes of 10–20% for best tuning accuracy.

Parameter 20-73 Minimum Feedback Level

Table 805: Parameter 20-73 Minimum Feedback Level

20-73 Minimum Feedback Level		
Default value: -999999 ProcessCtrlUnit	Parameter type: Range, -999999.999 - 999999.999 ProcessCtrlUnit	Setup: 2 setups
Conversion index: -3	Data type: Int 32	Change during operation: True

Enter the minimum allowable feedback level in user units as defined in *parameter 20-12 Reference/Feedback Unit*. If the level drops below *parameter 20-73 Minimum Feedback Level*, auto tuning is aborted and an error message appears in the LCP.

Parameter 20-74 Maximum Feedback Level

Table 806: Parameter 20-74 Maximum Feedback Level

20-74 Maximum Feedback Level		
Default value: 999999 ProcessCtrlUnit	Parameter type: Range, -999999.999 - 999999.999 ProcessCtrlUnit	Setup: 2 setups
Conversion index: -3	Data type: Int 32	Change during operation: True

Enter the maximum allowable feedback level in user units as defined in *parameter 20-12 Reference/Feedback Unit*. If the level rises above *parameter 20-74 Maximum Feedback Level*, auto tuning is aborted and an error message appears in the LCP.

Parameter 20-79 PID Autotuning

Table 807: Parameter 20-79 PID Autotuning

20-79 PID Autotuning		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter starts the auto tuning sequence. Once the auto tuning has successfully completed and the settings have been accepted or rejected via [OK] or [Cancel] at the end of tuning, this parameter resets to *[0] Disabled*.

Option	Name	Description
[0]*	Disabled	Auto tuning is disabled.
[1]	Enabled	Auto tuning is enabled.

5.19.6 20-8* PID Basic Settings

This parameter group is used to configure the basic operation of the PID controller, including:

- Response to feedback above or below the setpoint.
- The speed at which it starts functioning.
- When it indicates that the system has reached the setpoint.

Parameter 20-81 PID Normal/Inverse Control

Table 808: Parameter 20-81 PID Normal/Inverse Control

20-81 PID Normal/Inverse Control		
Default value: [0] Normal	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]*	Normal	The output frequency of the drive decreases when the feedback is greater than the setpoint reference. This behavior is common for pressure-controlled supply fan and pump applications.
[1]	Inverse	The output frequency of the drive increases when the feedback is greater than the setpoint reference. This behavior is common for temperature-controlled cooling applications, such as cooling towers.

Parameter 20-82 PID Start Speed [RPM]

Table 809: Parameter 20-82 PID Start Speed [RPM]

20-82 PID Start 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

NOTICE

This parameter is only visible if *parameter 0-02 Motor Speed Unit* is set to *[0] RPM*.

When the drive is first started, it initially ramps up to this output speed in open-loop mode, following the active ramp-up time. When the output speed programmed is reached, the drive automatically switches to closed-loop mode, and the PID controller begins to function. This is useful in applications that require quick acceleration to a minimum speed at start-up.

Parameter 20-83 PID Start Speed [Hz]

Table 810: Parameter 20-83 PID Start Speed [Hz]

20-83 PID Start 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

NOTICE

This parameter is only visible if *parameter 0-02 Motor Speed Unit* is set to *[1] Hz*.

When the drive is first started, it initially ramps up to this output frequency in open-loop mode, following the active ramp-up time. When the output frequency programmed is reached, the drive automatically switches to closed-loop mode, and the PID controller begins to function. This is useful in applications that require quick acceleration to a minimum speed at start-up.

Parameter 20-84 On Reference Bandwidth

Table 811: Parameter 20-84 On Reference Bandwidth

20-84 On Reference Bandwidth		
Default value: 5%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

When the difference between the feedback and the setpoint reference is less than the value of this parameter, the display of the drive shows *Run on reference*. This status can be communicated externally by programming the function of a digital output for *[8] Run on reference/no warning*. Also, for serial communication, the On Reference status bit of the drive status word is high (value = 1). The *On reference bandwidth* is calculated as a percentage of the setpoint reference.

5.19.7 20-9* PID Controller

This group enables manual adjustment of the PID controller. By adjusting the PID controller parameters, the control performance may be improved. See the VLT® HVAC Drive FC 102 Design Guide for guidelines on adjusting the PID controller parameters.

Parameter 20-91 PID Anti Windup

Table 812: Parameter 20-91 PID Anti Windup

20-91 PID Anti Windup		
Default value: [1] On	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

NOTICE

Option *[1] On* is activated automatically if 1 of the following options is selected in parameters in *parameter group 21-** Ext. Closed Loop*: *[0] Normal*, *[X] Enabled Ext CLX PID*.

Option	Name	Description
[0]	Off	The integrator continues to change value also after output has reached 1 of the extremes. This can afterwards cause a delay of change of the output of the controller.
[1]*	On	The integrator is locked if the output of the built-in PID controller has reached 1 of the extermes (minimum or maximum value) and therefore is not able to add further changes to the value of the process parameter controlled. This allows the controller to respond more quickly when it can control the system again.

Parameter 20-93 PID Proportional Gain

Table 813: Parameter 20-93 PID Proportional Gain

20-93 PID Proportional Gain		
Default value: 0.50	Parameter type: Range, 0=Off - 10	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

NOTICE

Always set the required value for *parameter 20-14 Maximum Reference/Feedb.* before setting the values for the PID controller in *parameter group 20-9* PID Controller*.

The proportional gain indicates the number of times the error between the setpoint and the feedback signal is to be applied.

If (error x gain) jumps with a value equal to what is set in *parameter 20-14 Maximum Reference/Feedb.*, the PID controller tries to change the output speed equal to what is set in *parameter 4-13 Motor Speed High Limit [RPM]*/*parameter 4-14 Motor Speed High Limit [Hz]*. However, the output speed is limited by this setting.

Calculate the proportional band (error causing output to change from 0–100%) with this formula:

$$\left(\frac{1}{\text{Proportional gain}}\right) \times (\text{Max reference})$$

Parameter 20-94 PID Integral Time

Table 814: Parameter 20-94 PID Integral Time

20-94 PID Integral Time		
Default value: 20 s	Parameter type: Range, 0.01 - 10000 s	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

The integrator accumulates a contribution to the output from the PID controller as long as there is a deviation between the reference/setpoint and feedback signals. The contribution is proportional to the size of the deviation. This ensures that the deviation (error) approaches zero. Quick response on any deviation is obtained when the integral time is set to a low value. Setting it too low, however, may cause the control to become unstable. The value set is the time needed for the integrator to add the same contribution as the proportional for a certain deviation. If the value is set to 10000, the controller acts as a pure proportional controller with a P-band based on the value set in *parameter 20-93 PID Proportional Gain*. When no deviation is present, the output from the proportional controller is 0.

Parameter 20-95 PID Differentiation Time

Table 815: Parameter 20-95 PID Differentiation Time

20-95 PID Differentiation Time		
Default value: 0 s	Parameter type: Range, 0=Off - 10 s	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

The differentiator monitors the rate of change of the feedback. If the feedback is changing quickly, it adjusts the output of the PID controller to reduce the rate of change of the feedback. Quick PID controller response is obtained when this value is large. However, if too large a value is used, the output frequency of the drive may become unstable. Differentiation time is useful in situations where extremely fast drive response and precise speed control are required. It can be difficult to adjust this for proper system control. Differentiation time is not commonly used in HVAC applications. Therefore, it is best to leave this parameter at 0 or OFF.

Parameter 20-96 PID Diff. Gain Limit

Table 816: Parameter 20-96 PID Diff. Gain Limit

20-96 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

The differential function of a PID controller responds to the rate of change of the feedback. As a result, an abrupt change in the feedback can cause the differential function to make a large change in the PID controller output. This parameter limits the maximum effect that the PID controller differential function can produce. A smaller value reduces the maximum effect of the PID controller differential function. This parameter is only active when *parameter 20-95 PID Differentiation Time* is not set to OFF (0 s).

5.20 Parameter Group 21-** Ext. Closed Loop

The VLT® HVAC Drive offers 3 extended closed-loop PID controllers in addition to the PID controller. These can be configured independently to control either external actuators (valves, dampers, and so on) or be used with the internal PID controller to improve the dynamic responses to setpoint changes or load disturbances.

The extended closed-loop PID controllers may be interconnected or connected to the PID closed-loop controller to form a dual-loop configuration.

To control a modulating device, for example a valve motor, this device must be a positioning servo motor with built-in electronics accepting either a 0–10 V (signal from VLT® Analog I/O Option MCB 109) or a 0/4–20 mA (signal from control card and/or VLT® General Purpose I/O MCB 101) control signal. The output function can be programmed in the following parameters:

- Control card, terminal 42: *Parameter 6-50 Terminal 42 Output* (settings [113]...[115] or [149]...[151], Ext. Closed Loop 1/2/3)
- VLT® General Purpose I/O MCB 101, terminal X30/8: *Parameter 6-60 Terminal X30/8 Output* (settings [113]...[115] or [149]...[151], Ext. Closed Loop 1/2/3)
- VLT® Analog I/O Option MCB 109, terminal X42/7 (settings [113]...[115], Ext. Closed Loop 1/2/3)

VLT® General Purpose I/O MCB 101 and VLT® Analog I/O Option MCB 109 are optional cards.

5.20.1 21-0* Extended CL Autotuning

The extended closed-loop PID controllers can each be auto tuned, which simplifies and saves time during commissioning, while ensuring accurate PID control adjustment.

To use PID auto tuning, configure the relevant extended PID controller for the application.

Use a graphical LCP to react to messages during the autotuning sequence.

When enabling auto tuning, *parameter 21-09 PID Autotuning* puts the relevant PID controller into PID autotuning mode. The LCP then provides on-screen instructions.

PID autotuning introduces step changes and then monitors the feedback. Based on the feedback response, the following required values are calculated:

- PID proportional gain

    - *Parameter 21-21 Ext. 1 Proportional Gain* for EXT CL 1.
    - *Parameter 21-41 Ext. 2 Proportional Gain* for EXT CL 2.
    - *Parameter 21-61 Ext. 3 Proportional Gain* for EXT CL 3.
- Integral time
    - *Parameter 21-22 Ext. 1 Integral Time* for EXT CL 1.
    - *Parameter 21-42 Ext. 2 Integral Time* for EXT CL 2.
    - *Parameter 21-62 Ext. 3 Integral Time* for EXT CL 3.

The PID differentiation time is set to 0 in the following parameters:

- *Parameter 21-23 Ext. 1 Differentiation Time* for EXT CL 1.
- *Parameter 21-43 Ext. 2 Differentiation Time* for EXT CL 2.
- *Parameter 21-63 Ext. 3 Differentiation Time* for EXT CL 3.
- *Parameter 21-20 Ext. 1 Normal/Inverse Control* for EXT CL 1.
- *Parameter 21-40 Ext. 2 Normal/Inverse Control* for EXT CL 2.
- *Parameter 21-60 Ext. 3 Normal/Inverse Control* for EXT CL 3.

These calculated values are presented on the LCP and can either be accepted or rejected. Once accepted, the values are written to the relevant parameters, and PID autotuning mode is disabled in *parameter 21-09 PID Autotuning*.

Depending on the system being controlled, the time required to carry out PID auto tuning could be several minutes.

Before activating the PID auto tuning, remove excessive feedback sensor noise using the input filter (*parameter groups 5-5* Pulse Input*, *6-** Analog In/Out*, and *26-** Analog I/O Option MCB 109*, terminal 53/54 filter time constant, and pulse filter time constant #29/33).

Parameter 21-00 Closed Loop Type

Table 817: Parameter 21-00 Closed Loop Type

21-00 Closed Loop Type		
Default value: [0] Auto	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter defines the application response. The default mode should be sufficient for most applications. If the relative application speed is known, it can be selected here. This decreases the time needed for carrying out PID auto tuning.

Option	Name	Description
[0*]	Auto	
[1]	Fast pressure	
[2]	Slow pressure	
[3]	Fast temperature	
[4]	Slow temperature	

Parameter 21-01 PID Performance

Table 818: Parameter 21-01 PID Performance

21-01 PID Performance		
Default value: [0] Normal	Parameter type: Option	Setup: 2 setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0*]	Normal	Normal setting for this parameter is suitable for pressure control in fan systems.
[1]	Fast	Fast setting would generally be used in pumping systems where a faster control response is desirable.

Parameter 21-02 PID Output Change

Table 819: Parameter 21-02 PID Output Change

21-02 PID Output Change		
Default value: 0.10	Parameter type: Range, 0.01 - 0.50	Setup: 2 setups
Conversion index: -2	Data type: Uint16	Change during operation: True

This parameter sets the magnitude of step change during auto tuning. The value is a percentage of full operating range. That is, if the maximum analog output voltage is set to 10 V, 0.10 is 10% of 10 V, which is 1 V. Set this parameter to a value resulting in feedback changes of 10–20% for best tuning accuracy.

Parameter 21-03 Minimum Feedback Level

Table 820: Parameter 21-03 Minimum Feedback Level

21-03 Minimum Feedback Level		
Default value: -999999.999	Parameter type: Range, -999999.999 - par. 21-04	Setup: 2 setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the minimum allowable feedback level in user units as defined:

- *Parameter 21-10 Ext. 1 Ref./Feedback Unit* for EXT CL 1.
- *Parameter 21-30 Ext. 2 Ref./Feedback Unit* for EXT CL 2.
- *Parameter 21-50 Ext. Ref./Feedback Unit* EXT CL.

If the level drops below *parameter 21-03 Minimum Feedback Level*, PID auto tuning is aborted, and an error message appears in the display.

Parameter 21-04 Maximum Feedback Level

Table 821: Parameter 21-04 Maximum Feedback Level

21-04 Maximum Feedback Level		
Default value: 999999.999	Parameter type: Range, Par. 21-04 - 999999.999	Setup: 2 setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the maximum allowable feedback level in user units as defined:

- *Parameter 21-10 Ext. 1 Ref./Feedback Unit* for EXT CL 1.
- *Parameter 21-30 Ext. 2 Ref./Feedback Unit* for EXT CL 2.
- *Parameter 21-50 Ext. Ref./Feedback Unit* EXT CL.

If the level rises above *parameter 21-04 Maximum Feedback Level*, PID auto tuning is aborted, and an error message appears in the display.

Parameter 21-09 PID Autotuning

Table 822: Parameter 21-09 PID Autotuning

21-09 PID Autotuning		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter enables selection of the extended PID controller to be autotuned and starts the PID autotuning for that controller. Once the autotuning has successfully completed, and the settings have been accepted or rejected with [OK] or [Cancel] when tuning has ended, this parameter resets to *[0] Disabled*.

Option	Name	Description
[0*]	Disabled	
[1]	Enabled EXT CL 1 PID	
[2]	Enabled EXT CL 2 PID	
[3]	Enabled EXT CL 3 PID	

5.20.2 21-1* Closed Loop 1 Ref/Feedback

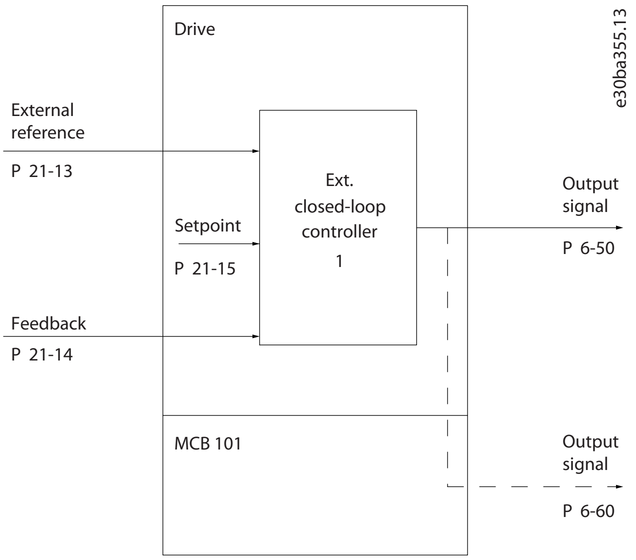


Illustration 81: Closed Loop 1 Ref/Feedback

Parameter 21-10 Ext. 1 Ref./Feedback Unit

Table 823: Parameter 21-10 Ext. 1 Ref./Feedback Unit

21-10 Ext. 1 Ref./Feedback Unit		
Default value: [1] %	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the unit for the reference and feedback.

Option	Name	Description
[0]	None	
[1]*	%	
[5]	PPM	
[10]	1/min	
[11]	RPM	
[12]	Pulse/s	
[20]	l/s	

Option	Name	Description
[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	
[75]	mm Hg	
[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	

Option	Name	Description
[140]	ft/s	
[141]	ft/min	
[145]	ft	
[160]	°F	
[170]	psi	
[171]	lb/in^2	
[172]	in WG	
[173]	ft WG	
[174]	in HG	
[180]	hp	

Parameter 21-11 Ext. 1 Minimum Reference

Table 824: Parameter 21-11 Ext. 1 Minimum Reference

21-11 Ext. 1 Minimum Reference		
Default value: 0 ExtPID1Unit	Parameter type: Range, -999999.999 - par. 21-12 Ext.PID1Unit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Select the minimum reference for the closed-loop 1 controller.

Parameter 21-12 Ext. 1 Maximum Reference

Table 825: Parameter 21-12 Ext. 1 Maximum Reference

21-12 Ext. 1 Maximum Reference		
Default value: 100 ExtPID1Unit	Parameter type: Range, par. 21-11 - 999999.999 Ext.PID1Unit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

N O T I C E

Set the value for *parameter 21-12 Ext. 1 Maximum Reference* before setting the values for the PID controller in *parameter group 20-9* PID Controller*.

Select the maximum reference for the closed-loop 1 controller. The dynamics of the PID controller depend on the value set in this parameter. See also *parameter 21-21 Ext. 1 Proportional Gain*.

Parameter 21-13 Ext. 1 Reference Source

Table 826: Parameter 21-13 Ext. 1 Reference Source

21-13 Ext. 1 Reference Source		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

N O T I C E

If feedback is not used, set its source to *[0] No function*. *Parameter 20-20 Feedback Function* determines how the PID controller uses the 3 possible feedbacks.

This parameter defines which input on the drive should be treated as the source of the reference signal for the closed-loop 1 controller. Analog input X30/11 and analog input X30/12 refer to inputs on the VLT® General Purpose I/O Card MCB 101.

Option	Name	Description
[0]*	No function	Use this selection if feedback is not used.
[1]	Analog input 53	
[2]	Analog input 54	
[3]	Pulse input 29	
[4]	Pulse input 33	
[7]	Analog input X30/11	
[8]	Analog input X30/12	
[11]	Local bus reference	
[20]	Digital pot. meter	
[21]	Analog input X30/11	
[22]	Analog input X30/12	
[23]	Analog input X42/1	
[24]	Analog input X42/3	
[25]	Analog input X42/5	
[29]	Analog input X48/2	
[30]	Ext. closed loop 1	
[31]	Ext. closed loop 2	
[32]	Ext. closed loop 3	
[37]	Analog input X49/1	
[38]	Analog input X49/3	
[39]	Analogi input X49/5	
[133]	Fieldbus REF 1	

Parameter 21-14 Ext. 1 Feedback Source

Table 827: Parameter 21-14 Ext. 1 Feedback Source

21-14 Ext. 1 Feedback Source		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter defines which input on the drive should be treated as the source of the feedback signal for the closed-loop 1 controller. Analog input X30/11 and analog input X30/12 refer to inputs on the VLT® General Purpose I/O Card MCB 101.

Option	Name	Description
[0]*	No function	
[1]	Analog input 53	

Option	Name	Description
[2]	Analog input 54	
[3]	Pulse input 29	
[4]	Pulse input 33	
[7]	Analog input X30/11	
[8]	Analog input X30/12	
[9]	Analog input X42/1	
[10]	Analog input X42/3	
[11]	Analog input X42/5	
[15]	Analog input X48/2	
[16]	Analog input X49/1	
[17]	Analog input X49/3	
[18]	Analog input X49/5	
[19]	Pressure 3	
[20]	Pressure 4	
[99]	Normal feedback	
[100]	Bus feedback 1	
[101]	Bus feedback 2	
[102]	Bus feedback 3	
[104]	Sensorless flow	Requires setup by VLT® Motion Control Tool MCT 10 with sensorless plug-in.
[105]	Sensorless pressure	Requires setup by VLT® Motion Control Tool MCT 10 with sensorless plug-in.
[110]	Air Pres. to Flow	

Parameter 21-15 Ext. 1 Setpoint

Table 828: Parameter 21-15 Ext. 1 Setpoint

21-15 Ext. 1 Setpoint		
Default value: 0 ExtPID1Unit	Parameter type: Range, -999999.999 - 999999.999 Ext.PID1Unit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

The setpoint reference is used in extended 1 closed loop. Ext. 1 setpoint is added to the value from the Ext. 1 reference source selected in *parameter 21-13 Ext. 1 Reference Source*.

Parameter 21-17 Ext. 1 Reference [Unit]

Table 829: Parameter 21-17 Ext. 1 Reference [Unit]

21-17 Ext. 1 Reference [Unit]		
Default value: 0 ExtPID1Unit	Parameter type: Range, -999999.999 - 999999.999 Ext.PID1Unit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Readout of the reference value for the closed-loop 1 controller.

Parameter 21-18 Ext. 1 Feedback [Unit]

Table 830: Parameter 21-18 Ext. 1 Feedback [Unit]

21-18 Ext. 1 Feedback [Unit]		
Default value: 0 ExtPID1Unit	Parameter type: Range, -999999.999 - 999999.999 Ext.PID1Unit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Readout of the feedback value for the closed-loop 1 controller.

Parameter 21-19 Ext. 1 Output [%]

Table 831: Parameter 21-19 Ext. 1 Output [%]

21-19 Ext. 1 Output [%]		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Readout of the output value for the closed-loop 1 controller.

5.20.3 21-2* Ext. CL 1 PID

Parameter 21-20 Ext. 1 Normal/Inverse Control

Table 832: Parameter 21-20 Ext. 1 Normal/Inverse Control

21-20 Ext. 1 Normal/Inverse Control		
Default value: [0] Normal	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0*]	Normal	Reduces the output when feedback is higher than the reference.
[1]	Inverse	Increases the output when feedback is higher than the reference.

Parameter 21-21 Ext. 1 Proportional Gain

Table 833: Parameter 21-21 Ext. 1 Proportional Gain

21-21 Ext. 1 Proportional Gain		
Default value: 0.01	Parameter type: Range, 0=Off - 10	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

The proportional gain indicates the number of times the error between the setpoint and the feedback signal is to be applied.

If (error x gain) jumps with a value equal to what is set in *parameter 20-14 Maximum Reference/Feedb.*, the PID controller tries to change the output speed equal to what is set in *parameter 4-13 Motor Speed High Limit [RPM]*/*parameter 4-14 Motor Speed High Limit [Hz]*. However, the output speed is limited by this setting. The proportional band (error causing output to change from 0–100%) can be calculated with this formula:

$$\left(\frac{1}{\text{Proportional gain}}\right) \times (\text{Maximum reference})$$

Parameter 21-22 Ext. 1 Integral Time

Table 834: Parameter 21-22 Ext. 1 Integral Time

21-22 Ext. 1 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

Over time, the integrator accumulates a contribution to the output from the PID controller as long as there is a deviation between the reference/setpoint and feedback signals. The contribution is proportional to the size of the deviation. This ensures that the deviation (error) approaches 0. Quick response on any deviation is obtained when the integral time is set to a low value. Setting it too low, however, may cause the control to become unstable. The value set is the time needed for the integrator to add the same contribution as the proportional for a certain deviation. If the value is set to 10000, the controller acts as a pure proportional controller with a P-band based on the value set in *parameter 20-93 PID Proportional Gain*. When no deviation is present, the output from the proportional controller is 0.

Parameter 21-23 Ext. 1 Differentiation Time

Table 835: Parameter 21-23 Ext. 1 Differentiation Time

21-23 Ext. 1 Differentiation Time		
Default value: 0 s	Parameter type: Range, 0=Off - 10 s	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

The differentiator does not react to a constant error. It only provides a gain when the feedback changes. The quicker the feedback changes, the stronger the gain from the differentiator.

Parameter 21-24 Ext. 1 Dif. Gain Limit

Table 836: Parameter 21-24 Ext. 1 Dif. Gain Limit

21-24 Ext. 1 Dif. Gain Limit		
Default value: 5	Parameter type: Range, 1 - 50	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Set a limit for the differentiator gain (DG). The DG increases if there are fast changes. Limit the DG to obtain a pure differentiator gain when changes are slow and a constant differentiator gain when quick changes occur.

Parameter 21-26 Ext. 1 On Reference Bandwidth

Table 837: Parameter 21-26 Ext. 1 On Reference Bandwidth

21-26 Ext. 1 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 high.

5.20.4 21-3* Ext. CL 2 Ref./Fb.

Parameter 21-30 Ext. 2 Ref./Feedback Unit

Table 838: Parameter 21-30 Ext. 2 Ref./Feedback Unit

21-30 Ext. 2 Ref./Feedback Unit		
Default value: [1] %	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the unit for the reference and feedback.

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

Option	Name	Description
[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	
[174]	in HG	
[180]	hp	

Parameter 21-31 Ext. 2 Minimum Reference

Table 839: Parameter 21-31 Ext. 2 Minimum Reference

21-31 Ext. 2 Minimum Reference		
Default value: 0 ExtPID2Unit	Parameter type: Range, -999999.999 - par. 21-32 Ext.PID2Unit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Select the minimum reference for the closed-loop 2 controller.

Parameter 21-32 Ext. 2 Maximum Reference

Table 840: Parameter 21-32 Ext. 2 Maximum Reference

21-32 Ext. 2 Maximum Reference		
Default value: 100 ExtPID2Unit	Parameter type: Range, par. 21-31 - 999999.999 Ext.PID1Unit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

NOTICE

Set the value for *parameter 21-32 Ext. 2 Maximum Reference* before setting the values for the PID controller in *parameter group 20-9* PID Controller*.

Select the maximum reference for the closed-loop 1 controller. The dynamics of the PID controller depend on the value set in this parameter. See also *parameter 21-41 Ext. 2 Proportional Gain*.

Parameter 21-33 Ext. 2 Reference Source

Table 841: Parameter 21-33 Ext. 2 Reference Source

21-33 Ext. 2 Reference Source		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

N O T I C E

If feedback is not used, set its source to *[0] No function*. *Parameter 20-20 Feedback Function* determines how the PID controller uses the 3 possible feedbacks.

This parameter defines which input on the drive should be treated as the source of the reference signal for the closed-loop 2 controller. Analog input X30/11 and analog input X30/12 refer to inputs on the VLT® General Purpose I/O Card MCB 101.

Option	Name	Description
[0]*	No function	Use this selection if feedback is not used.
[1]	Analog input 53	
[2]	Analog input 54	
[3]	Pulse input 29	
[4]	Pulse input 33	
[7]	Analog input X30/11	
[8]	Analog input X30/12	
[11]	Local bus reference	
[20]	Digital pot. meter	
[21]	Analog input X30/11	
[22]	Analog input X30/12	
[23]	Analog input X42/1	
[24]	Analog input X42/3	
[25]	Analog input X42/5	
[29]	Analog input X48/2	
[30]	Ext. closed loop 1	
[31]	Ext. closed loop 2	
[32]	Ext. closed loop 3	
[37]	Analog input X49/1	
[38]	Analog input X49/3	
[39]	Analogi input X49/5	
[133]	Fieldbus REF 1	

Parameter 21-34 Ext. 2 Feedback Source

Table 842: Parameter 21-34 Ext. 2 Feedback Source

21-34 Ext. 2 Feedback Source		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter defines which input on the drive should be treated as the source of the feedback signal for the closed-loop 2 controller. Analog input X30/11 and analog input X30/12 refer to inputs on the VLT® General Purpose I/O Card MCB 101.

Option	Name	Description
[0]*	No function	
[1]	Analog input 53	
[2]	Analog input 54	
[3]	Pulse input 29	
[4]	Pulse input 33	
[7]	Analog input X30/11	
[8]	Analog input X30/12	
[9]	Analog input X42/1	
[10]	Analog input X42/3	
[11]	Analog input X42/5	
[15]	Analog input X48/2	
[16]	Analog input X49/1	
[17]	Analog input X49/3	
[18]	Analog input X49/5	
[19]	Pressure 3	
[20]	Pressure 4	
[99]	Normal feedback	
[100]	Bus feedback 1	
[101]	Bus feedback 2	
[102]	Bus feedback 3	
[104]	Sensorless flow	Requires setup by VLT® Motion Control Tool MCT 10 with sensorless plug-in.
[105]	Sensorless pressure	Requires setup by VLT® Motion Control Tool MCT 10 with sensorless plug-in.
[110]	Air Pres. to Flow	

Parameter 21-35 Ext. 2 Setpoint

Table 843: Parameter 21-35 Ext. 2 Setpoint

21-35 Ext. 2 Setpoint		
Default value: 0 ExtPID2Unit	Parameter type: Range, -999999.999 - 999999.999 Ext.PID1Unit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

The setpoint reference is used in extended 2 closed loop. Ext. 1 setpoint is added to the value from the Ext. 1 reference source selected in *parameter 21-33 Ext. 2 Reference Source*.

Parameter 21-37 Ext. 2 Reference [Unit]

Table 844: Parameter 21-37 Ext. 2 Reference [Unit]

21-37 Ext. 2 Reference [Unit]		
Default value: 0 ExtPID2Unit	Parameter type: Range, -999999.999 - 999999.999 Ext.PID2Unit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Readout of the reference value for the closed-loop 2 controller.

Parameter 21-38 Ext. 2 Feedback [Unit]

Table 845: Parameter 21-38 Ext. 2 Feedback [Unit]

21-38 Ext. 2 Feedback [Unit]		
Default value: 0 ExtPID2Unit	Parameter type: Range, -999999.999 - 999999.999 Ext.PID1Unit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Readout of the feedback value for the closed-loop 2 controller.

Parameter 21-39 Ext. 2 Output [%]

Table 846: Parameter 21-39 Ext. 2 Output [%]

21-39 Ext. 2 Output [%]		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Readout of the output value for the closed-loop 2 controller.

5.20.5 21-4* Ext. CL 2 PID

Table 847: Parameter 21-40 Ext. 2 Normal/Inverse Control

21-40 Ext. 2 Normal/Inverse Control		
Default value: [0] Normal	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0*]	Normal	Reduces the output when feedback is higher than the reference.
[1]	Inverse	Increases the output when feedback is higher than the reference.

Parameter 21-41 Ext. 2 Proportional Gain

Table 848: Parameter 21-41 Ext. 2 Proportional Gain

21-41 Ext. 2 Proportional Gain		
Default value: 0.01	Parameter type: Range, 0=Off - 10	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

The proportional gain indicates the number of times the error between the setpoint and the feedback signal is to be applied.

Parameter 21-42 Ext. 2 Integral Time

Table 849: Parameter 21-42 Ext. 2 Integral Time

21-42 Ext. 2 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

Over time, the integrator accumulates a contribution to the output from the PID controller as long as there is a deviation between the reference/setpoint and feedback signals. The contribution is proportional to the size of the deviation. This ensures that the deviation (error) approaches 0. Quick response on any deviation is obtained when the integral time is set to a low value. Setting it too low, however, may cause the control to become unstable. The value set is the time needed for the integrator to add the same contribution as the proportional for a certain deviation. If the value is set to 10000, the controller acts as a pure proportional controller with a P-band based on the value set in *parameter 20-93 PID Proportional Gain*. When no deviation is present, the output from the proportional controller is 0.

Parameter 21-43 Ext. 2 Differentiation Time

Table 850: Parameter 21-43 Ext. 2 Differentiation Time

21-43 Ext. 2 Differentiation Time		
Default value: 0 s	Parameter type: Range, 0=Off - 10 s	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

The differentiator does not react to a constant error. It only provides a gain when the feedback changes. The quicker the feedback changes, the stronger the gain from the differentiator.

Parameter 21-44 Ext. 2 Dif. Gain Limit

Table 851: Parameter 21-44 Ext. 2 Dif. Gain Limit

21-44 Ext. 2 Dif. Gain Limit		
Default value: 5	Parameter type: Range, 1 - 50	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Set a limit for the differentiator gain (DG). The DG increases if there are fast changes. Limit the DG to obtain a pure differentiator gain when changes are slow and a constant differentiator gain when quick changes occur.

Parameter 21-46 Ext. 2 On Reference Bandwidth

Table 852: Parameter 21-46 Ext. 2 On Reference Bandwidth

21-46 Ext. 2 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 high.

5.20.6 21-5* Ext. CL 3 Ref./Fb.

Parameter 21-50 Ext. 3 Ref./Feedback Unit

Table 853: Parameter 21-50 Ext. 3 Ref./Feedback Unit

21-50 Ext. 3 Ref./Feedback Unit		
Default value: [1] %	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the unit for the reference and feedback.

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

Option	Name	Description
[75]	mm Hg	
[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	
[174]	in HG	
[180]	hp	

Parameter 21-51 Ext. 3 Minimum Reference

Table 854: Parameter 21-51 Ext. 3 Minimum Reference

21-51 Ext. 3 Minimum Reference		
Default value: 0 ExtPID3Unit	Parameter type: Range, -999999.999 - par. 21-52 Ext.PID3Unit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Select the minimum reference for the closed-loop 3 controller.

Parameter 21-52 Ext. 3 Maximum Reference

Table 855: Parameter 21-52 Ext. 3 Maximum Reference

21-52 Ext. 3 Maximum Reference		
Default value: 100 ExtPID3Unit	Parameter type: Range, par. 21-51 - 999999.999 Ext.PID3Unit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

N O T I C E

Set the value for *parameter 21-52 Ext. 3 Maximum Reference* before setting the values for the PID controller in *parameter group 20-9* PID Controller*.

Select the maximum reference for the closed-loop 3 controller. The dynamics of the PID controller depend on the value set in this parameter. See also *parameter 21-61 Ext. 3 Proportional Gain*.

Parameter 21-53 Ext. 3 Reference Source

Table 856: Parameter 21-53 Ext. 3 Reference Source

21-53 Ext. 3 Reference Source		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

N O T I C E

If feedback is not used, set its source to *[0] No function*. *Parameter 20-20 Feedback Function* determines how the PID controller uses the 3 possible feedbacks.

This parameter defines which input on the drive should be treated as the source of the reference signal for the closed-loop 3 controller. Analog input X30/11 and analog input X30/12 refer to inputs on the VLT® General Purpose I/O Card MCB 101.

Option	Name	Description
[0]*	No function	Use this selection if feedback is not used.
[1]	Analog input 53	
[2]	Analog input 54	
[3]	Pulse input 29	
[4]	Pulse input 33	
[7]	Analog input X30/11	
[8]	Analog input X30/12	
[11]	Local bus reference	
[20]	Digital pot. meter	
[21]	Analog input X30/11	
[22]	Analog input X30/12	
[23]	Analog input X42/1	
[24]	Analog input X42/3	
[25]	Analog input X42/5	

Option	Name	Description
[29]	Analog input X48/2	
[30]	Ext. closed loop 1	
[31]	Ext. closed loop 2	
[32]	Ext. closed loop 3	
[37]	Analog input X49/1	
[38]	Analog input X49/3	
[39]	Analogi input X49/5	
[133]	Fieldbus REF 1	

Parameter 21-54 Ext. 3 Feedback Source

Table 857: Parameter 21-54 Ext. 3 Feedback Source

21-54 Ext. 3 Feedback Source		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

This parameter defines which input on the drive should be treated as the source of the feedback signal for the closed-loop 3 controller. Analog input X30/11 and analog input X30/12 refer to inputs on the VLT® General Purpose I/O Card MCB 101.

Option	Name	Description
[0]*	No function	
[1]	Analog input 53	
[2]	Analog input 54	
[3]	Pulse input 29	
[4]	Pulse input 33	
[7]	Analog input X30/11	
[8]	Analog input X30/12	
[9]	Analog input X42/1	
[10]	Analog input X42/3	
[11]	Analog input X42/5	
[15]	Analog input X48/2	
[16]	Analog input X49/1	
[17]	Analog input X49/3	
[18]	Analog input X49/5	
[19]	Pressure 3	
[20]	Pressure 4	
[99]	Normal feedback	

Option	Name	Description
[100]	Bus feedback 1	
[101]	Bus feedback 2	
[102]	Bus feedback 3	
[104]	Sensorless flow	Requires setup by VLT® Motion Control Tool MCT 10 with sensorless plug-in.
[105]	Sensorless pressure	Requires setup by VLT® Motion Control Tool MCT 10 with sensorless plug-in.
[110]	Air Pres. to Flow	

Parameter 21-55 Ext. 3 Setpoint

Table 858: Parameter 21-55 Ext. 3 Setpoint

21-55 Ext. 3 Setpoint		
Default value: 0 ExtPID3Unit	Parameter type: Range, -999999.999 - 999999.999 Ext.PID3Unit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

The setpoint reference is used in extended 1 closed loop. Ext. 1 setpoint is added to the value from the Ext. 3 reference source selected in *parameter 21-53 Ext. 3 Reference Source*.

Table 859: Parameter 21-57 Ext. 3 Reference [Unit]

21-57 Ext. 3 Reference [Unit]		
Default value: 0 ExtPID3Unit	Parameter type: Range, -999999.999 - 999999.999 Ext.PID3Unit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Readout of the reference value for the closed-loop 3 controller.

Parameter 21-58 Ext. 3 Feedback [Unit]

Table 860: Parameter 21-58 Ext. 3 Feedback [Unit]

21-58 Ext. 3 Feedback [Unit]		
Default value: 0 ExtPID3Unit	Parameter type: Range, -999999.999 - 999999.999 Ext.PID3Unit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Readout of the feedback value for the closed-loop 3 controller.

Parameter 21-59 Ext. 3 Output [%]

Table 861: Parameter 21-59 Ext. 3 Output [%]

21-59 Ext. 3 Output [%]		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Readout of the output value for the closed-loop 3 controller.

5.20.7 21-6* Ext. CL 3 PID

Parameter 21-60 Ext. 3 Normal/Inverse Control

Table 862: Parameter 21-60 Ext. 3 Normal/Inverse Control

21-60 Ext. 3 Normal/Inverse Control		
Default value: [0] Normal	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0*]	Normal	Reduces the output when feedback is higher than the reference.
[1]	Inverse	Increases the output when feedback is higher than the reference.

Parameter 21-61 Ext. 3 Proportional Gain

Table 863: Parameter 21-61 Ext. 3 Proportional Gain

21-61 Ext. 3 Proportional Gain		
Default value: 0.01	Parameter type: Range, 0=Off - 10	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

The proportional gain indicates the number of times the error between the setpoint and the feedback signal is to be applied.

Parameter 21-62 Ext. 3 Integral Time

Table 864: Parameter 21-62 Ext. 3 Integral Time

21-62 Ext. 3 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

Over time, the integrator accumulates a contribution to the output from the PID controller as long as there is a deviation between the reference/setpoint and feedback signals. The contribution is proportional to the size of the deviation. This ensures that the deviation (error) approaches 0. Quick response on any deviation is obtained when the integral time is set to a low value. Setting it too low, however, may cause the control to become unstable. The value set is the time needed for the integrator to add the same contribution as the proportional for a certain deviation. If the value is set to 10000, the controller acts as a pure proportional controller with a P-band based on the value set in *parameter 20-93 PID Proportional Gain*. When no deviation is present, the output from the proportional controller is 0.

Parameter 21-63 Ext. 3 Differentiation Time

Table 865: Parameter 21-63 Ext. 3 Differentiation Time

21-63 Ext. 3 Differentiation Time		
Default value: 0 s	Parameter type: Range, 0=Off - 10 s	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

The differentiator does not react to a constant error. It only provides a gain when the feedback changes. The quicker the feedback changes, the stronger the gain from the differentiator.

Parameter 21-64 Ext. 3 Dif. Gain Limit

Table 866: Parameter 21-64 Ext. 3 Dif. Gain Limit

21-64 Ext. 3 Dif. Gain Limit		
Default value: 5	Parameter type: Range, 1 - 50	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Set a limit for the differentiator gain (DG). The DG increases if there are fast changes. Limit the DG to obtain a pure differentiator gain when changes are slow and a constant differentiator gain when quick changes occur.

Parameter 21-66 Ext. 3 On Reference Bandwidth

Table 867: Parameter 21-66 Ext. 3 On Reference Bandwidth

21-66 Ext. 3 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 high.

5.21 Parameter Group 22-** Appl. Functions

Parameter group for application monitoring functions.

5.21.1 22-0* Miscellaneous

Parameter 22-00 External Interlock Delay

Table 868: Parameter 22-00 External Interlock Delay

22-00 External Interlock Delay		
Default value: 0 s	Parameter type: Range, 0 - 600 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Set the delay time for the external interlock command.

Parameter 22-01 Power Filter Time

Table 869: Parameter 22-01 Power Filter Time

22-01 Power Filter Time		
Default value: 0.50 s	Parameter type: Range, 0.02 - 10 s	Setup: 2 setups
Conversion index: -2	Data type: Uint16	Change during operation: True

Set the time constant for the filtered power readout. A higher value will give a more steady readout but a slower system response to changes.

5.21.2 22-1* Air Pres. to Flow

Parameter 22-10 Air Pressure to Flow Signal Source

Table 870: Parameter 22-10 Air Pressure to Flow Signal Source

22-10 Air Pressure to Flow Signal Source		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select which signal source should be used for measuring the pressure difference from which the airflow is calculated. If using analog inputs, scaling must be used.

Option	Name	Description
[0*]	No function	
[1]	Analog input 53	
[2]	Analog input 54	

Option	Name	Description
[7]	Analog input X30/11	
[8]	Analog input X30/12	
[9]	Analog input X42/1	
[10]	Analog input X42/3	
[11]	Analog input X42/5	
[15]	Analog input X48/2	
[16]	Analog input X49/1	
[17]	Analog input X49/3	
[18]	Analog input X49/5	
[19]	Pressure 3	
[20]	Pressure 4	

Parameter 22-11 Air Pressure to Flow Fan k-factor

Table 871: Parameter 22-11 Air Pressure to Flow Fan k-factor

22-11 Air Pressure to Flow Fan k-factor		
Default value: 1000	Parameter type: Range, 1 - 10000	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Use the k-factor to calculate airflow. Enter the fan k-factor according to the value provided by the fan manufacturer.

Parameter 22-12 Air Pressure to Flow Air Density

Table 872: Parameter 22-12 Air Pressure to Flow Air Density

22-12 Air Pressure to Flow Air Density		
Default value: 1.2	Parameter type: Range, 0.001 - 10	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

Use the air density when calculating airflow. Enter the air density in environments with flowing air.

Parameter 22-13 Air Pressure to Flow Fan Flow Unit

Table 873: Parameter 22-13 Air Pressure to Flow Fan Flow Unit

22-13 Air Pressure to Flow Fan Flow Unit		
Default value: [0] m^3/h	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select in which unit the calculted airflow is shown.

Option	Name	Description
[0*]	m^3/h	
[1]	m^3/s	

Parameter 22-14 Air Pressure to Flow Signal Unit

Table 874: Parameter 22-14 Air Pressure to Flow Signal Unit

22-14 Air Pressure to Flow Signal Unit		
Default value: [0] None	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the unit for the signal source that should be used for measuring the pressure difference.

Option	Name	Description
[0*]	None	A reference/feedback unit is used instead of a signal unit.
[70]	mbar	
[71]	bar	
[72]	Pa	
[73]	kPa	
[74]	m WG	
[75]	mm Hg	
[170]	psi	
[171]	lb/in^2	
[172]	in WG	
[173]	ft WG	
[174]	in Hg	

5.21.3 22-2* No-flow Detection

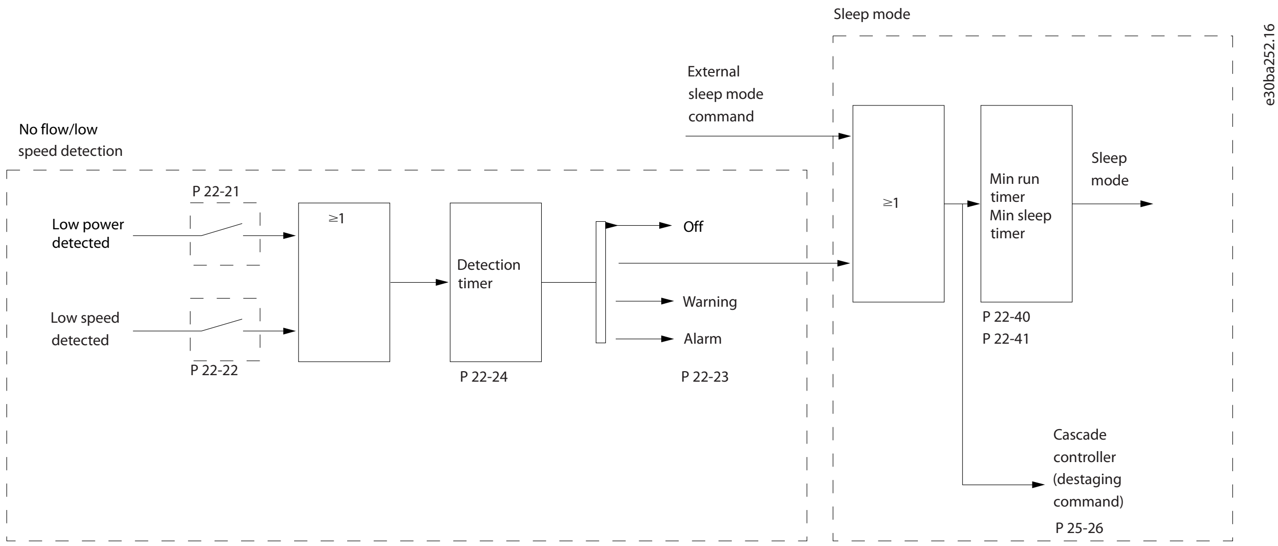


Illustration 82: No-flow Detection Diagram

The drive contains functions for detecting if the load conditions in the system allow the motor to be stopped:

- Low-power detection
- Low-speed detection

One of these 2 signals must be active for a set time (*parameter 22-24 No-flow Delay*) before the selected action takes place. The following actions are available in *parameter 22-23 No-flow Function*:

- No action
- Warning
- Alarm
- Sleep mode

No-flow detection

This function is used for detecting a no-flow situation in pump systems where all valves can be closed. Can be used both when controlled by the integrated PI controller in the drive or by an external PI controller. Program the actual configuration in *parameter 1-00 Configuration Mode*.

Configuration mode for

- integrated PI controller: closed loop
- external PI controller: open loop

NOTICE

Carry out no-flow tuning before setting the PI-controller parameters.

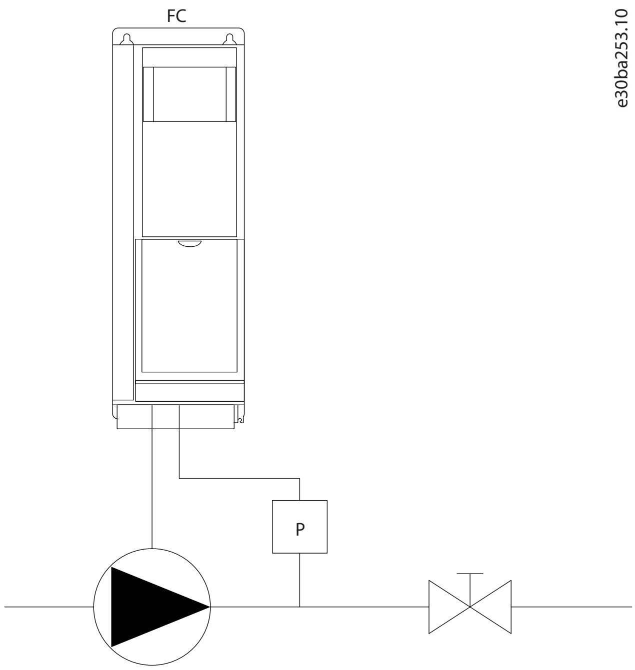


Illustration 83: No-flow Detection

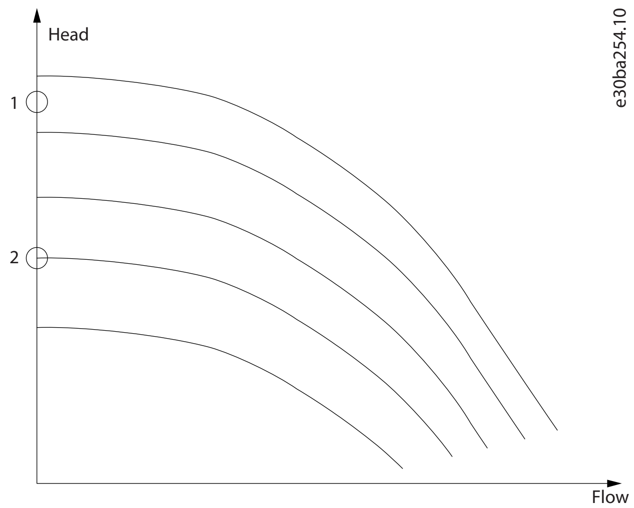


Illustration 84: No-flow Detection Curve

No-flow detection is based on the measurement of speed and power. For a certain speed, the drive calculates power at no flow. This coherence is based on the adjustment of 2 sets of speed and associated power at no flow. Monitoring power enables detection of no-flow conditions in systems with fluctuating suction pressure or of pump systems having a flat characteristic towards low speed.

The 2 sets of data must be based on measurement of power at approximately 50% and 85% of maximum speed with the valves closed. The data is programmed in *parameter group 22-3* No-flow Power Tuning*. It is also possible to run a *[0] Low Power Auto Set Up* (selected in *parameter 22-20 Low Power Auto Set-up*) automatically stepping through the commissioning process and storing the data measured. When carrying out the auto setup, select *[0] Open Loop* in *parameter 1-00 Configuration Mode*, see *parameter group 22-3* No-flow Power Tuning*.

NOTICE

If using the integrated PI controller, carry out no-flow tuning before setting the PI-controller parameters.

Low-speed detection

Low-speed detection gives a signal if the motor operates at minimum speed as set in *parameter 4-11 Motor Speed Low Limit [RPM]* or *parameter 4-12 Motor Speed Low Limit [Hz]*. Actions are common with no-flow detection (individual selection not possible).

The use of low-speed detection is not limited to systems with a no-flow situation. Low-speed detection can be used in any system where operation at minimum speed allows a stop of the motor until the load calls for a speed higher than minimum speed. This could, for example, be in systems with fans and compressors.

N O T I C E

In pump systems, ensure that the minimum speed in *parameter 4-11 Motor Speed Low Limit [RPM]* or *parameter 4-12 Motor Speed Low Limit [Hz]* is set high enough for detection as the pump can run with a rather high speed even with valves closed.

Dry-pump detection

If the pump has run dry (low power consumption - high speed), the no-flow detection can also be used for detecting. The function can be used with both the integrated and the external PI controller.

There are 2 conditions that trigger a dry-pump signal:

- Power consumption below no-flow level.
- Pump running at maximum speed or maximum reference open loop, whichever is lowest.

The signal must be active for at set time (*parameter 22-27 Dry Pump Delay*) before the selected action takes place. The following actions are available (*parameter 22-26 Dry Pump Function*):

- Warning
- Alarm

Enable and commission no-flow detection in *parameter 22-23 No-flow Function* and *parameter 22-3* No-flow Power Tuning*.

Parameter 22-20 Low Power Auto Set-up

Table 875: Parameter 22-20 Low Power Auto Set-up

22-20 Low Power Auto Set-up		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: False

Start of auto setup of power data for no-flow power tuning.

Option	Name	Description
[0*]	Off	
[1]	Enabled	**N O T I C E** Do the auto setup when the system has reached normal operating temperature. **N O T I C E** It is important that *parameter 4-13 Motor Speed High Limit [RPM]* or *parameter 4-14 Motor Speed High Limit [Hz]* is set to the maximum operational speed of the motor. **N O T I C E** Do the auto setup before configuring the integrated PI controller as the settings are reset when changing from closed loop to open loop in *parameter 1-00 Configuration Mode*.

Option	Name	Description
		NOTICE Carry out the tuning with the same settings in *parameter 1-03 Torque Characteristics* as for operation after the tuning. An auto setup sequence is activated, automatically setting the speed to approximately 50% and 85% of nominal motor speed (*parameter 4-13 Motor Speed High Limit [RPM]* and *parameter 4-14 Motor Speed High Limit [Hz]*). At those 2 speeds, the power consumption is automatically measured and stored. Before enabling auto setup: • Close valves to create a no-flow condition. • Set the drive to open loop (*parameter 1-00 Configuration Mode*). It is important also to set *parameter 1-03 Torque Characteristics*.

Parameter 22-21 Low Power Detection

Table 876: Parameter 22-21 Low Power Detection

22-21 Low Power Detection		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Use this parameter for enabling/disabling no-flow detection based on measured motor power.

Option	Name	Description
[0*]	Disabled	
[1]	Enabled	To set the parameters in *parameter group 22-3* No-flow Power Tuning* for proper operation, carry out the low-power detection commissioning.

Parameter 22-22 Low Speed Detection

Table 877: Parameter 22-22 Low Speed Detection

22-22 Low Speed Detection		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Use this parameter for enabling/disabling no-flow detection based on operation at motor speed low limit.

Option	Name	Description
[0*]	Disabled	
[1]	Enabled	Detects when the motor operates at a speed as set in *parameter 4-11 Motor Speed Low Limit [RPM]* or *parameter 4-12 Motor Speed Low Limit [Hz]*.

Parameter 22-23 No-flow Detection

Table 878: Parameter 22-23 No-flow Detection

22-23 No-flow Detection		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Common actions for low-power detection and low-speed detection (individual selections not possible).

Option	Name	Description
[0*]	Off	**NOTICE** Do not set *parameter 14-20 Reset Mode* to *[13] Infinite auto reset* when *parameter 22-23 No-flow Function* is set to *[3] Alarm*. Doing so causes the drive to continuously cycle between running and stopping when a no-flow condition is detected. **NOTICE** Disable the automatic bypass function of the bypass if – the drive has a constant-speed bypass with an automatic bypass function starting the bypass if a persistent alarm condition occurs, AND – *[3] Alarm* is selected as the no-flow function.
[1]	Sleep mode	The drive enters sleep mode and stops when a no-flow condition is detected. See *parameter group 22-4* Sleep Mode* for programming options for sleep mode.
[2]	Warning	The drive continues to run but activates a no-flow warning (*warning 92, NoFlow*). A digital output or a serial communication bus can communicate a warning to other equipment.
[3]	Alarm	The drive stops running and activates a no-flow alarm (*alarm 92, NoFlow*). A drive digital output or a serial communication bus can communicate an alarm to other equipment.

Parameter 22-24 No-flow Delay

Table 879: Parameter 22-24 No-flow Delay

22-24 No-flow Delay		
Default value: 10 s	Parameter type: Range, 1 - 600 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Set the time that low power/low speed must stay detected to activate a signal for actions. If detection disappears before the time runs out, the timer is reset.

Parameter 22-26 Dry Pump Function

Table 880: Parameter 22-26 Dry Pump Function

22-26 Dry Pump Function		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the action for dry-pump operation. To use the dry-pump detection:

- Enable low-power detection in *parameter 22-21 Low Power Detection*.
- Commission low-power detection using either *parameter group 22-3* No-flow Power Tuning* or *parameter 22-20 Low Power Auto Set-up*.

NOTICE

Do not set *parameter 14-20 Reset Mode* to *[13] Infinite auto reset* when *parameter 22-26 Dry Pump Function* is set to *[2] Alarm*. Doing so causes the drive to continuously cycle between running and stopping when a dry-pump condition is detected.

NOTICE

For drives with constant-speed bypass: If an automatic bypass function starts the bypass at persistent alarm conditions, disable the automatic bypass function, if *[2] Alarm* or *[3] Man. Reset Alarm* is selected as the dry-pump function.

Option	Name	Description
[0*]	Off	
[1]	Warning	The drive continues to run but activates a dry-pump warning (*warning 93, Dry pump*). A drive digital output or a serial communication bus can communicate a warning to other equipment.
[2]	Alarm	The drive stops running and activates a dry-pump alarm
[3]	Man. reset alarm	The drive stops running and activates a no-flow alarm (*alarm 92, NoFlow*). A drive digital output or a serial communication bus can communicate an alarm to other equipment.
[4]	Stop and trip	

Parameter 22-27 Dry Pump Delay

Table 881: Parameter 22-27 Dry Pump Delay

22-27 Dry Pump Delay		
Default value: 10 s	Parameter type: Range, 1 - 600 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

This parameter defines for how long the dry-pump condition must be active before activating a warning or an alarm. The drive waits for the no-flow delay time (*parameter 22-24 No-flow Delay*) to expire before the timer for the dry-pump delay starts.

Parameter 22-28 No-flow Low Speed [RPM]

Table 882: Parameter 22-28 No-flow Low Speed [RPM]

22-28 No-flow Low Speed [RPM]		
Default value: Size related	Parameter type: Range, par. 4-11 - par. 4-13 [RPM]	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Set the no-flow speed reference in RPM.

Parameter 22-29 No-flow Low Speed [Hz]

Table 883: Parameter 22-29 No-flow Low Speed [Hz]

22-29 No-flow Low Speed [Hz]		
Default value: Size related	Parameter type: Range, par. 4-12 - par. 4-14 [Hz]	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Set the no-flow speed reference in Hz.

5.21.4 22-3* No-flow Power Tuning

NOTICE

Set *parameter 1-03 Torque Characteristics* before tuning takes place.

If auto setup is disabled in *parameter 22-20 Low Power Auto Set-up*, the tuning sequence is as follows:

1. Close the main valve to stop flow.
2. Run with motor until the system has reached normal operating temperature.
3. Press [Hand On] and adjust speed for approximately 85% of rated speed. Note the exact speed.
4. Read power consumption either by looking for actual power in the data line in the LCP or by viewing 1 of the following parameters:
    1. *Parameter 16-10 Power [kW]*, or
    2. *Parameter 16-11 Power [hp]*

    in the Main Menu.
5. Note the power readout.
6. Change speed to approximately 50% of rated speed. Note the exact speed.
7. Read power consumption either by looking for actual power in the data line in the LCP or by viewing 1 of the following parameters:
    1. *Parameter 16-10 Power [kW]*, or
    2. *Parameter 16-11 Power [hp]*

    in the Main Menu.
8. Note the power readout.
9. Program the speeds used in:
    1. *Parameter 22-32 Low Speed [RPM]*
    2. *Parameter 22-33 Low Speed [Hz]*
    3. *Parameter 22-36 High Speed [RPM]*
    4. *Parameter 22-37 High Speed [Hz]*
10. Program the associated power values in:
    1. *Parameter 22-34 Low Speed Power [kW]*
    2. *Parameter 22-35 Low Speed Power [hp]*
    3. *Parameter 22-38 High Speed Power [kW]*
    4. *Parameter 22-39 High Speed Power [hp]*
11. Switch back with [Auto On] or [Off].

Parameter 22-30 No-flow Power

Table 884: Parameter 22-30 No-flow Power

22-30 No-flow Power		
Default value: 0 kW	Parameter type: Range, 0 - 0 kW	Setup: All setups
Conversion index: 1	Data type: Uint32	Change during operation: True

Readout of calculated no-flow power at actual speed. If power drops to the display value, the drive considers the condition as a no-flow situation.

Parameter 22-31 Power Correction Factor

Table 885: Parameter 22-31 Power Correction Factor

22-31 Power Correction Factor		
Default value: 100%	Parameter type: Range, 1 - 400%	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Make corrections to the calculated power in *parameter 22-30 No-flow Power*. If no-flow is detected when it should not be, decrease the setting. However, if no-flow is not detected when it should be, increase the setting to above 100%.

Parameter 22-32 Low Speed [RPM]

Table 886: Parameter 22-32 Low Speed [RPM]

22-32 Low Speed [RPM]		
Default value: Size related	Parameter type: Range, 0 - par. 22-36 [RPM]	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Use this parameter if *parameter 0-02 Motor Speed Unit* is set to *[0] RPM* (parameter is not visible if *[1] Hz* is selected). Set used speed at the 50% level. This function is used for storing values necessary for tuning no-flow detection.

Parameter 22-33 Low Speed [Hz]

Table 887: Parameter 22-33 Low Speed [Hz]

22-33 Low Speed [Hz]		
Default value: Size related	Parameter type: Range, 0 - par. 22-37 [Hz]	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Use this parameter if *parameter 0-02 Motor Speed Unit* is set to *[1] Hz* (parameter is not visible if *[0] RPM* is selected). Set used speed at the 50% level. This function is used for storing values necessary for tuning no-flow detection.

Parameter 22-34 Low Speed Power [kW]

Table 888: Parameter 22-34 Low Speed Power [kW]

22-34 Low Speed Power [kW]		
Default value: Size related	Parameter type: Range, 0 - 5.50 kW	Setup: All setups
Conversion index: 1	Data type: Uint32	Change during operation: True

Use this parameter if *parameter 0-03 Regional Settings* is set for *[0] International* (parameter not visible if *[1] North America* is selected). Set power consumption at the 50% speed level. This function is used for storing values necessary for tuning no-flow detection.

Parameter 22-35 Low Speed Power [hp]

Table 889: Parameter 22-35 Low Speed Power [hp]

22-35 Low Speed Power [hp]		
Default value: Size related	Parameter type: Range, 0 - 7.50 hp	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Use this parameter if *parameter 0-03 Regional Settings* is set for *[1] North America* (parameter not visible if *[0] International* is selected). Set power consumption at the 50% speed level. This function is used for storing values necessary for tuning no-flow detection.

Parameter 22-36 High Speed [RPM]

Table 890: Parameter 22-36 High Speed [RPM]

22-36 High 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

Use this parameter if *parameter 0-02 Motor Speed Unit* is set to *[0] RPM* (parameter is not visible if *[1] Hz* is selected). Set used speed at the 85% level. This function is used for storing values necessary for tuning no-flow detection.

Parameter 22-37 High Speed [Hz]

Table 891: Parameter 22-37 High Speed [Hz]

22-37 High 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

Use this parameter if *parameter 0-02 Motor Speed Unit* is set to *[1] Hz* (parameter is not visible if *[0] RPM* is selected). Set used speed at the 85% level. This function is used for storing values necessary for tuning no-flow detection.

Parameter 22-38 High Speed Power [kW]

Table 892: Parameter 22-38 High Speed Power [kW]

22-38 High Speed Power [kW]		
Default value: Size related	Parameter type: Range, 0 - 5.50 kW	Setup: All setups
Conversion index: 1	Data type: Uint32	Change during operation: True

Use this parameter if *parameter 0-03 Regional Settings* is set for *[0] International* (parameter not visible if *[1] North America* is selected). Set power consumption at the 85% speed level. This function is used for storing values necessary for tuning no-flow detection.

Parameter 22-39 High Speed Power [hp]

Table 893: Parameter 22-39 High Speed Power [hp]

22-39 High Speed Power [hp]		
Default value: Size related	Parameter type: Range, 0 - 7.50 hp	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Use this parameter if *parameter 0-03 Regional Settings* is set for *[1] North America* (parameter not visible if *[0] International* is selected). Set power consumption at the 85% speed level. This function is used for storing values necessary for tuning no-flow detection.

5.21.5 22-4* Sleep Mode

If the load on the system allows for stop of the motor and the load is monitored, the motor can be stopped by activating the sleep-mode function. This is not a normal stop command, but ramps the motor down to 0 RPM and stops energizing the motor. When in sleep mode, certain conditions are monitored to find out when load has been applied to the system again.

Sleep mode can be activated either from the no-flow detection/minimum speed detection (must be programmed via parameters for no-flow detection, see the signal flow-diagram in *parameter group 22-2* No-flow Detection*) or via an external signal applied to 1 of the digital inputs (must be programmed via the parameters for configuration of the digital inputs, *parameter group 5-1* Digital Inputs* selecting *[66] Sleep Mode*). Sleep mode is activated only when no wake-up conditions are present. To enable use of, for example, an electro-mechanical flow switch to detect a no-flow condition and activate sleep mode, the action takes place at the raising edge of the external signal applied (otherwise the drive would stay in sleep mode as the signal would be steadily connected).

N O T I C E
If sleep mode is to be based on no-flow detection/minimum speed, select *[1] Sleep Mode* in *parameter 22-23 No-flow Function*.

If *parameter 25-26 Destage at No-flow* is set to *[1] Enabled*, activating sleep mode sends a command to the cascade controller (if enabled) to start de-staging of lag pumps (fixed speed) before stopping the lead pump (variable speed).

When entering sleep mode, the lower status line in the LCP shows *Sleep Mode*.

See also signal flow chart in *parameter group 22-2* No-flow Detection*. There are the following ways of using the sleep mode function.

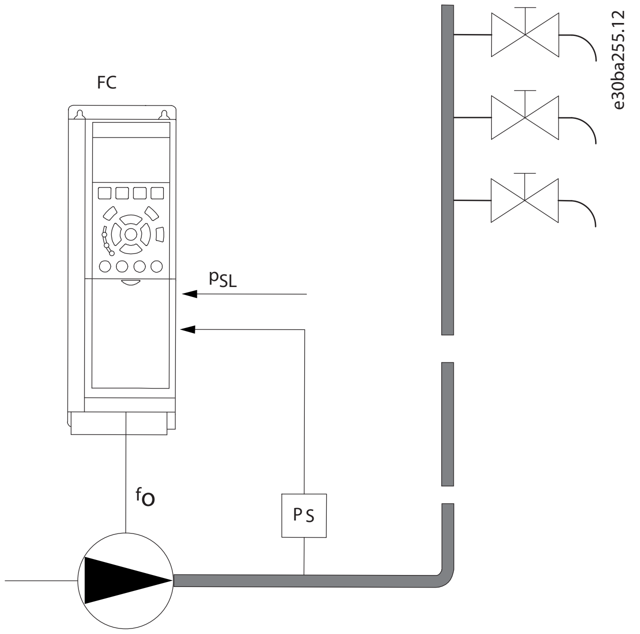


Illustration 85: Sleep-mode Function

1. Systems where the integrated PI controller is used for controlling pressure or temperature, for example, boost systems with a pressure feedback signal applied to the drive from a pressure transducer. Set *parameter 1-00 Configuration Mode* to *[3] Closed Loop* and configure the PI controller configured for desired reference and feedback signals.

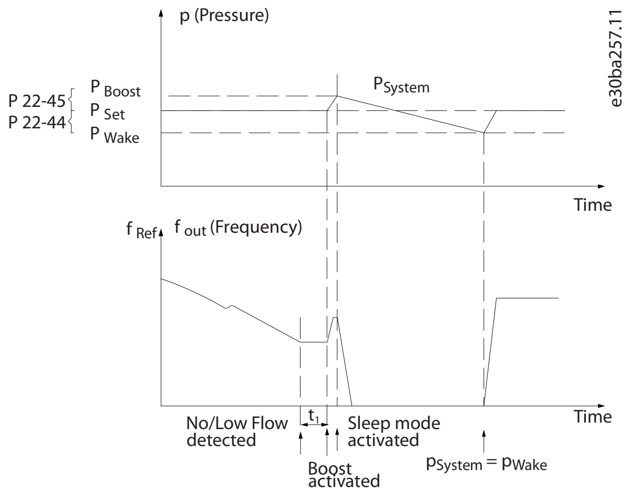


Illustration 86: Example with Boost System

If no-flow is detected, the drive increases the setpoint for pressure to ensure a slight overpressure in the system (boost set in *parameter 22-45 Setpoint Boost*). The feedback from the pressure transducer is monitored, and then this pressure has dropped with a set percentage below the normal setpoint for pressure (P_{set}). The motor ramps up again and the pressure reached the set value (P_{set}).

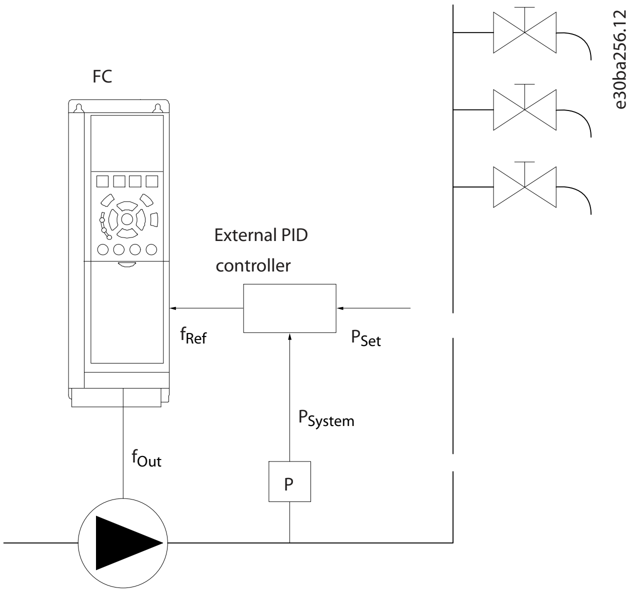


Illustration 87: Boost System

2. In systems where the pressure or temperature is controlled by an external PI controller, the wake-up conditions cannot be based on feedback from the pressure/temperature transducer as the setpoint is not known. In the example with a boost system, the desired pressure, P_{set}, is not known. Set *parameter 1-00 Configuration Mode* to *[0] Open Loop*.

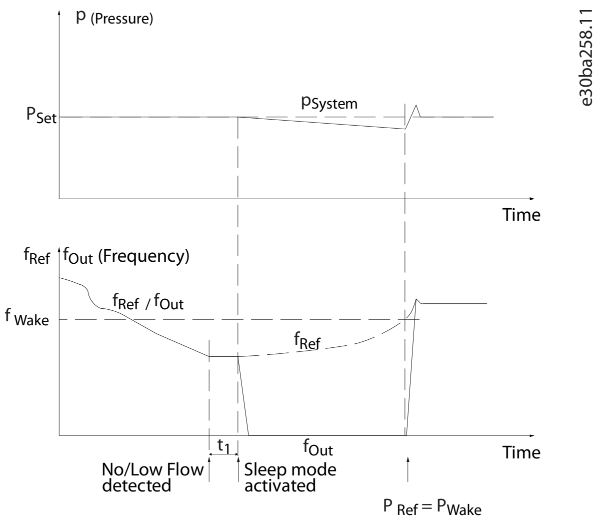


Illustration 88: Example with Boost System

When low power or low speed is detected, the motor is stopped, but the reference signal (f_{ref}) from the external controller is still monitored. Because of the the low pressure created, the controller increases the reference signal to gain pressure. When the reference signal has reached a set value, f_{wake}, the motor restarts. The speed is set manually by an external reference signal (remote reference). Use default settings (*parameter group 22-3* No-flow Power Tuning*) for tuning of the no-flow function.

Table 894: Configuration overview

	Internal PI controller (*parameter 1-00 Configuration Mode: closed loop*)		**External PI controller or manual control** (*parameter 1-00 Configuration Mode: open loop*)	
	Sleep mode	**Wake up**	**Sleep mode**	**Wake up**
No-flow detection (pumps only)	Yes	–	Yes (except manual setting of speed)	–
Low-speed detection	Yes	–	Yes	–

	Internal PI controller (*parameter 1-00 Configuration Mode: closed loop*)		**External PI controller or manual control** (*parameter 1-00 Configuration Mode: open loop*)	
	Sleep mode	**Wake up**	**Sleep mode**	**Wake up**
External signal	Yes	–	Yes	–
Pressure/temperature (transmitted)	–	Yes	–	No
Output frequency	–	No	–	Yes

NOTICE

Sleep mode is not active when local reference is active (press the navigation keys to set speed manually). See *parameter 3-13 Reference Site*. Sleep mode does not work in hand-on mode. Carry out auto setup in open loop before setting input/output in closed loop.

Parameter 22-40 Minimum Run Time

Table 895: Parameter 22-40 Minimum Run Time

22-40 Minimum Run Time		
Default value: 10 s	Parameter type: Range, 0 - 600 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Set the minimum running time for the motor after a start command (digital input or fieldbus) before entering sleep mode.

Parameter 22-41 Minimum Sleep Time

Table 896: Parameter 22-41 Minimum Sleep Time

22-41 Minimum Sleep Time		
Default value: 10 s	Parameter type: Range, 0 - 600 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Set the minimum time for staying in sleep mode. This setting overrides any wake-up conditions.

Parameter 22-42 Wake-up Speed [RPM]

Table 897: Parameter 22-42 Wake-up Speed [RPM]

22-42 Wake-up Speed [RPM]		
Default value: Size related	Parameter type: Range, par. 4-11 - par. 4-13 [RPM]	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

To be used if *parameter 0-02 Motor Speed Unit* has been set to *[0] RPM* (parameter not visible if *[1] Hz* is selected). Only to be used if *parameter 1-00 Configuration Mode* is set to *[0] Open loop* and an external controller applies speed reference. Set the reference speed at which the sleep mode should be canceled.

Parameter 22-43 Wake-up Speed [Hz]

Table 898: Parameter 22-43 Wake-up Speed [Hz]

22-43 Wake-up Speed [Hz]		
Default value: Size related	Parameter type: Range, par. 4-12 - par. 4-14 [Hz]	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

To be used if *parameter 0-02 Motor Speed Unit* has been set to *[1] Hz* (parameter not visible if *[0] RPM* is selected). Only to be used if *parameter 1-00 Configuration Mode* is set to *[0] Open loop* and speed reference is applied by an external controller controlling the pressure. Set the reference at which speed the sleep mode should be canceled.

Parameter 22-44 Wake-up Ref./FB Difference

Table 899: Parameter 22-44 Wake-up Ref./FB Difference

22-44 Wake-up Ref./FB Difference		
Default value: 10%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: Int8	Change during operation: True

To be used if *parameter 1-00 Configuration Mode* is set to *[3] Process Closed Loop* and the integrated PI controller is used for controlling the pressure. Set the pressure drop allowed in percentage of setpoint for the pressure (P_{set}) before canceling the sleep mode.

Parameter 22-45 Setpoint Boost

Table 900: Parameter 22-45 Setpoint Boost

22-45 Setpoint Boost		
Default value: 0%	Parameter type: Range, -100 - 100%	Setup: All setups
Conversion index: 0	Data type: Int8	Change during operation: True

To be used if *parameter 1-00 Configuration Mode* is set to *[3] Process Closed Loop* and the integrated PI controller is used. In a system with, for example, constant pressure control, it is advantageous to increase system pressure before the motor is stopped. This extends the time in which the motor is stopped and helps to avoid frequent start/stop. Set the overpressure/overtemperature in percentage of the setpoint for the pressure (P_{set})/temperature before entering sleep mode. If set to 5%, the boost pressure is P_{set} x 1.05. The negative values can be used, for example, in cooling tower control where a negative change is needed.

Parameter 22-46 Maximum Boost Time

Table 901: Parameter 22-46 Maximum Boost Time

22-46 Maximum Boost Time		
Default value: 60 s	Parameter type: Range, 0 - 600 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

To be used if *parameter 1-00 Configuration Mode* is set for *[3] Process Closed Loop* and the integrated PI controller is used for controlling the pressure. Set the maximum time for which boost mode is allowed. If the set time is exceeded, sleep mode is entered, not waiting for the set boost pressure to be reached.

5.21.6 22-5* End of Curve

The end-of-curve conditions occur when a pump is yielding a too large volume to ensure the set pressure. This situation can occur if a leakage occurs in the distribution pipe system after the pump. Such a leakage causes the pump to operate at the end of the pump characteristic valid for the maximum speed set in *parameter 4-13 Motor Speed High Limit [RPM]* or *parameter 4-14 Motor Speed High Limit [Hz]*. If the feedback is 2.5% of the programmed value in *parameter 20-14 Maximum Reference/Feedb.* (or numerical value of *parameter 20-13 Minimum Reference/Feedb.*, whichever is highest) below the setpoint for the required pressure for a set time (*parameter 22-51 End of Curve Delay*), and the pump runs with maximum speed set in *parameter 4-13 Motor Speed High Limit [RPM]* or *parameter 4-14 Motor Speed High Limit [Hz]*, the function selected in *parameter 22-50 End of Curve Function* takes place. It is possible to get a signal on 1 of the digital outputs by selecting *[192] End of Curve* in *parameter group 5-3* Digital Outputs* and/or *parameter group 5-4* Relays*. The signal is present when an end-of-curve condition occurs and the selection in *parameter 22-50 End of Curve Function* is different from *[0] Off*. The end-of-curve function can only be used when operating with the built-in PID controller (*[3] Closed loop* in *parameter 1-00 Configuration Mode*).

Parameter 22-50 End of Curve Function

Table 902: Parameter 22-50 End of Curve Function

22-50 End of Curve Function		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

NOTICE

Automatic restart resets the alarm and restarts the system.

NOTICE

Do not set *parameter 14-20 Reset Mode* to *[13] Infinite auto reset* when *parameter 22-50 End of Curve Function* is set to *[2] Alarm*. Doing so would cause the drive to cycle continuously between running and stopping when an end-of-curve condition is detected.

NOTICE

If the drive is equipped with a constant speed bypass with an automatic bypass function activating the bypass when persistent alarm conditions occur, disable the automatic bypass function if *[2] Alarm* or *[3] Man. reset alarm* is selected as the end-of-curve function.

Option	Name	Description
[0*]	Off	End-of-curve monitoring is not active.
[1]	Warning	The drive continues to run, but activates an end-of-curve warning (*warning 94, End of Curve*). A drive digital output or a fieldbus can communicate a warning to other equipment.
[2]	Alarm	The drive stops running and activates an end-of-curve alarm (*alarm 94, End of Curve*). A drive digital output or a fieldbus can communicate an alarm to other equipment.
[3]	Man. reset alarm	The drive stops running and activates an end-of-curve alarm (*alarm 94, End of Curve*). A drive digital output or a fieldbus can communicate an alarm to other equipment.
[4]	Stop and Trip	

Parameter 22-51 End of Curve Delay

Table 903: Parameter 22-51 End of Curve Delay

22-51 End of Curve Delay		
Default value: 10 s	Parameter type: Range, 0 - 600 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

When an end-of-curve condition is detected, a timer is activated. When the time set in this parameter expires, and the end-of-curve condition is steady during the entire period, the function set in *parameter 22-50 End of Curve Function* is activated. If the condition disappears before the timer expires, the timer is reset.

Parameter 22-52 End of Curve Tolerance

Table 904: Parameter 22-52 End of Curve Tolerance

22-52 End of Curve Tolerance		
Default value: 2.5%	Parameter type: Range, 0.5 - 20.0%	Setup: All setups
Conversion index: -1	Data type: Int16	Change during operation: True

Set the required tolerance of the end-of-curve function.

5.21.7 22-6* Broken Belt Detection

The broken-belt detection can be used in both closed-loop and open-loop systems for pumps, fans, and compressors. If the estimated motor torque is below the broken-belt torque value (*parameter 22-61 Broken Belt Torque*), and the drive output frequency is above or equal to 15 Hz, the broken-belt function (*parameter 22-60 Broken Belt Function*) is performed.

Parameter 22-60 Broken Belt Function

Table 905: Parameter 22-60 Broken Belt Function

22-60 Broken Belt Function		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

NOTICE

Do not set *parameter 14-20 Reset Mode* to *[13] Infinite auto reset* when *parameter 22-60 Broken Belt Function* is set to *[2] Trip*. Doing so would cause the drive to cycle continuously between running and stopping when a broken-belt condition is detected.

NOTICE

If the drive is equipped with a constant speed bypass with an automatic bypass function activating the bypass when persistent alarm conditions occur, disable the automatic bypass function if *[2] Alarm* or *[3] Man. reset alarm* is selected as the broken-belt function.

Option	Name	Description
[0*]	Off	End-of-curve monitoring is not active.
[1]	Warning	The drive continues to run, but activates a broken-belt warning (*warning 95, Broken Belt*). A drive digital output or a fieldbus can communicate a warning to other equipment.
[2]	Trip	The drive stops running and activates a broken-belt alarm (*alarm 95, Broken Belt*). A drive digital output or a fieldbus can communicate an alarm to other equipment.

Parameter 22-61 Broken Belt Torque

Table 906: Parameter 22-61 Broken Belt Torque

22-61 Broken Belt Torque		
Default value: 10%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Set the broken-belt torque as a percentage of the rated motor torque.

Parameter 22-62 Broken Belt Delay

Table 907: Parameter 22-62 Broken Belt Delay

22-62 Broken Belt Delay		
Default value: 10 s	Parameter type: Range, 0 - 600 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Sets the time for which the broken-belt conditions must be active before carrying out the action selected in *parameter 22-60 Broken Belt Function*.

5.21.8 22-7* Short Cycle Protection

When controlling refrigeration compressors, there is often a need for limiting the number of starts. One way to do this is to ensure a minimum run time (time between a start and a stop) and a minimum interval between starts. This means that any normal stop command can be overridden by the minimum run time function (*parameter 22-77 Minimum Run Time*) and any normal start command (start/jog/freeze) can be overridden by the interval between starts function (*parameter 22-76 Interval between Starts*). None of the 2 functions are active if hand-on or off modes are selected via the LCP. If selecting [Hand On] or [Off], the 2 timers are reset to 0 and do not start counting until [Auto] is pressed and an active start command applied.

NOTICE

A coast command or missing run permissive signal override both minimum run time and interval between start functions.

Parameter 22-75 Short Cycle Protection

Table 908: Parameter 22-75 Short Cycle Protection

22-75 Short Cycle Protection		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0*]	Disabled	The timer set in *parameter 22-76 Interval between Starts* is disabled.
[1]	Enabled	The timer set in *parameter 22-76 Interval between Starts* is enabled.

Parameter 22-76 Interval between Starts

Table 909: Parameter 22-76 Interval between Starts

22-76 Interval between Starts		
Default value: Setting in par. 22-77	Parameter type: Range, par. 22-77 - 3600 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Sets the minimum time between 2 starts. Any normal start command (start/jog/freeze) is disregarded until the timer has expired.

Parameter 22-77 Minimum Run Time

Table 910: Parameter 22-77 Minimum Run Time

22-77 Minimum Run Time		
Default value: 0 s	Parameter type: Range, 0 - par. 22-76 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

NOTICE

This parameter does not work in casacde mode.

Sets the minimum run time after a normal start command (start/jog/freeze). Any normal stop command is disregarded until the set time has expired. The timer starts counting following a normal start command (start/jog/freeze). A coast (inverse) or an external interlock command overrides the timer.

5.21.9 22-8* Flow Compensation

Sometimes it is not possible for a pressure transducer to be placed at a remote point in the system, and it can only be placed close to the fan/pump outlet. Flow compensation operates by adjusting the setpoint according to the output frequency, which is almost proportional to flow, thus compensating for higher losses at higher flow rates.

H_{DESIGN} (required pressure) is the setpoint for closed-loop (PI) operation of the drive and is set for closed-loop operation without flow compensation.

It is recommended to use slip compensation and RPM unit.

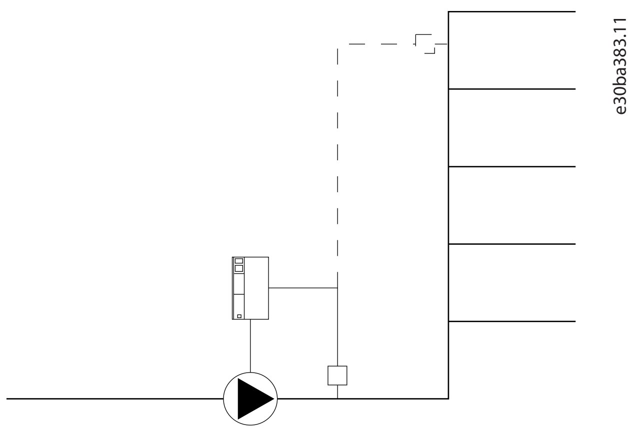


Illustration 89: Flow Compensation

NOTICE

When flow compensation is used with the cascade controller (*parameter group 25-** Cascade Pack Controller*), the actual setpoint does not depend on speed (flow), but on the number of pumps cut in.

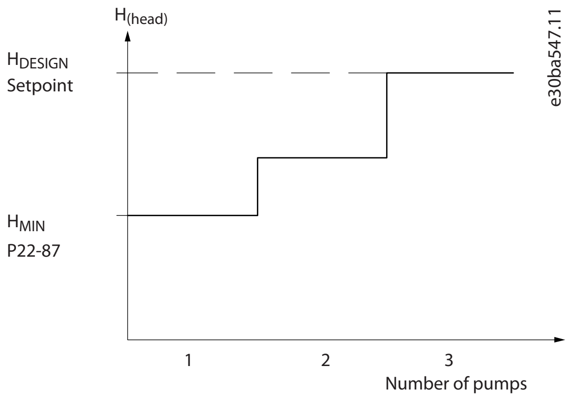


Illustration 90: Flow Compensation with Cascade Controller

There are 2 methods which can be employed, depending on whether or not the speed at system design working point is known.

Table 911: Setpoint Defined by Number of Pumps

Parameter used	Speed at design point KNOWN	Speed at design point UN-KNOWN	Cascade controller
Parameter 22-80 Flow Compensation	+	+	+
Parameter 22-81 Square-linear Curve Approximation	+	+	–
Parameter 22-82 Work Point Calculation	+	+	–
Parameter 22-83 Speed at No Flow [RPM]/parameter 22-84 Speed at No Flow [Hz]	+	+	–
Parameter 22-85 Speed at Design Point [RPM]/Parameter 22-86 Speed at Design Point [Hz]	+	–	–
Parameter 22-87 Pressure at No-Flow Speed	+	+	+

Parameter used	Speed at design point KNOWN	Speed at design point UN-KNOWN	Cascade controller
Parameter 22-88 Pressure at Rated Speed	–	+	–
Parameter 22-89 Flow at Design Point	–	+	–
Parameter 22-90 Flow at Rated Speed	–	+	–

Parameter 22-80 Flow Compensation

Table 912: Parameter 22-80 Flow Compensation

22-80 Flow Compensation		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Option	Name	Description
[0*]	Disabled	Setpoint compensation is not active.
[1]	Enabled	Setpoint compensation is active and allows flow-compensated setpoint operation.

22-81 Square-Linear Curve Approximation

Table 913: 22-81 Square-Linear Curve Approximation

22-81 Square-Linear Curve Approximation		
Default value: 100%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

N O T I C E

This parameter is invisible in casacde mode.

Example 1: Adjustment of this parameter allows the shape of the control curve to be adjusted.

- 0% = Linear
- 100% = Ideal shape (theoretical)

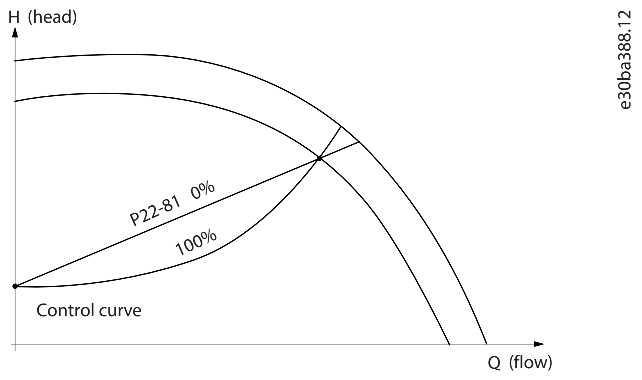


Illustration 91: Square-Linear Curve Approximation

Parameter 22-82 Work Point Calculation

Table 914: Parameter 22-82 Work Point Calculation

22-82 Work Point Calculation		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

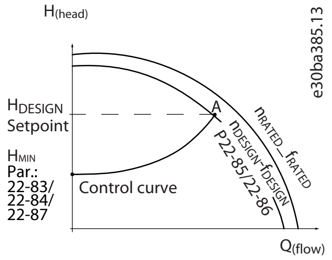


Illustration 92: Example 1: Speed at Known System Design Working Point

From the datasheet showing characteristics for the specific equipment at different speeds, reading across from the H_{DESIGN} point and the Q_{DESIGN} point allows finding point A, which is the system design working point. The pump characteristics at this point should be identified and the associated speed programmed. Closing the valves and adjusting the speed until H_{MIN} has been achieved allows the speed at the no-flow point to be identified. Adjustment of *parameter 22-81 Square-linear Curve Approximation* then allows the shape of the control curve to be adjusted infinitely.

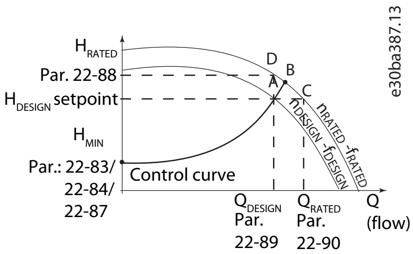


Illustration 93: Example 2: Speed at Unknown System Design Working Point

Speed at system design working point is not known: Where the speed at system design working point is unknown, another reference point on the control curve has to be determined based on the datasheet. Looking at the curve for the rated speed and plotting the design pressure (H_{DESIGN}, Point C), the flow at that pressure, Q_{RATED}, can be determined. Similarly, by plotting the design flow (Q_{DESIGN}, Point D), the pressure H_{DESIGN} at that flow can be determined. Knowing these 2 points on the pump curve, along with H_{MIN} as described, allows the drive to calculate the reference point B and thus to plot the control curve, which also includes the system design working point A.

Option	Name	Description
[0*]	Disabled	Work point calculation is not active. To be used if speed at design point is known.
[1]	Enabled	Work point calculation is active. Enabling this parameter allows the calculation of the unknown system design working point at 50/60 Hz speed, from the input data set in: • *Parameter 22-83 Speed at No-Flow [RPM]* • *Parameter 22-84 Speed at No-Flow [Hz]* • *Parameter 22-87 Pressure at No-Flow Speed* • *Parameter 22-88 Pressure at Rated Speed* • *Parameter 22-89 Flow at Design Point* • *Parameter 22-90 Flow at Rated Speed*

Parameter 22-83 Speed at No-Flow [RPM]

Table 915: Parameter 22-83 Speed at No-Flow [RPM]

22-83 Speed at No-Flow [RPM]		
Default value: Size related	Parameter type: Range, 0 - par. 22-85 [RPM]	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Resolution 1 RPM. Enter the speed of the motor in RPM at which flow is 0, and minimum pressure, H_{MIN}, is achieved. Alternatively, enter the speed in Hz in *parameter 22-84 Speed at No-Flow [Hz]*. If *parameter 0-02 Motor Speed Unit* is set to RPM, *parameter 22-85 Speed at Design Point [RPM]* should also be used. Closing the valves and reducing the speed until minimum pressure, H_{MIN}, is achieved determines this value.

Parameter 22-84 Speed at No-Flow [Hz]

Table 916: Parameter 22-84 Speed at No-Flow [Hz]

22-84 Speed at No-Flow [Hz]		
Default value: Size related	Parameter type: Range, 0 - par. 22-86 [Hz]	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Resolution 0.033 Hz. Enter the motor speed in Hz at which flow has effectively stopped and minimum pressure, H_{MIN}, is achieved Alternatively, enter the speed in RPM in *parameter 22-83 Speed at No-Flow [RPM]*. If *parameter 0-02 Motor Speed Unit* is set to Hz, *parameter 22-86 Speed at Design Point [Hz]* should also be used. Closing the valves and reducing the speed until minimum pressure, H_{MIN}, is achieved determines this value.

Parameter 22-85 Speed at Design Point [RPM]

Table 917: Parameter 22-85 Speed at Design Point [RPM]

22-85 Speed at Design Point [RPM]		
Default value: Size related	Parameter type: Range, par. 22-83 - 60000 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Resolution 1 RPM. Only visible when *parameter 22-82 Work Point Calculation* is set to *[0] Disabled*. Enter the motor speed in RPM at which the system design working point is achieved. Alternatively, enter the speed in Hz in *parameter 22-86 Speed at Design Point [Hz]*. If *parameter 0-02 Motor Speed Unit* is set to RPM, *parameter 22-83 Speed at No-Flow [RPM]* should also be used.

Parameter 22-86 Speed at Design Point [Hz]

Table 918: Parameter 22-86 Speed at Design Point [Hz]

22-86 Speed at Design Point [Hz]		
Default value: Size related	Parameter type: Range, par. 22-84 - par. 4-19 [Hz]	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Resolution 0.033 Hz. Only visible when *parameter 22-82 Work Point Calculation* is set to *[0] Disabled*. Enter the motor speed in Hz at which the system design working point is achieved. Alternatively, enter the speed in RPM in *parameter 22-85 Speed at Design Point [RPM]*. If *parameter 0-02 Motor Speed Unit* is set to Hz, *parameter 22-83 Speed at No-Flow [RPM]* should also be used.

Parameter 22-87 Pressure at No-Flow Speed

Table 919: Parameter 22-87 Pressure at No-Flow Speed

22-87 Pressure at No-Flow Speed		
Default value: 0	Parameter type: Range, 0 - par. 22-88	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the pressure H_{MIN} corresponding to speed at no-flow in reference/feedback units.

Parameter 22-88 Pressure at Rated Speed

Table 920: Parameter 22-88 Pressure at Rated Speed

22-88 Pressure at Rated Speed		
Default value: 999999.999	Parameter type: Range, par. 22-87 - 999999.999	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the value corresponding to the pressure at rated speed in reference/feedback units. This value can be defined using the pump datasheet.

Parameter 22-89 Flow at Design Point

Table 921: Parameter 22-89 Flow at Design Point

22-89 Flow at Design Point		
Default value: 0	Parameter type: Range, 0 - 999999.999	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the value corresponding to the flow at design point. No units are required.

Parameter 22-90 Flow at Rated Speed

Table 922: Parameter 22-90 Flow at Rated Speed

22-90 Flow at Rated Speed		
Default value: Size related	Parameter type: Range, 0 - 999999999	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the value corresponding to the flow at rated speed. This value can be defined using the pump datasheet.

5.22 Parameter Group 23-** Time-based Functions

5.22.1 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*).

N O T I C E

A change in mode via the digital inputs can only take place if *parameter 23-08 Timed Actions Mode* is set to *[0] Times Actions Auto*. If commands are applied simultaneously to the digital inputs for constant OFF and constant ON, the timed actions mode changes to timed actions auto and the 2 commands are disregarded. If *parameter 0-70 Date and Time* is not set or the drive is set to hand-on mode or OFF mode (for example via the LCP), the timed actions mode is changed to *[0] Disabled*. The timed actions have a higher priority than the same actions/commands activated by the digital inputs or the smart logic controller.

The actions programmed in timed actions are merged with corresponding actions from digital inputs, control word via bus, and smart logic controller, according to merge rules set up in *parameter group 8-5* Digital/Bus*.

N O T I C E

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

NOTICE

When mounting VLT® Analog I/O Option MCB 109, a battery backup of the date and time is included.

NOTICE

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

Parameter 23-00 ON Time

Table 923: Parameter 23-00 ON Time

23-00 ON Time		
Default value: Size related	Parameter type: Range, 0 - 0, Array [10]	Setup: 2 setups
Conversion index: 0	Data type: TimeOfDayWoDate	Change during operation: True

Sets the ON time for the desired action.

NOTICE

The drive has no back-up of the clock function. The set date/time resets to default (2000-01-01 00:00) after a power-down unless a real-time clockmodule with back-up is installed. In *parameter 0-79 Clock Fault*, it is possible to program a warning if the clock has not been set properly, for example after a power-down.

Parameter 23-01 ON Action

Table 924: Parameter 23-01 ON Action

23-01 ON Action		
Default value: [0] Disabled	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

NOTICE

For options *[32] Set digital out A low–[43] Set digital out F high*, see also *parameter group 5-3* Digital Outputs* and *parameter group 5-4* Relays*.

Select the action during ON time. See *parameter 13-52 SL Controller Action* for descriptions of the options.

Option	Name	Description
[0]*	Disabled	
[1]	No action	
[2]	Select set-up 1	
[3]	Select set-up 2	
[4]	Select set-up 3	
[5]	Select set-up 4	
[10]	Select preset ref 0	
[11]	Select preset ref 1	
[12]	Select preset ref 2	

Option	Name	Description
[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	
[22]	Run	
[23]	Run reverse	
[24]	Stop	
[26]	Dc brake	
[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)	

Option	Name	Description
[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	
[80]	Sleep mode	
[90]	Set ECB bypass mode	
[91]	Set ECB drive mode	
[100]	Reset alarms	

Parameter 23-02 OFF Time

Table 925: Parameter 23-02 OFF Time

23-02 OFF Time		
Default value: Size related	Parameter type: Range, 0 - 0, Array [10]	Setup: 2 setups
Conversion index: 0	Data type: TimeOfDayWoDate	Change during operation: True

Sets the OFF time for the desired action.

N O T I C E

The drive has no back-up of the clock function. The set date/time resets to default (2000-01-01 00:00) after a power-down unless a real-time clockmodule with back-up is installed. In *parameter 0-79 Clock Fault*, it is possible to program a warning if the clock has not been set properly, for example after a power-down.

Parameter 23-03 OFF Action

Table 926: Parameter 23-03 OFF Action

23-03 OFF Action		
Default value: [1] No action	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the action during OFF time. See *parameter 13-52 SL Controller Action* for descriptions of the options.

Option	Name	Description
[1]*	No action	
[2]	Select set-up 1	
[3]	Select set-up 2	

Option	Name	Description
[4]	Select set-up 3	
[5]	Select set-up 4	
[10]	Select preset ref 0	
[11]	Select preset ref 1	
[12]	Select preset ref 2	
[13]	Select preset ref 3	
[14]	Select preset ref 4	
[15]	Select preset ref 5	
[16]	Select preset ref 6	
[17]	Select preset ref 7	
[18]	Select ramp 1	
[19]	Select ramp 2	
[22]	Run	
[23]	Run reverse	
[24]	Stop	
[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	

Option	Name	Description
[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	
[71]	Start timer 4	
[72]	Start timer 5	
[73]	Start timer 6	
[74]	Start timer 7	
[75]	Start timer 8	
[76]	Start timer 9	
[80]	Sleep mode	
[90]	Set ECB bypass mode	
[91]	Set ECB drive mode	
[100]	Reset alarms	

Parameter 23-04 Occurrence

Table 927: Parameter 23-04 Occurrence

23-04 Occurrence		
Default value: [0] All days	Parameter type: Option, Array [10]	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select which days the timed action applies to. Specify working/nonworking days in:

- *Parameter 0-81 Working Days.*
- *Parameter 0-82 Additional Working Days.*
- *Parameter 0-83 Additional Non-Working Days.*

Option	Name	Description
[0]*	All days	
[1]	Working days	
[2]	Non-working days	
[3]	Monday	
[4]	Tuesday	

Option	Name	Description
[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	
[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	

Option	Name	Description
[37]	Day 28 of month	
[38]	Day 29 of month	
[39]	Day 30 of month	
[40]	Day 31 of month	

Parameter 23-08 Timed Actions Mode

Table 928: Parameter 23-08 Timed Actions Mode

23-08 Timed Actions Mode		
Default value: [0] Timed actions auto	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Enable and disable automatic timed actions.

Option	Name	Description
[0]*	Timed actions auto	Enable timed actions.
[1]	Timed actions disabled	Disable timed actions, normal operation according to control commands.
[2]	Constant on actions	Disable timed actions. Constant on actions are activated.
[3]	Constant off actions	Disable timed actions. Constant off actions are activated.

Parameter 23-09 Timed Actions Reactivation

Table 929: Parameter 23-09 Timed Actions Reactivation

23-09 Timed Actions Reactivation		
Default value: [1] Enabled	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Option	Name	Description
[0]	Disabled	After an update of: • power cycling • setting date • time • change of summertime • change of Hand Auto mode • change of Constant On and Off • setup change where all activated ON actions are overridden to OFF actions until passing the next time for an ON action. Any OFF actions remain unchanged.
[1]*	Enabled	After an update of time/condition On and OFF actions are immediately set to the actual time programming of ON and OFF actions.

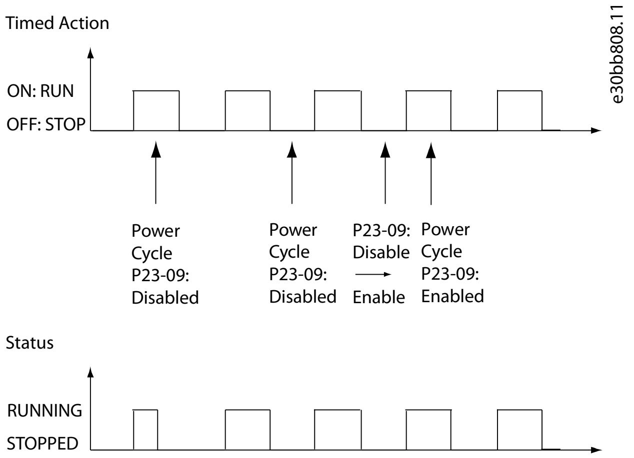


Illustration 94: Example of Reactivation Test

5.22.2 23-1* Maintenance

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

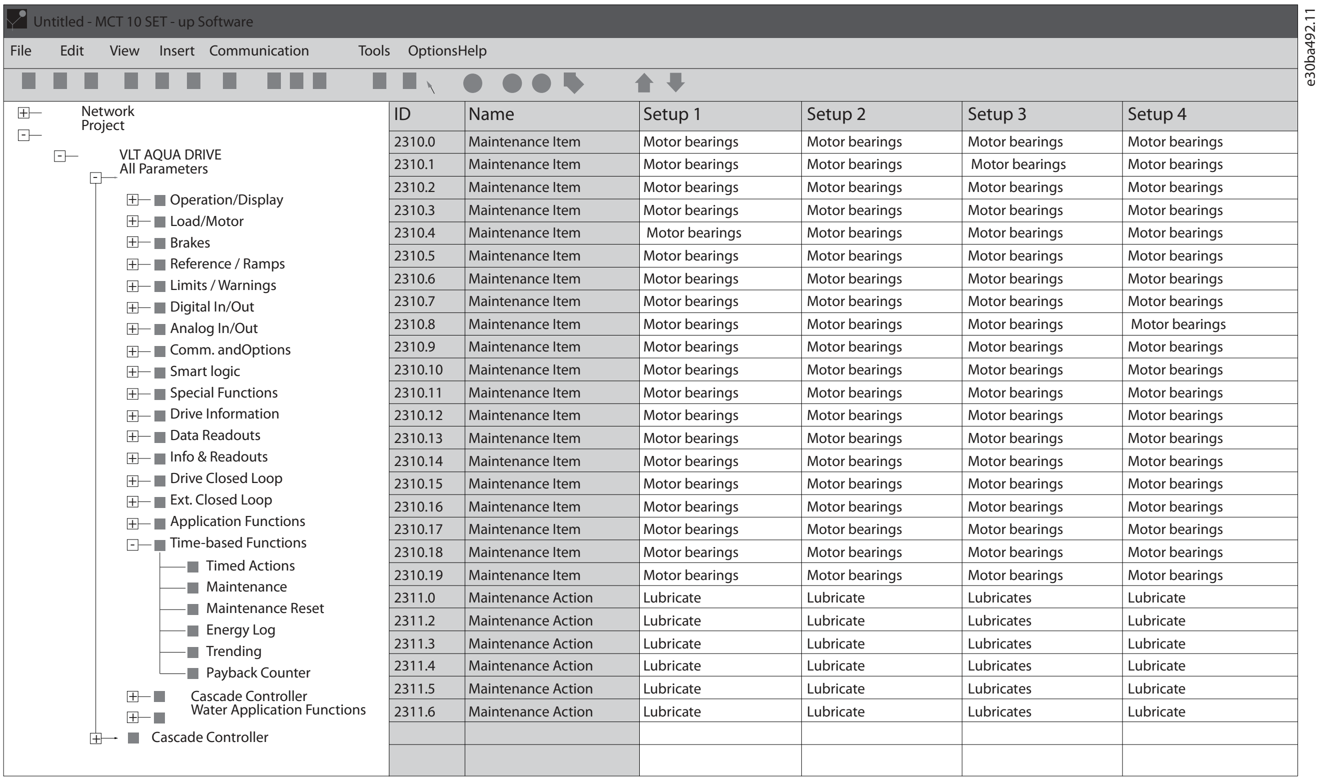
Specify the following for each event:

- Maintenance item (for example, motor bearings).
- Maintenance action (for example, replacement).
- Maintenance time base (for example, running hours, or a specific date and time).
- Maintenance time interval or the date and time of next maintenance.

N O T I C E

To disable a preventive maintenance event, set the associated *parameter 23-12 Maintenance Base* to *[0] Disabled*.

Preventive maintenance can be programmed from the LCP, but use of the PC-based VLT® Motion Control Tool MCT 10 is recommended.



ID	Name	Setup 1	Setup 2	Setup 3	Setup 4
2310.0	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.1	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.2	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.3	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.4	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.5	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.6	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.7	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.8	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.9	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.10	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.11	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.12	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.13	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.14	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.15	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.16	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.17	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.18	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2310.19	Maintenance Item	Motor bearings	Motor bearings	Motor bearings	Motor bearings
2311.0	Maintenance Action	Lubricate	Lubricate	Lubricates	Lubricate
2311.2	Maintenance Action	Lubricate	Lubricate	Lubricates	Lubricate
2311.3	Maintenance Action	Lubricate	Lubricate	Lubricates	Lubricate
2311.4	Maintenance Action	Lubricate	Lubricate	Lubricates	Lubricate
2311.5	Maintenance Action	Lubricate	Lubricate	Lubricates	Lubricate
2311.6	Maintenance Action	Lubricate	Lubricate	Lubricates	Lubricate

Illustration 95: Maintenance Menu, MCT 10

The LCP indicates (with a wrench icon and letter M) when it is time for a preventive maintenance action and can be programmed to be indicated on a digital output in *parameter group 5-3* Digital Outputs*. The preventive maintenance status is shown in *parameter 16-96 Maintenance Word*. A preventive maintenance indication can be reset from a digital input, the FC bus, or manually from the LCP through *parameter 23-15 Reset Maintenance Word*.

N O T I C E

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

Parameter 23-10 Maintenance Item

Table 930: Parameter 23-10 Maintenance Item

23-10 Maintenance Item		
Default value: [1] Motor Bearings	Parameter type: Option, Array [20]	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	
[2]	Fan bearings	
[3]	Pump bearings	
[4]	Valve	
[5]	Pressure transmitter	

Option	Name	Description
[6]	Flow transmitter	
[7]	Temperature transm.	
[8]	Pump seals	
[9]	Fan belt	
[10]	Filter	
[11]	Drive cooling fan	
[12]	System health check	
[13]	Warranty	
[20]	Maintenance text 0	
[21]	Maintenance text 1	
[22]	Maintenace text 2	
[23]	Maintenance text 3	
[24]	Maintenance text 4	
[25]	Maintenance text 5	
[26]	Service log full	

Parameter 23-11 Maintenance Action

Table 931: Parameter 23-11 Maintenance Action

23-11 Maintenance Action		
Default value: [1] Lubricate	Parameter type: Option, Array [20]	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	

Option	Name	Description
[23]	Maintenance text 3	
[24]	Maintenance text 4	
[25]	Maintenance text 5	
[28]	Clear logs	

Parameter 23-12 Maintenance Base

Table 932: Parameter 23-12 Maintenance Base

23-12 Maintenance Base		
Default value: [0] Disabled	Parameter type: Option, Array [20]	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

Select the time base to be associated with the preventive maintenance event.

Option	Name	Description
[0]*	Disabled	Disables the preventive maintenance event.
[1]	Running hours	The number of hours the motor has run. Running hours are not reset at power-on. Specify the maintenance time interval in *parameter 23-13 Maintenance Interval*.
[2]	Operating hours	The number of hours the drive has run. Operating hours are not reset at power-on. Specify the maintenance time interval in *parameter 23-13 Maintenance Interval*.
[3]	Date & time	Uses the internal clock. Specify the date and time of the next maintenance occurrence in *parameter 23-14 Maintenance Date and Time*.

Parameter 23-13 Maintenance Interval

Table 933: Parameter 23-13 Maintenance Interval

23-13 Maintenance Interval		
Default value: 1	Parameter type: Range, 1 - 2147483647, Array [20]	Setup: 1 setup
Conversion index: 0	Data type: Uint32	Change during operation: True

Set the interval associated with the current preventive maintenance event. This parameter is only used if *[1] Running Hours* or *[2] Operating Hours* is selected in *parameter 23-12 Maintenance Base*. The timer is reset in *parameter 23-15 Reset Maintenance Word*.
Example
A preventive maintenance event is set up Monday at 8:00. *Parameter 23-12 Maintenance Base* is *[2] Operating hours* and *parameter 23-13 Maintenance Interval* is 7 x 24 hours=168 hours. Next maintenance event is indicated the following Monday at 8:00. If this maintenance event is not reset until Tuesday at 9:00, the next occurrence is the following Tuesday at 9:00.

Parameter 23-14 Maintenance Data and Time

Table 934: Parameter 23-14 Maintenance Data and Time

23-14 Maintenance Data and Time		
Default value: Size related	Parameter type: Range, 0 - 0, Array [20]	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*.

NOTICE

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.

NOTICE

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

Parameter 23-15 Reset Maintenance Word

Table 935: Parameter 23-15 Reset Maintenance Word

23-15 Reset Maintenance Word		
Default value: [0] Do not reset	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

NOTICE

When messages are reset, maintenance item, action, and maintenance date/time are not canceled. *Parameter 23-12 Maintenance Time Base* is set to *[0] Disabled*.

Set this parameter to *[1] Do reset* to reset the maintenance word in *parameter 16-96 Maintenance Word* and reset the message shown in the LCP. This parameter changes back to *[0] Do not reset* when pressing [OK].

Option	Name	Description
[0]*	Do not reset	
[1]	Do reset	

Parameter 23-16 Maintenance Text

Table 936: Parameter 23-16 Maintenance Text

23-16 Maintenance Text		
Default value: 0	Parameter type: Range, 0 - 20, Array [6]	Setup: 1 setup
Conversion index: 0	Data type: VisStr[20]	Change during operation: True

6 individual texts (Maintenance Text 0...Maintenance Text 5) can be written for use in either *parameter 23-10 Maintenance Item* or *parameter 23-11 Maintenance Action*. The text is written according to the guidelines in *parameter 0-37 Display Text 1*.

5.22.3 23-5* Energy Log

The drive is continuously accumulating the consumption of the motor controlled, based on the actual power yielded by the drive.

This data can be used for an energy log function allowing to compare and structure the information about the energy consumption related to time.

There are 2 functions:

- Data related to a preprogrammed period defined by a set date and time for start.
- Data related to a predefined period back in time, for example, last 7 days within the preprogrammed period.

For each of the above 2 functions, the data is stored in several counters allowing for selection time frame and a split on hours, days, or weeks.

The period/split (resolution) can be set in *parameter 23-50 Energy Log Resolution*.

The data is based on the value registered by the kWh counter in the drive. This counter value can be read in *parameter 15-02 kWh Counter* containing the accumulated value since the 1st power-up or latest reset of the counter (*parameter 15-06 Reset kWh Counter*).

All data for the energy log is stored in counters, which can be read from *parameter 23-53 Energy Log*.

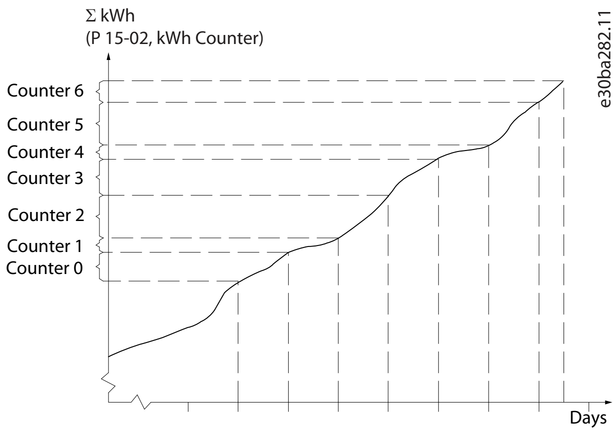


Illustration 96: Energy Log Graph

Counter 00 always contains the oldest data. A counter covers a period from XX:00 to XX:59 if hours, or 00:00 to 23:59 if days. If logging either the last hours or last days, the counters shift contents at XX:00 every hour, or at 00:00 every day. The counter with the highest index is always subject to update (containing data for the actual hour since XX:00 or the actual day since 00:00).

The contents of counters can be shown as bars on the LCP. Select *Quick Menu*, *Loggings*, *Energy Log: Trending Continued Bin/Trending Timed Bin/Trending Comparison*.

Parameter 23-50 Energy Log Resolution

Table 937: Parameter 23-50 Energy Log Resolution

23-50 Energy Log Resolution		
Default value: [5] Last 24 hours	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

N O T I C E

The drive has no backup 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 backup is installed. Therefore, the logging is stopped until date/time is readjusted in *parameter -70 Date and Time*. 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.

Select the type of period for logging consumption: *[0] Hour of day*, *[1] Day of week*, or *[2] Day of month*. The counters contain the logging data from the preprogrammed date/time for start (*parameter 23-51 Period Start*) and the numbers of hours/days as programmed for *parameter 23-50 Energy Log Resolution*. The logging starts on the date programmed in *parameter 23-51 Period Start* and continues until 1 day/week/month has passed. The counters contain data for 1 day, 1 week, or 5 weeks back in time and up to the actual time. The logging starts at the date programmed in *parameter 23-51 Period Start*. In all cases, the period split refers to operating hours (time where the drive is powered up).

Option	Name	Description
[0]	Hour of day	
[1]	Day of week	
[2]	Day of month	
[5]*	Last 24 hours	
[6]	Last 7 days	
[7]	Last 5 weeks	

Parameter 23-51 Period Start

Table 938: Parameter 23-51 Period Start

23-51 Period Start		
Default value: Size related	Parameter type: Range, 0 - 0	Setup: 2 setups
Conversion index: 0	Data type: TimeOfDay	Change during operation: True

NOTICE

When mounting VLT® Analog I/O Option MCB 109, a battery backup of the date and time is included.

Set the date and time at which the energy log starts updating the counters. First, data is stored in counter [00] and starts at the time/date programmed in this parameter. Date format depends on the setting in *parameter 0-71 Date Format* and time format on the setting in *parameter 0-72 Time Format*.

Parameter 23-53 Energy Log

Table 939: Parameter 23-53 Energy Log

23-53 Energy Log		
Default value: 0	Parameter type: Range, 0 - 4294967295, Array [31]	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

NOTICE

All counters are automatically reset when changing the setting in *parameter 23-50 Energy Log Resolution*. At overflow, the update of the counters stops at maximum value.

NOTICE

When mounting VLT® Analog I/O Option MCB 109, a battery backup of the date and time is included.

Array with several elements equal to the number of counters ([00]-[xx] below parameter numbers in display). Press [OK] and step between elements with [▵] [▿]. Array elements:

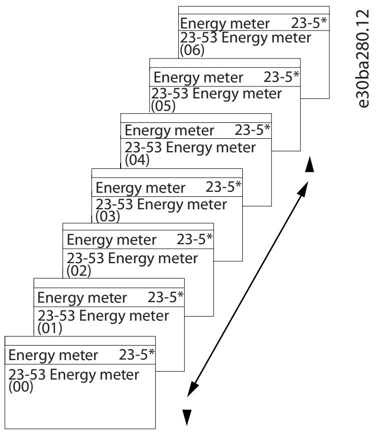


Illustration 97: Energy Log

Data from the latest period is stored in the counter with the highest index. At power-down, all counter values are stored and resumed at next power-up.

Parameter 23-54 Reset Energy Log

Table 940: Parameter 23-54 Reset Energy Log

23-54 Reset Energy Log		
Default value: [0] Do not reset	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select *[1] Do reset* to reset all values in the energy log counters shown in *parameter 23-53 Energy Log*. After pressing [OK], the setting of the parameter value automatically changes to *[0] Do not reset*.

Option	Name	Description
[0]*	Do not reset	
[1]	Do reset	

5.22.4 23-6* Trending

Trending is used to monitor a process variable over time and record how often the data falls into each of 10 user-defined data ranges. This is a convenient tool to obtain a quick overview indicating where to focus on improvement of operation.

Two sets of data for trending can be created to make it possible to compare current values for a selected operating variable with data for a certain reference period for the same variable. This reference period can be preprogrammed (*parameter 23-63 Timed Period Start* and *23-64 Timed Period Stop*). The 2 sets of data can be read from *parameter 23-61 Continuous Bin Data* (current) and *parameter 23-62 Timed Bin Data* (reference).

It is possible to create trending for the following operation variables:

- Power
- Current
- Output frequency
- Motor speed

The trending function includes 10 counters (forming a bin) for each set of data containing the numbers of registrations reflecting how often the operating variable is within each of 10 predefined intervals. The sorting is based on a relative value of the variable.

The relative value for the operating variable is determined as:

- Actual/rated x 100% - for power and current.
- Actual/max x 100% - for output frequency and motor speed.

The size of each interval can be adjusted individually, but is 10% for each as default. Power and current can exceed rated value, but those registrations are included in 90–100% (MAX) counter.

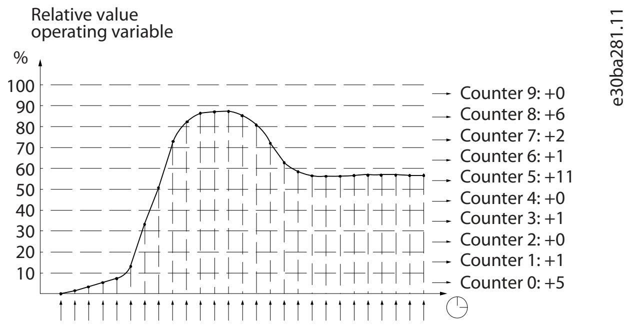


Illustration 98: Time and Relative Values

Once per second, the value of the operating variable selected is registered. If a value has been registered to equal 13%, the counter 10 to <20% is updated with the value 1. If the value stays at 13% for 10 s, 10 is added to the counter value.

The contents of counters can be shown as bars on the LCP. Select *Quick Menu⇒Loggings: Trending Continued Bin/Trending Timed Bin/Trending Comparison*.

NOTICE

The counters start counting whenever the drive is powered up. A power cycle shortly after a reset resets the counters. EEPROM data is updated once per hour.

Parameter 23-60 Trend Variable

Table 941: Parameter 23-60 Trend Variable

23-60 Trend Variable		
Default value: [2] Frequency [Hz]	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the required operating variable to be monitored for trending.

Option	Name	Description
[0]	Power [kW]	Power yielded to the motor. Reference for the relative value is the rated motor power programmed in *parameter 1-20 Motor Power [kW]* or *parameter 1-21 Motor Power [hp]*. The actual value can be read in *parameter 16-10 Power [kW]* or *parameter 16-11 Power [hp]*.
[1]	Current [A]	Output current to the motor. Reference for the relative value is the rated motor current in *parameter 1-24 Motor Current*. The actual value can be read in *parameter 16-14 Motor Current*.
[2]*	Frequency [Hz]	Output frequency to the mtor. Reference for the relative value is the maximum output frequency programmed in *parameter 4-14 Motor Speed High Limit [Hz]*. The actual value can be read in *parameter 16-13 Frequency*.
[3]	Motor speed [RPM]	Reference for the relative value is the maximum motor speed programmed in *parameter 4-13 Motor Speed High Limit [RPM]*.

Parameter 23-61 Continuous Bin Data

Table 942: Parameter 23-61 Continuous Bin Data

23-61 Continuous Bin Data		
Default value: 0	Parameter type: Range, 0 - 4294967295, Array [10]	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Array with 10 elements ([0]–[9] below parameter number in display). Press [OK] and step between the elements with [▵] and [▿]. 10 counters with the frequency of occurrence for the operating variable monitored, sorted according to the following intervals:

- Counter [0]: 0–<10%
- Counter [1]: 10–<20%
- Counter [2]: 20–<30%
- Counter [3]: 30–<40%
- Counter [4]: 40–<50%
- Counter [5]: 50–<60%
- Counter [6]: 60–<70%
- Counter [7]: 70–<80%
- Counter [8]: 80–<90%
- Counter [9]: 90–100% or maximum

The above minimum limits for the intervals are the default limits. These can be changed in *parameter 23-65 Minimum Bin Value*. Starts to count when the drive is powered up for the 1st time. All counters can be reset to 0 in *parameter 23-66 Reset Continuous Bin Data*.

Parameter 23-62 Timed Bin Data

Table 943: Parameter 23-62 Timed Bin Data

23-62 Timed Bin Data		
Default value: 0	Parameter type: Range, 0 - 4294967295, Array [10]	Setup: All setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Array with 10 elements ([0]–[9] below parameter number in display). Press [OK] and step between the elements with [▵] and [▿]. 10 counters with the frequency of occurrence for the operating variable monitored, sorted according to the following intervals:

- Counter [0]: 0–<10%
- Counter [1]: 10–<20%
- Counter [2]: 20–<30%
- Counter [3]: 30–<40%
- Counter [4]: 40–<50%
- Counter [5]: 50–<60%
- Counter [6]: 60–<70%
- Counter [7]: 70–<80%
- Counter [8]: 80–<90%
- Counter [9]: 90–100% or maximum

Starts to count at the date/time programmed in *parameter 23-63 Timed Period Start*, and stops at the date/time programmed in *parameter 23-64 Timed Period Stop*. All counters can be reset to 0 in *parameter 23-67 Reset Timed Bin Data*.

Parameter 23-63 Timed Period Start

Table 944: Parameter 23-63 Timed Period Start

23-63 Timed Period Start		
Default value: 0	Parameter type: Range, 0 - 0	Setup: 2 setups
Conversion index: 0	Data type: TimeOfDay	Change during operation: True

N O T I C E

The drive has no backup 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 backup is installed. Therefore, the logging is stopped until date/time is readjusted in *parameter -70 Date and Time*. 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.

N O T I C E

When mounting VLT® Analog I/O Option MCB 109, a battery backup of the date and time is included.

Set the date and time at which the trending starts the update of the timed bin counters. Date format depends on the setting in *parameter 0-71 Date Format*, and time format depends on the setting in *parameter 0-72 Time Format*.

Parameter 23-64 Timed Period Stop

Table 945: Parameter 23-64 Timed Period Stop

23-64 Timed Period Stop		
Default value: 0	Parameter type: Range, 0 - 0	Setup: 2 setups
Conversion index: 0	Data type: TimeOfDay	Change during operation: True

NOTICE

When mounting VLT® Analog I/O Option MCB 109, a battery backup of the date and time is included.

Set the date and time at which the trend analyses must stop updating the timed bin counters. Date format depends on the setting in *parameter 0-71 Date Format*, and time format depends on the setting in *parameter 0-72 Time Format*.

Parameter 23-65 Minimum Bin Value

Table 946: Parameter 23-65 Minimum Bin Value

23-65 Minimum Bin Value		
Default value: Size related	Parameter type: Range, 0 - 100%, Array [10]	Setup: 2 setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Array with 10 elements ([0]–[9] below parameter number in display). Press [OK] and step between the elements with [▴] and [▾]. Set the minimum limit for each interval in *parameter 23-61 Continuous Bin Data* and *parameter 23-62 Timed Bin Data*. Example: If selecting *[1] counter* and changing setting from 10% to 12%, *[0] counter* is based on the interval 0 to <12% and *[1] counter* on interval 12 to <20%.

Parameter 23-66 Reset Continuous Bin Data

Table 947: Parameter 23-66 Reset Continuous Bin Data

23-66 Reset Continuous Bin Data		
Default value: [0] Do not reset	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select *[1] Do reset* to reset all values in the energy log counters shown in *parameter 23-61 Continuous Bin Data*. After pressing [OK], the setting of the parameter value automatically changes to *[0] Do not reset*.

Option	Name	Description
[0]*	Do not reset	
[1]	Do reset	

Parameter 23-67 Reset Timed Bin Data

Table 948: Parameter 23-67 Reset Timed Bin Data

23-67 Reset Timed Bin Data		
Default value: [0] Do not reset	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select *[1] Do reset* to reset all values in the energy log counters shown in *parameter 23-62 Timed Bin Data*. After pressing [OK], the setting of the parameter value automatically changes to *[0] Do not reset*.

Option	Name	Description
[0]*	Do not reset	
[1]	Do reset	

5.22.5 23-8* Payback Counter

The drive includes a feature which can give a rough calculation on payback in cases where the drive has been installed in an existing plant to ensure energy savings. Reference for the savings is a set value representing the average power yielded before the upgrade with variable-speed control.

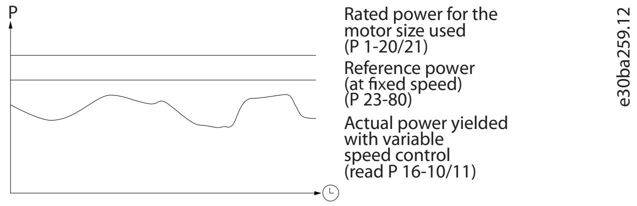


Illustration 99: Variable-speed Control

The difference between the reference power at fixed speed and the actual power yielded with speed control represents the actual saving.

As value for the fixed speed case, the rated motor size (kW) is multiplied with a factor (set in %) representing the power produced at fixed speed. The difference between this reference power and the actual power is accumulated and stored. The difference in energy can be read in *parameter 23-83 Energy Savings*. The accumulated value for the difference in power consumption is multiplied with the energy cost in local currency and the investment is subtracted. This calculation for cost savings can also be read in *parameter 23-84 Cost Savings*.

Cost savings =

$$\left\{\sum_{t=0}^{t}\left[(\text{motor rated power} \times \text{power reference factor}) - \text{actual power consumption}\right] \times \text{energy cost}\right\} - \text{investment cost}$$

Breakeven (payback) occurs when the value read in the parameter turns from negative to positive.

It is not possible to reset the energy savings counter, but the counter can be stopped any time by setting *parameter 23-80 Power Reference Factor* to 0.

Table 949: Parameter Overview

Parameter for settings		Parameters for readout	
Rated motor power	*Parameter 1-20 Motor Power [kW]/1-21 Motor Power [hp]*	Energy savings	*Parameter 23-83 Energy Savings*
Power reference factor in %	*Parameter 23-80 Power Reference Factor*	Actual power	*Parameter 16-10 Power [kW]/16-11 Power [hp]*
Energy cost per kWh	*Parameter 23-81 Energy Cost*	Cost savings	*Parameter 23-84 Cost Savings*
Investment	*Parameter 23-82 Investment*	–	–

Parameter 23-80 Power Reference Factor

Table 950: Parameter 23-80 Power Reference Factor

23-80 Power Reference Factor		
Default value: 100%	Parameter type: Range, 0 - 100%	Setup: 2 setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Set the percentage of the rated motor size (set in *parameter 1-20 Motor Power [kW]* or *parameter 1-21 Motor Power [HP]*), which shows the average power yielded at the time running with fixed speed (before upgrade with variable-speed control). Set a value different from 0 to start counting.

Parameter 23-81 Energy Cost

Table 951: Parameter 23-81 Energy Cost

23-81 Energy Cost		
Default value: 1	Parameter type: Range, 0 - 999999.99	Setup: 2 setups
Conversion index: -2	Data type: Uint32	Change during operation: True

Set the actual cost for a kWh in local currency. If the energy cost is changed later on, it impacts the calculation for the entire period.

Parameter 23-82 Investment

Table 952: Parameter 23-82 Investment

23-82 Investment		
Default value: 0	Parameter type: Range, 0 - 999999999	Setup: 2 setups
Conversion index: 0	Data type: Uint32	Change during operation: True

Set the value of the investment spent on upgrading the plant with speed control. Use the same currency as in *parameter 23-81 Energy Cost*.

Parameter 23-83 Energy Savings

Table 953: Parameter 23-83 Energy Savings

23-83 Energy Savings		
Default value: 0 kWh	Parameter type: Range, 0 - 0 kWh	Setup: All setups
Conversion index: 75	Data type: Int32	Change during operation: True

This parameter allows a readout of the accumulated difference between the reference power and the actual output power. If motor size is set in hp (*parameter 1-21 Motor Power [hp]*), the equivalent kW value is used for the energy savings.

Parameter 23-84 Cost Savings

Table 954: Parameter 23-84 Cost Savings

23-84 Cost Savings		
Default value: 0	Parameter type: Range, 0 - 2147483647	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

This parameter allows a readout of the calculation based on the above formula (in local currency).

Parameter 23-85 CO2 Conversion Factor

Table 955: Parameter 23-85 CO2 Conversion Factor

23-85 CO2 Conversion Factor		
Default value: 500 g	Parameter type: Range, 0 - 1000 g	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

Enter the CO_2 emission in grams per 1 kWh of electrical energy produced. Typical life-cycle greenhouse-gas emission values for different power sources are:

- Renewable: 25 g.
- Nuclear: 70 g.
- Natural gas: 350 g.
- Oil: 800 g.
- Coal: 1000 g

For more precise emission values in local regions, contact the regional environment agency.

Parameter 23-86 CO2 Reduction

Table 956: Parameter 23-86 CO2 Reduction

23-86 CO2 Reduction		
Default value: 0 kg	Parameter type: Range, 0 - 0 kg	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Shows the CO_2 depletion in kg based on the CO_2 conversion factor (*parameter 23-85 CO2 Conversion Factor*) and saved energy (*parameter 23-83 Energy Savings*).

5.23 Parameter Group 24-** Application Functions 2

5.23.1 24-0* Fire Mode

CAUTION

The drive is only 1 component of the HVAC system. Correct function of fire mode depends on the correct design and selection of system components. Ventilation systems working on life safety applications have to be approved by the local fire authorities. Non-interruption of the drive due to fire-mode operation could cause overpressure and damage the HVAC system and components, including dampers in air ducts. The drive itself could be damaged, and/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, HVAC systems and components herein, or other property when the drive has been programmed for fire 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 fire mode. Danfoss warranty is only affected or reduced if a critical alarm occurs during fire-mode operation, and the drive is programmed to continue even though the HVAC system would be damaged eventually.

If critical alarms have been activated during fire mode operation, the drive informs the user that its performance and expected lifetime may be affected (*warning 280*), where an inspection of the drive may be needed to secure maximum operation in a new critical situation.

Background

Fire 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 fire-mode function cause alarms and trip conditions to be disregarded, enabling the motor to run without interruption.

Activation

Fire mode can be activated via digital input and/or over the fieldbus network. In digital activation, normal or inverse signal 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*, *parameter 24-06 Fire Mode reference Source*, *parameter 24-07 Fire Mode Feedback Source*, and *parameter 24-43 Fire Mode Signal Operation*.

Messages in the display

When fire mode is activated, the display shows a status message *Fire Mode* and a warning *Fire Mode*. Once the fire mode is deactivated, the status messages disappear and the warning is replaced by the warning *Fire M Was Active*.

- For software versions older than 5.41, this message can only be reset by power-cycling the drive supply. If a warranty-affecting alarm (see *parameter 24-09 Fire Mode Alarm Handling*) should occur while the drive is active in fire mode, the display shows the warning *Fire M Limits Exceeded*.
- For software version 5-41 onwards, the message is automatically reset in the LCP after the fire mode has been disabled for 1 minute.
- From software version 5.82 onwards, a new fire mode message, W280, is included. The warning is issued when the drive has operated outside its specification, which may affect performance and lifetime operation during the suppression of critical alarms. The drive can continue in fire mode and in normal operation mode again, but before a normal operation is possible, the drive must be power-cycled to enter the self-check function and reset the trip-lock alarm. After the self-check, W280 appears to indicate that a service inspection is required to secure a safe operation if a new critical situation should arise. The W280 can only be removed by a Danfoss service inspection.
- From software version 6.01 onwards, there is a special setup switch within the Fire Mode parameters, which enables switching the fire mode setup without changing the general setup. The LCP indicates both the active FM setup and the general setup operation number. The switch can be activated via input signal and fieldbus control word. The actual fire mode setup can be read in *parameter 0-17 Active Fire Mode Setup*. The value 0 indicates that the drive operates according to the main setup selection, whereas the values 1–4 indicate that a defined fire mode setup is selected.

Digital and relay outputs can be configured for the status fire mode messages *Fire Mode Active* and the warning *Fire M Was Active*. See *parameter group 5-3* Digital Outputs* and *parameter group 5-4* Relays*. Fire mode messages can also be accessed in the warning word via serial communication (see relevant documentation). Access the status messages *Fire Mode* via the extended status word.

Table 957: Messages in Display

Messages	Type	LCP	Messages in display	Alarm word (parameter 16-90)	Warning word 2 (parameter 16-93)	Warning word 3 (Parameter 16-98)	Ext. status word 2 (parameter 16-95)
FM active (*Warning 200*)	Warning	+	+		–	+ (bit 7)	+ (bit 25)
Fire M Was Active (*Warning 201*)	Warning	+	+		+ (bit 3)	+ (bit 8)	–
Fire M Limits Exceeded (*Warning 202*)	Alarm (log)	+	+		–	+ (bit 9)	+ (bit 27)
Fire M service need (*Warning 280*)	Alarm (log)	+	+			+ (bit 10)	
Fire M not working as expected (*Warning 281*)	Warning	+	+			+ (bit 11)	

Log

To see an overview of the fire mode-related events, view the fire-mode log, *parameter group 18-1* Fire 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 FM alarm log can only be reset by a Danfoss authorized service partner. To secure the FM operation documentation, the 1st critical alarms can never be removed.

The following events are logged:

- Warning 200 - Fire mode active.
- Warning 201 - Fire mode was active (deactivated).
- Warning 202 - Fire mode limits exceeded - covered by the activated critical alarm number.
- (Warning 280) - Fire mode service is needed.
- (Warning 281) - Fire mode not working as expected.

All critical alarms occurring while fire mode is activated are logged as usual, and critical fire mode alarms are logged in the the fire mode log in *parameter group 18-1* Fire Mode Log*.

N O T I C E

During fire-mode operation, all stop commands to the drive are ignored, including coast/coast inverse and external interlock. The keypad is also locked during fire 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.

N O T I C E

Fire mode has a special live zero function for handling lost analog signal inputs used for fire mode setpoint/feedback, for example, for handling a burned cable. How fire mode should continue in these live zero situations is configured in *parameter 6-02 Fire Mode Live Zero Timeout Function*. If live zero is activated, *Fire mode not working as expected* is activated too in order for a redundant system to take over or a setup change to be activated. A warning for live zero has a higher priority than the warning *Fire mode* and will replace that information in the display.

N O T I C E

If setting the command *[11] Start Reversing* on a digital input terminal in *parameter 5-10 Terminal 18 Digital Input*, the drive understands this as a reversing command.

Parameter 24-00 Fire Mode Function

Table 958: Parameter 24-00 Fire Mode Function

24-00 Fire Mode Function		
Default value: [0] Disabled	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

N O T I C E

Alarms are produced or ignored in accordance with the selection in *parameter 24-09 Fire Mode Alarm Handling*.

Option	Name	Description
[0]*	Disabled	The fire-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 Fire 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 Fire 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 with standard parameters and control operation, but where the alarms are suppressed as in normal fire mode. The FM LCP information and status word are updated as the fire mode operation is logged in the fire mode log.

Parameter 24-01 Fire Mode Configuration

Table 959: Parameter 24-01 Fire Mode Configuration

24-01 Fire Mode Configuration		
Default value: [0] Open loop	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

N O T I C E

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

N O T I C E

If *[2] Enable-run reverse* is selected in *parameter 24-00 Fire Mode Function*, *[3] Closed loop* cannot be selected in *parameter 24-01 Fire Mode Configuration*.

The fire 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]*	Open loop	When fire 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*.
[3]	Closed loop	When fire mode is active, the built-in PID controller controls the speed based on the setpoint and a feedback signal selected in *parameter 24-07 Fire Mode Feedback Source*. Select the unit in *parameter 24-02 Fire Mode Unit*. For PID controller settings, use *parameter group 20-** FC Closed Loop* as for normal operation.

Op-tion	Name	Description
		The same PID configuration can be selected for both normal and fire mode, and the operation can be continued as setup 1–4.

Parameter 24-02 Fire Mode Unit

Table 960: Parameter 24-02 Fire Mode Unit

24-02 Fire Mode Unit		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

By default, fire 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	
[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	

Option	Name	Description
[60]	°C	
[70]	mbar	
[71]	bar	
[72]	Pa	
[73]	kPa	
[74]	m WG	
[75]	mm HG	
[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	
[174]	in HG	
[180]	HP	

Parameter 24-03 Fire Mode Min Reference

Table 961: Parameter 24-03 Fire Mode Min Reference

24-03 Fire Mode Min Reference		
Default value: Size related	Parameter type: Range, -999999.999 - par. 24-04 FireModeMaxReference	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 Fire Mode Preset Reference* and value of signal on input selected in *parameter 24-06 Fire Mode Reference Source*). If running in open loop when fire 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 Fire Mode Unit*.

Parameter 24-04 Fire Mode Max Reference

Table 962: Parameter 24-04 Fire Mode Max Reference

24-04 Fire Mode Max Reference		
Default value: Size related	Parameter type: Range, par. 24-03 - 999999.999 FireModeMinReference	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

This parameter defines the maximum speed reference which the fire mode can operate to, although the motor limits in *parameter 4-10 Motor Speed Direction* has the highest priority. This maximum value is also used as reference value for the 8 preset value calculations in %. If running in open loop when fire 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 Fire Mode Unit*.

Parameter 24-05 Fire Mode Preset Reference

Table 963: Parameter 24-05 Fire Mode Preset Reference

24-05 Fire 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 preset values (zones) are for open-loop control. Index [0] is used for basic fire mode control. Indexes 1–7 are used to enhance fire mode control, which also overwrites the basic control. More reference values can be added via *parameter group 24-** Application Functions 2*.

Parameter 24-06 Fire Mode Reference Source

Table 964: Parameter 24-06 Fire Mode Reference Source

24-06 Fire 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 fire mode. In open-loop mode, this signal value is added to the preset values in *parameter 24-05 Fire 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	

Option	Name	Description
[11]	Local bus reference	Serial inputs from internal COM interfaces.
[20]	Digital pot.meter	
[21]	Analog input X30/11	
[22]	Analog input X30/12	
[23]	Analog input X42/1	
[24]	Analog input X42/3	
[25]	Analog input X42/5	
[37]	Analog input X49/1	
[38]	Analog input X49/3	
[39]	Analog input X49/5	
[133]	Fieldbus REF 1	A reference value can also come via selected fieldbus.

Parameter 24-07 Fire Mode Feedback Source

Table 965: Parameter 24-07 Fire Mode Feedback Source

24-07 Fire Mode Feedback Source		
Default value: [0] No function	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

In fire 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]	Pulse input 29	
[4]	Pulse input 33	
[7]	Analog input X30/11	
[8]	Analog input X30/12	
[9]	Analog input X42/1	
[10]	Analog input X42/3	
[11]	Analog input X42/5	
[15]	Analog input X48/2	
[16]	Analog input X49/1	
[17]	Analog input X49/3	
[18]	Analog input X49/5	

Option	Name	Description
[19]	Pressure 3	
[20]	Pressure 4	
[99]	Normal feedback	
[100]	Bus feedback 1	Different feedback channels can be selected via fieldbus network.
[101]	Bus feedback 2	Different feedback channels can be selected via fieldbus network.
[102]	Bus feedback 3	Different feedback channels can be selected via fieldbus network.
[104]	Sensorless flow	Select this option when feedback control must be related to water flow.
[105]	Sensorless pressure	Select this option when feedback control must be related to water pressure.
[110]	Air pres. to flow	Select this option when feedback control must be related to airflow.

Parameter 24-09 Fire Mode Alarm Handling

Table 966: Parameter 24-09 Fire Mode Alarm Handling

24-09 Fire Mode Alarm Handling		
Default value: [1] Trip, critical alarms	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: False

N O T I C E

Warranty-affecting alarms. Certain alarms can affect the lifetime of the drive. Should 1 of these ignored alarms occur while in fire mode, the alarms are logged and stored in the fire-mode log.

N O T I C E

The setting in *parameter 14-20 Reset Mode* is disregarded if fire mode is active (see *parameter group 24-0* Fire Mode*).

Select an option to define the response to alarms when fire 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 fire mode and enabling fire mode again.
[2]	Trip, all alarms/test	Option for testing fire mode operation without compromising the normal handling of warnings and alarms. All alarms are handled normally as defined in 6.1.2 Alarm/Warning Code List.

Table 967: Fire Mode Alarm Handling

Alarm number	Description	Fire mode alarm handling selected in *parameter 24-09 Fire Mode Alarm Handling*. Critical alarms cause a trip.			Warranty-affecting alarms in fire mode
		[0] Trip+reset	[1] Trip	[2] Test	
4	Mains phase loss	Ignored	Ignored	(Warning/Trip)	X
7	DC over voltage	Trip+Reset	Trip	Warning/Trip	–
8	DC under voltage	Trip+Reset	Trip	Warning/Trip	–
9	Inverter overloaded	Ignored	Ignored	(Warning/Trip)	X
13	Over current	Trip+Reset	Trip	(Warning/Trip/Trip lock)	–
14	Ground fault	Trip+Reset	Trip	(Warning/Trip/Trip lock)	–
16	Short circuit	Trip+Reset	Trip	(Trip/Trip lock)	–
29	Power module temp	Ignored	Ignored	(Warning/Trip/Trip lock	X
33	Inrush fault	Ignored	Ignored	Trip/Trip lock	X
38	Internal fault	Ignored	Ignored	Trip/Trip lock	X
39	Heatsink sensor	Ignored	Ignored	(Trip/Trip lock)	X
45	Ground fault 2				–
65	Control board over temperature	Ignored	Ignored	Warning/Trip/(Trip lock)	X
68	Safe stop	Trip	Trip	Trip	–
69	Pwr card temp.	Ignored	Ignored	Trip/(Trip lock)	X
79	Illegal PS config				–
200	Fire mode				–
201	Fire M was active				–
202	Fire M limits exceeded				–
244	Heatsink temp	Ignored	Ignored	(Trip/Trip lock)	X
245	Heatsink sensor	Ignored	Ignored	(Trip/Trip lock)	X
247	Pwr.card temp	Ignored	Ignored	(Trip/Trip lock)	X
280	Fire M service warning				–
281	Fire m not working as expected				–

5.23.2 24-1* Drive Bypass

The drive includes a feature which can be used to automatically activate an external electro-mechanical bypass if the drive trips or if there is a fire-mode coast (see *parameter 24-00 Fire Mode Function*).

The bypass switches the motor top operation direct on line. The external bypass is activated by 1 of the digital outputs or relays in the drive when programmed in *parameter group 5-3* Digital Outputs* or *parameter group 5-4* Relays*.

NOTICE

After enabling the drive bypass function, the drive is no longer safety certified (for using the Safe Torque Off in versions where included).

To deactivate the drive bypass at normal operation (emergency mode not activated), carry out 1 of the following actions:

- Press [Off] on the LCP, or program 2 of the digital inputs for Hand On-Off-Auto.
- Activate external interlock via digital input.
- Carry out a power cycle.

NOTICE

The drive bypass cannot be deactivated if in fire mode. It can be deactivated only by either removing the fire mode command signal or the power supply to the drive.

When the drive bypass function is activated, the display on the LCP shows the status message *Drive Bypass*. This message has a higher priority than the fire mode status messages. When the automatic drive bypass function is enabled, it cuts in the external bypass according to the sequence shown in Illustration 100.

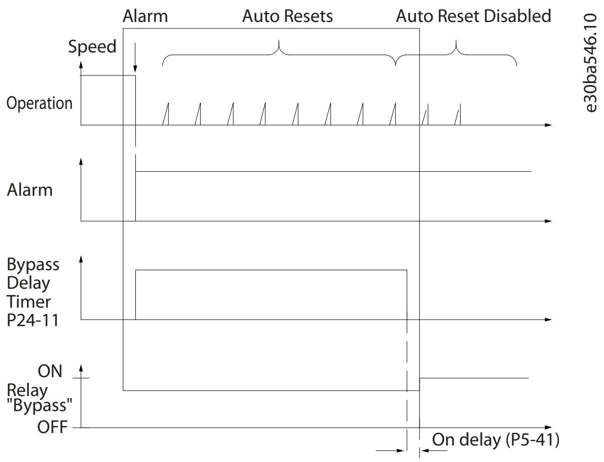


Illustration 100: Drive Bypass

The status can be read in the extended status word 2, bit number 24.

Parameter 24-10 Drive Bypass Function

Table 968: Parameter 24-10 Drive Bypass Function

24-10 Drive Bypass Function		
Default value: [0] Disabled	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

NOTICE

After enabling the drive bypass function, the Safe Torque Off function (where included) does not comply with standard EN 954-1, Cat. 3 installations.

This parameter determines the circumstances that activate the drive bypass function.

Option	Name	Description
[0]*	Disabled	
[1]	Enabled	If in normal operation, the drive bypass function is activated under the following conditions: • If there is a trip lock or a trip. • After the number of reset attempts programmed in *parameter 14-20 Reset Mode*. • If the bypass delay timer (*parameter 24-11 Drive Bypass Delay Time*) expires before reset attempts have been completed.
[2]	Enabled (Fire M Only)	

Parameter 24-11 Drive Bypass Delay Time

Table 969: Parameter 24-11 Drive Bypass Delay Time

24-11 Drive Bypass Delay Time		
Default value: 0 s	Parameter type: Range, 0 - 600 s	Setup: 2 setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Programmable in 1 s increments. Once the bypass function is activated in accordance with the setting in *parameter 24-10 Drive Bypass Function*, the bypass delay timer begins to operate. If the drive has been set for several restart attempts, the timer continues to run while the drive tries to restart. Should the motor have restarted within the time period of the bypass delay timer, the timer is reset. Should the motor fail to restart at the end of the bypass delay time, the drive bypass relay programmed for bypass in *parameter 5-40 Function Relay* is activated. If a relay delay has also been programmed in *parameter 5-41 On Delay, Relay*, [Relay] or *parameter 5-42 Off Delay, Relay* [Relay], this time must also elapse before the relay action is performed. Where no restart attempts are programmed, the timer runs for the delay period set in this parameter and activates the drive bypass relay, which has been programmed for bypass in *parameter 5-40 Function Relay*. If a relay delay has also been programmed in *parameter 5-41 On Delay, Relay* or *parameter 5-42 Off Delay, Relay* [Relay], this time must also elapse before the relay action is performed.

5.23.3 24-4* Fire Mode 2

Parameter 24-40 Fire Mode Ramp Up Time

Table 970: Parameter 24-40 Fire Mode Ramp Up Time

24-40 Fire Mode Ramp Up Time		
Default value: 3 s	Parameter type: Range, 1.0 - 3600 s, Array [8]	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

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

Parameter 24-41 Fire Mode Ramp Down Time

Table 971: Parameter 24-41 Fire Mode Ramp Down Time

24-41 Fire Mode Ramp Down Time		
Default value: 3 s	Parameter type: Range, 1.0 - 3600 s, Array [8]	Setup: All setups
Conversion index: -2	Data type: Uint32	Change during operation: True

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

Parameter 24-42 Timeout for Fire Mode Test

Table 972: Parameter 24-42 Timeout for Fire Mode Test

24-42 Timeout for Fire 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

Specify for how long fire mode is running after activation via either a digital input or configurable control word bit *Test Fire Mode*.

Parameter 24-43 Fire Mode Signal Operation

Table 973: Parameter 24-43 Fire Mode Signal Operation

24-43 Fire Mode Signal Operation		
Default value:	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

Select how fire mode signals are handled. Before changing this parameter, disable *parameter 24-00 Fire Mode Function*.

Option	Name	Description
[0]*	Standard, active-high	Normal high input and output signals operate the fire mode function as long as they are active (high).
[1]	Standard, active-low	This option adds safety rules to ensure that fire mode still operates if a signal is lost.
[2]	Impulse, set-reset	This option activates and stops the fire mode operation on high signal impulse. Operation mode is defined and activated by selected input signals and is freezed 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. **NOTICE** LCP copy and software download only accept parameter changes if *parameter 24-00 Fire Mode* is set to *[0] Disabled*.

5.23.4 24-9* Multi-Motor Funct.

Parameter 24-90 Missing Motor Function

Table 974: Parameter 24-90 Missing Motor Function

24-90 Missing Motor Function		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the action to be taken if the motor current is below the limit calculated as a function of the output frequency. The function is used for detecting, for example, a missing motor in multi-motor applications.

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

Parameter 24-91 Missing Motor Coefficient 1

Table 975: Parameter 24-91 Missing Motor Coefficient 1

24-91 Missing Motor Coefficient 1		
Default value: 0	Parameter type: Range, -10 - 10	Setup: All setups
Conversion index: -4	Data type: Int32	Change during operation: True

Enter the cubic coefficient of the missing motor detection function multiplied by 1000.

Parameter 24-92 Missing Motor Coefficient 2

Table 976: Parameter 24-92 Missing Motor Coefficient 2

24-92 Missing Motor Coefficient 2		
Default value: 0	Parameter type: Range, -100 - 100	Setup: All setups
Conversion index: -4	Data type: Int32	Change during operation: True

Enter the quadratic coefficient of the missing motor detection function multiplied by 1000.

Parameter 24-93 Missing Motor Coefficient 3

Table 977: Parameter 24-93 Missing Motor Coefficient 3

24-93 Missing Motor Coefficient 3		
Default value: 0	Parameter type: Range, -100 - 100	Setup: All setups
Conversion index: -4	Data type: Int32	Change during operation: True

Enter the linear coefficient of the missing motor detection function multiplied by 1000.

Parameter 24-94 Missing Motor Coefficient 4

Table 978: Parameter 24-94 Missing Motor Coefficient 4

24-94 Missing Motor Coefficient 4		
Default value: 0	Parameter type: Range, -500 - 500	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the constant coefficient of the missing motor detection function multiplied by 1000.

Parameter 24-95 Locked Rotor Function

Table 979: Parameter 24-95 Locked Rotor Function

24-95 Locked Rotor Function		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the action to be taken if the motor current is above the limit calculated as a function of the output frequency. The function is used for detecting, for example, a locked rotor in multi-motor applications.

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

Parameter 24-96 Locked Rotor Coefficient 1

Table 980: Parameter 24-96 Locked Rotor Coefficient 1

24-96 Locked Rotor Coefficient 1		
Default value: 0	Parameter type: Range, -10 - 10	Setup: All setups
Conversion index: -4	Data type: Int32	Change during operation: True

Enter the cubic coefficient of the locked-rotor detection function multiplied by 1000.

Parameter 24-97 Locked Rotor Coefficient 2

Table 981: Parameter 24-97 Locked Rotor Coefficient 2

24-97 Locked Rotor Coefficient 2		
Default value: 0	Parameter type: Range, -100 - 100	Setup: All setups
Conversion index: -4	Data type: Int32	Change during operation: True

Enter the quadratic coefficient of the locked-rotor detection function multiplied by 1000.

Parameter 24-98 Locked Rotor Coefficient 3

Table 982: Parameter 24-98 Locked Rotor Coefficient 3

24-98 Locked Rotor Coefficient 3		
Default value: 0	Parameter type: Range, -100 - 100	Setup: All setups
Conversion index: -4	Data type: Int32	Change during operation: True

Enter the linear coefficient of the locked-rotor detection function multiplied by 1000.

Parameter 24-99 Locked Rotor Coefficient 4

Table 983: Parameter 24-99 Locked Rotor Coefficient 4

24-99 Locked Rotor Coefficient 4		
Default value: 0	Parameter type: Range, -500 - 500	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the constant coefficient of the locked-rotor detection function multiplied by 1000.

5.24 Parameter Group 25-** Cascade Controller

Parameters for configuring the basic cascade controller for sequence control of multiple pumps. For a more application-oriented description and wiring examples, see the section *Application Examples, Cascade Controller* in the design guide.

To configure the cascade controller to the actual system and the required control strategy, follow the sequence starting with *parameter group 25-0* System Settings* and next *parameter group 25-5* Alternation Settings*. These parameters can normally be set in advance. Parameters in *parameter groups 25-2* Bandwidth Settings* and *25-4* Staging Settings* often depend on the dynamic of the system and final adjustment to be done at the commissioning of the plant.

NOTICE

The cascade controller is supposed to operate in closed loop controlled by the built-in PI controller (*[3] Closed loop* selected in *parameter 1-00 Configuration Mode*). If *[0] Open loop* is selected in *parameter 1-00 Configuration Mode*, all fixed-speed pumps are destaged, but the variable-speed pump is still controlled by the drive, now as an open-loop configuration.

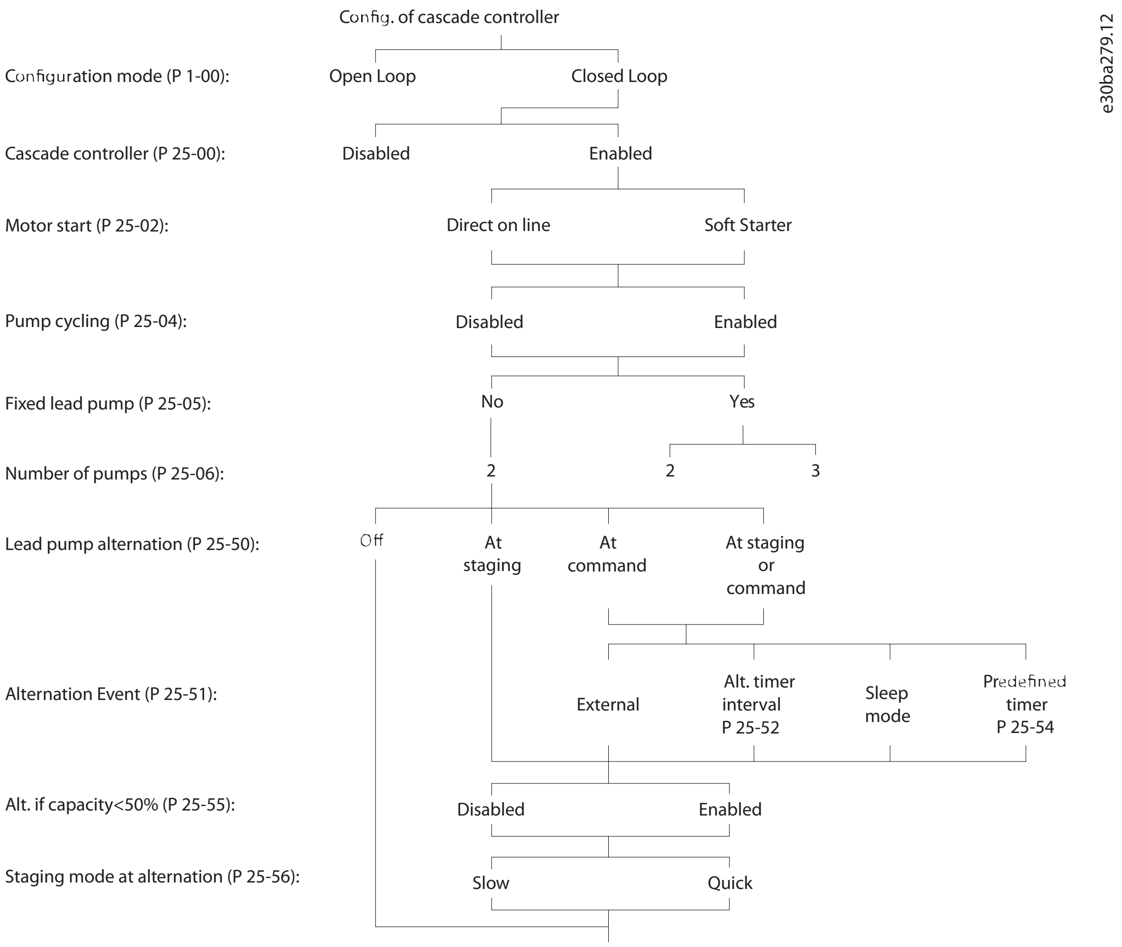


Illustration 101: Cascade Controller Sample Setup

5.24.1 25-0* System Settings

Parameter 25-00 Cascade Controller

Table 984: Parameter 25-00 Cascade Controller

25-00 Cascade Controller		
Default value: [0] Disabled	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: False

For operation of multiple devices (pump/fan) systems where capacity is adapted to actual load with speed control combined with on/off control of the devices. For simplicity, only pump systems are described. To enable the cascade controller functionality, set *parameter 1-00 Configuration Mode* to *[3] Closed loop*.

Option	Name	Description
[0]*	Disabled	The cascade controller is not active. All built-in relays assigned to pump motors in the cascade function are de-energized. If a variable-speed pump is connected to the drive directly (not controlled by a built-in relay), this pump/fan is controlled as a single-pump system.
[1]	Enabled	The cascade controller is active and stages/destages the pump according to the load on the system.

Parameter 25-02 Motor Start

Table 985: Parameter 25-02 Motor Start

25-02 Motor Start		
Default value: [0] Direct on line	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: False

Motors are connected to mains directly with a contactor or with a soft starter. When the value of *parameter 25-02 Motor Start* is set to an option other than *[0] Direct on line*, *parameter 25-50 Lead Pump Alternation* is automatically set to the default of *[0] Direct on line*.

Option	Name	Description
[0]*	Direct on line	Each fixed-speed pump is connected to mains directly via a contactor.
[1]	Soft starter	Each fixed-speed pump is connected to mains via a soft starter.
[2]	Star-Delta	Fixed pumps connected with star-delta starters are staged in the same way as pumps connected with soft starters. They are destaged in the same way as pumps connected directly to mains.

Parameter 25-04 Pump Cycling

Table 986: Parameter 25-04 Pump Cycling

25-04 Pump Cycling		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

To provide equal hours of operation with fixed-speed pumps, the pump used can be cycled. The selection of pump cycling is either first in-last out or equal running hours for each pump.

Option	Name	Description
[0]*	Disabled	The fixed-speed pumps are connected in the order 1–2 and disconnected in the order 2–1 (last in-first out).
[1]	Enabled	The fixed-speed pumps are connected/disconnected to have equal running hours for each pump.

Parameter 25-05 Fixed Lead Pump

Table 987: Parameter 25-05 Fixed Lead Pump

25-05 Fixed Lead Pump		
Default value: [1] Yes	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: False

Fixed lead pump is a configuration when the variable-speed pump is connected directly to the drive. If a contactor is applied between the drive and the pump, this contactor is not controlled by the drive. If operating with *parameter 25-50 Lead Pump Alternation* set to other than *[0] Off*, set this parameter to *[0] No*.

Option	Name	Description
[0]	No	The lead-pump function can alternate between the pumps controlled by the 2 built-in relays. Connect 1 pump to the built-in relay 1 and the other pump to relay 2. The pump function (cascade pump1 and cascade pump2) is automatically assigned to the relays (maximum 2 pumps can be controlled by the drive in this case).
[1]*	Yes	The lead pump is fixed (no alternation) and connected directly to the drive. *Parameter 25-50 Lead Pump Alternation* is automatically set to *[0] Off*. Built-in relays, relay 1 and relay 2, can be assigned to separate fixed-speed pumps. In total, the drive can control 3 pumps.

Parameter 25-06 Number of Pumps

Table 988: Parameter 25-06 Number of Pumps

25-06 Number of Pumps		
Default value: 2	Parameter type: Range, 2-3	Setup: 2 setups
Conversion index: 0	Data type: Uint8	Change during operation: False

The number of pumps connected to the cascade controller including the variable-speed pump. If the variable-speed pump is connected directly to the drive, and the other fixed-speed pumps (lag pumps) are controlled by the 2 built-in relays, 3 pumps can be controlled. If both the variable-speed and fixed-speed pumps are to be controlled by built-in relays, only 2 pumps can be connected. If *parameter 25-05 Fixed Lead Pump* is set to *[0] No*: 1 variable-speed pump and 1 fixed-speed pump, both controlled by built-in relay. If *parameter 25-05 Fixed Lead Pump* is set to *[1] Yes*: 1 variable-speed pump and 1 fixed-speed pump controlled by built-in relays. 1 lead pump, see *parameter 25-05 Fixed Lead Pump*. 2 fixed-speed pumps controlled by built-in relays.

5.24.2 25-2* Bandwidth Settings

Parameters for setting the bandwidth within which the pressure is allowed to operate before staging/destaging fixed-speed pumps. The parameter group also includes various timers to stabilize control.

Parameter 25-20 Staging Bandwidth

Table 989: Parameter 25-20 Staging Bandwidth

25-20 Staging Bandwidth		
Default value: 10%	Parameter type: Range, 1 - par. 25-21 %	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Set the staging bandwidth (SBW) percentage to accommodate normal system pressure fluctuation. In cascade control systems, to avoid frequent switching of fixed speed pumps, the desired system pressure is typically kept within a bandwidth rather than at a constant level. The SBW is programmed as a percentage of *parameter 20-13 Minimum Reference/ Feedb.* and *parameter 20-14 Maximum Reference/Feedb*. For example, if the setpoint is 5 bar and the SBW is set to 10%, a system pressure between 4.5 and 5.5 bar is tolerated. No staging or de-staging occurs within this bandwidth.

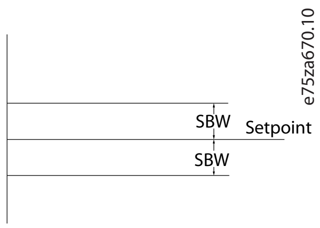


Illustration 102: Staging Bandwidth

Parameter 25-21 Override Bandwidth

Table 990: Parameter 25-21 Override Bandwidth

25-21 Override Bandwidth		
Default value: 100%	Parameter type: Range, par. 25-20 - 100 %	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

When a large and quick change in the system demand occurs (such as a sudden water demand), the system pressure rapidly changes and an immediate staging or destaging of a fixed-speed pump becomes necessary to match the requirement. The override bandwidth (OBW) is programmed to override the staging/destaging timer (*parameter 25-23 SBW Staging Delay* and *parameter 25-24 SBW Destaging Delay*) for immediate response. Always program the OBW to a higher value than the value set in *parameter 25-20 Staging Bandwidth*. The OBW is a percentage of *parameter 3-02 Minimum Reference* and *parameter 3-03 Maximum Reference*.

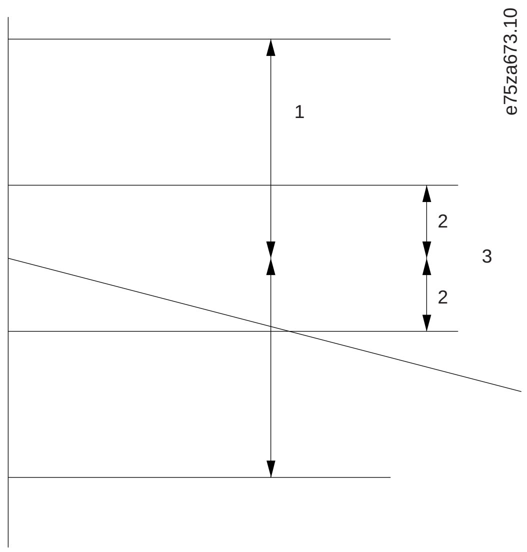


Illustration 103: Override Bandwidth

1	Override bandwidth	3	Setpoint
2	SBW		

Setting the OBW too close to the SBW could defeat the purpose with frequent staging at momentary pressure changes. Setting the OBW too high might lead to unacceptably high or low pressure in the system while the SBW timers are running. The value can be optimized with increased familiarity with the system. See *parameter 25-25 OBW Time*. To avoid unintended staging during the commissioning phase and fine-tuning of the controller, initially leave the OBW at the factory setting of 100% (Off). When the fine-tuning is completed, set the OBW to the required value. Initial value of 10% is suggested.

Parameter 25-22 Fixed Speed Bandwidth

Table 991: Parameter 25-22 Fixed Speed Bandwidth

25-22 Fixed Speed Bandwidth		
Default value: Size related	Parameter type: Range, par. 25-20 - par. 25-21 %	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

When the cascade control system runs normally and the drive issues a trip alarm, it is important to maintain the system head. The cascade controller does this by continuing to stage/destage the fixed-speed pump on and off. As keeping the head at the setpoint would require frequent staging and destaging when only a fixed-speed pump is running, a wider fixed-speed bandwidth (FSBW) is used instead of SBW. In alarm situations, or if the start signal on the digital input goes low, it is possible to stop the fixed-speed pumps by pressing [Off] or [Hand On]. If the issued alarm is a trip lock alarm, the cascade controller stops the system immediately by cutting out all the fixed-speed pumps. This is basically the same as emergency stop (coast/coast inverse command) for the cascade controller.

Parameter 25-23 SBW Staging Delay

Table 992: Parameter 25-23 SBW Staging Delay

25-23 SBW Staging Delay		
Default value: 15 s	Parameter type: Range, 0 - 3000 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Immediate staging of a fixed-speed pump is not desirable when a momentary pressure drop in the system exceeds the staging bandwidth (SBW). Staging is delayed by the length of the time programmed. If the pressure increases within the SBW before the timer has elapsed, the timer is reset.

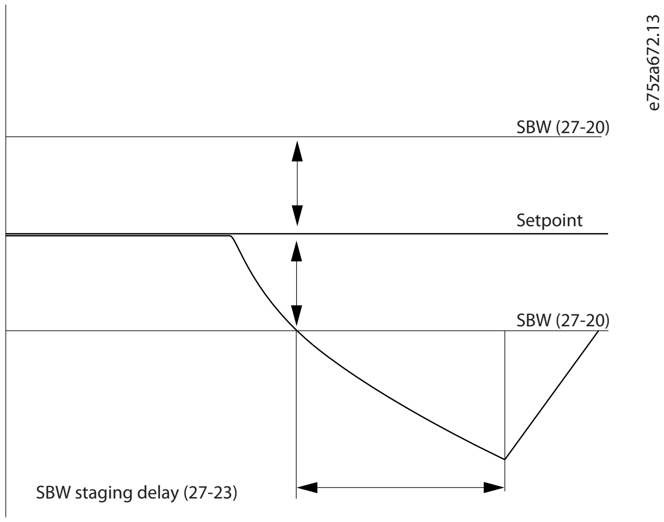


Illustration 104: SBW Staging Delay

Parameter 25-24 SBW Destaging Delay

Table 993: Parameter 25-24 SBW Destaging Delay

25-24 SBW Destaging Delay		
Default value: 15 s	Parameter type: Range, 0 - 3000 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Immediate destaging of a fixed-speed pump is not recommended when a momentary pressure increases in the system that exceeds the staging bandwidth (SBW). Destaging is delayed by the length of time programmed. If the pressure decreases within the SBW before the timer has elapsed, the timer is reset.

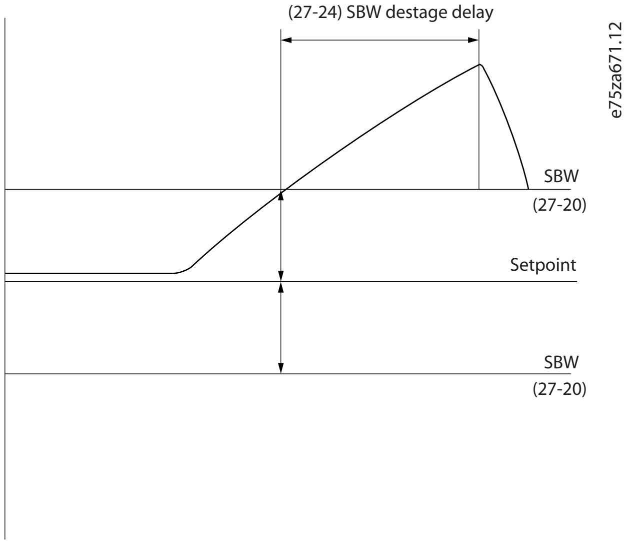


Illustration 105: SBW Destaging Delay

Parameter 25-25 OBW Time

Table 994: Parameter 25-25 OBW Time

25-25 OBW Time		
Default value: 10 s	Parameter type: Range, 0 - 300 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Staging a fixed-speed pump creates a momentary pressure peak in the system, which might exceed the override bandwidth (OBW). It is not recommended to destage a pump in response to a staging pressure peak. The OBW time can be programmed to prevent staging until the system pressure has stabilized and normal control established. Set the timer to a value that allows the system to stabilize after staging. The 10 s factory setting is appropriate in most applications. In highly dynamic systems, a shorter time may be wanted.

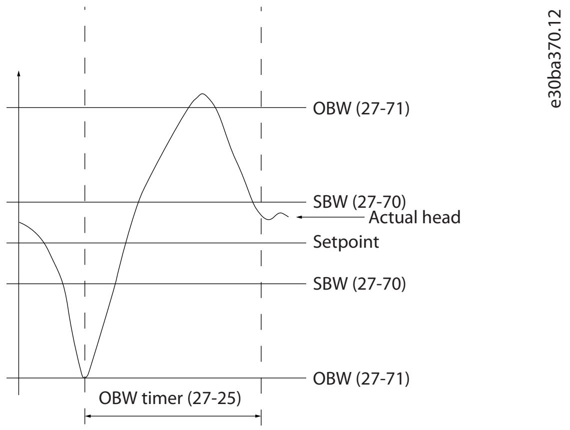


Illustration 106: Override Bandwidth Time

Parameter 25-26 Destage at No-Flow

Table 995: Parameter 25-26 Destage at No-Flow

25-26 Destage at No-Flow		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

This parameter ensures that when a no-flow situation occurs, the fixed-speed pumps are destaged 1 by 1 until the no-flow signal disappears. This requires that no-flow detection is active. See *parameter group 22-2* No-Flow Detection*. If *[0] Disabled* is selected, the cascade controller does not change the normal behavior of the system.

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

Parameter 25-27 Stage Function

Table 996: Parameter 25-27 Stage Function

25-27 Stage Function		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

If the stage function is set to *[0] Disabled*, *parameter 25-28 Stage Function Time* is not activated.

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

Parameter 25-28 Stage Function Time

Table 997: Parameter 25-28 Stage Function Time

25-28 Stage Function Time		
Default value: 15 s	Parameter type: Range, 0 - 300 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

The stage function time is programmed to avoid frequent staging of the fixed-speed pumps. The stage function time starts if *[1] Enabled* is selected in *parameter 25-27 Stage Function*, and the variable-speed pump runs at motor speed high limit (*parameter 4-13 Motor Speed High Limit [RPM]* or *parameter 4-14 Motor Speed High Limit [Hz]*) with at least 1 fixed-speed pump in the stop position. When the programmed value of the timer expires, a fixed-speed pump is staged.

Parameter 25-29 Destage Function

Table 998: Parameter 25-29 Destage Function

25-29 Destage Function		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

The destage function ensures that the lowest numbers of pumps are running to save energy and to avoid dead-head water circulation in the variable-speed pump. If the destage function is set to *[0] Disabled*, *parameter 25-30 Destage Function Time* is not activated.

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

Parameter 25-30 Destage Function Time

Table 999: Parameter 25-30 Destage Function Time

25-30 Destage Function Time		
Default value: 15 s	Parameter type: Range, 0 - 300 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

The destage function timer is programmable to avoid frequent staging/destaging of the fixed-speed pumps. The destage function time starts when the adjustable-speed pump is running at *parameter 4-11 Motor Speed Low Limit [RPM]* or *parameter 4-12 Motor Speed Low Limit [Hz]*, with 1 or more fixed-speed pumps in operation and system requirements satisfied. In this situation, the adjustable-speed pump contributes a little to the system. When the programmed value of the timer expires, a stage is removed, avoiding dead-head water circulation in the adjustable-speed pump.

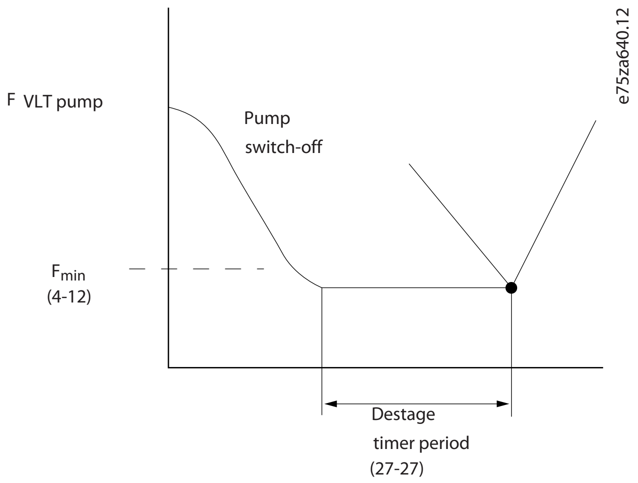


Illustration 107: Destage Function Time

5.24.3 25-4* Staging Settings

Use the parameters in this group to determine the conditions for staging/destaging the pumps.

N O T I C E
Fixed pumps connected with star-delta starters are staged in the same way as pumps connected with soft starters. They are de-staged in the same way as pumps connected directly to mains.

Parameter 25-40 Ramp Down Delay

Table 1000: Parameter 25-40 Ramp Down Delay

25-40 Ramp Down Delay		
Default value: 10 s	Parameter type: Range, 0 - 120 s	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

N O T I C E
Use this option only if *[1] Soft starter* or *[2] Star-Delta* is selected in *parameter 25-02 Motor Start*.

When adding a fixed-speed pump controlled by a soft starter or a star-delta starter, it is possible to delay the ramp down of the lead pump until a preset time after the start of the fixed-speed pump. This delay eliminates pressure surges or water hammer in the system.

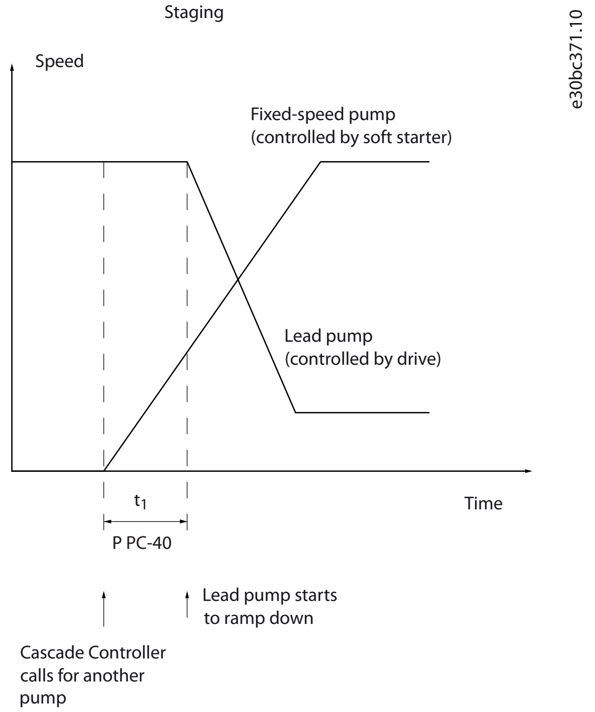


Illustration 108: Staging with Ramp-down Delay

Parameter 25-41 Ramp Up Delay

Table 1001: Parameter 25-41 Ramp Up Delay

25-41 Ramp Up Delay		
Default value: 2 s	Parameter type: Range, 0 - 12 s	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

NOTICE

Use this option only if *[1] Soft starter* is selected in *parameter 25-02 Motor Start*.

When removing a fixed-speed pump controlled by a soft starter, it is possible to delay the ramp up of the lead pump until a preset time after the stop of the fixed-speed pump. This delay eliminates pressure surges or water hammer in the system.

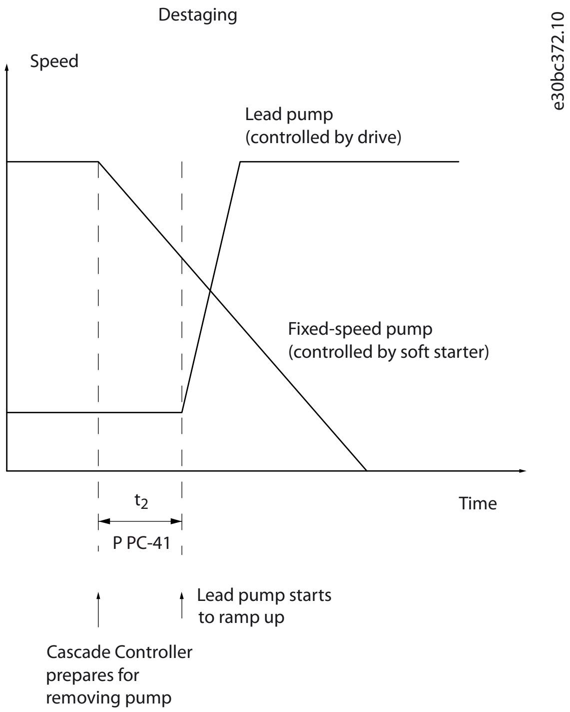


Illustration 109: Destaging with Ramp-up Delay

Parameter 25-42 Staging Threshold

Table 1002: Parameter 25-42 Staging Threshold

25-42 Staging Threshold		
Default value: Size related	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

When adding a fixed-speed pump to prevent an overshoot of pressure, the variable-speed pump ramps down to a lower speed. When the variable-speed pump reaches the staging speed, the fixed-speed pump is staged on. The staging threshold is used to calculate the speed of the variable-speed pump when the "cut-in point" of the fixed-speed pump occurs. The calculation of the staging threshold is the ratio of *parameter 4-11 Motor Speed Low Limit [RPM]* or *parameter 4-12 Motor Speed Low Limit [Hz]*, to *parameter 4-13 Motor Speed High Limit [RPM]* or *parameter 4-14 Motor Speed High Limit [Hz]*, expressed in percent. Staging threshold must range from

$$\text{Stage}\,\% = \frac{\text{LOW}}{\text{HIGH}} \times 100\%$$

to 100%, where n_{HIGH} is motor speed high limit.

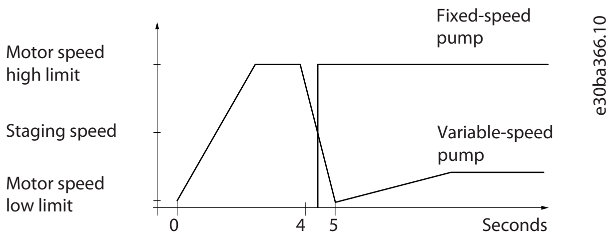


Illustration 110: Staging Threshold

Parameter 25-43 Destaging Threshold

Table 1003: Parameter 25-43 Destaging Threshold

25-43 Destaging Threshold		
Default value: Size related	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

When removing a fixed-speed pump to prevent an undershoot of pressure, the variable-speed pump ramps up to a higher speed. When the variable-speed pump reaches the destaging speed, the fixed-speed pump is destaged. The destaging threshold is used to calculate the speed of the variable-speed pump when the destaging of the fixed-speed pump occurs. The calculation of the destaging threshold is the ratio of *parameter 4-11 Motor Speed Low Limit [RPM]* or *parameter 4-12 Motor Speed Low Limit [Hz]*, to *parameter 4-13 Motor Speed High Limit [RPM]* or *parameter 4-14 Motor Speed High Limit [Hz]*, expressed in percent. Destaging threshold must range from

$$\text{Stage \%} = \frac{\text{LOW}}{\text{HIGH}} \times 100\%$$

to 100%, where n_{LOW} is motor speed low limit and n_{HIGH} is motor speed high limit.

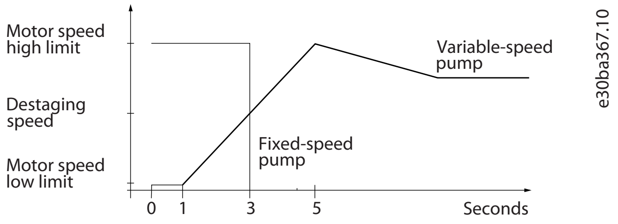


Illustration 111: Destaging Threshold

Parameter 25-44 Staging Speed [RPM]

Table 1004: Parameter 25-44 Staging Speed [RPM]

25-44 Staging Speed [RPM]		
Default value: 0 RPM	Parameter type: Range, 000 - 0 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Readout of the calculated value for staging speed. When adding a fixed-speed pump to prevent an overshoot of pressure, the variable-speed pump ramps down to a lower speed. When the variable-speed pump reaches the staging speed, the fixed-speed pump is staged on. Staging speed calculation is based on *parameter 25-42 Staging Threshold* and *parameter 4-13 Motor Speed High Limit [RPM]*. Staging speed is calculated with the following formula:

$$\eta_{STAGE} = \eta_{HIGH} \frac{\eta_{STAGE\,\%}}{100}$$

where n_{HIGH} is motor speed high limit and $n_{STAGE100\%}$ is the value of the staging threshold.

Parameter 25-46 Destaging Speed [RPM]

Table 1005: Parameter 25-46 Destaging Speed [RPM]

25-46 Destaging Speed [RPM]		
Default value: 0 RPM	Parameter type: Range, 000 - 0 RPM	Setup: All setups
Conversion index: 67	Data type: Uint16	Change during operation: True

Readout of the calculated value for destaging speed. When removing a fixed-speed pump to prevent an undershoot of pressure, the variable-speed pump ramps up to a higher speed. When the variable-speed pump reaches the destaging speed, the fixed-speed pump is destaged. Destaging speed is calculated based on *parameter 25-43 Destaging Threshold* and *parameter 4-13 Motor Speed High Limit [RPM]*. Destaging speed is calculated with the following formula:

$$\eta_{DESTAGE} = \eta_{HIGH}\frac{\eta_{DESTAGE\,\%}}{100}$$

where n_{HIGH} is motor speed high limit and $n_{DESTAGE100\%}$ is the value of the destaging threshold.

Table 1006: Parameter 25-47 Destaging Speed [Hz]

25-47 Destaging Speed [Hz]		
Default value: 0 Hz	Parameter type: Range, 0 - 0 Hz	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

Readout of the calculated value for destaging speed. When removing a fixed-speed pump to prevent an undershoot of pressure, the variable-speed pump ramps up to a higher speed. When the variable-speed pump reaches the destaging speed, the fixed-speed pump is destaged. Destaging speed is calculated based on *parameter 25-43 Destaging Threshold* and *parameter 4-14 Motor Speed High Limit [Hz]*. Destaging speed is calculated with the following formula:

$$\eta_{STAGE} = \eta_{HIGH}\frac{\eta_{STAGE\,\%}}{100}$$

where n_{HIGH} is motor speed high limit and $n_{STAGE100\%}$ is the value of the staging threshold.

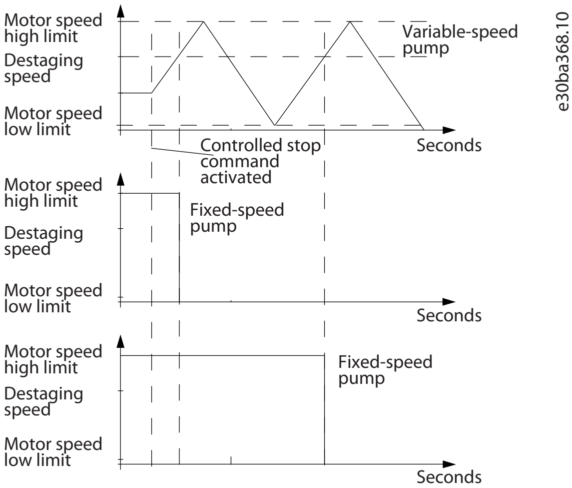


Illustration 112: Destaging Speed

5.24.4 25-5* Alternation Settings

The parameters in this group are for defining the conditions for alternation of the variable-speed pump if alternation is selected as control strategy.

Parameter 25-50 Lead Pump Alternation

Table 1007: Parameter 25-50 Lead Pump Alternation

25-50 Lead Pump Alternation		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

NOTICE

If *parameter 25-05 Fixed Lead Pump* is set to *[1] Yes*, it is only possible to select *[0] Off*.

Lead pump alternation equalizes the use of pumps by periodically changing the pump that is speed-controlled. This ensures that pumps are equally used over time. Alternation equalizes the usage of pumps by always selecting the pump with the lowest number of hours run to stage on next.

Option	Name	Description
[0]*	Off	No alternation of lead-pump function takes place. If *parameter 25-02 Motor Start* is set to other than *[0] Direct on line*, it is not possible to set this parameter to options other than *[0] Off*.
[1]	At staging	Alternation of the lead-pump function takes place when staging another pump.
[2]	At command	Alternation of the lead-pump function takes place at an external command signal or a preprogrammed event. See *parameter 25-51 Alternation Event* for available options.
[3]	At staging or command	Alternation of the lead pump takes place at staging or according to *[2] At command*.

Parameter 25-51 Alternation Event

Table 1008: Parameter 25-51 Alternation Event

25-51 Alternation Event		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

This parameter is only active if the options *[2] At command* or *[3] At staging or command* have been selected in *parameter 25-50 Lead Pump Alternation*. If an alternation event is selected, the alternation of lead pump takes place every time the event occurs.

Option	Name	Description
[0]*	External	Alternation takes place when a signal is applied to 1 of the digital inputs on the terminal strip and this input has been assigned to *[121] Lead Pump Alternation* in *parameter group 5-1*, Digital Inputs*.
[1]	Alternation time interval	Alternation takes place every time *parameter 25-52 Alternation Time Interval* expires.
[2]	Sleep mode	Alternation takes place each time the lead pump goes into sleep mode. Set *parameter 20-23 Setpoint 3* to *[1] Sleep Mode* or apply an external signal for this function.
[3]	Predefined time	Alternation takes place at a defined time of the day. If *parameter 25-54 Alternation Predefined Time* is set, the alternation is carried out every day at the specified time. Default time is midnight (00:00 or 12:00AM depending on the time format).

Parameter 25-52 Alternation Time Interval

Table 1009: Parameter 25-52 Alternation Time Interval

25-52 Alternation Time Interval		
Default value: 24 h	Parameter type: Range, 1 - 999 h	Setup: All setups
Conversion index: 74	Data type: Uint16	Change during operation: True

If selecting *[1] Alternation time interval* in *parameter 25-21 Alternation Event*, the alternation of the variable-speed pump takes place every time the alternation time interval expires (can be checked in *parameter 25-53 Alternation Time Value*). The timer pauses when the drive is not running.

Parameter 25-53 Alternation Timer Value

Table 1010: Parameter 25-53 Alternation Timer Value

25-53 Alternation Timer Value		
Default value: 0	Parameter type: Range, 0 - 7	Setup: All setups
Conversion index: 0	Data type: VisStr[7]	Change during operation: True

Readout parameter for the alternation time interval value set in *parameter 25-52 Alternation Time Interval*.

Parameter 25-54 Alternation Predefined Time

Table 1011: Parameter 25-54 Alternation Predefined Time

25-54 Alternation Predefined Time		
Default value: Size related	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: TimeOfDaywoDate	Change during operation: True

If selecting *[3] Predefined Time* in *parameter 25-51 Alternation Event*, the variable-speed pump alternation is carried out every day at the specified time set in alternation predefined time. Default time is midnight (00:00 or 12:00AM depending on the time format).

Parameter 25-55 Alternation if Load < 50%

Table 1012: Parameter 25-55 Alternation if Load < 50%

25-55 Alternation if Load < 50%		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

N O T I C E

Only valid if *parameter 25-50 Lead Pump Alternation* is different from *[0] Off*.

If selecting *[1] Enabled*, the pump alternation can only occur if the capacity is equal to or below 50%. The capacity calculation is the ratio of running pumps (including the variable-speed pump) to the total number of available pumps (including variable-speed pump, but not those that are interlocked).

$$\text{Capacity} = \frac{N_{\text{RUNNING}}}{N_{\text{TOTAL}}} \times 100\%$$

For the basic cascade controller, all pumps are of equal size.

Option	Name	Description
[0]	Disabled	The lead-pump alternation takes place at any pump capacity.
[1]*	Enabled	The lead-pump function is alternated only if the number of pumps running are providing less than 50% of total pump capacity.

Parameter 25-56 Staging Mode at Alternation

Table 1013: Parameter 25-56 Staging Mode at Alternation

25-56 Staging Mode at Alternation		
Default value: [0] Slow	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

N O T I C E

Only valid if *parameter 25-50 Lead Pump Alternation* is different from *[0] Off*.

This parameter is only active if the option selected in *parameter 25-50 Lead Pump Alternation* is different from *[0] Off*. 2 types of staging and destaging of pumps are possible. Slow transfer makes staging and destaging smooth. Quick transfer makes staging and destaging as fast as possible; the variable-speed pump is just cut out (coasted).

Option	Name	Description
[0]*	Slow	At alternation, the variable-speed pump is ramped up to maximum speed and then ramped down to a standstill.
[1]	Quick	At alternation, the variable-speed pump is ramped up to maximum speed and then coasted to a standstill.
[2]	Slow down	At alternation, the variable-speed pump is ramped down to a standstill.

The following illustration is an example of the slow transfer-staging. The variable-speed pump (top graph) and 1 fixed-speed pump (bottom graph) run before the staging command. When the *[0] Slow transfer command* is activated, an alternation is carried out by ramping the variable-speed pump to *parameter 4-13 Motor Speed High Limit [RPM]* or *parameter 4-14 Motor Speed High Limit [Hz]*, and then decelerated to zero speed. After a delay before starting the next pump (*parameter 25-58 Run Next Pump Delay*), the next lead pump (middle graph) is accelerated and another original lead pump (top graph) is added after the delay before running on mains (*parameter 25-59 Run on Mains Delay*) as a fixed-speed pump. The next lead pump (middle graph) is decelerated to motor speed low limit and then allowed to vary speed to maintain system pressure.

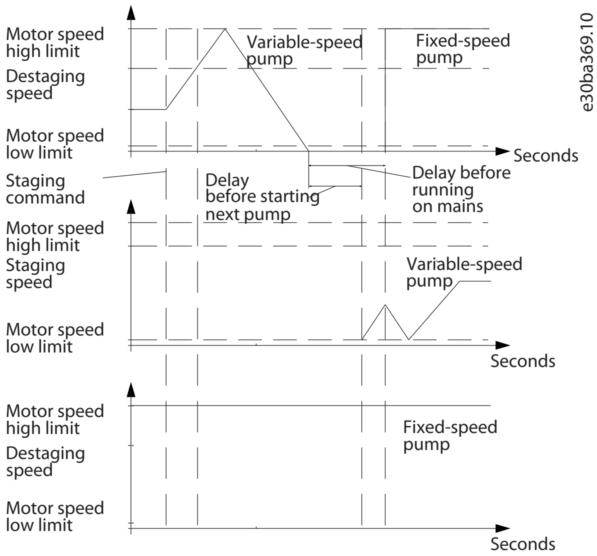


Illustration 113: Staging Mode at Alternation

Parameter 25-58 Run Next Pump Delay

Table 1014: Parameter 25-58 Run Next Pump Delay

25-58 Run Next Pump Delay		
Default value: 0.1 s	Parameter type: Range, 0.1 - 5 s	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

This parameter is only active if the option selected in *parameter 25-50 Lead Pump Alternation* is different from *[0] Off*. This parameter sets the time between stopping the old variable-speed pump and starting another pump as a new variable-speed pump. Refer to *parameter 25-56 Staging Mode at Alternation* for a description of staging and alternation.

Parameter 25-59 Run on Mains Delay

Table 1015: Parameter 25-59 Run on Mains Delay

25-59 Run on Mains Delay		
Default value: 0.5 s	Parameter type: Range, Par. 25-58 - 5 s	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: True

NOTICE

This parameter is only active if the option selected in *parameter 25-50 Lead Pump Alternation* is different from *[0] Off*.

This parameter sets the time between stopping the old variable-speed pump and starting this pump as a new fixed-speed pump. Refer to Illustration 113 for a description of staging and alternation.

5.24.5 25-8* Status

Readout parameters informing about the operation status of the cascade controller and the pumps controlled.

Parameter 25-80 Cascade Status

Table 1016: Parameter 25-80 Cascade Status

25-80 Cascade Status		
Default value: 0	Parameter type: Range, 0 - 25	Setup: All setups
Conversion index: 0	Data type: VisStr[25]	Change during operation: True

Readout of the status of the cascade controller.

Parameter 25-81 Pump Status

Table 1017: Parameter 25-81 Pump Status

25-81 Pump Status		
Default value: 0	Parameter type: Range, 0 - 25	Setup: All setups
Conversion index: 0	Data type: VisStr[25]	Change during operation: True

Pump status shows the status for the number of pumps selected in *parameter 25-06 Number of Pumps*. It is a readout of the status for each of the pumps showing a string, which consists of the pump number and the status of the pump. Example: Readout is with the abbreviation like “1:D 2:O” This means that pump 1 is running and the speed is controlled by the drive, and pump 2 is stopped.

Parameter 25-82 Lead Pump

Table 1018: Parameter 25-82 Lead Pump

25-82 Lead Pump		
Default value: 0	Parameter type: Range, 0 - par. 25-06	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Readout parameter for the actual variable-speed pump in the system. The lead-pump parameter is updated to reflect the current variable-speed pump in the system when an alternation takes place. If no lead pump is selected (cascade controller disabled or all pumps interlocked), the display shows N1.

Parameter 25-83 Relay Status

Table 1019: Parameter 25-83 Relay Status

25-83 Relay Status		
Default value: 0	Parameter type: Range, 0 - 4, Array [9]	Setup: All setups
Conversion index: 0	Data type: VisStr[4]	Change during operation: True

Readout of the status for each of the relays assigned to control the pumps. Every element in the array shows a relay. If a relay is activated, the corresponding element is set to On. If a relay is deactivated, the corresponding element is set to Off.

Parameter 25-84 Pump ON Time

Table 1020: Parameter 25-84 Pump ON Time

25-84 Pump ON Time		
Default value: 0 h	Parameter type: Range, 0 - 2147483647 h, Array [10]	Setup: All setups
Conversion index: 74	Data type: Uint32	Change during operation: True

Readout of the value for pump ON time. The cascade controller has separate counters for the pumps and for the relays that control the pumps. Pump ON time monitors the operating hours of each pump. The value of each pump ON time counter can be reset to 0 by writing in the parameter, for example, if the pump is replaced at a service.

Parameter 25-85 Relay ON Time

Table 1021: Parameter 25-85 Relay ON Time

25-85 Relay ON Time		
Default value: 0 h	Parameter type: Range, 0 - 2147483647 h, Array [9]	Setup: All setups
Conversion index: 74	Data type: Uint32	Change during operation: True

Readout of the value for relay ON time. The cascade controller has separate counters for the pumps and for the relays that control the pumps. Pump cycling is always done based on the relay counters, otherwise it would always use the new pump if a pump is replaced and its value in *parameter 25-84 Pump ON Time* is reset. To use *parameter 25-04 Pump Cycling*, the cascade controller is monitoring the relay ON time.

Parameter 25-86 Reset Relay Counters

Table 1022: Parameter 25-86 Reset Relay Counters

25-86 Reset Relay Counters		
Default value: [0] Do not reset	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Resets all elements in *parameter 25-85 Relay ON Time* counters.

Option	Name	Description
[0]*	Do not reset	
[1]	Reset	

5.24.6 25-9* Service

Parameters used if there is a service on 1 or more of the pumps controlled.

Parameter 25-90 Pump Interlock

Table 1023: Parameter 25-90 Pump Interlock

25-90 Pump Interlock		
Default value: [0] Off	Parameter type: Option, Array [10]	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

In this parameter, it is possible to disable 1 or more of the fixed lead pumps. For example, the pump is not selected for staging on even if it is the next pump in the operation sequence. It is not possible to disable the lead pump with the pump interlock command. The digital input interlocks are selected as *[130] Pump 1 interlock – [132] Pump 3 interlock* in *parameter group 5-1* Digital In/Out*.

Option	Name	Description
[0]*	Off	The pump is active for staging/destaging.
[1]	On	The pump interlock command is given. If a pump runs, it is immediately destaged. If the pump does not run, it is not allowed to stage on.

Parameter 25-91 Manual Alternation

Table 1024: Parameter 25-91 Manual Alternation

25-91 Manual Alternation		
Default value: 0	Parameter type: Range, 0 - par. 25-06	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

Readout parameter for the actual variable-speed pump in the system. When an alternation takes place, the lead pump parameter is updated to reflect the current variable-speed pump in the system. If no lead pump is selected (cascade controller disabled or all pumps interlocked), the display shows N1.

5.25 Parameter Group 26-** Analog I/O Option

VLT® Analog I/O Option MCB 109 extends the functionality of VLT® drives by adding some more, programmable analog inputs and outputs. This could be especially useful in building management system installations where the drive may be used as decentral I/O, obviating the need for an outstation and thus reducing cost.

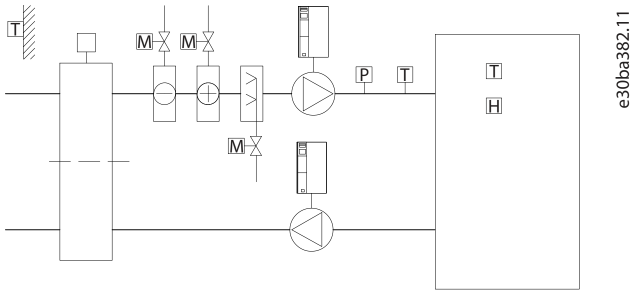


Illustration 114: VLT® Analog I/O Option MCB 109 in an Air-handling Unit

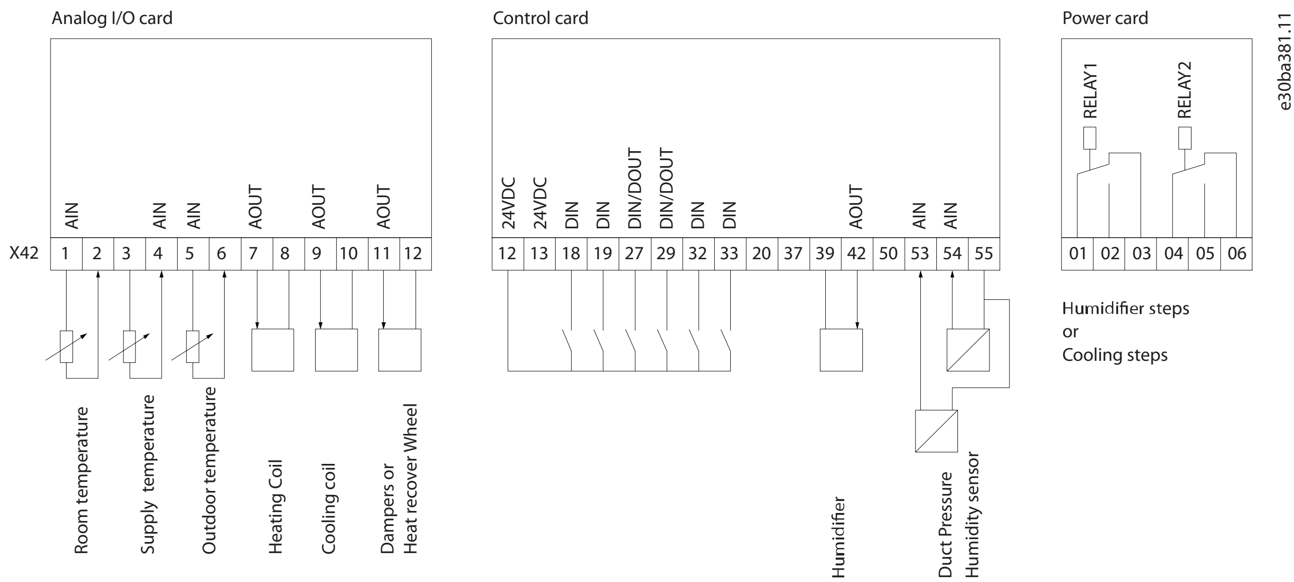


Illustration 115: Overview of Terminals, VLT® Analog I/O Option MCB 109

Illustration 114 shows a typical air-handling unit (AHU). As shown in the illustration, adding an analog I/O option offers the possibility to control all functions via the drive, such as inlet, return-, and exhaust dampers, or heating/cooling coils with temperature and pressure measurements being read by the drive.

NOTICE

The maximum current for the analog outputs 0–10 V is 1 mA.

NOTICE

Where live zero monitoring is used, it is important that any analog inputs not being used for the drive, that is, being used as part of the building management system decentral I/O, should have their live zero-function disabled.

Table 1025: Relevant Parameters

Terminal	Parameters	Terminal	Parameters	Terminal	Parameters
Analog inputs		Analog inputs		Relays	
X42/1	*Parameter 26-00 terminal X42/1 Mode, 26-1**	53	6-1*	Relay 1 term 1, 2, 3	5-4*
X42/3	*Parameter 26-01 terminal X42/3 Mode, 26-2**	54	6-2*	Relay 2 term 4, 5, 6	5-4*
X42/5	*Parameter 26-02 terminal X42/5 Mode, 26-3**				
Analog outputs		Analog outputs			
X42/7	*Parameter group 26-4* Analog Out X42/7*	42	6-5*		
X42/9	*Parameter group 26-5* Analog Out X42/9*				
X42/11	*Parameter group 26-6* Analog Out X42/11*				

It is also possible to read the analog inputs, write to the analog outputs, and control the relays, using communication via the fieldbus. In this instance, these are the relevant parameters.

Table 1026: Relevant Parameters when using Fieldbus

Terminal	Parameters	Terminal	Parameters	Terminal	Parameters
Analog inputs (read)		Analog inputs (read)		Relays	
X42/1	*Parameter 18-30 Analog Input X42/1*	53	*Parameter 16-62 Analog Input 53*	Relay term 1, 2, 3	*Parameter 16-71 Relay Output [bin]*
X42/3	*Parameter 18-31 Analog Input X42/3*	54	*Parameter 16-64 Analog Input 54*	Relay term 4, 5, 6	*Parameter 16-71 Relay Output [bin]*
X42/5	*Parameter 18-32 Analog Input X42/5*				
Analog outputs (write)		Analog outputs (write)			

Terminal	Parameters	Termi-nal	Parameters	Terminal	Parameters
X42/7	*Parameter 18-33 Analog Out X42/7 [V]*	42	*Parameter 6-53 Terminal 42 Output Bus Control*	NOTICE: Enable the relay outputs via control word bit 11 (relay 1) and bit 12 (relay 2).	
X42/9	*Parameter 18-34 Analog Out X42/9 [V]*				
X42/99	*Parameter 18-35 analog Out X42/11 [V]*				

Setting of on-board real-time clock

The analog I/O option incorporates a real-time clock with battery backup. This can be used as backup of the clock function included in the drive as standard. See *parameter group 0-7* Clock Settings*.

The analog I/O option can be used for the control of devices such as actuators or valves, using the extended closed-loop facility, thus removing control from the building management system. See *parameter group 21-** Extended Closed Loop*. There are 3 independent closed-loop PID controllers.

5.25.1 26-0* Analog I/O Mode

Parameter group for setting up the analog I/O configuration. The option is equipped with 3 analog inputs. These analog inputs can be freely allocated to either voltage (0–10 V), Pt 1000, or Ni 1000 temperature sensor input.

Parameter 26-00 Terminal X42/1 Mode

Table 1027: Parameter 26-00 Terminal X42/1 Mode

26-00 Terminal X42/1 Mode		
Default value: [1] Voltage	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Terminal X42/1 can be programmed as an analog input accepting a voltage or input from either Pt 1000 (1000 Ω at 0 °C (32 °F)) or Ni 1000 (1000 Ω at 0 °C (32 °F)) temperature sensors. Select the mode. *[2] Pt 1000 [°C]* and *[4] Ni 1000 [°C]* if operating in Celsius, or *[3] Pt 1000 [°F]* and *[5] Ni 1000 [°F]* if operating in Fahrenheit.

NOTICE

If the input is not in use, set it for voltage.

If set for temperature and used as feedback, set the unit for either Celsius or Fahrenheit.

- *Parameter 20-12 Reference/ Feedback Unit.*
- *Parameter 21-10 Ext. 1 Ref./ Feedback Unit.*
- *Parameter 21-30 Ext. 2 Ref./ Feedback Unit.*
- *Parameter 21-50 Ext. 3 Ref./ Feedback Unit.*

Option	Name	Description
[1]*	Voltage	
[2]	Pt 1000 [°C]	
[3]	Pt 1000 [°F]	
[4]	Ni 1000 [°C]	
[5]	Ni 1000 [°F]	

Parameter 26-01 Terminal X42/3 Mode

Table 1028: Parameter 26-01 Terminal X42/3 Mode

26-01 Terminal X42/3 Mode		
Default value: [1] Voltage	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Terminal X42/3 can be programmed as an analog input accepting a voltage or input from either Pt 1000 (1000 Ω at 0 °C (32 °F)) or Ni 1000 (1000 Ω at 0 °C (32 °F)) temperature sensors. Select the mode. *[2] Pt 1000 [°C]* and *[4] Ni 1000 [°C]* if operating in Celsius, or *[3] Pt 1000 [°F]* and *[5] Ni 1000 [°F]* if operating in Fahrenheit.

N O T I C E

If the input is not in use, set it for voltage.

If set for temperature and used as feedback, set the unit for either Celsius or Fahrenheit.

- *Parameter 20-12 Reference/ Feedback Unit.*
- *Parameter 21-10 Ext. 1 Ref./ Feedback Unit.*
- *Parameter 21-30 Ext. 2 Ref./ Feedback Unit.*
- *Parameter 21-50 Ext. 3 Ref./ Feedback Unit.*

Option	Name	Description
[1]*	Voltage	
[2]	Pt 1000 [°C]	
[3]	Pt 1000 [°F]	
[4]	Ni 1000 [°C]	
[5]	Ni 1000 [°F]	

Table 1029: Parameter 26-02 Terminal X42/5 Mode

26-02 Terminal X42/5 Mode		
Default value: [1] Voltage	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Terminal X42/5 can be programmed as an analog input accepting a voltage or input from either Pt 1000 (1000 Ω at 0 °C (32 °F)) or Ni 1000 (1000 Ω at 0 °C (32 °F)) temperature sensors. Select the mode. *[2] Pt 1000 [°C]* and *[4] Ni 1000 [°C]* if operating in Celsius, or *[3] Pt 1000 [°F]* and *[5] Ni 1000 [°F]* if operating in Fahrenheit.

N O T I C E

If the input is not in use, set it for voltage.

If set for temperature and used as feedback, set the unit for either Celsius or Fahrenheit.

- *Parameter 20-12 Reference/Feedback Unit.*
- *Parameter 21-10 Ext. 1 Ref./Feedback Unit.*
- *Parameter 21-30 Ext. 2 Ref./Feedback Unit.*
- *Parameter 21-50 Ext. 3 Ref./Feedback Unit.*

Option	Name	Description
[1]*	Voltage	
[2]	Pt 1000 [°C]	
[3]	Pt 1000 [°F]	
[4]	Ni 1000 [°C]	
[5]	Ni 1000 [°F]	

Parameter 26-02 Terminal X42/5 Mode

Table 1030: Parameter 26-02 Terminal X42/5 Mode

26-02 Terminal X42/5 Mode		
Default value: [1] Voltage	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Terminal X42/5 can be programmed as an analog input accepting a voltage or input from either Pt 1000 (1000 Ω at 0 °C (32 °F)) or Ni 1000 (1000 Ω at 0 °C (32 °F)) temperature sensors. Select the mode. *[2] Pt 1000 [°C]* and *[4] Ni 1000 [°C]* if operating in Celsius, or *[3] Pt 1000 [°F]* and *[5] Ni 1000 [°F]* if operating in Fahrenheit.

NOTICE

If the input is not in use, set it for voltage.

If set for temperature and used as feedback, set the unit for either Celsius or Fahrenheit.

- *Parameter 20-12 Reference/Feedback Unit.*
- *Parameter 21-10 Ext. 1 Ref./Feedback Unit.*
- *Parameter 21-30 Ext. 2 Ref./Feedback Unit.*
- *Parameter 21-50 Ext. 3 Ref./Feedback Unit.*

Option	Name	Description
[1]*	Voltage	
[2]	Pt 1000 [°C]	
[3]	Pt 1000 [°F]	
[4]	Ni 1000 [°C]	
[5]	Ni 1000 [°F]	

5.25.2 26-1* Analog Input X42/1

Parameters for configuring the scaling and limits for analog input terminal X42/1.

Parameter 26-10 Terminal X42/1 Low Voltage

Table 1031: Parameter 26-10 Terminal X42/1 Low Voltage

26-10 Terminal X42/1 Low Voltage		
Default value: 0.07 V	Parameter type: Range, 0 - par. 26-11	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 low reference/feedback value set in *parameter 26-14 Term. X42/1 Low Ref./Feedb. Value*.

Parameter 26-11 Terminal X42/1 High Voltage

Table 1032: Parameter 26-11 Terminal X42/1 High Voltage

26-11 Terminal X42/1 High Voltage		
Default value: 10 V	Parameter type: Range, Par. 26-10 - 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 26-15 Term. X42/1 High Ref./Feedb. Value*.

Parameter 26-14 Term. X42/1 Low Ref./Feedb. Value

Table 1033: Parameter 26-14 Term. X42/1 Low Ref./Feedb. Value

26-14 Term. X42/1 Low Ref./Feedb. Value		
Default value: 0	Parameter type: Range, -999999.999 - 999999.999	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 value set in *parameter 26-10 Terminal X42/1 Low Voltage*.

Parameter 26-15 Term. X42/1 High Ref./Feedb. Value

Table 1034: Parameter 26-15 Term. X42/1 High Ref./Feedb. Value

26-15 Term. X42/1 High Ref./Feedb. Value		
Default value: 100	Parameter type: Range, -999999.999 - 999999.999	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the analog input scaling value that corresponds to the high-voltage value set in *parameter 26-11 Terminal X42/1 High Voltage*.

Parameter 26-16 Term. X42/1 Filter Time Constant

Table 1035: Parameter 26-16 Term. X42/1 Filter Time Constant

26-16 Term. X42/1 Filter Time Constant		
Default value: 0.005 s	Parameter type: Range, 0.005 - 10 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

N O T I C E

This parameter cannot be adjusted while the motor is running.

This is a first-order digital low-pass filter time constant for suppressing noise in terminal X42/1. A high value of time constant improves dampening, but also increases the time delay through the filter.

Parameter 26-17 Term. X42/1 Live Zero

Table 1036: Parameter 26-17 Term. X42/1 Live Zero

26-17 Term. X42/1 Live Zero		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

This parameter makes it possible to enable the live zero monitoring, for example, where the analog input is the drive control, rather than being used as a decentral I/O system, such as a building management system. If set for temperature and used as feedback, set the unit for either Celsius or Fahrenheit.

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

5.25.3 26-2* Analog Input X42/3

Parameters for configuring the scaling and limits for analog input terminal X42/3.

Parameter 26-20 Terminal X42/3 Low Voltage

Table 1037: Parameter 26-20 Terminal X42/3 Low Voltage

26-20 Terminal X42/3 Low Voltage		
Default value: 0.07 V	Parameter type: Range, 0 - par. 26-21	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 low reference/feedback value set in *parameter 26-24 Term. X42/3 Low Ref./Feedb. Value*.

Parameter 26-21 Terminal X42/3 High Voltage

Table 1038: Parameter 26-21 Terminal X42/3 High Voltage

26-21 Terminal X42/3 High Voltage		
Default value: 10 V	Parameter type: Range, Par. 26-20 - 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 26-25 Term. X42/3 High Ref./Feedb. Value*.

Parameter 26-24 Term. X42/3 Low Ref./Feedb. Value

Table 1039: Parameter 26-24 Term. X42/3 Low Ref./Feedb. Value

26-24 Term. X42/3 Low Ref./Feedb. Value		
Default value: 0	Parameter type: Range, -999999.999 - 999999.999	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 value set in *parameter 26-20 Terminal X42/3 Low Voltage*.

Parameter 26-25 Term. X42/3 High Ref./Feedb. Value

Table 1040: Parameter 26-25 Term. X42/3 High Ref./Feedb. Value

26-25 Term. X42/3 High Ref./Feedb. Value		
Default value: 100	Parameter type: Range, -999999.999 - 999999.999	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the analog input scaling value that corresponds to the high-voltage value set in *parameter 26-21 Terminal X42/3 High Voltage*.

Parameter 26-26 Term. X42/3 Filter Time Constant

Table 1041: Parameter 26-26 Term. X42/3 Filter Time Constant

26-26 Term. X42/3 Filter Time Constant		
Default value: 0.005 s	Parameter type: Range, 0.005 - 10 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

N O T I C E

This parameter cannot be adjusted while the motor is running.

This is a first-order digital low-pass filter time constant for suppressing noise in terminal X42/3. A high value of time constant improves dampening, but also increases the time delay through the filter.

Parameter 26-27 Term. X42/3 Live Zero

Table 1042: Parameter 26-27 Term. X42/3 Live Zero

26-27 Term. X42/3 Live Zero		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

This parameter makes it possible to enable the live zero monitoring, for example, where the analog input is the drive control, rather than being used as a decentral I/O system, such as a building management system. If set for temperature and used as feedback, set the unit for either Celsius or Fahrenheit.

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

5.25.4 26-3* Analog Input X42/5

Parameters for configuring the scaling and limits for analog input terminal X42/5.

Parameter 26-30 Terminal X42/5 Low Voltage

Table 1043: Parameter 26-30 Terminal X42/5 Low Voltage

26-10 Terminal X42/1 Low Voltage		
Default value: 0.07 V	Parameter type: Range, 0 - par. 26-31	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 low reference/feedback value set in *parameter 26-34 Term. X42/5 Low Ref./Feedb. Value*.

Parameter 26-31 Terminal X42/5 High Voltage

Table 1044: Parameter 26-31 Terminal X42/5 High Voltage

26-31 Terminal X42/5 High Voltage		
Default value: 10 V	Parameter type: Range, Par. 26-30 - 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 26-35 Term. X42/5 High Ref./Feedb. Value*.

Parameter 26-34 Term. X42/5 Low Ref./Feedb. Value

Table 1045: Parameter 26-34 Term. X42/5 Low Ref./Feedb. Value

26-34 Term. X42/5 Low Ref./Feedb. Value		
Default value: 0	Parameter type: Range, -999999.999 - 999999.999	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 value set in *parameter 26-30 Terminal X42/5 Low Voltage*.

Parameter 26-35 Term. X42/5 High Ref./Feedb. Value

Table 1046: Parameter 26-35 Term. X42/5 High Ref./Feedb. Value

26-35 Term. X42/5 High Ref./Feedb. Value		
Default value: 100	Parameter type: Range, -999999.999 - 999999.999	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

Enter the analog input scaling value that corresponds to the high-voltage value set in *parameter 26-31 Terminal X42/5 High Voltage*.

Parameter 26-36 Term. X42/5 Filter Time Constant

Table 1047: Parameter 26-36 Term. X42/5 Filter Time Constant

26-36 Term. X42/5 Filter Time Constant		
Default value: 0.005 s	Parameter type: Range, 0.005 - 10 s	Setup: All setups
Conversion index: -3	Data type: Uint16	Change during operation: True

N O T I C E

This parameter cannot be adjusted while the motor is running.

This is a first-order digital low-pass filter time constant for suppressing noise in terminal X42/5. A high value of time constant improves dampening, but also increases the time delay through the filter.

Parameter 26-37 Term. X42/5 Live Zero

Table 1048: Parameter 26-37 Term. X42/5 Live Zero

26-37 Term. X42/5 Live Zero		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

This parameter makes it possible to enable the live zero monitoring, for example, where the analog input is the drive control, rather than being used as a decentral I/O system, such as a building management system. If set for temperature and used as feedback, set the unit for either Celsius or Fahrenheit.

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

5.25.5 26-4* Analog Out X42/7

Parameters for configuring the scaling and output function for analog output terminal X42/7.

Parameter 26-40 Terminal X42/7 Output

Table 1049: Parameter 26-40 Terminal X42/7 Output

26-40 Terminal X42/7 Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Set the function of terminal X42/7 as an analog current output.

Option	Name	Description
[0]*	No operation	
[52]	MCO	
[86]	Pressure sensor 1	
[88]	Pressure sensor 2	
[93]	Pressure sensor 3	
[100]	Output freq. 0–100	0–100 Hz, (0–10 V)
[101]	Reference Min-Max	Minimum reference–maximum reference, (0–10 V).
[102]	Feedback +-200%	-200%...+200% of *parameter 3-03 Maximum Reference* (0–10 V)
[103]	Motor cur. 0–Imax	0–inverter maximum current (*parameter 16-37 Inv. Max. Current*), (0–10 V).
[104]	Torque 0–Tlim	0–torque limit (*parameter 4-16 Torque Limit Motor Mode*), (0–10 V).
[105]	Torque 0–Tnom	0–motor rated torque, (0–10 V).
[106]	Power 0–Pnom	0–motor rated power, (0–10 V).
[107]	Speed 0–HighLim	0–speed high limit (*parameter 4-13 Motor Speed High Limit [RPM]* and *parameter Motor Speed High Limit [Hz]*), (0–10 V).
[113]	Ext. closed loop 1	0–100%, (0–10 V).
[114]	Ext. closed loop 2	0–100%, (0–10 V).
[115]	Ext. closed loop 3	0–100%, (0–10 V).
[117]	Shaft power	
[121]	Air pres. to flow	
[139]	Bus ctrl	0–100%, (0–10 V).
[141]	Bus ctrl t.o.	0–100%, (0–10 V).
[186]	Pressure sensor 4	

Parameter 26-41 Terminal X42/7 Min. Scale

Table 1050: Parameter 26-41 Terminal X42/7 Min. Scale

26-41 Terminal X42/7 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 X42/7 as a percentage of the maximum signal level. For example, if 0 V (or 0 Hz) is required at 25% of the maximum output value, program 25%. Scaling values up to 100% can never be higher than the corresponding setting in *parameter 26-42 Terminal X42/7 Max. Scale*.

Parameter 26-42 Terminal X42/7 Max. Scale

Table 1051: Parameter 26-42 Terminal X42/7 Max. Scale

26-42 Terminal X42/7 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 X42/7. Set the value to the maximum value of the voltage signal output. Scale the output to give a voltage lower than 10 V at full scale; or 10 V at an output below 100% of the maximum signal value. If 10 V is the required output current at a value between 0–100% of the full-scale output, program the percentage value in the parameter, that is 50%=10 V. If a voltage 0–10 V is required at maximum output, calculate the percentage as follows:

$$\left(\frac{10\,V}{\text{Desired maximum voltage}}\right) \times 100\%$$

that is

$$5\,V: \frac{10\,V}{5\,V} \times 100\,\% \;=\; 200\,\%$$

Parameter 26-43 Terminal X42/7 Bus Control

Table 1052: Parameter 26-43 Terminal X42/7 Bus Control

26-43 Terminal X42/7 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 terminal X42/7 if controlled by bus.

Parameter 26-44 Terminal X42/7 Timeout Preset

Table 1053: Parameter 26-44 Terminal X42/7 Timeout Preset

26-44 Terminal X42/7 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 terminal X42/7. If a fieldbus and a timeout function are selected in *parameter 26-50 Terminal X42/9 Output*, the output presets to this level.

5.25.6 26-5* Analog Out X42/9

Parameters for configuring the scaling and output function for analog output terminal X42/9.

Parameter 26-50 Terminal X42/9 Output

Table 1054: Parameter 26-50 Terminal X42/9 Output

26-50 Terminal X42/9 Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Set the function of terminal X42/9 as an analog current output.

Option	Name	Description
[0]*	No operation	
[52]	MCO	

Option	Name	Description
[86]	Pressure sensor 1	
[88]	Pressure sensor 2	
[93]	Pressure sensor 3	
[100]	Output freq. 0–100	0–100 Hz, (0–10 V)
[101]	Reference Min-Max	Minimum reference–maximum reference, (0–10 V).
[102]	Feedback +-200%	-200%...+200% of *parameter 3-03 Maximum Reference* (0–10 V)
[103]	Motor cur. 0–Imax	0–inverter maximum current (*parameter 16-37 Inv. Max. Current*), (0–10 V).
[104]	Torque 0–Tlim	0–torque limit (*parameter 4-16 Torque Limit Motor Mode*), (0–10 V).
[105]	Torque 0–Tnom	0–motor rated torque, (0–10 V).
[106]	Power 0–Pnom	0–motor rated power, (0–10 V).
[107]	Speed 0–HighLim	0–speed high limit (*parameter 4-13 Motor Speed High Limit [RPM]* and *parameter Motor Speed High Limit [Hz]*), (0–10 V).
[113]	Ext. closed loop 1	0–100%, (0–10 V).
[114]	Ext. closed loop 2	0–100%, (0–10 V).
[115]	Ext. closed loop 3	0–100%, (0–10 V).
[117]	Shaft power	
[121]	Air pres. to flow	
[139]	Bus ctrl	0–100%, (0–10 V).
[141]	Bus ctrl t.o.	0–100%, (0–10 V).
[186]	Pressure sensor 4	

Parameter 26-51 Terminal X42/9 Min. Scale

Table 1055: Parameter 26-51 Terminal X42/9 Min. Scale

26-51 Terminal X42/9 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 X42/9 as a percentage of the maximum signal level. For example, if 0 V (or 0 Hz) is required at 25% of the maximum output value, program 25%. Scaling values up to 100% can never be higher than the corresponding setting in *parameter 26-52 Terminal X42/9 Max. Scale*.

Parameter 26-52 Terminal X42/9 Max. Scale

Table 1056: Parameter 26-52 Terminal X42/9 Max. Scale

26-52 Terminal X42/9 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 X42/9. Set the value to the maximum value of the voltage signal output. Scale the output to give a voltage lower than 10 V at full scale; or 10 V at an output below 100% of the maximum signal value. If 10 V is the required output current at a value between 0–100% of the full-scale output, program the percentage value in the parameter, that is 50%=10 V. If a voltage 0–10 V is required at maximum output, calculate the percentage as follows:

$$\left(\frac{10\ V}{\text{Desired maximum voltage}}\right) \times 100\%$$

that is

$$5\ V: \frac{10\ V}{5\ V} \times 100\,\% = 200\,\%$$

Parameter 26-53 Terminal X42/9 Bus Control

Table 1057: Parameter 26-53 Terminal X42/9 Bus Control

26-53 Terminal X42/9 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 terminal X42/9 if controlled by bus.

Parameter 26-54 Terminal X42/9 Timeout Preset

Table 1058: Parameter 26-54 Terminal X42/9 Timeout Preset

26-54 Terminal X42/9 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 terminal X42/9. If a fieldbus and a timeout function are selected in *parameter 26-60 Terminal X42/11 Output*, the output presets to this level.

5.25.7 26-6* Analog Out X42/11

Parameter for configuring the scaling and output function for analog output terminal X42/11.

Parameter 26-60 Terminal X42/11 Output

Table 1059: Parameter 26-60 Terminal X42/11 Output

26-60 Terminal X42/11 Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Set the function of terminal X42/11 as an analog current output.

Option	Name	Description
[0]*	No operation	
[52]	MCO	
[86]	Pressure sensor 1	
[88]	Pressure sensor 2	
[93]	Pressure sensor 3	
[100]	Output freq. 0–100	0–100 Hz, (0–10 V)
[101]	Reference Min-Max	Minimum reference–maximum reference, (0–10 V).
[102]	Feedback +-200%	-200%...+200% of *parameter 3-03 Maximum Reference* (0–10 V)

Option	Name	Description
[103]	Motor cur. 0–Imax	0–inverter maximum current (*parameter 16-37 Inv. Max. Current*), (0–10 V).
[104]	Torque 0–Tlim	0–torque limit (*parameter 4-16 Torque Limit Motor Mode*), (0–10 V).
[105]	Torque 0–Tnom	0–motor rated torque, (0–10 V).
[106]	Power 0–Pnom	0–motor rated power, (0–10 V).
[107]	Speed 0–HighLim	0–speed high limit (*parameter 4-13 Motor Speed High Limit [RPM]* and *parameter Motor Speed High Limit [Hz]*), (0–10 V).
[113]	Ext. closed loop 1	0–100%, (0–10 V).
[114]	Ext. closed loop 2	0–100%, (0–10 V).
[115]	Ext. closed loop 3	0–100%, (0–10 V).
[117]	Shaft power	
[121]	Air pres. to flow	
[139]	Bus ctrl	0–100%, (0–10 V).
[141]	Bus ctrl t.o.	0–100%, (0–10 V).
[186]	Pressure sensor 4	

Parameter 26-61 Terminal X42/11 Min. Scale

Table 1060: Parameter 26-61 Terminal X42/11 Min. Scale

26-61 Terminal X42/11 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 X42/11 as a percentage of the maximum signal level. For example, if 0 V (or 0 Hz) is required at 25% of the maximum output value, program 25%. Scaling values up to 100% can never be higher than the corresponding setting in *parameter 26-62 Terminal X42/11 Max. Scale*.

Parameter 26-62 Terminal X42/11 Max. Scale

Table 1061: Parameter 26-62 Terminal X42/11 Max. Scale

26-62 Terminal X42/11 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 X42/11. Set the value to the maximum value of the voltage signal output. Scale the output to give a voltage lower than 10 V at full scale; or 10 V at an output below 100% of the maximum signal value. If 10 V is the required output current at a value between 0–100% of the full-scale output, program the percentage value in the parameter, that is 50%=10 V. If a voltage 0–10 V is required at maximum output, calculate the percentage as follows:

$$\left(\frac{10\,V}{\text{Desired maximum voltage}}\right) \times 100\%$$

that is

$$5\,V\colon \frac{10\,V}{5\,V} \times 100\,\% \; = \; 200\,\%$$

Parameter 26-63 Terminal X42/11 Bus Control

Table 1062: Parameter 26-63 Terminal X42/11 Bus Control

26-63 Terminal X42/11 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 terminal X42/11 if controlled by bus.

Parameter 26-64 Terminal X42/11 Timeout Preset

Table 1063: Parameter 26-64 Terminal X42/11 Timeout Preset

26-64 Terminal X42/11 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 terminal X42/11. If a fieldbus and a timeout function are selected, the output presets to this level.

5.26 Parameter Group 30-** Special Features

5.26.1 30-2* Adv. Start Adjust

Parameter 30-20 High Starting Torque Time [s]

Table 1064: Parameter 30-20 High Starting Torque Time [s]

30-20 High Starting Torque Time [s]		
Default value: 0 s	Parameter type: Range, 0 - 60 s	Setup: All setups
Conversion index: -2	Data type: Uint16	Change during operation: True

Define for how long the increased high starting torque current defined in *parameter 30-21 High Starting Torque Current* should be applied.

Parameter 30-21 High Starting Torque Current [%]

Table 1065: Parameter 30-21 High Starting Torque Current [%]

30-21 High Starting Torque Current [%]		
Default value: Size related	Parameter type: Range, 0 - 200.0%	Setup: All setups
Conversion index: -1	Data type: Uint32	Change during operation: True

Set the high starting current that should be applied for the time specified in *parameter 30-20 High Starting Torque Time*. The increased current will improve the starting torque and starting performance in demanding applications. The high starting torque current is valid for VVC+ and flux in speed open loop. The parameter can be used with the following motors:

- SPM
- IPM
- SynRM
- PMaSynRM

Parameter 30-22 Locked Rotor Protection

Table 1066: Parameter 30-22 Locked Rotor Protection

30-22 Locked Rotor Protection		
Default value: [0] Off	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Available for PM motors only, in flux sensorless mode and VVC^{+} open-loop mode.

Option	Name	Description
[0]*	Off	
[1]	On	Protects the motor from the locked rotor condition. The control algorithm detects a possible locked rotor condition in the motor and trips the drive to protect the motor.

Parameter 30-23 Locked Rotor Detection Time [s]

Table 1067: Parameter 30-23 Locked Rotor Detection Time [s]

30-23 Locked Rotor Detection Time [s]		
Default value: Size related	Parameter type: Range, 0.05 - 1 s	Setup: All setups
Conversion index: -2	Data type: Uint8	Change during operation: True

Time period for detecting the locked rotor condition. A low parameter value leads to faster detection.

5.26.2 30-5* Unit Configuration

Parameters in this group allow to configure the operation of internal units that communicate with the drive. The settings affect the behavior of hardware components inside the drive.

Parameter 30-50 Heat Sink Fan Mode

Table 1068: Parameter 30-50 Heat Sink Fan Mode

30-50 Heat Sink Fan Mode		
Default value: Size related	Parameter type: Option	Setup: 2 setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select how the heat sink fan responds to operating conditions. Use *parameter 14-52 Fan Control* to control the minimum fan speed.

Option	Name	Description
[0]	Simple profile	The simple profile is a passive fan control based on the current temperature state of the drive. This option represents the classic operating behavior of fans.
[1]	Reduced acoustics	
[2]	Standard	
[3]	Cooler operation	

5.26.3 30-8* Compatibility (I)

Parameter 30-85 Motor Frequency

Table 1069: Parameter 30-85 Motor Frequency

30-85 Motor Frequency		
Default value: Size related	Parameter type: Range, 20.0 - 1000.0 Hz	Setup: All setups
Conversion index: -1	Data type: Uint32	Change during operation: False

NOTICE

Changing this parameter affects the settings of other parameters.

Select the motor frequency from the motor nameplate data.

5.26.4 30-9* Wifi LCP

Parameters for configuring the wireless LCP 103.

Parameter 30-90 SSID

Table 1070: Parameter 30-90 SSID

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*.

Parameter 30-91 Channel

Table 1071: Parameter 30-91 Channel

30-91 Channel		
Default value: 5	Parameter type: Range, 1 - 11	Setup: 1 setup
Conversion index: 0	Data type: Uint8	Change during operation: True

Enter the wireless channel number. The default channel number is 5. Change the channel number, if there is an interference from other wireless networks. Recommended channels: USA territory: 1, 6, 11. Europe: 1, 7, 13.

Parameter 30-92 Password

Table 1072: Parameter 30-92 Password

30-92 Password		
Default value: Size related	Parameter type: Range, 8 - 48	Setup: 1 setup
Conversion index: 0	Data type: VisStr[48]	Change during operation: True

Enter the wireless network password. Password length: 8–48 characters.

Parameter 30-93 Security Type

Table 1073: Parameter 30-93 Security Type

30-93 Security Type		
Default value: [2] WPA_WPA2	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

Select the wireless network security type.

Option	Name	Description
[2]*	WPA_WPA2	

Parameter 30-94 IP Address

Table 1074: Parameter 30-94 IP Address

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.

Parameter 30-95 Submask

Table 1075: Parameter 30-95 Submask

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.

Parameter 30-96 Port

Table 1076: Parameter 30-96 Port

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.

Parameter 30-97 Wifi Timeout Action

Table 1077: Parameter 30-97 Wifi Timeout Action

30-97 Wifi Timeout Action		
Default value: [0] Do nothing	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

Select which action to execute if a local reference (hand-on mode) or a remote reference (auto-on mode) is set via the wireless connection and the connection is lost.

Option	Name	Description
[0]*	Do nothing	The drive does not do any extra actions.
[1]	Stop motor	The drive stops the motor (if the motor was started via a wireless connection).

Parameter 30-98 Remote SSID

Table 1078: Parameter 30-98 Remote SSID

30-98 Remote SSID		
Default value: Size related	Parameter type: Range, 1 - 32	Setup: 1 setup
Conversion index: 0	Data type: VisStr[32]	Change during operation: True

Parameter 30-99 Wifi Network Mode

Table 1079: Parameter 30-99 Wifi Network Mode

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	

5.27 Parameter Group 31-** Pressure Sensor Option

The pressure transmitter unit sensors are calibrated from factory to ensure correct pressure measurement from the 1st power-up. It delivers pressure values on the LCP, analog output, or fieldbus interface without any further sensor calibrations. It also has an internal pressure compensation measurement to adjust for absolute pressure measurement. Each pressure sensor has a -/+ measuring input to enable a selection of absolute of differential pressure signal, related to the way the inputs are mechanically connected in the application.

The pressure transmitter unit has built-in functions to monitor air filters and general pressure level. Each sensor input has its own individual trigger levels when pressure level drops below or above the defined threshold values. It is possible to define the time window after which a notification informs about the pressure trigger status change. This status can be manually or automatically reset, as soon as the pressure conditions return outside the trigger levels. The pressure status information can be used in different ways, as warnings and alarms or as part of the process control via SLC and PID controller. See parameters in *parameter group 20-** Drive Closed Loop* and *parameter group 22-** Application Functions* for air to volume control calculation.

5.27.1 31-2* Configuration

Parameter 31-20 Pressure/Speed Curve Adjustment

Table 1080: Parameter 31-20 Pressure/Speed Curve Adjustment

31-20 Pressure/Speed Curve Adjustment		
Default value: [0] None	Parameter type: Option, Array [4]	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

The pressure status is based on individual thresholds levels which are triggered when the pressure goes above or below the threshold. The minimum and maximum values are working as disable of the function (indicated in the LCP). The trigger levels are defined at nominal speed operation and are adjusted to the actual speed of the drive after different pressure curves. Select the individual type of speed adjustment curve for the individual threshold value, defined at nominal speed. For options *[1] Linear* and *[2] Square root*, the pressure threshold at 0 speed equals 10% of the value entered in *parameter 31-21 Below level threshold* or *parameter 31-22 Above level threshold*.

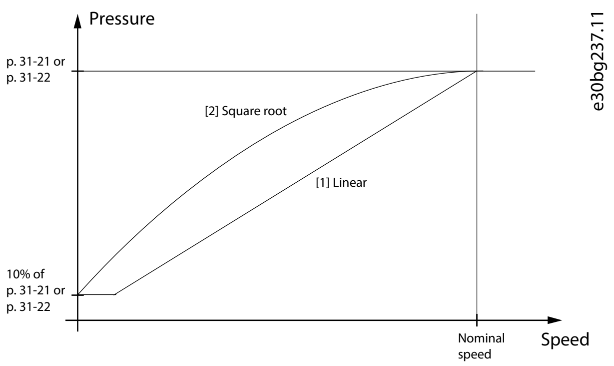


Illustration 116: Pressure/Speed Dependency

Option	Name	Description
[0]*	None	The pressure threshold is constant and does not depend on speed.
[1]	Linear	The pressure threshold is proportional to the speed.
[2]	Square root	The pressure threshold depends on the speed. The dependency is quadratic.

Parameter 31-21 Below Level Threshold

Table 1081: Parameter 31-21 Below Level Threshold

31-21 Below Level Threshold		
Default Value: Size related	Parameter Type: Range, -5000 - 5000 Pa, Array [4]	Setup: All setups
Conversion Index: 0	Data Type: Int16	Change during operation: True

This is an array parameter with 4 elements, 1 for each sensor. Enter the lowest threshold level to trigger pressure sensor status notifications. To disable the function, select the lowest value.

Parameter 31-22 Above Level Threshold

Table 1082: Parameter 31-22 Above Level Threshold

31-22 Above Level Threshold		
Default Value: Size related	Parameter Type: Range, -5000 - 5000 Pa, Array [4]	Setup: All setups
Conversion Index: 0	Data Type: Int16	Change during operation: True

This is an array parameter with 4 elements, 1 for each sensor. Enter the lowest threshold level to trigger pressure sensor status notifications. To disable the function, select the highest value.

Parameter 31-23 On Delay Time

Table 1083: Parameter 31-23 On Delay Time

31-23 On Delay Time		
Default Value: 60 s	Parameter Type: Range, 0 - 3600 s, Array [4]	Setup: All setups
Conversion Index: 0	Data Type: Uint16	Change during operation: True

This is an array parameter with 4 elements, 1 for each sensor. An individual on time delay ensures that the actual conditions are active before the status change. Enter the on delay time. When the current pressure value remains above or below the threshold after the on delay time, notifications are triggered.

Parameter 31-24 Reset Delay Time

Table 1084: Parameter 31-24 Reset Delay Time

31-24 Reset Delay Time		
Default Value: 9999 s	Parameter Type: Range, 0 - 9999 s, Array [4]	Setup: All setups
Conversion Index: 0	Data Type: Uint16	Change during operation: True

This is an array parameter with 4 elements, 1 for each sensor. A reset delay time enables an automatic reset when conditions disappear after a certain time. The status reset can also be managed by a local manual reset via the LCP or fieldbus interface. Enter the reset delay time as the time the period in which the actual value must be off before resetting the status. When entering the highest value, the function is disabled and a manual reset is needed via LCP or fieldbus.

Parameter 31-25 Pressure Filter Time Constant

Table 1085: Parameter 31-25 Pressure Filter Time Constant

31-25 Pressure Filter Time Constant		
Default Value: 1 s	Parameter Type: Range, 0.01 - 60 s, Array [4]	Setup: All setups
Conversion Index: -2	Data Type: Uint16	Change during operation: True

This is an array parameter with 4 elements, 1 for each sensor. A pressure filter time constant adjusts the dynamic of the reaction to the actual pressure input to ensure reliable and stable status generation. Enter the pressure filter time constant. A higher value makes the pressure signal more stable but less dynamic. A lower value makes the system more dynamic and allows signal spikes to affect the control.

5.27.2 31-2* Readouts

Parameters in this group contain the actual pressure levels and status information. The LCP can be configured to show the values of these parameters in different display lines. Use *parameter 0-20 Display Line 1.1 Small* to *parameter 0-24 Display Line 3 Large* when configuring the LCP to show different pressure values. The toggle function allows to show multiple pressure signals in the same LCP line. Each of the sensors can have individual customized text followed by the sensor number and the actual pressure value. The status lines indicate status for all 4 sensor status or for individual sensors where 1 indicates an active On status.

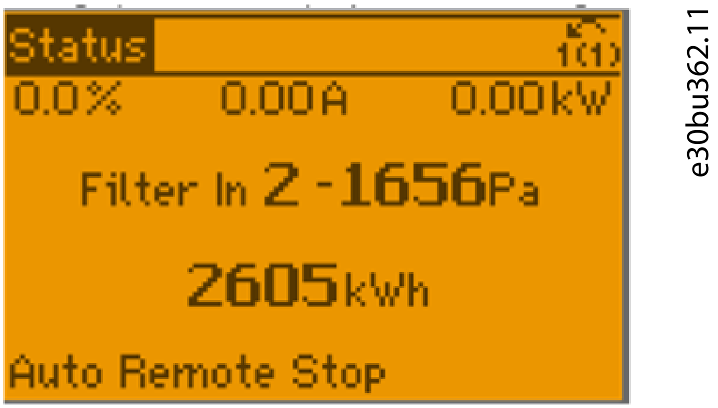


Illustration 117: Pressure Sensor Data on the LCP

Parameter 31-26 Pressure Sensor 1

Table 1086: Parameter 31-26 Pressure Sensor 1

31-26 Pressure Sensor 1		
Default Value: -5000 Pa	Parameter Type: Range, -5000 - 5000 Pa	Setup: All setups
Conversion Index: 0	Data Type: Int16	Change during operation: True

Actual value and value range for sensor 1 is updated at power-up. Shows the readout of pressure sensor 1.

Parameter 31-27 Pressure Sensor 2

Table 1087: Parameter 31-27 Pressure Sensor 2

31-27 Pressure Sensor 2		
Default Value: -5000 Pa	Parameter Type: Range, -5000 - 5000 Pa	Setup: All setups
Conversion Index: 0	Data Type: Int16	Change during operation: True

Actual value and value range for sensor 2 is updated at power-up. Shows the readout of pressure sensor 2.

Parameter 31-28 Pressure Sensor 3

Table 1088: Parameter 31-28 Pressure Sensor 3

31-28 Pressure Sensor 3		
Default Value: -5000 Pa	Parameter Type: Range, -5000 - 5000 Pa	Setup: All setups
Conversion Index: 0	Data Type: Int16	Change during operation: True

Actual value and value range for sensor 3 is updated at power-up. Shows the readout of pressure sensor 3.

Parameter 31-29 Pressure Sensor 4

Table 1089: Parameter 31-29 Pressure Sensor 4

31-29 Pressure Sensor 4		
Default Value: -5000 Pa	Parameter Type: Range, -5000 - 5000 Pa	Setup: All setups
Conversion Index: 0	Data Type: Int16	Change during operation: True

Actual value and value range for sensor 4 is updated at power-up. Shows the readout of pressure sensor 4.

Parameter 31-30 Press Sens Cmp State

Table 1090: Parameter 31-30 Press Sens Cmp State

31-30 Press Sens Cmp State		
Default Value: 0	Parameter Type: Range, 0 - 255	Setup: All setups
Conversion Index: 0	Data Type: Uint8	Change during operation: True

Shows the value for all 4 sensors. The state is in 8-digit binary value where 1 indicates an active status (On), and 0 indicates an inactive status (Off). Reading from right to left, the 1st 4 digits indicate the alarms for the below-level threshold, and the last 4 digits indicate the alarms for the above-level threshold. For example, counting from right to left, sensor 1 for the below-level threshold is at position 1, and sensor 1 for the above-level threshold at position 5. The status information includes digital outputs or fieldbus as for the SLC control function. The information can include all sensors or individual sensor selection via the SLC function.

Parameter 31-31 Press Sens Toggle

Table 1091: Parameter 31-31 Press Sens Toggle

31-31 Press Sens Toggle		
Default Value: 0	Parameter Type: Range, 0 - 21	Setup: All setups
Conversion Index: 0	Data Type: VisStr[21]	Change during operation: True

The pressure sensors can be configured for readouts. The pressure sensor toggle function makes it possible to include all active sensors in 1 readout when the readout switches between the defined sensors in a loop, starting from sensor 1 to sensor 4. The individual sensor information is shown with sensor text, number, and value. The sensor number is followed by a hash sign.

5.27.3 31-3* Readout Conf.

Parameter 31-32 Toggled Readout Configuration

Table 1092: Parameter 31-32 Toggled Readout Configuration

31-32 Toggled Readout Configuration		
Default value: [1] Enabled	Parameter type: Option, Array [4]	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Use this parameter to configure sensors which are shown in *parameter 31-31 Press Sens Toggle*.

Option	Name	Description
[0]	Disabled	The addressed sensor is not shown in *parameter 31-31 Press Sens Toggle*.
[1]*	Enabled	The addressed sensor is shown in *parameter 31-31 Press Sens Toggle*.

Parameter 31-33 Toggled Readout Text

Table 1093: Parameter 31-33 Toggled Readout Text

31-33 Toggled Readout Text		
Default Value: Size related	Parameter Type: Range, 0 - 12, Array [4]	Setup: All setups
Conversion Index: 0	Data Type: VisStr[12]	Change during operation: True

This is an array parameter with 4 elements, 1 for each sensor. Each of the sensors allows a customized text of up to 11 characters. Customizing of text enables better understanding of the sensor pressure signal. The text is shown in *parameter 31-31 Press Sens Toggle*.

5.28 Parameter Group 34-** MCO Data Readouts

Parameters in this group are available when VLT® Motion Control Option MCO 305 is installed in the drive. For information about the option, refer to VLT® Motion Control Option MCO 302 Operating Instructions.

5.28.1 34-0* PCD Write Par.

Parameter 34-01 PCD 1 Write to MCO

Table 1094: Parameter 34-01 PCD 1 Write to MCO

34-01 PCD 1 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD1 of the fieldbus telegram.

Parameter 34-02 PCD 2 Write to MCO

Table 1095: Parameter 34-02 PCD 2 Write to MCO

34-02 PCD 2 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD2 of the fieldbus telegram.

Parameter 34-03 PCD 3 Write to MCO

Table 1096: Parameter 34-03 PCD 3 Write to MCO

34-03 PCD 3 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD3 of the fieldbus telegram.

Parameter 34-04 PCD 4 Write to MCO

Table 1097: Parameter 34-04 PCD 4 Write to MCO

34-04 PCD 4 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD4 of the fieldbus telegram.

Parameter 34-05 PCD 5 Write to MCO

Table 1098: Parameter 34-05 PCD 5 Write to MCO

34-05 PCD 5 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD5 of the fieldbus telegram.

Parameter 34-06 PCD 6 Write to MCO

Table 1099: Parameter 34-06 PCD 6 Write to MCO

34-06 PCD 6 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD6 of the fieldbus telegram.

Parameter 34-07 PCD 7 Write to MCO

Table 1100: Parameter 34-07 PCD 7 Write to MCO

34-07 PCD 7 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD7 of the fieldbus telegram.

Parameter 34-08 PCD 8 Write to MCO

Table 1101: Parameter 34-08 PCD 8 Write to MCO

34-08 PCD 8 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD8 of the fieldbus telegram.

Parameter 34-09 PCD 9 Write to MCO

Table 1102: Parameter 34-09 PCD 9 Write to MCO

34-09 PCD 9 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD9 of the fieldbus telegram.

Parameter 34-10 PCD 10 Write to MCO

Table 1103: Parameter 34-10 PCD 10 Write to MCO

34-10 PCD 10 Write to MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value received in PCD10 of the fieldbus telegram.

5.28.2 34-2* PCD Read Par.

Parameter 34-21 PCD 1 Read from MCO

Table 1104: Parameter 34-21 PCD 1 Read from MCO

34-21 PCD 1 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD1 of the fieldbus telegram.

Parameter 34-22 PCD 2 Read from MCO

Table 1105: Parameter 34-22 PCD 2 Read from MCO

34-22 PCD 2 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD2 of the fieldbus telegram.

Parameter 34-23 PCD 3 Read from MCO

Table 1106: Parameter 34-23 PCD 3 Read from MCO

34-23 PCD 3 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD3 of the fieldbus telegram.

Parameter 34-24 PCD 4 Read from MCO

Table 1107: Parameter 34-24 PCD 4 Read from MCO

34-24 PCD 4 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD4 of the fieldbus telegram.

Parameter 34-25 PCD 5 Read from MCO

Table 1108: Parameter 34-25 PCD 5 Read from MCO

34-25 PCD 5 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD5 of the fieldbus telegram.

Parameter 34-26 PCD 6 Read from MCO

Table 1109: Parameter 34-26 PCD 6 Read from MCO

34-26 PCD 6 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD6 of the fieldbus telegram.

Parameter 34-27 PCD 7 Read from MCO

Table 1110: Parameter 34-27 PCD 7 Read from MCO

34-27 PCD 7 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD7 of the fieldbus telegram.

Parameter 34-28 PCD 8 Read from MCO

Table 1111: Parameter 34-28 PCD 8 Read from MCO

34-28 PCD 8 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD8 of the fieldbus telegram.

Parameter 34-29 PCD 9 Read from MCO

Table 1112: Parameter 34-29 PCD 9 Read from MCO

34-29 PCD 9 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD9 of the fieldbus telegram.

Parameter 34-30 PCD 10 Read from MCO

Table 1113: Parameter 34-30 PCD 10 Read from MCO

34-30 PCD 10 Read from MCO		
Default value: 0	Parameter type: Range, 0 - 65535	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Shows the value sent in PCD10 of the fieldbus telegram.

5.29 Parameter Group 35-** Sensor Input Option

Parameters for configuring the functionality of VLT® Sensor Input MCB 114.

5.29.1 35-0* Temp. Input Mode

Parameter 35-00 Term. X48/4 Temperature Unit

Table 1114: Parameter 35-00 Term. X48/4 Temperature Unit

35-00 Term. X48/4 Temperature Unit		
Default value: [60] °C	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the unit to be used with temperature input X48/4 settings and readouts.

Option	Name	Description
[60]*	°C	
[160]	°F	

Parameter 35-01 Term. X48/4 Input Type

Table 1115: Parameter 35-01 Term. X48/4 Input Type

35-01 Term. X48/4 Input Type		
Default value: [0] Not connected	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

View the temperature sensor type detected at input X48/4.

Option	Name	Description
[0]*	Not connected	
[1]	PT100 2-wire	
[3]	PT1000 2-wire	
[5]	PT100 3-wire	
[7]	PT1000 3-wire	

Parameter 35-02 Term. X48/7 Temperature Unit

Table 1116: Parameter 35-02 Term. X48/7 Temperature Unit

35-02 Term. X48/7 Temperature Unit		
Default value: [60] °C	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the unit to be used with temperature input X48/7 settings and readouts.

Option	Name	Description
[60]*	°C	
[160]	°F	

Parameter 35-03 Term. X48/7 Input Type

Table 1117: Parameter 35-03 Term. X48/7 Input Type

35-03 Term. X48/7 Input Type		
Default value: [0] Not connected	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

View the temperature sensor type detected at input X48/7.

Option	Name	Description
[0]*	Not connected	
[1]	PT100 2-wire	
[3]	PT1000 2-wire	
[5]	PT100 3-wire	
[7]	PT1000 3-wire	

Parameter 35-04 Term. X48/10 Temperature Unit

Table 1118: Parameter 35-04 Term. X48/10 Temperature Unit

35-04 Term. X48/10 Temperature Unit		
Default value: [60] °C	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the unit to be used with temperature input X48/10 settings and readouts.

Option	Name	Description
[60]*	°C	
[160]	°F	

Parameter 35-05 Term. X48/10 Input Type

Table 1119: Parameter 35-05 Term. X48/10 Input Type

35-05 Term. X48/10 Input Type		
Default value: [0] Not connected	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

View the temperature sensor type detected at input X48/10.

Option	Name	Description
[0]*	Not connected	
[1]	PT100 2-wire	
[3]	PT1000 2-wire	
[5]	PT100 3-wire	
[7]	PT1000 3-wire	

Parameter 35-06 Temperature Sensor Alarm Function

Table 1120: Parameter 35-06 Temperature Sensor Alarm Function

35-06 Temperature Sensor Alarm Function		
Default value: [5] Stop and trip	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Set the alarm function.

Option	Name	Description
[0]	Off	
[2]	Stop	
[5]*	Stop and trip	
[27]	Forced stop and trip	

5.29.2 35-1* Temp. Input X48/4

Parameter 35-14 Term. X48/4 Filter Time Constant

Table 1121: Parameter 35-14 Term. X48/4 Filter Time Constant

35-14 Term. X48/4 Filter Time Constant		
Default value: 0.005 s	Parameter type: Range, 0.005 - 10 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the filter time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal X48/4. A high time constant value improves dampening but also increases the time delay through the filter.

Parameter 35-15 Term. X48/4 Temp. Monitor

Table 1122: Parameter 35-15 Term. X48/4 Temp. Monitor

35-15 Term. X48/4 Temp. Monitor		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

This parameter facilitates the possibility of enabling or disabling the temperature monitor for terminal X48/4. Set the temperature limits in *parameter 35-16 Term. X48/4 Low Temp. Limit* and *parameter 35-17 Term. X48/4 High Temp. Limit*.

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

Parameter 35-16 Term. X48/4 Low Temp. Limit

Table 1123: Parameter 35-16 Term. X48/4 Low Temp. Limit

35-16 Term. X48/4 Low Temp. Limit		
Default value: Size related	Parameter type: Range, -50 - par. 35-17	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Enter the minimum temperature reading that is expected for normal operation of the temperature sensor at terminal X48/4.

Parameter 35-17 Term. X48/4 High Temp. Limit

Table 1124: Parameter 35-17 Term. X48/4 High Temp. Limit

35-17 Term. X48/4 High Temp. Limit		
Default value: Size related	Parameter type: Range, par. 35-16 - 204	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Enter the maximum temperature reading that is expected for normal operation of the temperature sensor at terminal X48/4.

5.29.3 35-2* Temp. Input X48/7

Parameter 35-24 Term. X48/7 Filter Time Constant

Table 1125: Parameter 35-24 Term. X48/7 Filter Time Constant

35-24 Term. X48/7 Filter Time Constant		
Default value: 0.005 s	Parameter type: Range, 0.005 - 10 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the filter time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal X48/7. A high time constant value improves dampening but also increases the time delay through the filter.

Parameter 35-25 Term. X48/7 Temp. Monitor

Table 1126: Parameter 35-25 Term. X48/7 Temp. Monitor

35-25 Term. X48/7 Temp. Monitor		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

This parameter facilitates the possibility of enabling or disabling the temperature monitor for terminal X48/4. Set the temperature limits in *parameter 35-26 Term. X48/7 Low Temp. Limit* and *parameter 35-27 Term. X48/7 High Temp. Limit*.

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

Parameter 35-26 Term. X48/7 Low Temp. Limit

Table 1127: Parameter 35-26 Term. X48/7 Low Temp. Limit

35-26 Term. X48/7 Low Temp. Limit		
Default value: Size related	Parameter type: Range, -50 - par. 35-27	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Enter the minimum temperature reading that is expected for normal operation of the temperature sensor at terminal X48/7.

Parameter 35-27 Term. X48/7 High Temp. Limit

Table 1128: Parameter 35-27 Term. X48/7 High Temp. Limit

35-27 Term. X48/7 High Temp. Limit		
Default value: Size related	Parameter type: Range, Par. 35-26 - 204	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Enter the maximum temperature reading that is expected for normal operation of the temperature sensor at terminal X48/7.

5.29.4 35-3* Temp. Input X48/10

Parameter 35-34 Term. X48/10 Filter Time Constant

Table 1129: Parameter 35-34 Term. X48/10 Filter Time Constant

35-34 Term. X48/10 Filter Time Constant		
Default value: 0.005 s	Parameter type: Range, 0.005 - 10 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the filter time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal X48/10. A high time constant value improves dampening but also increases the time delay through the filter.

Parameter 35-35 Term. X48/10 Temp. Monitor

Table 1130: Parameter 35-35 Term. X48/10 Temp. Monitor

35-35 Term. X48/10 Temp. Monitor		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

This parameter facilitates the possibility of enabling or disabling the temperature monitor for terminal X48/4. Set the temperature limits in *parameter 35-36 Term. X48/10 Low Temp. Limit* and *parameter 35-37 Term. X48/10 High Temp. Limit*.

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

Parameter 35-36 Term. X48/10 Low Temp. Limit

Table 1131: Parameter 35-36 Term. X48/10 Low Temp. Limit

35-36 Term. X48/10 Low Temp. Limit		
Default value: Size related	Parameter type: Range, -50 - par. 35-37	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Enter the minimum temperature reading that is expected for normal operation of the temperature sensor at terminal X48/10.

Parameter 35-37 Term. X48/10 High Temp. Limit

Table 1132: Parameter 35-37 Term. X48/10 High Temp. Limit

35-37 Term. X48/10 High Temp. Limit		
Default value: Size related	Parameter type: Range, par. 35-36 - 204	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Enter the maximum temperature reading that is expected for normal operation of the temperature sensor at terminal X48/10.

5.29.5 35-4* Analog Input X48/2

Parameter 35-42 Term. X48/2 Low Current

Table 1133: Parameter 35-42 Term. X48/2 Low Current

35-42 Term. X48/2 Low Current		
Default value: 4 mA	Parameter type: Range, 0 - 20 mA	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: True

Enter the current (mA) that corresponds to the low reference value set in *parameter 35-44 Term. X48/2 Low Ref./Feedb. Value*. The value must be more than 2 mA to activate the live zero timeout function in *parameter 6-01 Live Zero Timeout Function*.

Parameter 35-43 Term. X48/2 High Current

Table 1134: Parameter 35-43 Term. X48/2 High Current

35-43 Term. X48/2 High Current		
Default value: 20 mA	Parameter type: Range, 0 - 20 mA	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: True

Enter the current (mA) that corresponds to the high reference value set in *parameter 35-45 Term. X48/2 High Ref./Feedb. Value*.

Parameter 35-44 Term. 48/2 Low Ref./Feedb. Value

Table 1135: Parameter 35-44 Term. 48/2 Low Ref./Feedb. Value

35-44 Term. 48/2 Low Ref./Feedb. Value		
Default value: 0 ReferenceFeedbackUnit	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Enter the reference or feedback value (in RPM, Hz, bar, and so on) that corresponds to the voltage or current set in *parameter 35-42 Term. X48/2 Low Current*.

Parameter 35-45 Term. 48/2 High Ref./Feedb. Value

Table 1136: Parameter 35-45 Term. 48/2 High Ref./Feedb. Value

35-45 Term. 48/2 High Ref./Feedb. Value		
Default value: 100 ReferenceFeedbackU-nit	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Enter the reference or feedback value (in RPM, Hz, bar, and so on) that corresponds to the voltage or current set in *parameter 35-43 Term. X48/2 High Current*.

Parameter 35-46 Term. X48/2 Filter Time Constant

Table 1137: Parameter 35-46 Term. X48/2 Filter Time Constant

35-46 Term. X48/2 Filter Time Constant		
Default value: 0.005 s	Parameter type: Range, 0.005 - 10 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the filter time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal X48/2. A high time constant value improves dampening but also increases the time delay through the filter.

Parameter 35-48 Term. X48/10 Live Zero

Table 1138: Parameter 35-48 Term. X48/10 Live Zero

35-48 Term. X48/10 Live Zero		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Use this parameter for either disabling or enabling the live zero monitoring function.

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

5.30 Parameter Group 36-** Programmable I/O Option

Parameters for configuring VLT® Programmable I/O MCB 115.

Parameters in this group are only active if VLT® Programmable I/O MCB 115 is installed.

5.30.1 36-0* I/O Mode

Use the parameters in this group to configure the mode of inputs and outputs of VLT® Programmable I/O. Terminals can be programmed to provide voltage, current, or digital output.

Parameter 36-00 Term. X49/1 Mode

Table 1139: Parameter 36-00 Term. X49/1 Mode

36-00 Term. X49/1 Mode		
Default value: [1] Voltage	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the output mode of analog terminal X49/1.

Option	Name	Description
[0]	Current	
[1]*	Voltage	
[2]	PT1000 [°C]	
[3]	PT1000 [°F]	
[4]	Ni 1000 [°C]	
[5]	Ni 1000 [°F]	

Parameter 36-01 Term. X49/3 Mode

Table 1140: Parameter 36-01 Term. X49/3 Mode

36-01 Term. X49/3 Mode		
Default value: [1] Voltage	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the output mode of analog terminal X49/3.

Option	Name	Description
[0]	Current	
[1]*	Voltage	
[2]	PT1000 [°C]	
[3]	PT1000 [°F]	
[4]	Ni 1000 [°C]	
[5]	Ni 1000 [°F]	

Parameter 36-02 Term. X49/5 Mode

Table 1141: Parameter 36-02 Term. X49/5 Mode

36-02 Term. X49/5 Mode		
Default value: [1] Voltage	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the output mode of analog terminal X49/5.

Option	Name	Description
[0]	Current	
[1]*	Voltage	
[2]	PT1000 [°C]	
[3]	PT1000 [°F]	
[4]	Ni 1000 [°C]	
[5]	Ni 1000 [°F]	

Parameter 36-03 Term. X49/7 Mode

Table 1142: Parameter 36-03 Term. X49/7 Mode

36-03 Term. X49/7 Mode		
Default value: [0] Voltage 0–10V	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the output mode of analog terminal X49/7.

Option	Name	Description
[0]*	Voltage 0–10V	
[1]	Voltage 2–10V	
[2]	Current 0–20mA	
[3]	Current 4–20mA	
[4]	Digital	

Parameter 36-04 Term. X49/9 Mode

Table 1143: Parameter 36-04 Term. X49/9 Mode

36-04 Term. X49/9 Mode		
Default value: [0] Voltage 0–10V	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the output mode of analog terminal X49/9.

Option	Name	Description
[0]*	Voltage 0–10V	
[1]	Voltage 2–10V	

Option	Name	Description
[2]	Current 0–20mA	
[3]	Current 4–20mA	
[4]	Digital	

Parameter 36-05 Term. X49/11 Mode

Table 1144: Parameter 36-05 Term. X49/11 Mode

36-05 Term. X49/11 Mode		
Default value: [0] Voltage 0–10V	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Select the output mode of analog terminal X49/11.

Option	Name	Description
[0]*	Voltage 0–10V	
[1]	Voltage 2–10V	
[2]	Current 0–20mA	
[3]	Current 4–20mA	
[4]	Digital	

5.30.2 36-1* Analog Input X49/1

Parameter 36-10 Terminal X49/1 Low Voltage

Table 1145: Parameter 36-10 Terminal X49/1 Low Voltage

36-10 Terminal X49/1 Low Voltage		
Default value: 0.07 V	Parameter type: Range, 0 - 10 V	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Parameter 36-11 Terminal X49/1 Low Current

Table 1146: Parameter 36-11 Terminal X49/1 Low Current

36-11 Terminal X49/1 Low Current		
Default value: 4 mA	Parameter type: Range, 0 - 20 mA	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: True

Parameter 36-12 Terminal X49/1 High Voltage

Table 1147: Parameter 36-12 Terminal X49/1 High Voltage

36-12 Terminal X49/1 High Voltage		
Default value: 10 V	Parameter type: Range, 0 - 10 V	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Parameter 36-13 Terminal X49/1 High Current

Table 1148: Parameter 36-13 Terminal X49/1 High Current

36-13 Terminal X49/1 High Current		
Default value: 20 mA	Parameter type: Range, 0 - 20 mA	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: True

Parameter 36-14 Terminal X49/1 Low Ref./Feedb. Value

Table 1149: Parameter 36-14 Terminal X49/1 Low Ref./Feedb. Value

36-14 Terminal X49/1 Low Ref./Feedb. Value		
Default value: 0 ReferenceFeedbackUnit	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 36-15 Terminal X49/1 High Ref./Feedb. Value

Table 1150: Parameter 36-15 Terminal X49/1 High Ref./Feedb. Value

36-15 Terminal X49/1 High Ref./Feedb. Value		
Default value: 100 ReferenceFeedbackUnit	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 36-16 Term. X49/1 Filter Time Constant

Table 1151: Parameter 36-16 Term. X49/1 Filter Time Constant

36-16 Term. X49/1 Filter Time Constant		
Default value: 0.005 s	Parameter type: Range, 0.005 - 10 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the filter time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal X49/1. A high time constant value improves dampening but also increases the time delay through the filter.

Parameter 36-17 Term. X49/1 Live Zero

Table 1152: Parameter 36-17 Term. X49/1 Live Zero

36-17 Term. X49/1 Live Zero		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Use this parameter for either disabling or enabling the live zero monitoring function.

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

5.30.3 36-2* Analog Input X49/3

Parameter 36-20 Terminal X49/3 Low Voltage

Table 1153: Parameter 36-20 Terminal X49/3 Low Voltage

36-20 Terminal X49/3 Low Voltage		
Default value: 0.07 V	Parameter type: Range, 0 - 10 V	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Parameter 36-21 Terminal X49/3 Low Current

Table 1154: Parameter 36-21 Terminal X49/3 Low Current

36-21 Terminal X49/3 Low Current		
Default value: 4 mA	Parameter type: Range, 0 - 20 mA	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: True

Parameter 36-22 Terminal X49/3 High Voltage

Table 1155: Parameter 36-22 Terminal X49/3 High Voltage

36-22 Terminal X49/3 High Voltage		
Default value: 10 V	Parameter type: Range, 0 - 10 V	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Parameter 36-23 Terminal X49/3 High Current

Table 1156: Parameter 36-23 Terminal X49/3 High Current

36-23 Terminal X49/3 High Current		
Default value: 20 mA	Parameter type: Range, 0 - 20 mA	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: True

Parameter 36-24 Terminal X49/3 Low Ref./Feedb. Value

Table 1157: Parameter 36-24 Terminal X49/3 Low Ref./Feedb. Value

36-24 Terminal X49/3 Low Ref./Feedb. Value		
Default value: 0 ReferenceFeedbackUnit	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter Parameter 36-25 Terminal X49/3 High Ref./Feedb. Value

Table 1158: Parameter 36-25 Terminal X49/3 High Ref./Feedb. Value

36-25 Terminal X49/3 High Ref./Feedb. Value		
Default value: 100 ReferenceFeedbackU-nit	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 36-26 Term. X49/3 Filter Time Constant

Table 1159: Parameter 36-26 Term. X49/3 Filter Time Constant

36-26 Term. X49/3 Filter Time Constant		
Default value: 0.005 s	Parameter type: Range, 0.005 - 10 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the filter time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal X49/3. A high time constant value improves dampening but also increases the time delay through the filter.

Parameter 36-27 Term. X49/3 Live Zero

Table 1160: Parameter 36-27 Term. X49/3 Live Zero

36-27 Term. X49/3 Live Zero		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Use this parameter for either disabling or enabling the live zero monitoring function.

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

5.30.4 36-3* Analog Input X49/5

Parameter 36-30 Terminal X49/5 Low Voltage

Table 1161: Parameter 36-30 Terminal X49/5 Low Voltage

36-30 Terminal X49/5 Low Voltage		
Default value: 0.07 V	Parameter type: Range, 0 - 10 V	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Parameter 36-31 Terminal X49/3 Low Current

Table 1162: Parameter 36-31 Terminal X49/3 Low Current

36-31 Terminal X49/3 Low Current		
Default value: 4 mA	Parameter type: Range, 0 - 20 mA	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: True

Parameter 36-32 Terminal X49/5 High Voltage

Table 1163: Parameter 36-32 Terminal X49/5 High Voltage

36-32 Terminal X49/5 High Voltage		
Default value: 10 V	Parameter type: Range, 0 - 10 V	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Parameter 36-33 Terminal X49/5 High Current

Table 1164: Parameter 36-33 Terminal X49/5 High Current

36-33 Terminal X49/5 High Current		
Default value: 20 mA	Parameter type: Range, 0 - 20 mA	Setup: All setups
Conversion index: -3	Data type: Int16	Change during operation: True

Parameter 36-34 Terminal X49/5 Low Ref./Feedb. Value

Table 1165: Parameter 36-34 Terminal X49/5 Low Ref./Feedb. Value

36-34 Terminal X49/5 Low Ref./Feedb. Value		
Default value: 0 ReferenceFeedbackUnit	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 36-35 Terminal X49/5 High Ref./Feedb. Value

Table 1166: Parameter 36-35 Terminal X49/5 High Ref./Feedb. Value

36-35 Terminal X49/5 High Ref./Feedb. Value		
Default value: 100 ReferenceFeedbackUnit	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: True

Parameter 36-36 Term. X49/5 Filter Time Constant

Table 1167: Parameter 36-26 Term. X49/3 Filter Time Constant

36-26 Term. X49/3 Filter Time Constant		
Default value: 0.005 s	Parameter type: Range, 0.005 - 10 s	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: True

Enter the filter time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal X49/3. A high time constant value improves dampening but also increases the time delay through the filter.

Parameter 36-37 Term. X49/5 Live Zero

Table 1168: Parameter 36-37 Term. X49/5 Live Zero

36-37 Term. X49/5 Live Zero		
Default value: [1] Enabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Use this parameter for either disabling or enabling the live zero monitoring function.

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

5.30.5 36-4* Output X49/7

Use the parameters in this group to configure the mode of inputs and outputs of VLT® Programmable I/O MCB 115.

Parameter 36-40 Terminal X49/7 Analogue Output

Table 1169: Parameter 36-40 Terminal X49/7 Analogue Output

36-40 Terminal X49/7 Analogue Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the functionality of terminal X49/7.

Option	Name	Description
[0]*	No operation	Indicates no signal on the analog output.
[52]	MCO	
[86]	Pressure sensor 1	
[88]	Pressure sensor 2	
[93]	Pressure sensor 3	
[100]	Output frequency	0 Hz = 0 mA; 100 Hz = 20 mA.
[101]	Reference Min-Max	*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 +200%	-200% to +200% of *parameter 3-03 Maximum reference*, (0–100 V)
[103]	Motor cur. 0-Imax	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. **Example:** Inverter normal current (11 kW) is 24 A. 160 %=38.4 A. Motor normal current is 22 A, the readout is 11.46 mA. $\frac{20\ \text{mA} \times 22\ A}{38.4\ A} = 11.46\ \text{mA}$ When the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{\text{VLT, MAX}} \times 100}{I_{\text{Motor, Nom}}} = \frac{38.4 \times 100}{22} = 175\,\%$
[104]	Torque rel to limit	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[105]	Torque 0-Tlim	The torque is related to the motor torque setting.
[106]	Power 0-Pnom	Taken from *parameter 1-20 Motor Power [kW]*.
[107]	Speed 0-HighLim	Taken from *parameter 3-03 Maximum Reference*. 20 mA equals the value in *parameter 3-03 Maximum Reference*.
[113]	Ext. closed loop 1	0–100%, (0–10 V)
[114]	Ext. closed loop 2	0–100%, (0–10 V)
[115]	Ext. closed loop 3	0–100%, (0–10 V)
[117]	Shaft power	
[121]	Air pres- to flow	
[135]	Torq.% nom 4–20mA	The torque setting is related to the motor torque setting.

Option	Name	Description
[139]	Bus ctrl	An output value set from fieldbus process data. The output works independently of internal functions in the drive.
[141]	Bus ctrl t.o.	*Parameter 4-54 Warning Reference Low* defines the behavior of the analog output in case of fieldbus timeout.
[186]	Pressure sensor 4	

Parameter 36-41 Terminal X49/7 Digital Output

Table 1170: Parameter 36-41 Terminal X49/7 Digital Output

36-41 Terminal X49/7 Digital Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the function of terminal X49/7 as a digital output.

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]	Standby/no warning	The drive is ready for operation. No start or stop command is given (start/disable). There are no warnings.
[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.
[8]	Run on ref/no warn	The motor runs at reference speed. No warnings.
[9]	Alarm	An alarm activates the output. No warnings.
[10]	Alarm or warning	An alarm or a warning activates the output.
[11]	At torque limit	The torque limit set in *parameter 4-16 Torque Limit Motor Mode* or *parameter 4-17 Torque Limit Generator Mode* has been exceeded.
[12]	Out of current range	The motor current is outside the range set in *parameter 4-18 Current Limit*.
[13]	Below current, low	The motor current is lower than set in *parameter 4-50 Warning Current Low*.
[14]	Above current, high	The motor current is higher than set in *parameter 4-51 Warning Current High*.
[15]	Out of speed range	Output speed/frequency is outside the frequency range set in *parameter 4-52 Warning Speed Low* and *parameter 4-53 Warning Speed High*.
[16]	Below speed, low	Output speed is lower than the setting in *parameter 4-52 Warning Speed Low*.
[17]	Above speed, high	Output speed is higher than the setting in *parameter 4-53 Warning Speed High*.
[18]	Out of feedb. range	Feedback is outside the range set in *parameter 4-56 Warning Feedback Low* and *parameter 4-57 Warning Feedback High*.

Option	Name	Description
[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.
[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*.
[33]	Safe stop active	Indicates that the Safe Torque Off on terminal 37 has been activated.
[35]	External interlock	The external interlock function has been activated via 1 of the digital inputs.
[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.
[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 a 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 *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.
[62]	Comparator 2	See *parameter group 13-1* Comparators*. If comparator 2 in SLC is true, the output goes high. Otherwise, it is low.

Option	Name	Description
[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]*.
[81]	SL digital output B	See *parameter 13-52 SL Controller Action*. Output B is low on smart logic action *[33] Set digital out B low*. Output B is high on smart logic action *[39]*.
[82]	SL digital output C	See *parameter 13-52 SL Controller Action*. Output C is low on smart logic action *[34] Set digital out C low*. Output C is high on smart logic action *[40]*.
[83]	SL digital output D	See *parameter 13-52 SL Controller 1 Action*. Output D is low on smart logic action *[35] Set digital out D low*. Output D is high on smart logic action *[41]*.

Option	Name	Description
[84]	SL digital output E	See *parameter 13-52 SL Controller Action*. Output E is low on smart logic action *[36] Set digital out E low*. Output E is high on smart logic action *[42]*.
[85]	SL digital output F	See *parameter 13-52 SL Controller Action*. Output F is low on smart logic action *[37] Set digital out F low*. Output F is high on smart logic action *[43]*.
[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.
[160]	No alarm	The output is high when no alarm is present.
[161]	Running reverse	The output is high when the drive is running counterclockwise (the logical product of the status bits running AND reverse).
[163]	Pressure sensor	
[165]	Local ref active	The output is high when *parameter 3-13 Reference Site* is set to *[2] Local* or when *parameter 3-13 Reference Site* is set to *[0] Linked to hand/auto* at the same time as the LCP is in hand-on mode.
[166]	Remote ref active	The output is high when *parameter 3-13 Reference Site* is set to *[1] Remote* or *[0] Linked to hand/auto* while the LCP is in auto-on mode.
[167]	Start command activ	The output is high when there is an active start command (via digital input, bus connection, [Hand On], or [Auto On]), and no stop command is active.
[168]	Hand/Off	The output is high when the drive is in hand-on mode (as indicated by the LED light above [Hand On]).
[169]	Auto mode	The output is high when the drive is in auto-on mode (as indicated by the LED light above [Auto On]).
[173]	10Wh counter pulse	
[180]	Clock fault	The clock function has been reset to default (2000-01-01) because of a power failure.
[181]	Prev. maintenance	One or more of the preventive maintenance events programmed in *parameter 23-10 Maintenance Item* has passed the time for the specified action in *parameter 23-22 Maintenance Action*.
[188]	AHF capacitor connect	
[189]	External fan control	The internal logics for internal fan control is transferred to this output to make it possible to control an external fan (relevant for hp duct cooling).
[190]	No-flow	
[191]	Dry pump	
[192]	End of curve	
[193]	Sleep mode	The drive/system has entered sleep mode. See *parameter group 22-4* Sleep Mode*.

Option	Name	Description
[194]	Broken belt	A broken-belt condition has been detected. Enable this function in *parameter 22-60 Broken Belt Function*.
[195]	Bypass valve control	
[196]	Fire mode	The drive operates in fire mode. See *parameter group 24-0* Fire Mode*.
[197]	Fire mode was act.	The drive has been operating in fire mode. In software version 7.2X, this output is only active 1 min after fire mode is stopped. See *parameter 24-0* Fire Mode*.
[198]	Drive bypass	To be used as signal for activating an external electro-mechanical bypass, switching the motor direct on line. See *parameter group 24-1* Drive Bypass*. **NOTICE** **LOSS OF CERTIFICATION** If enabling the drive bypass function, the drive is no longer certified for using the Safe Torque Off in versions where included.
[200]	Full capacity	
[201]	Pump 1 running	
[202]	Pump 2 running	
[203]	Pump 3 running	
[234]	PE power off	
[236]	Ext. CL 1 on ref	
[237]	Ext. CL 2 on ref	
[238]	Ext. CL 3 on ref	
[240]	RS flipflop 0	See *parameter group 13-1* Comparators*.
[241]	RS flipflop 1	See *parameter group 13-1* Comparators*.
[242]	RS flipflop 2	See *parameter group 13-1* Comparators*.
[243]	RS flipflop 3	See *parameter group 13-1* Comparators*.
[244]	RS flipflop 4	See *parameter group 13-1* Comparators*.
[245]	RS flipflop 5	See *parameter group 13-1* Comparators*.
[246]	RS flipflop 6	See *parameter group 13-1* Comparators*.
[247]	RS flipflop 7	See *parameter group 13-1* Comparators*.
[249]	Fire m OPR unex-pected	Fire mode input or safe stop is not operating as expected, for example, live zero monitoring on an analog input is activated.
[250]	Fire mode limits	During fire mode operation, 1 of the critical alarms has been activated and suppressed by fire mode. This may lead to reduced drive performance and expected operation lifetime before service is required.
[254]	Testing fire mode	Fire mode is activated in a special test mode where the drive stops on all alarms.

Parameter 36-42 Terminal X49/7 Min Scale

Table 1171: Parameter 36-42 Terminal X49/7 Min Scale

36-42 Terminal X49/7 Min Scale		
Default value: 0%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: -2	Data type: Int16	Change during operation: True

Match the minimum output of terminal X49/7 with a required value. The required value is defined as a percentage of the value selected in *parameter 36-40 Terminal X49/7 Analogue Output*. To know more about how this parameter works, see *parameter 6-52 Terminal 42 Output Max Scale*. The following example describes how the drive uses this parameter. **Example:**

- *Parameter 36-03 Terminal X49/7 Mode = [0] Voltage 0–10 V*.
- *Parameter 36-40 Terminal X49/7 Analogue Output = [100] Output frequency*.
- *Parameter 4-19 Max Output Frequency* = 200 Hz.

Application requirement: If the output frequency is lower than 20 Hz, the output of terminal X49/7 should be 0 V. To fulfil the example requirement, enter 10% in *parameter 36-42 Terminal X49/7 Min. Scale*.

Parameter 36-43 Terminal X49/7 Max. Scale

Table 1172: Parameter 36-43 Terminal X49/7 Max. Scale

Parameter 36-43 Terminal X49/7 Max. Scale		
Default value: 100%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Scale the maximum output of terminal X49/7. For example, the scaling is done for the following reasons:

- To provide an output value lower than the maximum possible value.
- To provide the full signal range using output values lower than a certain limit.

To know more about how this parameter works, see *parameter 6-52 Terminal 42 Output Max Scale*. **Example:**

- *Parameter 36-03 Terminal X49/7 Mode = [0] Voltage 0–10 V*
- *Parameter 36-40 Terminal X49/7 Analogue Output = [100] Output Frequency*.
- *Parameter 4-19 Max Output Frequency* = 200 Hz.

Example case 1: 5 V maximum output is required when the output frequency is 200 Hz. *Parameter 36-43 Terminal X49/7 Max. Scale* x 100% = 200%. **Example case 2:** 10 V maximum output is required when the output frequency is 150 Hz (75% of the maximum output frequency). *Parameter 36-43 Terminal X49/7 Max. Scale* = 75%.

Parameter 36-44 Terminal X49/7 Bus Ctrl

Table 1173: Parameter 36-44 Terminal X49/7 Bus Ctrl

36-44 Terminal X49/7 Bus Ctrl		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: N2	Change during operation: True

This parameter contains the output level of terminal X49/7 if the terminal is controlled by bus.

Parameter 36-45 Terminal X49/7 Timeout Preset

Table 1174: Parameter 36-45 Terminal X49/7 Timeout Preset

36-45 Terminal X49/7 Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

The drive sends the value of this parameter to the output terminal when the terminal is controlled by a fieldbus and a timeout is detected.

5.30.6 36-5* Output X49/9

Use the parameters in this group to configure the mode of inputs and outputs of VLT® Programmable I/O MCB 115.

Parameter 36-50 Terminal X49/9 Analogue Output

Table 1175: Parameter 36-50 Terminal X49/9 Analogue Output

36-50 Terminal X49/9 Analogue Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the functionality of terminal X49/9.

Option	Name	Description
[0]*	No operation	Indicates no signal on the analog output.
[52]	MCO	
[86]	Pressure sensor 1	
[88]	Pressure sensor 2	
[93]	Pressure sensor 3	
[100]	Output frequency	0 Hz = 0 mA; 100 Hz = 20 mA.
[101]	Reference Min-Max	*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 +200%	-200% to +200% of *parameter 3-03 Maximum reference*, (0–100 V)
[103]	Motor cur. 0-Imax	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. **Example:** Inverter normal current (11 kW) is 24 A. 160 %=38.4 A. Motor normal current is 22 A, the readout is 11.46 mA. $\frac{20\text{ mA} \times 22\,A}{38.4\,A} = 11.46\text{ mA}$ When the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{\text{VLT, MAX}} \times 100}{I_{\text{Motor, Nom}}} = \frac{38.4 \times 100}{22} = 175\,\%$
[104]	Torque rel to limit	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[105]	Torque 0-Tlim	The torque is related to the motor torque setting.
[106]	Power 0-Pnom	Taken from *parameter 1-20 Motor Power [kW]*.
[107]	Speed 0-HighLim	Taken from *parameter 3-03 Maximum Reference*. 20 mA equals the value in *parameter 3-03 Maximum Reference*.
[113]	Ext. closed loop 1	0–100%, (0–10 V)
[114]	Ext. closed loop 2	0–100%, (0–10 V)
[115]	Ext. closed loop 3	0–100%, (0–10 V)
[117]	Shaft power	

Option	Name	Description
[121]	Air pres- to flow	
[135]	Torq.% nom 4–20mA	The torque setting is related to the motor torque setting.
[139]	Bus ctrl	An output value set from fieldbus process data. The output works independently of internal functions in the drive.
[141]	Bus ctrl t.o.	*Parameter 4-54 Warning Reference Low* defines the behavior of the analog output in case of fieldbus timeout.
[186]	Pressure sensor 4	

Parameter 36-51 Terminal X49/9 Digital Output

Table 1176: Parameter 36-51 Terminal X49/9 Digital Output

36-51 Terminal X49/9 Digital Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the function of terminal X49/9 as a digital output.

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]	Standby/no warning	The drive is ready for operation. No start or stop command is given (start/disable). There are no warnings.
[5]	Running	The motor is running, and shaft torque is present.
[6]	Running/no warn-ing	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.
[8]	Run on ref/no warn	The motor runs at reference speed. No warnings.
[9]	Alarm	An alarm activates the output. No warnings.
[10]	Alarm or warning	An alarm or a warning activates the output.
[11]	At torque limit	The torque limit set in *parameter 4-16 Torque Limit Motor Mode* or *parameter 4-17 Torque Limit Generator Mode* has been exceeded.
[12]	Out of current range	The motor current is outside the range set in *parameter 4-18 Current Limit*.
[13]	Below current, low	The motor current is lower than set in *parameter 4-50 Warning Current Low*.
[14]	Above current, high	The motor current is higher than set in *parameter 4-51 Warning Current High*.
[15]	Out of speed range	Output speed/frequency is outside the frequency range set in *parameter 4-52 Warning Speed Low* and *parameter 4-53 Warning Speed High*.
[16]	Below speed, low	Output speed is lower than the setting in *parameter 4-52 Warning Speed Low*.
[17]	Above speed, high	Output speed is higher than the setting in *parameter 4-53 Warning Speed High*.

Option	Name	Description
[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.
[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*.
[33]	Safe stop active	Indicates that the Safe Torque Off on terminal 37 has been activated.
[35]	External interlock	The external interlock function has been activated via 1 of the digital inputs.
[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.
[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 a 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 *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]*.
[81]	SL digital output B	See *parameter 13-52 SL Controller Action*. Output B is low on smart logic action *[33] Set digital out B low*. Output B is high on smart logic action *[39]*.
[82]	SL digital output C	See *parameter 13-52 SL Controller Action*. Output C is low on smart logic action *[34] Set digital out C low*. Output C is high on smart logic action *[40]*.

Option	Name	Description
[83]	SL digital output D	See *parameter 13-52 SL Controller 1 Action*. Output D is low on smart logic action *[35] Set digital out D low*. Output D is high on smart logic action *[41]*.
[84]	SL digital output E	See *parameter 13-52 SL Controller Action*. Output E is low on smart logic action *[36] Set digital out E low*. Output E is high on smart logic action *[42]*.
[85]	SL digital output F	See *parameter 13-52 SL Controller Action*. Output F is low on smart logic action *[37] Set digital out F low*. Output F is high on smart logic action *[43]*.
[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.
[160]	No alarm	The output is high when no alarm is present.
[161]	Running reverse	The output is high when the drive is running counterclockwise (the logical product of the status bits running AND reverse).
[163]	Pressure sensor	
[165]	Local ref active	The output is high when *parameter 3-13 Reference Site* is set to *[2] Local* or when *parameter 3-13 Reference Site* is set to *[0] Linked to hand/auto* at the same time as the LCP is in hand-on mode.
[166]	Remote ref active	The output is high when *parameter 3-13 Reference Site* is set to *[1] Remote* or *[0] Linked to hand/auto* while the LCP is in auto-on mode.
[167]	Start command activ	The output is high when there is an active start command (via digital input, bus connection, [Hand On], or [Auto On]), and no stop command is active.
[168]	Hand/Off	The output is high when the drive is in hand-on mode (as indicated by the LED light above [Hand On]).
[169]	Auto mode	The output is high when drive is in auto-on mode (as indicated by the LED light above [Auto On]).
[173]	10Wh counter pulse	
[180]	Clock fault	The clock function has been reset to default (2000-01-01) because of a power failure.
[181]	Prev. maintenance	One or more of the preventive maintenance events programmed in *parameter 23-10 Maintenance Item* has passed the time for the specified action in *parameter 23-22 Maintenance Action*.
[188]	AHF capacitor connect	
[189]	External fan control	The internal logics for internal fan control is transferred to this output to make it possible to control an external fan (relevant for hp duct cooling).
[190]	No-flow	
[191]	Dry pump	
[192]	End of curve	

Option	Name	Description
[193]	Sleep mode	The drive/system has entered sleep mode. See *parameter group 22-4* Sleep Mode*.
[194]	Broken belt	A broken-belt condition has been detected. Enable this function in *parameter 22-60 Broken Belt Function*.
[195]	Bypass valve control	
[196]	Fire mode	The drive operates in fire mode. See *parameter group 24-0* Fire Mode*.
[197]	Fire mode was act.	The drive has been operating in fire mode. In software version 7.2X, this output is only active 1 min after fire mode is stopped. See *parameter 24-0* Fire Mode*.
[198]	Drive bypass	To be used as signal for activating an external electro-mechanical bypass, switching the motor direct on line. See *parameter group 24-1* Drive Bypass*. **NOTICE** **LOSS OF CERTIFICATION** If enabling the drive bypass function, the drive is no longer certified for using the Safe Torque Off in versions where included.
[200]	Full capacity	
[201]	Pump 1 running	
[202]	Pump 2 running	
[203]	Pump 3 running	
[234]	PE power off	
[236]	Ext. CL 1 on ref	
[237]	Ext. CL 2 on ref	
[238]	Ext. CL 3 on ref	
[240]	RS flipflop 0	See *parameter group 13-1* Comparators*.
[241]	RS flipflop 1	See *parameter group 13-1* Comparators*.
[242]	RS flipflop 2	See *parameter group 13-1* Comparators*.
[243]	RS flipflop 3	See *parameter group 13-1* Comparators*.
[244]	RS flipflop 4	See *parameter group 13-1* Comparators*.
[245]	RS flipflop 5	See *parameter group 13-1* Comparators*.
[246]	RS flipflop 6	See *parameter group 13-1* Comparators*.
[247]	RS flipflop 7	See *parameter group 13-1* Comparators*.
[249]	Fire m OPR unex-pected	Fire mode input or safe stop is not operating as expected, for example, live zero monitoring on an analog input is activated.
[250]	Fire mode limits	During fire mode operation, 1 of the critical alarms has been activated and suppressed by fire mode. This may lead to reduced drive performance and expected operation lifetime before service is required.
[254]	Testing fire mode	Fire mode is activated in a special test mode where the drive stops on all alarms.

Parameter 36-52 Terminal X49/9 Min. Scale

Table 1177: Parameter 36-52 Terminal X49/9 Min. Scale

36-52 Terminal X49/9 Min. Scale		
Default value: 0%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Match the minimum output of terminal X49/9 with a required value. The required value is defined as a percentage of the value selected in *parameter 36-50 Terminal X49/9 Analogue Output*. To know more about how this parameter works, see *parameter 6-52 Terminal 42 Output Max Scale*. The following example describes how the drive uses this parameter. **Example:**

- *Parameter 36-04 Terminal X49/9 Mode = [0] Voltage 0–10 V*.
- *Parameter 36-50 Terminal X49/9 Analogue Output = [100] Output frequency*.
- *Parameter 4-19 Max Output Frequency* = 200 Hz.

Application requirement: If the output frequency is lower than 20 Hz, the output of terminal X49/9 should be 0 V. To fulfil the example requirement, enter 10% in *parameter 36-52 Terminal X49/9 Min. Scale*.

Parameter 36-53 Terminal X49/9 Max. Scale

Table 1178: Parameter 36-53 Terminal X49/9 Max. Scale

36-53 Terminal X49/9 Max. Scale		
Default value: 100%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Scale the maximum output of terminal X49/9. For example, the scaling is done for the following reasons:

- To provide an output value lower than the maximum possible value.
- To provide the full signal range using output values lower than a certain limit.

To know more about how this parameter works, see *parameter 6-52 Terminal 42 Output Max Scale*. **Example:**

- *Parameter 36-04 Terminal X49/9 Mode = [0] Voltage 0–10 V*
- *Parameter 36-50 Terminal X49/9 Analogue Output = [100] Output Frequency*.
- *Parameter 4-19 Max Output Frequency* = 200 Hz.

Example case 1: 5 V maximum output is required when the output frequency is 200 Hz. *Parameter 36-53 Terminal X49/9 Max. Scale* x 100% = 200%. **Example case 2:** 10 V maximum output is required when the output frequency is 150 Hz (75% of the maximum output frequency). *Parameter 36-53 Terminal X49/9 Max. Scale* = 75%.

Parameter 36-54 Terminal X49/9 Bus Ctrl

Table 1179: Parameter 36-54 Terminal X49/9 Bus Ctrl

36-54 Terminal X49/9 Bus Ctrl		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: N2	Change during operation: True

This parameter contains the output level of terminal X49/9 if the terminal is controlled by bus.

Parameter 36-55 Terminal X49/9 Timeout Preset

Table 1180: Parameter 36-55 Terminal X49/9 Timeout Preset

36-55 Terminal X49/9 Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

The drive sends the value of this parameter to the output terminal when the terminal is controlled by a fieldbus and a timeout is detected.

5.30.7 36-6* Output X49/11

Use the parameters in this group to configure the mode of inputs and outputs of VLT® Programmable I/O MCB 115.

Parameter 36-60 Terminal X49/11 Analogue Output

Table 1181: Parameter 36-60 Terminal X49/11 Analogue Output

36-60 Terminal X49/11 Analogue Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the functionality of terminal X49/11.

Option	Name	Description
[0]*	No operation	Indicates no signal on the analog output.
[52]	MCO	
[86]	Pressure sensor 1	
[88]	Pressure sensor 2	
[93]	Pressure sensor 3	
[100]	Output frequency	0 Hz = 0 mA; 100 Hz = 20 mA.
[101]	Reference Min-Max	*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 +200%	-200% to +200% of *parameter 3-03 Maximum reference*, (0–100 V)
[103]	Motor cur. 0-Imax	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. **Example:** Inverter normal current (11 kW) is 24 A. 160 %=38.4 A. Motor normal current is 22 A, the readout is 11.46 mA. $\frac{20\ \text{mA} \times 22\ A}{38.4\ A} = 11.46\ \text{mA}$ When the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{\text{VLT, MAX}} \times 100}{I_{\text{Motor, Nom}}} = \frac{38.4 \times 100}{22} = 175\,\%$
[104]	Torque rel to limit	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[105]	Torque 0-Tlim	The torque is related to the motor torque setting.
[106]	Power 0-Pnom	Taken from *parameter 1-20 Motor Power [kW]*.
[107]	Speed 0-HighLim	Taken from *parameter 3-03 Maximum Reference*. 20 mA equals the value in *parameter 3-03 Maximum Reference*.
[113]	Ext. closed loop 1	0–100%, (0–10 V)
[114]	Ext. closed loop 2	0–100%, (0–10 V)
[115]	Ext. closed loop 3	0–100%, (0–10 V)
[117]	Shaft power	

Option	Name	Description
[121]	Air pres- to flow	
[135]	Torq.% nom 4–20mA	The torque setting is related to the motor torque setting.
[139]	Bus ctrl	An output value set from fieldbus process data. The output works independently of internal functions in the drive.
[141]	Bus ctrl t.o.	*Parameter 4-54 Warning Reference Low* defines the behavior of the analog output in case of fieldbus timeout.
[186]	Pressure sensor 4	

Parameter 36-61 Terminal X49/11 Digital Output

Table 1182: Parameter 36-61 Terminal X49/11 Digital Output

36-61 Terminal X49/11 Digital Output		
Default value: [0] No operation	Parameter type: Option	Setup: All setups
Conversion index: –	Data type: Uint8	Change during operation: True

Select the function of terminal X49/11 as a digital output.

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]	Standby/no warning	The drive is ready for operation. No start or stop command is given (start/disable). There are no warnings.
[5]	Running	The motor is running, and shaft torque is present.
[6]	Running/no warn- ing	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.
[8]	Run on ref/no warn	The motor runs at reference speed. No warnings.
[9]	Alarm	An alarm activates the output. No warnings.
[10]	Alarm or warning	An alarm or a warning activates the output.
[11]	At torque limit	The torque limit set in *parameter 4-16 Torque Limit Motor Mode* or *parameter 4-17 Torque Limit Generator Mode* has been exceeded.
[12]	Out of current range	The motor current is outside the range set in *parameter 4-18 Current Limit*.
[13]	Below current, low	The motor current is lower than set in *parameter 4-50 Warning Current Low*.
[14]	Above current, high	The motor current is higher than set in *parameter 4-51 Warning Current High*.
[15]	Out of speed range	Output speed/frequency is outside the frequency range set in *parameter 4-52 Warning Speed Low* and *parameter 4-53 Warning Speed High*.
[16]	Below speed, low	Output speed is lower than the setting in *parameter 4-52 Warning Speed Low*.
[17]	Above speed, high	Output speed is higher than the setting in *parameter 4-53 Warning Speed High*.

Option	Name	Description
[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.
[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*.
[33]	Safe stop active	Indicates that the Safe Torque Off on terminal 37 has been activated.
[35]	External interlock	The external interlock function has been activated via 1 of the digital inputs.
[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.
[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 a 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 *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]*.
[81]	SL digital output B	See *parameter 13-52 SL Controller Action*. Output B is low on smart logic action *[33] Set digital out B low*. Output B is high on smart logic action *[39]*.
[82]	SL digital output C	See *parameter 13-52 SL Controller Action*. Output C is low on smart logic action *[34] Set digital out C low*. Output C is high on smart logic action *[40]*.

Option	Name	Description
[83]	SL digital output D	See *parameter 13-52 SL Controller 1 Action*. Output D is low on smart logic action *[35] Set digital out D low*. Output D is high on smart logic action *[41]*.
[84]	SL digital output E	See *parameter 13-52 SL Controller Action*. Output E is low on smart logic action *[36] Set digital out E low*. Output E is high on smart logic action *[42]*.
[85]	SL digital output F	See *parameter 13-52 SL Controller Action*. Output F is low on smart logic action *[37] Set digital out F low*. Output F is high on smart logic action *[43]*.
[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. warn-ing	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.
[160]	No alarm	The output is high when no alarm is present.
[161]	Running reverse	The output is high when the drive is running counterclockwise (the logical product of the status bits running AND reverse).
[163]	Pressure sensor	
[165]	Local ref active	The output is high when *parameter 3-13 Reference Site* is set to *[2] Local* or when *parameter 3-13 Reference Site* is set to *[0] Linked to hand/auto* at the same time as the LCP is in hand-on mode.
[166]	Remote ref active	The output is high when *parameter 3-13 Reference Site* is set to *[1] Remote* or *[0] Linked to hand/auto* while the LCP is in auto-on mode.
[167]	Start command ac-tiv	The output is high when there is an active start command (via digital input, bus connection, [Hand On], or [Auto On]), and no stop command is active.
[168]	Hand/Off	The output is high when the drive is in hand-on mode (as indicated by the LED light above [Hand On]).
[169]	Auto mode	The output is high when drive is in auto-on mode (as indicated by the LED light above [Auto On]).
[173]	10Wh counter pulse	
[180]	Clock fault	The clock function has been reset to default (2000-01-01) because of a power failure.
[181]	Prev. maintenance	One or more of the preventive maintenance events programmed in *parameter 23-10 Mainte-nance Item* has passed the time for the specified action in *parameter 23-22 Maintenance Action*.
[188]	AHF capacitor con-nect	
[189]	External fan control	The internal logics for internal fan control is transferred to this output to make it possible to control an external fan (relevant for hp duct cooling).
[190]	No-flow	
[191]	Dry pump	
[192]	End of curve	

Option	Name	Description
[193]	Sleep mode	The drive/system has entered sleep mode. See *parameter group 22-4* Sleep Mode*.
[194]	Broken belt	A broken-belt condition has been detected. Enable this function in *parameter 22-60 Broken Belt Function*.
[195]	Bypass valve control	
[196]	Fire mode	The drive operates in fire mode. See *parameter group 24-0* Fire Mode*.
[197]	Fire mode was act.	The drive has been operating in fire mode. In software version 7.2X, this output is only active 1 min after fire mode is stopped. See *parameter 24-0* Fire Mode*.
[198]	Drive bypass	To be used as signal for activating an external electro-mechanical bypass, switching the motor direct on line. See *parameter group 24-1* Drive Bypass*. **NOTICE** **LOSS OF CERTIFICATION** If enabling the drive bypass function, the drive is no longer certified for using the Safe Torque Off in versions where included.
[200]	Full capacity	
[201]	Pump 1 running	
[202]	Pump 2 running	
[203]	Pump 3 running	
[234]	PE power off	
[236]	Ext. CL 1 on ref	
[237]	Ext. CL 2 on ref	
[238]	Ext. CL 3 on ref	
[240]	RS flipflop 0	See *parameter group 13-1* Comparators*.
[241]	RS flipflop 1	See *parameter group 13-1* Comparators*.
[242]	RS flipflop 2	See *parameter group 13-1* Comparators*.
[243]	RS flipflop 3	See *parameter group 13-1* Comparators*.
[244]	RS flipflop 4	See *parameter group 13-1* Comparators*.
[245]	RS flipflop 5	See *parameter group 13-1* Comparators*.
[246]	RS flipflop 6	See *parameter group 13-1* Comparators*.
[247]	RS flipflop 7	See *parameter group 13-1* Comparators*.
[249]	Fire m OPR unex-pected	Fire mode input or safe stop is not operating as expected, for example, live zero monitoring on an analog input is activated.
[250]	Fire mode limits	During fire mode operation, 1 of the critical alarms has been activated and suppressed by fire mode. This may lead to reduced drive performance and expected operation lifetime before service is required.
[254]	Testing fire mode	Fire mode is activated in a special test mode where the drive stops on all alarms.

Parameter 36-62 Terminal X49/11 Min. Scale

Table 1183: Parameter 36-62 Terminal X49/11 Min. Scale

36-62 Terminal X49/11 Min. Scale		
Default value: 0%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Match the minimum output of terminal X49/11 with a required value. The required value is defined as a percentage of the value selected in *parameter 36-60 Terminal X49/11 Analogue Output*. To know more about how this parameter works, see *parameter 6-52 Terminal 42 Output Max Scale*. The following example describes how the drive uses this parameter. **Example:**

- *Parameter 36-05 Terminal X49/16 Mode = [0] Voltage 0–10 V*.
- *Parameter 36-50 Terminal X49/11 Analogue Output = [100] Output frequency*.
- *Parameter 4-19 Max Output Frequency* = 200 Hz.

Application requirement: If the output frequency is lower than 20 Hz, the output of terminal X49/9 should be 0 V. To fulfil the example requirement, enter 10% in *parameter 36-62 Terminal X49/11 Min. Scale*.

Parameter 36-63 Terminal X49/11 Max. Scale

Table 1184: Parameter 36-63 Terminal X49/11 Max. Scale

36-63 Terminal X49/11 Max. Scale		
Default value: 100%	Parameter type: Range, 0 - 200%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

Scale the maximum output of terminal X49/11. For example, the scaling is done for the following reasons:

- To provide an output value lower than the maximum possible value.
- To provide the full signal range using output values lower than a certain limit.

To know more about how this parameter works, see *parameter 6-52 Terminal 42 Output Max Scale*. **Example:**

- *Parameter 36-05 Terminal X49/11 Mode = [0] Voltage 0–10 V*
- *Parameter 36-60 Terminal X49/11 Analogue Output = [100] Output Frequency*.
- *Parameter 4-19 Max Output Frequency* = 200 Hz.

Example case 1: 5 V maximum output is required when the output frequency is 200 Hz. *Parameter 36-63 Terminal X49/11 Max. Scale* x 100% = 200%. **Example case 2:** 10 V maximum output is required when the output frequency is 150 Hz (75% of the maximum output frequency). *Parameter 36-63 Terminal X49/11 Max. Scale* = 75%.

Parameter 36-64 Terminal X49/11 Bus Ctrl

Table 1185: Parameter 36-64 Terminal X49/11 Bus Ctrl

36-64 Terminal X49/11 Bus Ctrl		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: All setups
Conversion index: 0	Data type: N2	Change during operation: True

This parameter contains the output level of terminal X49/11 if the terminal is controlled by bus.

Parameter 36-65 Terminal X49/11 Timeout Preset

Table 1186: Parameter 36-65 Terminal X49/11 Timeout Preset

36-65 Terminal X49/11 Timeout Preset		
Default value: 0%	Parameter type: Range, 0 - 100%	Setup: 1 setup
Conversion index: 0	Data type: Uint16	Change during operation: True

The drive sends the value of this parameter to the output terminal when the terminal is controlled by a fieldbus and a timeout is detected.

5.31 Parameter Group 40-** Special Settings

5.31.1 40-4* Extend. Fault Log

Parameters in this group are array parameters, where up to 10 alarm logs can be viewed. [0] is the most recently logged data and [9] is the oldest. This parameter group provides details on reference, frequency, motor current, voltage, DC-link voltage, status, and control word values at the time an alarm occurred.

Parameter 40-40 Fault Log: Ext. Reference

Table 1187: Parameter 40-40 Fault Log: Ext. Reference

40-40 Fault Log: Ext. Reference		
Default value: 0%	Parameter type: Range, -200 - 200%, Array [10]	Setup: All setups
Conversion index: -1	Data type: Int16	Change during operation: False

View the present reference value applied on impulse or analog basis when the logged event occurred.

Parameter 40-41 Fault Log: Frequency

Table 1188: Parameter 40-41 Fault Log: Frequency

40-41 Fault Log: Frequency		
Default value: 0 Hz	Parameter type: Range, 0 - 6500 Hz, Array [10]	Setup: All setups
Conversion index: -1	Data type: Uint16	Change during operation: False

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

Parameter 40-42 Fault Log: Current

Table 1189: Parameter 40-42 Fault Log: Current

40-42 Fault Log: Current		
Default value: 0 A	Parameter type: Range, 0 - 10000 A, Array [10]	Setup: All setups
Conversion index: 0	Data type: Int32	Change during operation: False

View the motor current measured when the logged event occurred.

Parameter 40-43 Fault Log: Voltage

Table 1190: Parameter 40-43 Fault Log: Voltage

40-43 Fault Log: Voltage		
Default value: 0 V	Parameter type: Range, 0 - 6000 V, Array [10]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View the motor voltage when the logged event occurred.

Parameter 40-44 Fault Log: DC Link Voltage

Table 1191: Parameter 40-44 Fault Log: DC Link Voltage

40-44 Fault Log: DC Link Voltage		
Default value: 0 V	Parameter type: Range, 0 - 10000 V, Array [10]	Setup: All setups
Conversion index: 0	Data type: Uint16	Change during operation: False

View the DC-link voltage when the logged event occurred.

Parameter 40-45 Fault Log: Control Word

Table 1192: Parameter 40-45 Fault Log: Control Word

40-45 Fault Log: Control Word		
Default value: 0	Parameter type: Range, 0 - 65535, Array [10]	Setup: All setups
Conversion index: 0	Data type: V2	Change during operation: False

View the control word sent from the drive when the logged event occurred.

Parameter 40-46 Fault Log: Status Word

Table 1193: Parameter 40-46 Fault Log: Status Word

40-46 Fault Log: Status Word		
Default value: 0	Parameter type: Range, 0 - 65535, Array [10]	Setup: All setups
Conversion index: 0	Data type: V2	Change during operation: False

View the status word sent from the drive when the logged event occurred.

5.31.2 40-5* Advanced Control Settings

Parameters for configuring the advanced motor control settings.

Parameter 40-50 Flux Sensorless Model Shift

Table 1194: Parameter 40-50 Flux Sensorless Model Shift

40-50 Flux Sensorless Model Shift		
Default value: Size related	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Use this parameter to enable or disable the shifting between flux model 1 and flux model 2 at low speed. See also *parameter 1-66 Min. Current at Low Speed*.

Option	Name	Description
[0]	Off	
[1]	On	

Parameter 40-51 Flux Sensorless Corr. Gain

Table 1195: Parameter 40-51 Flux Sensorless Corr. Gain

40-51 Flux Sensorless Corr. Gain		
Default value: Size related	Parameter type: Range, 0.1 - 200.0	Setup: All setups
Conversion index: -1	Data type: Uint32	Change during operation: True

Adjust the flux correction gain used at low speed.

Parameter 40-52 Speed PID Anti Windup Gain

Table 1196: Parameter 40-52 Speed PID Anti Windup Gain

40-52 Speed PID Anti Windup Gain		
Default value: Size related	Parameter type: Range, 0 - 500%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

This Flux parameter is active in the drive when the following parameters are set to 1 of the values listed here:

- *Parameter 1-00 Configuration Mode*
  - *[0] Speed open loop* or
  - *[1] Speed closed loop* or
  - *[4] Torque open loop*
- *Parameter 1-01 Motor Control Principle*
  - *[2] Flux sensorless* or
  - *[3] Flux w/motor feedback*
- *Parameter 1-10 Motor Construction*
  - *[0] Asynchron* or
  - *[1] PM, non-salient SPM* or
  - *[2] PM, salient IPM*

Parameter 40-53 Current PID Anti Windup Gain

Table 1197: Parameter 40-53 Current PID Anti Windup Gain

40-53 Current PID Anti Windup Gain		
Default value: Size related	Parameter type: Range, 0 - 500%	Setup: All setups
Conversion index: 0	Data type: Int16	Change during operation: True

This Flux parameter is active in the drive when the following parameters are set to 1 of the values listed here:

- *Parameter 1-00 Configuration Mode*
  - *[0] Speed open loop* or
  - *[1] Speed closed loop* or
  - *[4] Torque open loop*
- *Parameter 1-01 Motor Control Principle*
  - *[2] Flux sensorless* or
  - *[3] Flux w/motor feedback*
- *Parameter 1-10 Motor Construction*
  - *[0] Asynchron* or
  - *[1] PM, non-salient SPM* or
  - *[2] PM, salient IPM*

Parameter 40-55 Modulation Index

Table 1198: Parameter 40-55 Modulation Index

40-55 Modulation Index		
Default value: 100%	Parameter type: Range, 80 - 106%	Setup: All setups
Conversion index: 0	Data type: Uint8	Change during operation: True

NOTICE

This parameter is for IPM and SPM motors in VVC+ control principle only.

Activate this parameter by setting *parameter 14-03 Overmodulation* to *[2] User Defined*. Use this parameter to set the maximum modulation index and thus trim the application, especially if running with high-power motors without sine-wave filters. Increasing the maximum modulation index increases the motor voltage and improves efficiency and stability. Setting the modulation index too high may lead to torque ripples on the motor shaft.

Parameter 40-56 Rotor Position Estimation Gain

Table 1199: Parameter 40-56 Rotor Position Estimation Gain

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.

5.31.3 40-6* IPv6 Settings

Parameter 40-60 IPv6 Address Assignment

Table 1200: Parameter 40-60 IPv6 Address Assignment

40-60 IPv6 Address Assignment		
Default value: [3] Disable	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

Select the method for assigning the IP address. If selecting *[0] Manual*, the IP address can be set in *parameter 40-61 IPv6 Address*. To stop communication via IPv6, select *[3] Disable*.

Option	Name	Description
[0]	Manual	
[1]	Auto configuration	
[2]	DHCPv6	
[3]	Disable	

Parameter 40-61 IPv6 Address

Table 1201: Parameter 40-61 IPv6 Address

40-61 IPv6 Address		
Default value: Size related	Parameter type: Range, 3 - 39, Array [4]	Setup: 1 setup
Conversion index: 0	Data type: VisStr[39]	Change during operation: True

Use this parameter for configuring the IP address of the option in IPv6 format.

Parameter 40-62 Prefix Length

Table 1202: Parameter 40-62 Prefix Length

40-62 Prefix Length		
Default value: 0	Parameter type: Range, 0 - 128, Array [4]	Setup: 1 setup
Conversion index: 0	Data type: Uint8	Change during operation: True

NOTICE

If *parameter 40-60 IPv6 Address* is set to *[1] Auto Configuration* or *[2] DHCPv6*, this parameter is read-only.

Use this parameter for configuring the submask of the option.

Parameter 40-63 Default Gateway

Table 1203: Parameter 40-63 Default Gateway

40-63 Default Gateway		
Default value: Size related	Parameter type: Range, 3 - 39	Setup: 1 setup
Conversion index: 0	Data type: VisStr[39]	Change during operation: True

Use this parameter for setting the default gateway for IPv6.

Parameter 40-64 DHCPv6 Server

Table 1204: Parameter 40-64 DHCPv6 Server

40-64 DHCPv6 Server		
Default value: Size related	Parameter type: Range, 3 - 39	Setup: 1 setup
Conversion index: 0	Data type: VisStr[39]	Change during operation: True

This parameter shows the IP address of the detected DHCPv6 server.

Parameter 40-65 Lease Expires IPv6

Table 1205: Parameter 40-65 Lease Expires IPv6

40-65 Lease Expires IPv6		
Default value: Size related	Parameter type: Range, 0 - 0	Setup: All setups
Conversion index: 0	Data type: TimD	Change during operation: True

This parameter shows the remaining time for the currently assigned IP address by the DHCPv6 server in the format DD:HH:MM:SS.

Parameter 40-66 Name Servers IPv6

Table 1206: Parameter 40-66 Name Servers IPv6

40-66 Name Servers IPv6		
Default value: Size related	Parameter type: Range, 3 - 39, Array [2]	Setup: 1 setup
Conversion index: 0	Data type: VisStr[39]	Change during operation: True

This parameter shows the IP address found on the DHCPv6 server.

5.31.4 40-8* IoT Settings

Parameter 40-80 IoT Profile

Table 1207: Parameter 40-80 IoT Profile

40-80 IoT Profile		
Default value: [0] Disable	Parameter type: Option	Setup: 1 setup
Conversion index: -	Data type: Uint8	Change during operation: True

Select the profile to publish data on the selected IoT protocol.

Option	Name	Description
[0]*	Disable	
[1]	Profile 1	
[2]	Profile 2	
[3]	Profile 3	

Parameter 40-81 IoT Connection Info

Table 1208: Parameter 40-81 IoT Connection Info

40-81 IoT Connection Info		
Default value: 0	Parameter type: Range, 0 - 64, Array [8]	Setup: 1 setup
Conversion index: 0	Data type: VisStr[64]	Change during operation: True

Shows status and configuration information of the current IoT protocol.

5.31.5 40-9* Security

Parameter 40-90 UUID

Table 1209: Parameter 40-90 UUID

40-90 UUID		
Default value: Size related	Parameter type: Range, 36 - 36	Setup: 1 setup
Conversion index: 0	Data type: VisStr[36]	Change during operation: True

The Universal Unique Identifier (UUID) identifies this device within the network.

Parameter 40-92 802.1X Port-Based Network Access Control

Table 1210: Parameter 40-92 802.1X Port-Based Network Access Control

40-92 802.1X Port-Based Network Access Control		
Default value: [0] Disabled	Parameter type: Option	Setup: All setups
Conversion index: -	Data type: Uint8	Change during operation: True

Use this parameter for setting the protocol used for network port access control using 802.1X.

Option	Name	Description
[0]*	Disable	
[1]	Enable EAP-TLS	

Parameter 40-99 Protocol Status Word

Table 1211: Parameter 40-99 Protocol Status Word

40-99 Protocol Status Word		
Default value: 0	Parameter type: Range, 0 - 0xFFFFFFFF, Array [10]	Setup: 1 setup
Conversion index: 0	Data type: Uint32	Change during operation: True

This parameter shows the protocol status word for the drive in hex code.

5.32 Parameter Group 43-** Unit Readouts

The parameters in this group provide readouts for monitoring the operation of drives in enclosure sizes D–F.

5.32.1 43-0* Component Status

This parameter group contains read-only information on hardware components in the power section. All parameters in this group are arrays:

- [0]: Power card 1 (the master power card in a parallel drive, or the only power card in a drive with a single inverter section).
- [1]: Power card 2 (inverter connection in a parallel drive).
- [2]: Power card 3 (inverter connection in a parallel drive).
- [3]: Power card 4 (inverter connection in a parallel drive).
- [4]: Power card 5 (rectifier connection in a parallel drive).
- [5]: Power card 6 (rectifier connection in a parallel drive).
- [6]: Power card 7 (rectifier connection in a parallel drive).
- [7]: Power card 8 (rectifier connection in a parallel drive).
- [8]: Inrush card (optional).
- [9]: Fan power card 1 (optional).
- [10]: Fan power card 2 (optional).

Parameter 43-00 Component Temp.

Table 1212: Parameter 43-00 Component Temp.

43-00 Component Temp.		
Default value: 0 °C	Parameter type: Range, -128 - 127 °C, Array [18]	Setup: All set-ups
Conversion index: 100	Data type: Int8	Change during operation: True

Shows the temperature of a system component. The elements of the array reference local PCB temperature sensor measurements. *Parameter 16-31 System Temp*. uses all elements in this array to calculate the system temperature.

Parameter 43-01 Auxiliary Temp.

Table 1213: Parameter 43-01 Auxiliary Temp.

43-01 Auxiliary Temp.		
Default value: 0 °C	Parameter type: Range, -128 - 127 °C, Array [18]	Setup: All set-ups
Conversion index: 100	Data type: Int8	Change during operation: True

Shows the temperature of an auxiliary component. The elements of the array reference the temperature measurements from the NTC temperature sensors connected to hardware components in the drive. Refer to the Operating Guide for specifications of temperature sensor placement.

Parameter 43-02 Component SW ID

Table 1214: Parameter 43-02 Component SW ID

43-02 Component SW ID		
Default value: 0	Parameter type: Range, 0 - 20, Array [18]	Setup: All set-ups
Conversion index: 0	Data type: VisStr[18]	Change during operation: True

Shows the software version of the installed option.

5.32.2 43-1* Power Card Status

This parameter group contains read-only information on the power card status. All parameters in this group are arrays:

- [0]: Power card 1 (the master power card in a parallel drive, or the only power card in a drive with a single inverter section).
- [1]: Power card 2 (inverter connection in a parallel drive).

- [2]: Power card 3 (inverter connection in a parallel drive).
- [3]: Power card 4 (inverter connection in a parallel drive).
- [4]: Power card 5 (rectifier connection in a parallel drive).
- [5]: Power card 6 (rectifier connection in a parallel drive).
- [6]: Power card 7 (rectifier connection in a parallel drive).
- [7]: Power card 8 (rectifier connection in a parallel drive).

Parameter 43-10 HS Temp. ph.U

Table 1215: Parameter 43-10 HS Temp. ph.U

43-10 HS Temp. ph.U		
Default value: 0 °C	Parameter type: Range, -128 - 127, Array [8]	Setup: All set-ups
Conversion index: 100	Data type: Int8	Change during operation: True

Shows the heat sink temperature at the location of the phase U IGBT power module. This measurement is not available in all enclosure sizes. *Parameter 16-34 Heatsink Temp.* uses the value in this parameter.

Parameter 43-11 HS Temp. ph.V

Table 1216: Parameter 43-11 HS Temp. ph.V

43-11 HS Temp. ph.V		
Default value: 0 °C	Parameter type: Range, -128 - 127, Array [8]	Setup: All set-ups
Conversion index: 100	Data type: Int8	Change during operation: True

Shows the heat sink temperature at the location of the phase V IGBT power module. This measurement is not available in all enclosure sizes. *Parameter 16-34 Heatsink Temp.* uses the value in this parameter.

Parameter 43-12 HS Temp. ph.W

Table 1217: Parameter 43-12 HS Temp. ph.W

43-12 HS Temp. ph.W		
Default value: 0 °C	Parameter type: Range, -128 - 127, Array [8]	Setup: All set-ups
Conversion index: 100	Data type: Int8	Change during operation: True

Shows the heat sink temperature at the location of the phase W IGBT power module. This measurement is not available in all enclosure sizes. *Parameter 16-34 Heatsink Temp.* uses the value in this parameter.

Parameter 43-13 PC Fan A Speed

Table 1218: Parameter 43-13 PC Fan A Speed

43-13 PC Fan A Speed		
Default value: 0 RPM	Parameter type: Range, 0 - 65535, Array [8]	Setup: All set-ups
Conversion index: 67	Data type: Uint16	Change during operation: True

Shows the measured speed of fan A on the power card. Each power card has up to 3 fan connections. Place the fan in the drive according to the Operating Guide. A typical placement for fan A is in the backchannel (the external fan). The value of this parameter is:

- The actual fan speed when there is a DC fan in the drive.
- Relative speed when there is an AC fan in the drive.

Parameter 43-14 PC Fan B Speed

Table 1219: Parameter 43-14 PC Fan B Speed

43-14 PC Fan B Speed		
Default value: 0 RPM	Parameter type: Range, 0 - 65535, Array [8]	Setup: All set-ups
Conversion index: 67	Data type: Uint16	Change during operation: True

Shows the measured speed of fan B on the power card. Each power card has up to 3 fan connections. Place the fan in the drive according to the Operating Guide. A typical placement for fan B is on the enclosure door (the internal fan). The value of this parameter is:

- The actual fan speed when there is a DC fan in the drive.
- Relative speed when there is an AC fan in the drive.

Parameter 43-15 PC Fan C Speed

Table 1220: Parameter 43-15 PC Fan C Speed

43-15 PC Fan C Speed		
Default value: 0 RPM	Parameter type: Range, 0 - 65535, Array [8]	Setup: All set-ups
Conversion index: 67	Data type: Uint16	Change during operation: True

Shows the measured speed of fan C on the power card. Each power card has up to 3 fan connections. Place the fan in the drive according to the Operating Guide. A typical placement for fan C is inside the enclosure (the mixing fan). The value of this parameter is:

- The actual fan speed when there is a DC fan in the drive.
- Relative speed when there is an AC fan in the drive.

5.32.3 43-2* Fan Pow.Card Status

Parameter 43-20 FPC Fan A Speed

Table 1221: Parameter 43-20 FPC Fan A Speed

43-20 FPC Fan A Speed		
Default value: 0 RPM	Parameter type: Range, 0 - 65535, Array [4]	Setup: All set-ups
Conversion index: 67	Data type: Uint16	Change during operation: True

Shows the speed of the power card fan A.

Parameter 43-21 FPC Fan B Speed

Table 1222: Parameter 43-21 FPC Fan B Speed

43-21 FPC Fan B Speed		
Default value: 0 RPM	Parameter type: Range, 0 - 65535, Array [4]	Setup: All set-ups
Conversion index: 67	Data type: Uint16	Change during operation: True

Shows the speed of the power card fan B.

Parameter 43-23 FPC Fan D Speed

Table 1223: Parameter 43-23 FPC Fan D Speed

43-23 FPC Fan D Speed		
Default value: 0 RPM	Parameter type: Range, 0 - 65535, Array [4]	Setup: All set-ups
Conversion index: 67	Data type: Uint16	Change during operation: True

Shows the speed of the power card fan D.

Parameter 43-24 FPC Fan E Speed

Table 1224: Parameter 43-24 FPC Fan E Speed

43-24 FPC Fan E Speed		
Default value: 0 RPM	Parameter type: Range, 0 - 65535, Array [4]	Setup: All set-ups
Conversion index: 67	Data type: Uint16	Change during operation: True

Shows the speed of the power card fan E.

Parameter 43-25 FPC Fan F Speed

Table 1225: Parameter 43-25 FPC Fan F Speed

43-25 FPC Fan F Speed		
Default value: 0 RPM	Parameter type: Range, 0 - 65535, Array [4]	Setup: All set-ups
Conversion index: 67	Data type: Uint16	Change during operation: True

Shows the speed of the power card fan F.

5.33 Parameter Group 50-** License

Parameter 50-00 License Installed

Table 1226: Parameter 50-00 License Installed

50-00 License Installed		
Default value: 0	Parameter type: Range, 0 - 40, Array [3]	Setup: All setups
Conversion index: 0	Data type: VisStr[40]	Change during operation: False

Shows all licenses activated in the drive.

Parameter 50-01 License Code

Table 1227: Parameter 50-01 License Code

50-01 License Code		
Default value: Size related	Parameter type: Range, 0 - 19	Setup: 1 setup
Conversion index: 0	Data type: VisStr[19]	Change during operation: True

Enter the license code provided by the Danfoss sales representative to activate licensed features in the drive. The license code comprises 16 alphanumeric characters in the format (XXXX-XXXX-XXXX-XXXX). When the license is accepted by the drive, the parameter is shown as 0000-0000-0000-0000.

N O T I C E

Restart the drive after entering the new license code. Parameters relevant for configuring the new feature(s) are now shown in the drive. The new type code is reflected in *parameter 15-45 Actual Typecode String*. The original type code of the drive can be viewed in *parameter 15-44 Ordered Typecode String*. The activated license is shown in *parameter 50-00 License Installed*.

The license code can also be set from the factory.

5.34 Parameter Group 600-** PROFIsafe

Parameter 600-00 Velocity Reference Value

Table 1228: Parameter 600-00 Velocity Reference Value

600-00 Velocity Reference Value		
Default value: 50.000 ReferenceFeedback-Unit	Parameter type: Range, -999999.999 - 999999.999 ReferenceFeedbackUnit	Setup: All setups
Conversion index: -3	Data type: Int32	Change during operation: True

The velocity reference sets the speed value for 100% for N2/N4 normalized speed signals.

6 Troubleshooting

6.1 Status Messages

6.1.1 Warnings and Alarms

A warning or an alarm is signaled by the relevant indicator light on the front of the drive and indicated by a code on the display.

A warning remains active until its cause is no longer present. Under certain circumstances, operation of the motor may still be continued. Warning messages may be critical, but are not necessarily so.

In the event of an alarm, the drive trips. Reset the alarm to resume operation once the cause has been rectified.

3 ways to reset:

- Press [Reset].
- Via a digital input with the reset function.
- Via serial communication/optional fieldbus.

NOTICE

After a manual reset pressing [Reset], press [Auto On] to restart the motor.

If an alarm cannot be reset, the reason may be that its cause has not been rectified, or the alarm is trip locked.

Alarms that are trip locked offer extra protection, meaning that the mains supply must be switched off before the alarm can be reset. After being switched back on, the drive is no longer blocked and can be reset once the cause has been rectified.

Alarms that are not trip locked can also be reset using the automatic reset function in *parameter 14-20 Reset Mode* (Warning: Automatic wake up is possible.)

If a warning or alarm is marked against a code in the alarm/warning code list, this means that either a warning occurs before an alarm, or it is possible to specify whether a warning or an alarm should be shown for a given fault.

This is possible, for instance, in *parameter 1-90 Motor Thermal Protection*. After an alarm or trip, the motor carries on coasting, and the alarm and warning flash. Once the problem has been rectified, only the alarm continues flashing until the drive is reset.

NOTICE

No missing motor phase detection (numbers 30-32) and no stall detection are active when *parameter 1-10 Motor Construction* is set to *[1] PM non-salient SPM*.

6.1.2 Alarm/Warning Code List

NOTICE

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 1229: Alarm/Warning Code List

Number	Description	Warning	Alarm/trip	Alarm/trip lock	Parameter reference	Fire mode alarm handling selected in *parameter 24-09 Fire Mode Alarm Handling*. Critical alarms cause a trip			Warranty-affecting alarms in fire mode
						[0] Trip + Reset	[1] Trip	[2] Test	
1	10 volts 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 Fire Mode Live Zero Timeout Function*	Ignored	Ignored	(Warning/Trip)	–
3	No motor connec.	X	(X)	–	*Parameter 1-80 Function at Stop*	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	–
9	Inverter overld.	–	X	–	Alternatively, *parameter 14-61 Function at Inverter Overload* can be set to *[0] Derate*	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	–	–	*Parameter 14-90.6 Fault level* and *parameter 14-25 Trip Delay at Torque Limit*	Ignored	Ignored	Warning/Trip	–

Number	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	Fire mode alarm handling selected in *parameter 24-09 Fire Mode Alarm Handling*. Critical alarms cause a trip			Warranty-affecting alarms in fire mode
						[0] Trip + Reset	[1] Trip	[2] Test	
13	Overcurrent	–	–	X	*Parameter 14-90 Fault Settings*	Trip+Reset	Trip	Trip lock	–
14	Ground fault	–	X	–	*Parameter 14-90.4 Fault Level*	Trip+Reset	Trip	Trip	–
15	Incomp. hardware	–	X	X	–	Ignored	Ignored	Trip/Trip lock	–
16	Short circuit	–	–	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)	–
18	Start failed	–	X	–	–	Ignored	Ignored	Trip	–
20	Temp. input error	–	X	–	–				
21	Param error	–	–	X	–				
23	Internal fans	X	(X)	–	*Parameter 14-53 Fan Monitor*	Ignored	Ignored	(Warning/ Trip)	–
24	External fans	X	(X)	–	*Parameter 14-53 Fan Monitor*	Ignored	Ignored	(Warning/ Trip)	–
25	Brake resistor	X	(X)	(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)	(X)	*Parameter 2-15 Brake Check*	Ignored	Ignored	(Warning/ Trip lock)	–
29	Power module temp	–	–	X	*Parameter 14-90.9 Fault Level*	Ignored	Ignored	Trip lock	X
30	U phase loss	–	–	–	Alternatively, *parameter 4-58 Missing Motor Phase Function* can be set to *[0] Disable*.	Ignored	Ignored	Trip lock	–

Number	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	Fire mode alarm handling selected in *parameter 24-09 Fire Mode Alarm Handling*. Critical alarms cause a trip			Warranty-affecting alarms in fire mode
						[0] Trip + Reset	[1] Trip	[2] Test	
		–	–	X	*Parameter 14-90.16 Fault Level*				
31	V phase loss	–	–	–	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	–	–	–	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	–	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)	–
38	Internal fault	–	–	X	–	Ignored	Ignored	Trip/Trip lock	X
39	Heat sink sensor	–	–	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)	–
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	–	–	–				

Number	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	Fire mode alarm handling selected in *parameter 24-09 Fire Mode Alarm Handling*. Critical alarms cause a trip			Warranty-affecting alarms in fire mode
						[0] Trip + Reset	[1] Trip	[2] Test	
45	Ground fault 2	–	X(1)	–	*Parameter 14-90.5 Fault Level*	Ignored	Ignored	Trip	–
46	Pwr. card supply	–	–	X	–	Ignored	Ignored	Trip/Trip lock	–
47	24 V supply low	–	–	X	*Parameter 14-90 Fault Settings*	Ignored	Ignored	Trip lock	–
48	1.2 V supply low	–	–	X	*Parameter 14-90 Fault Settings*	Ignored	Ignored	Trip lock	–
49	Speed limit	X	(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	–	–				
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	–	–	Ignored	Ignored	Trip	–
59	Current limit	X	–	–	*Parameter 14-90 Fault Settings*	Ignored	Ignored	Warning	–
60	External interlock	–	X	–	–	Ignored	Ignored	Warning	–
61	Tracking 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	*Parameter 14-90.11 Fault Level*	Ignored	Ignored	Trip lock	X
66	Low temp.	X	–	–	–	Ignored	Ignored	Warning	–

Number	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	Fire mode alarm handling selected in *parameter 24-09 Fire Mode Alarm Handling*. Critical alarms cause a trip			Warranty-affecting alarms in fire mode
						[0] Trip + Reset	[1] Trip	[2] Test	
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	*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)	–
76	Power unit setup	X	–	–	–	Ignored	Ignored	Warning	–
77	Reduced power mode	X	–	–	*Parameter 14-59 Actual Number of Inverter Units*				
79	Illegal PS config	–	–	X	–	Ignored	Ignored	Trip/Trip lock	–
80	Drive initialized	–	X	–	–	Ignored	Ignored	Trip	–
81	CSIV corrupt	–	X	–	–				
82	CSIV parameter error	–	X	–	–				
88	Option detection	–	–	X	–				
90	Feedback mon.	X	X	–					
91	AI54 set wrong	–	X	–		Ignored	Ignored	Trip lock	–
92	No-flow	(X)	(X)	–	*Parameter 22-23 No-flow Function*	Ignored	Ignored	(Warning/ Trip)	–
93	Dry pump	(X)	(X)	–	*Parameter 22-26 Dry Pump Function*	Ignored	Ignored	(Warning/ Trip)	–
94	End of curve	(X)	(X)	–	*Parameter 22-50 End of Curve Function*	Ignored	Ignored	(Warning/ Trip)	–

Number	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	Fire mode alarm handling selected in *parameter 24-09 Fire Mode Alarm Handling*. Critical alarms cause a trip			Warranty-affecting alarms in fire mode
						[0] Trip + Reset	[1] Trip	[2] Test	
95	Broken belt	(X)	(X)	–	*Parameter 22-60 Broken Belt Function*	Ignored	Ignored	(Warning/ Trip)	–
96	Start delayed	X	–	–	–	Ignored	Ignored	Warning	–
97	Stop delayed	X	–	–	–	Ignored	Ignored	Warning	–
98	Clock fault	X	–	–	–	Ignored	Ignored	Warning	–
99	Locked rotor	–	(X)	X	*Parameter 14-90 Fault Settings*	Ignored	Ignored	Trip/Trip lock	–
103	Illegal axis num.	–	X	–	–				
104	Mixing fans	X	X	–	*Parameter 14-53 Fan Monitor*	Ignored	Ignored	(Warning/ Trip)	–
105	Error not reset								
106	HOME not done								
108	Position error								
109	Index not found								
110	Unknown cmd.								
111	SW end limit								
112	Unknown param								
113	FC not enabled								
114	Too many loops								
115	Par.save failed								
116	Param. memory								
117	Progr. memory								
118	Reset by CPU								
119	User abort								
122	Mot. rotat. unexp.	–	X	–	–				
124	User alert	X	(X)	(X)					

Number	Description	Warning	Alarm/trip	Alarm/trip lock	Parameter reference	Fire mode alarm handling selected in *parameter 24-09 Fire Mode Alarm Handling*. Critical alarms cause a trip			Warranty-affecting alarms in fire mode
						[0] Trip + Reset	[1] Trip	[2] Test	
125	HW end limit								
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. 24 V								
151	GOSUB > limit								
152	Return @ limit								
154	D.out overload								
155	LINK failed								
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								
179	WAITNDX TO.								
184	ONTIME > limit								
187	Out of memory								

Number	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	Fire mode alarm handling selected in *parameter 24-09 Fire Mode Alarm Handling*. Critical alarms cause a trip			Warranty-affecting alarms in fire mode
						[0] Trip + Reset	[1] Trip	[2] Test	
190	Memory locked								
191	Ill. cam array								
192	Encoder error								
199	Intern MCO err								
200	Fire mode	X	–	–	–	Ignored	Ignored	Warning	–
201	Fire m was active	X	–	–	–	Ignored	Ignored	Warning	–
202	Fire m limits exceeded	X	–	X	–	Ignored	Ignored	Warning	–
203	Missing motor	X	–	–	–	Ignored	Ignored	Warning	–
204	Locked rotor	X	–	–		Ignored	Ignored	Warning	–
219	Pump interlock	X	–	–					
220	Overload trip	–	X	–	–				
221	Bypass interlock	–	X	–					
222	M2 open failed	–	–	X					
223	M2 close failed	–	–	X					
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	Read in progress	–	X	–					
239	SAS file invalid	–	X	–					

Number	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference	Fire mode alarm handling selected in *parameter 24-09 Fire Mode Alarm Handling*. Critical alarms cause a trip			Warranty-affecting alarms in fire mode
						[0] Trip + Reset	[1] Trip	[2] Test	
240	Write failed	–	X	–					
241	Write complete	–	X	–					
242	Write in progress	–	X	–					
243	Brake IGBT	(X)	(X)	(X)	*Parameter 2-13 Brake Power Monitoring*, default *[0] Off*	Ignored	Ignored	Warning/ Trip	–
244	Heatsink temp	–	–	X	*Parameter 14-90 Fault Settings*	Ignored	Ignored	Trip lock	X
245	Heatsink 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
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	–	Ignored	Ignored	Trip/Trip lock	–
252	X49/7 overload								
253	X49/9 overload								
254	X49/11 overload								
280	Fire m service warning	X	–	–	–				
281	FM OPR unexpected	X	–	–	–				
290	Connection to one master is lost	X	–	–					
300	Mains cont. fault	–	–	X	*Parameter 14-90 Fault Settings*	Ignore	Ignore	Trip lock	
301	SC cont. fault								

Number	Description	Warning	Alarm/trip	Alarm/trip lock	Parameter reference	Fire mode alarm handling selected in *parameter 24-09 Fire Mode Alarm Handling*. Critical alarms cause a trip			Warranty-affecting alarms in fire mode
						[0] Trip + Reset	[1] Trip	[2] Test	
421	FPC temp	–	X	–					
423	FPC updating	–	X	–					
424	FPC update success	–	X	–					
425	FPC update failure	–	–	X					
426	FPC config	–	–	X					
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 high S2	(X)	(X)		*Parameter 45-00.1 Function*	Ignored	Ignored	Ignored	
502	Sensor 1 high S2	(X)	(X)		*Parameter 45-00.2 Function*	Ignored	Ignored	Ignored	
503	Sensor 2 high S2	(X)	(X)		*Parameter 45-00.3 Function*	Ignored	Ignored	Ignored	
504	Sensor 3 high S2	(X)	(X)		*Parameter 45-00.4 Function*	Ignored	Ignored	Ignored	
505	Sensor 4 high 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 high S1	(X)	(X)		*Parameter 45-00.2 Function*	Ignored	Ignored	Ignored	
513	Sensor 2 high S1	(X)	(X)		*Parameter 45-00.3 Function*	Ignored	Ignored	Ignored	
514	Sensor 3 high S1	(X)	(X)		*Parameter 45-00.4 Function*	Ignored	Ignored	Ignored	
515	Sensor 4 high S1	(X)	(X)		*Parameter 45-00.5 Function*	Ignored	Ignored	Ignored	

Number	Description	Warning	Alarm/trip	Alarm/trip lock	Parameter reference	Fire mode alarm handling selected in *parameter 24-09 Fire Mode Alarm Handling*. Critical alarms cause a trip			Warranty-affecting alarms in fire mode
						[0] Trip + Reset	[1] Trip	[2] Test	
516	Load low S1	(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 threshold calculation exceeds maximum value	(X)							
523	Sensor 2 threshold calculation exceeds maximum value	(X)							
524	Sensor 3 threshold calculation exceeds maximum value	(X)							
525	Sensor 4 threshold calculation exceeds maximum value	(X)							
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 licence.

[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.

(X) Dependent on parameter.

A trip is the action following an alarm. The trip coasts the motor and is reset by pressing [Reset] or by a digital input (*parameter group 5-1* Digital Inputs*). The original event that caused an alarm cannot damage the drive or cause dangerous conditions.

A trip lock is an action when an alarm occurs, which could damage the drive or connected parts. A trip lock situation can only be reset by cycling power.

6.1.3 Indicator Light

Table 1230: Indicator Light

Warning	Yellow
Alarm	Flashing red
Trip locked	Yellow and red

6.1.4 Alarm Word, Warning Word, and Extended Status Word

Table 1231: Description of Alarm Word

Bit	Hex	Dec	Alarm word	Alarm word 2	Alarm word 3
			Parameter 16-90 Alarm Word	*Parameter 16-91 Alarm Word 2*	*Parameter 16-97 Alarm Word 3*
Alarm Word Extended Status Word					
0	00000001	1	Brake check (A28)	Servicetrip, read/ write	Temp. input error
1	00000002	2	Pwr.card temp (A69)	Servicetrip, (reserved)	Memory module fault
2	00000004	4	Earth fault (A14)	Servicetrip, typecode/spare part	Internal fan error
3	00000008	8	Ctrl.card temp (A65)	Servicetrip, (reserved)	Sync. fault
4	00000010	16	Ctrl. word TO (A17)	Servicetrip, (reserved)	OPM fault
5	00000020	32	Overcurrent (A13)	Reserved	–
6	00000040	64	Torque limit (A12)	Reserved	Profibus converter invalid
7	00000080	128	Motor th over (A11)	Reserved	–
8	00000100	256	Motor ETR over (A10)	Reserved	–
9	00000200	512	Inverter overld. (A9)	Discharge high	–
10	00000400	1024	DC under volt (A8)	Start failed	–
11	00000800	2048	DC over volt (A7)	Speed limit	–
12	00001000	4096	Short circuit (A16)	External interlock	–
13	00002000	8192	Inrush fault (A33)	Illegal option combi.	–
14	00004000	16384	Mains ph. loss (A4)	No safety option	–
15	00008000	32768	AMA not OK	Reserved	–
16	00010000	65536	Live zero error (A2)	Reserved	–
17	00020000	131072	Internal fault (A38)	KTY error	–
18	00040000	262144	Brake overload (A26)	Fans error	–
19	00080000	524288	U phase loss (A30)	ECB error	–
20	00100000	1048576	V phase loss (A31)	Hoist mechanical brake (A22)	–
21	00200000	2097152	W phase loss (A32)	Reserved	–
22	00400000	4194304	Fieldbus fault (A34)	Reserved	–

Bit	Hex	Dec	Alarm word	Alarm word 2	Alarm word 3
			Parameter 16-90 Alarm Word	*Parameter 16-91 Alarm Word 2*	*Parameter 16-97 Alarm Word 3*
23	00800000	8388608	24 V supply low (A47)	Reserved	–
24	01000000	16777216	Mains failure (A36)	Reserved	–
25	02000000	33554432	1.8 V supply low (A48)	Current limit (A59)	Emergency mode
26	04000000	67108864	Brake resistor (A25)	Motor rotating unexpectedly (A122)	Sensor 4
27	08000000	134217728	Brake IGBT (A27)	Reserved	Sensor 3
28	10000000	268435456	Option change (A67)	Reserved	Sensor 2
29	20000000	536870912	Drive initialized (A80)	Encoder loss (A90)	Sensor 1
30	40000000	1073741824	Safe stop (A68)	PTC thermistor (A74)	Load
31	80000000	2147483648	Mech. brake low (A63	Dangerous failure (A72)	Stator

Table 1232: Description of Warning Word

Bit	Hex	Dec	Warning word	Warning word 2	Warning word 3
			Parameter 16-92 Warning Word	*Parameter 16-93 Warning Word 2*	*Parameter 16-98 Warning Word 3*
Warning Word					
0	00000001	1	Brake check (W28)	Start delayed	Temp. input error
1	00000002	2	Pwr.card temp (A69)	Stop delayed	–
2	00000004	4	Earth fault (W14)	Reserved	Internal fan warning
3	00000008	8	Ctrl.card temp (W65)	Reserved	–
4	00000010	16	Ctrl. word TO (W17)	–	–
5	00000020	32	Overcurrent (W13)	Reserved	Test MOC function
6	00000040	64	Torque limit (W12)	Reserved	Profibus converter time warning
7	00000080	128	Motor th over (W11)	Reserved	EmcymodeActive
8	00000100	256	Motor ETR over (W10)	Reserved	EmcymodeHasBeenActive
9	00000200	512	Inverter Overld (W9)	Discharge high	EmcymodeLimits active
10	00000400	1024	DC under volt (W8)	Multi-motor underload	EmcymodeServiceRequest due to limits
11	00000800	2048	DC over volt (W7)	Multi-motor overload	EmcymodeNotRedyToOperate
12	00001000	4096	DC voltage low (W6)	Compressor interlock	CBM Reserved
13	00002000	8192	DC voltage high (W5)	Mechanical brake sliding	CBM Reserved
14	00004000	16384	Mains ph. loss (W4)	Safe option warning	CBM Reserved
15	00008000	32768	No motor (W3)	Auto DC braking	CBM Reserved

Bit	Hex	Dec	Warning word	Warning word 2	Warning word 3
			Parameter 16-92 Warning Word	*Parameter 16-93 Warning Word 2*	*Parameter 16-98 Warning Word 3*
16	00010000	65536	Live zero error (W2)		CBM Reserved
17	00020000	131072	10 V low (W1)	KTY warn	CBM Reserved
18	00040000	262144	Brake overload (W26)	Fans warn	Load low S2
19	00080000	524288	Brake resistor (W25)	ECB warn	Load low
20	00100000	1048576	Brake IGBT (W27)	Hoist mechanical brake (W22)	Sensor 4 S2
21	00200000	2097152	Speed limit (W49)	Reserved	Sensor 4
22	00400000	4194304	Fieldbus fault (W34)	Reserved	Sensor 3 S2
23	00800000	8388608	24 V supply low (W47)	Reserved	Sensor 3
24	01000000	16777216	Mains failure (W36)	Reserved	Sensor 2 S2
25	02000000	33554432	Current limit (W59)	Power Limit Motor	Sensor 2
26	04000000	67108864	Low temp (W66)	Power Limit Generator	Sensor 1 S2
27	08000000	134217728	Voltage limit (W64)	Reserved	Sensor 1
28	10000000	268435456	Encoder loss (W90)	Reserved	Load S2
29	20000000	536870912	Output freq. lim. (W62)	BackEMF too high	Load
30	40000000	1073741824	Safe stop (W68)	PTC thermistor (W74)	Stator S2
31	80000000	2147483648	Extended status word	–	Stator

Table 1233: Description of Extended Status Word

Bit	Hex	Dec	Ext. status word	Ext. status word 2	Ext. status word 3
			Parameter 16-94 Ext. Status Word	*Parameter 16-95 Ext. Status Word 2*	*Parameter 16-99 Ext. Status Word 3*
Extended Status Word					
0	00000001	1	Ramping	Off	High pressure stop
1	00000002	2	AMA running	Hand/auto	Low pressure stop
2	00000004	4	Start CW/CCW start_possible is active, when the DI selections [12] OR [13] are active and the requested direction matches the reference sign	Profibus OFF1 active	Defrost
3	00000008	8	Slow down slow down command active, for example via CTW bit 11 or DI	Profibus OFF2 active	Pre/post lube

Bit	Hex	Dec	Ext. status word	Ext. status word 2	Ext. status word 3
			Parameter 16-94 Ext. Status Word	*Parameter 16-95 Ext. Status Word 2*	*Parameter 16-99 Ext. Status Word 3*
4	00000010	16	Catch up catch up command active, for example via CTW bit 12 or DI	Profibus OFF3 active	User-defined alerts
5	00000020	32	Feedback high feedback >*parameter 4-57 Warning Feedback High*	Relay 123 active	–
6	00000040	64	Feedback low feedback <*parameter 4-56 Warning Feedback Low*	Start prevented	–
7	00000080	128	Output current high current >*parameter 4-51 Warning Current High*	Control ready	–
8	00000100	256	Output current low current <*parameter 4-50 Warning Current Low*	Drive ready	–
9	00000200	512	Output freq high speed >*parameter 4-53 Warning Speed High*	Quick stop	–
10	00000400	1024	Output freq low speed <*parameter 4-52 Warning Speed Low*	DC brake	–
11	00000800	2048	Brake check OK brake test NOT OK	Stop	–
12	00001000	4096	Braking max. BrakePower > Brakepowerlimit (2-12)	Standby	–
13	00002000	8192	Braking	Freeze output re-quest	–
14	00004000	16384	Out of speed range	Freeze output	–
15	00008000	32768	OVC active	Jog request	–
16	00010000	65536	AC brake	Jog	–
17	00020000	131072	Password timelock number of allowed password trials exceeded - timelock active	Start request	–
18	00040000	262144	Password protection 0-61 = ALL_NO_ACCESS OR BUS_NO_ACCESS OR BUS_READONLY	Start	–
19	00080000	524288	Reference high reference >*parameter 4-55 Warning Reference High*	Start applied	–

Bit	Hex	Dec	Ext. status word	Ext. status word 2	Ext. status word 3
			Parameter 16-94 Ext. Status Word	*Parameter 16-95 Ext. Status Word 2*	*Parameter 16-99 Ext. Status Word 3*
20	00100000	1048576	Reference low reference <*parameter 4-54 Warning Reference Low*	Start delay	–
21	00200000	2097152	Local reference reference site = REMOTE -> auto on pressed & active	Sleep	–
22	00400000	4194304	Protection mode notification	Sleep boost	–
23	00800000	8388608	Unused	Running/pipe filling	–
24	01000000	16777216	Unused	Drive bypass	–
25	02000000	33554432	Unused	Emergency mode	–
26	04000000	67108864	Unused	External interlock	–
27	08000000	134217728	Unused	Emerg. m limit exceeded	–
28	10000000	268435456	Unused	FlyStart active	–
29	20000000	536870912	Unused	–	–
30	40000000	1073741824	Unused	–	–
31	80000000	2147483648	Protection mode	No function	–

The alarm words, warning words and extended status words can be read out via a serial bus or optional fieldbus for diagnostics. See also *parameter 16-94 Ext. Status Word*.

6.2 Descriptions of Warnings and Alarms

Depending on settings, FC 301/302 is able to give warnings or trigger alarms. Below, an extract of most common alarms and warnings can be found.

The following warning and alarm information defines each warning or alarm condition, provides the probable cause for the condition, and entails a remedy or troubleshooting procedure.

6.2.1 WARNING 1, 10 Volts Low

Cause

The control card voltage is less than 10 V from terminal 50. Remove some of the load from terminal 50, as the 10 V supply is overloaded. Maximum 15 mA or minimum 590 Ω.

A short circuit in a connected potentiometer or incorrect wiring of the potentiometer can cause this condition.

Troubleshooting

Remove the wiring from terminal 50.

- If the warning clears, the problem is with the wiring.
- If the warning does not clear, replace the control card.

6.2.2 WARNING/ALARM 2, Live Zero Error

Cause

This warning or alarm only appears if programmed in *parameter 6-01 Live Zero Timeout Function*. The signal on 1 of the analog inputs is less than 50% of the minimum value programmed for that input. Broken wiring or a faulty device sending the signal can cause this condition.

Troubleshooting

- Check connections on all analog mains terminals.
  - Control card terminals 53 and 54 for signals, terminal 55 common.
  - VLT® General Purpose I/O MCB 101 terminals 11 and 12 for signals, terminal 10 common.
  - VLT® Analog I/O Option MCB 109 terminals 1, 3, and 5 for signals, terminals 2, 4, and 6 common.
- Check that the drive programming and switch settings match the analog signal type.
- Perform an input terminal signal test.

6.2.3 WARNING/ALARM 3, No Motor

Cause

No motor is connected to the output of the drive.

6.2.4 WARNING/ALARM 4, Mains Phase Loss

Cause

A phase is missing on the supply side, or the mains voltage imbalance is too high. This message also appears for a fault in the input rectifier. Options are programmed in *parameter 14-12 Function at Mains Imbalance*.

Troubleshooting

- Check the supply voltage and supply currents to the drive.

6.2.5 WARNING 5, DC Link Voltage High

Cause

The DC-link voltage (DC) is higher than the high-voltage warning limit. The limit depends on the drive voltage rating. The unit is still active.

6.2.6 WARNING 6, DC Link Voltage Low

Cause

The DC-link voltage (DC) is lower than the low-voltage warning limit. The limit depends on the drive voltage rating. The unit is still active.

6.2.7 WARNING/ALARM 7, DC Overvoltage

Cause

If the DC-link voltage exceeds the limit, the drive trips after a certain time.

Troubleshooting

- Extend the ramp time.
- Change the ramp type.
- Activate the functions in *parameter 2-10 Brake Function*.
- Increase *parameter 14-26 Trip Delay at Inverter Fault*.
- If the alarm/warning occurs during a power sag, use kinetic back-up (*parameter 14-10 Mains Failure*).
- Connect a brake resistor.

6.2.8 WARNING/ALARM 8, DC Undervoltage

Cause

If the DC-link voltage drops below the undervoltage limit, the drive checks for 24 V DC back-up supply. If no 24 V DC back-up supply is connected, the drive trips after a fixed time delay. The time delay varies with unit size.

Troubleshooting

- Check that the supply voltage matches the drive voltage.
- Perform an input voltage test.
- Perform a soft-charge circuit test.

6.2.9 WARNING/ALARM 9, Inverter Overload

Cause

The drive has run with more than 100% overload for too long and is about to cut out. The counter for electronic thermal inverter protection issues a warning at 98% and trips at 100% with an alarm. The drive cannot be reset until the counter is below 90%.

Troubleshooting

- Compare the output current shown on the LCP with the drive rated current.
- Compare the output current shown on the LCP with the measured motor current.
- Show the thermal drive load on the LCP and monitor the value.
  - When running above the drive continuous current rating, the counter increases.
  - When running below the drive continuous current rating, the counter decreases.

6.2.10 WARNING/ALARM 10, Motor Overload Temperature

Cause

According to the electronic thermal protection (ETR), the motor is too hot.

This warning/alarm is controlled by *parameter 1-90 Motor Thermal Protection*:

- If the parameter is set to warning options, the drive issues a warning or an alarm when the counter is >90%.
- If the parameter is set to trip options, the drive trips when the counter reaches 100%.

The fault occurs when the motor runs with more than 100% overload for too long.

Troubleshooting

- Check for motor overheating.
- Check whether the motor is mechanically overloaded.
- Check that the motor current set in *parameter 1-24 Motor Current* is correct.
- Ensure that the motor data in *parameters 1-20* to *1-25* is set correctly.
- If an external fan is in use, check that it is selected in *parameter 1-91 Motor External Fan*.
- Run AMA in *parameter 1-29 Automatic Motor Adaptation (AMA)*. This tunes the drive to the motor more accurately and reduces thermal loading.

6.2.11 WARNING/ALARM 11, Motor Thermistor Overtemp

Cause

The motor thermistor indicates that the motor temperature is too high.

Troubleshooting

- Check for motor overheating.
- Check that the thermistor is securely connected.
- Check whether the motor is mechanically overloaded.
- When using terminal 53 or 54:
  - Check that the thermistor is connected correctly between either terminal 53 or 54 (analog voltage input) and terminal 50 (+10 V supply).
  - Check that the terminal switch for 53 and 54 is set for voltage.
  - Check that *parameter 1-93 Thermistor Resource* selects 53 or 54.
- When using terminal 18, 19, 31, 32, or 33 (digital inputs):
  - Check that the thermistor is connected correctly between the digital input terminal used (digital input PNP only) and terminal 50.
  - Select the terminal to use in *parameter 1-93 Thermistor Resource*.

6.2.12 WARNING/ALARM 12, Torque Limit

Cause

The torque has exceeded the value in *parameter 4-16 Torque Limit Motor Mode* or the value in *parameter 4-17 Torque Limit Generator Mode*. *Parameter 14-25 Trip Delay at Torque Limit* can change this warning from a warning-only condition to a warning followed by an alarm.

Troubleshooting

- If the motor torque limit is exceeded during ramp-up, extend the ramp-up time.
- If the generator torque limit is exceeded during ramp-down time, extend the ramp-down time.
- If torque limit occurs while running, increase the torque limit. Make sure that the system can operate safely at a higher torque.
- Check the application for excessive current draw on the motor.

6.2.13 WARNING/ALARM 13, Overcurrent

Cause

The inverter peak current limit (approximately 200% of the rated current) is exceeded. The warning lasts approximately 1.5 s, then the drive trips and issues an alarm. Shock loading or quick acceleration with high-inertia loads can cause this fault. If the acceleration during ramp-up is quick, the fault can also appear after kinetic back-up. If extended mechanical brake control is selected, a trip can be reset externally.

Troubleshooting

- Remove power and check if the motor shaft can be turned.
- Check that the motor size matches the drive.
- Check that the motor data is correct in *parameters 1-20* to *1-25*.

6.2.14 ALARM 14, Earth (Ground) Fault

Cause

There is current from the output phase to ground, either in the cable between the drive and the motor, or in the motor itself. The current sensors detect the ground fault by measuring current going out from the drive and current going into the drive from the motor. Ground fault is issued if the deviation of the 2 currents is too large. The current going out of the drive must be the same as the current going into the drive.

Troubleshooting

- Remove power to the drive and repair the ground fault.
- Check for ground faults in the motor by measuring the resistance to ground of the motor cables and the motor with a megohmmeter.
- Reset any potential individual offset in the 3 current sensors in the drive. Perform a manual initialization or perform a complete AMA. This method is most relevant after changing the power card.

6.2.15 ALARM 15, Hardware Mismatch

Cause

A fitted option is not operational with the present control card hardware or software.

Troubleshooting

Record the value of the following parameters and contact Danfoss.

- *Parameter 15-40 FC Type*.
- *Parameter 15-41 Power Section*.
- *Parameter 15-42 Voltage*.
- *Parameter 15-43 Software Version*.
- *Parameter 15-45 Actual Typecode String*.
- *Parameter 15-49 SW ID Control Card*.
- *Parameter 15-50 SW ID Power Card*.
- *Parameter 15-60 Option Mounted*.
- *Parameter 15-61 Option SW Version* (for each option slot).

6.2.16 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 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.

6.2.17 WARNING/ALARM 17, Control Word Timeout

Cause

There is no communication to the drive. The warning is only active when *parameter 8-04 Control Word Timeout Function* is NOT set to *[0] Off*.

If *parameter 8-04 Control Word Timeout Function* is set to *[5] Stop and trip*, a warning appears, and the drive ramps down to a stop and shows an alarm.

Troubleshooting

- Check the connections on the serial communication cable.
- Increase *parameter 8-03 Control Word Timeout Time*.
- Check the operation of the communication equipment.
- Verify that proper EMC installation was performed.

6.2.18 ALARM 18, Start Failed

The speed has not been able to exceed *parameter 1-77 Compressor Start Max Speed [RPM]* during start within the allowed time (set in *parameter 1-79 Compressor Max Time to Trip*).

Troubleshooting

- Check if the motor is blocked.

6.2.19 WARNING/ALARM 20, Temp. Input Error

Cause

The temperature sensor is not connected.

6.2.20 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.

6.2.21 WARNING 23, Internal Fan Fault

Cause

The fan warning function is a protective function that checks if the fan is running/mounted. The fan warning can be disabled in *parameter 14-53 Fan Monitor* (*[0] Disabled*).

For drives with DC fans, a feedback sensor is mounted in the fan. If the fan is commanded to run and there is no feedback from the sensor, this warning appears. For drives with AC fans, the voltage to the fan is monitored.

Troubleshooting

- Check for proper fan operation.
- Cycle power to the drive and check that the fan operates briefly at start-up.
- Check the sensors on the control card.

6.2.22 WARNING 24, External Fan Fault

Cause

The fan warning function is a protective function that checks if the fan is running/mounted. The fan warning can be disabled in *parameter 14-53 Fan Monitor* (*[0] Disabled*).

For drives with DC fans, a feedback sensor is mounted in the fan. If the fan is commanded to run and there is no feedback from the sensor, this warning appears. For drives with AC fans, the voltage to the fan is monitored.

Troubleshooting

- Check for proper fan operation.
- Cycle power to the drive and check that the fan operates briefly at start-up.
- Check the sensors on the heat sink.

6.2.23 WARNING 25, Brake Resistor Short Circuit

Cause

The brake resistor is monitored during operation. If a short circuit occurs, the brake function is disabled and the warning appears. The drive is still operational, but without the brake function.

Troubleshooting

- Remove the power to the drive and replace the brake resistor (refer to *parameter 2-15 Brake Check*).

6.2.24 WARNING/ALARM 26, Brake Resistor Power Limit

Cause

The power transmitted to the brake resistor is calculated as a mean value over the last 120 s of run time. The calculation is based on the DC-link voltage and the brake resistor value set in *parameter 2-16 AC Brake Max. Current*. The warning is active when the dissipated braking power is higher than 90% of the brake resistor power. If option *[2] Trip* is selected in *parameter 2-13 Brake Power Monitoring*, the drive trips when the dissipated braking power reaches 100%.

6.2.25 WARNING/ALARM 27, Brake Chopper Fault

Cause

The brake transistor is monitored during operation, and if a short circuit occurs, the brake function is disabled, and a warning is issued. The drive is still operational, but since the brake transistor has short-circuited, substantial power is transmitted to the brake resistor, even if it is inactive.

Troubleshooting

- Remove the power to the drive and remove the brake resistor.

6.2.26 WARNING/ALARM 28, Brake Check Failed

Cause

The brake resistor is not connected or not working.

Troubleshooting

- Check *parameter 2-15 Brake Check*.

6.2.27 ALARM 29, Heat Sink Temp

Cause

The maximum temperature of the heat sink is exceeded. The temperature fault is not reset until the temperature drops below a defined heat sink temperature. The trip and reset points are different based on the drive power size.

Troubleshooting

Check for the following conditions:

- The ambient temperature is too high.
- The motor cables are too long.
- Incorrect airflow clearance above and below the drive.
- Blocked airflow around the drive.
- Damaged heat sink fan.
- Dirty heat sink.

6.2.28 ALARM 30, Motor Phase U Missing

Cause

Motor phase U between the drive and the motor is missing.

Troubleshooting

WARNING

HAZARDOUS VOLTAGE

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

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

- Disconnect power before proceeding.
- Remove the power from the drive and check motor phase U.

6.2.29 ALARM 31, Motor Phase V Missing

Cause

Motor phase V between the drive and the motor is missing.

Troubleshooting

WARNING

HAZARDOUS VOLTAGE

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

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

- Disconnect power before proceeding.
- Remove the power from the drive and check motor phase V.

6.2.30 ALARM 32, Motor Phase W Missing

Cause

Motor phase W between the drive and the motor is missing.

Troubleshooting

WARNING

HAZARDOUS VOLTAGE

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

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

- Disconnect power before proceeding.
- Remove the power from the drive and check motor phase W.

6.2.31 ALARM 33, Inrush Fault

Cause

Too many power-ups have occurred within a short time period.

Troubleshooting

- Let the unit cool to operating temperature.
- Check potential DC-link fault to ground.

6.2.32 WARNING/ALARM 34, Fieldbus Communication Fault

Cause

The fieldbus on the communication option card is not working.

6.2.33 WARNING/ALARM 35, Option Fault

Cause

An option alarm is received. The alarm is option-specific. The most likely cause is a power-up or a communication fault.

6.2.34 WARNING/ALARM 36, Mains Failure

Cause

This warning/alarm is only active if the supply voltage to the drive is lost and *parameter 14-10 Mains Failure* is not set to *[0] No Function*.

Troubleshooting

- Check the fuses to the drive and mains supply to the unit.

6.2.35 ALARM 38, Internal Fault

Cause

When an internal fault occurs, a code number defined in Table 1234 is shown.

Troubleshooting

- Cycle power.
- Check that the option is properly installed.
- Check for loose or missing wiring.

It may be necessary to contact the Danfoss supplier or service department. Note the code number for further troubleshooting guidance.

Table 1234: Internal Fault Codes

Number	Text
0	The serial port cannot be initialized. Contact the Danfoss supplier or Danfoss service department.
256–258	The power EEPROM data is defective or too old. Replace the power card.
512–519	Internal fault. Contact the Danfoss supplier or Danfoss service department.
783	Parameter value outside of minimum/maximum limits.
1024–1284	Internal fault. Contact the Danfoss supplier or Danfoss service department.
1299	The option software in slot A is too old.
1300	The option software in slot B is too old.
1302	The option software in slot C1 is too old.
1315	The option software in slot A is not supported/allowed.
1316	The option software in slot B is not supported/ allowed.
1318	The option software in slot C1 is not supported/ allowed.
1379–2819	Internal fault. Contact the Danfoss supplier or Danfoss service department.
1792	Hardware reset of digital signal processor.
1793	Motor-derived parameters not transferred correctly to the digital signal processor.
1794	Power data not transferred correctly at power-up to the digital signal processor.
1795	The digital signal processor has received too many unknown SPI telegrams. The AC drive also uses this fault code if the MCO does not power up correctly. This situation can occur due to poor EMC protection or improper grounding.
1796	RAM copy error.
2561	Replace the control card.

Number	Text
2820	LCP stack overflow.
2821	Serial port overflow.
2822	USB port overflow.
3072–5122	Parameter value is outside its limits.
5123	Option in slot A: Hardware incompatible with the control board hardware.
5124	Option in slot B: Hardware incompatible with the control board hardware.
5125	Option in slot C0: Hardware incompatible with the control board hardware.
5126	Option in slot C1: Hardware incompatible with the control board hardware.
5376– 6231	Internal fault. Contact the Danfoss supplier or Danfoss service department.

6.2.36 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.

6.2.37 WARNING 40, Overload of Digital Output Terminal 27

Troubleshooting

- Check the load connected to terminal 27 or remove the short-circuit connection.
- Check *parameter 5-00 Digital I/O Mode* and *parameter 5-01 Terminal 27 Mode*.

6.2.38 WARNING 41, Overload of Digital Output Terminal 29

Troubleshooting

- Check the load connected to terminal 29 or remove the short-circuit connection.
- Check *parameter 5-00 Digital I/O Mode* and *parameter 5-02 Terminal 29 Mode*.

6.2.39 WARNING 42, Ovrld X30/6-7

Troubleshooting

For terminal X30/6:

- Check the load connected to the terminal, or remove the short-circuit connection.
- Check *parameter 5-32 Term X30/6 Digi out (MCB 101)* (VLT® General Purpose I/O MCB 101).

For terminal X30/7:

- Check the load connected to the terminal, or remove the short-circuit connection.
- Check *parameter 5-33 Term X30/7 Digi Out (MCB 101)* (VLT® General Purpose I/O MCB 101).

6.2.40 ALARM 43, Ext. Supply

Cause

VLT® Extended Relay Option MCB 113 is mounted without 24 V DC.

Troubleshooting

Choose 1 of the following:

- Connect a 24 V DC external supply.
- Specify that no external supply is used via *parameter 14-80 Option Supplied by External 24VDC*, *[0] No*. A change in *parameter 14-80 Option Supplied by External 24VDC* requires a power cycle.

6.2.41 ALARM 45, Earth Fault 2

Cause

Ground fault.

Troubleshooting

- Check for proper grounding and loose connections.
- Check for proper wire size.
- Check the motor cables for short circuits or leakage currents.

6.2.42 ALARM 46, Power Card Supply

Cause

The supply on the power card is out of range. Another reason can be a defective heat sink fan.

There are 3 supplies generated by the switch mode supply (SMPS) on the power card:

- 24 V.
- 5 V.
- ±18 V.

When powered with VLT® 24 V DC Supply MCB 107, only 24 V and 5 V supplies are monitored. When powered with 3-phase mains voltage, all 3 supplies are monitored.

Troubleshooting

- Check for a defective power card.
- Check for a defective control card.
- Check for a defective option card.
- If a 24 V DC supply is used, verify proper supply power.
- Check for a defective heat sink fan.

6.2.43 WARNING 47, 24 V Supply Low

Cause

The supply on the power card is out of range.

There are 3 supplies generated by the switch mode supply (SMPS) on the power card:

- 24 V.
- 5 V.
- ±18 V.

Troubleshooting

- Check for a defective power card.

6.2.44 WARNING 48, 1.8 V Supply Low

Cause

The 1.8 V DC supply used on the control card is outside of the allowed limits. The supply is measured on the control card.

Troubleshooting

- Check for a defective control card.
- If an option card is present, check for overvoltage.

6.2.45 WARNING 49, Speed Limit

Cause

The warning is shown when the speed is outside of the specified range in *parameter 4-11 Motor Speed Low Limit [RPM]* and *parameter 4-13 Motor Speed High Limit [RPM]*. When the speed is below the specified limit in *parameter 1-86 Trip Speed Low [RPM]* (except when starting or stopping), the drive trips.

6.2.46 ALARM 50, AMA Calibration Failed

Cause

A calibration error has occurred.

Troubleshooting

- Contact the Danfoss supplier or Danfoss service department.

6.2.47 ALARM 51, AMA Check Unom and Inom

Cause

The settings for motor voltage, motor current, and motor power are wrong.

Troubleshooting

- Check settings in *parameters 1-20* to *1-25*.

6.2.48 ALARM 52, AMA Low Inom

Cause

The motor current is too low.

Troubleshooting

- Check the settings in *parameter 1-24 Motor Current*.

6.2.49 ALARM 53, AMA Motor Too Big

Cause

The motor is too big for the AMA to operate.

Troubleshooting

- Check the settings in *parameter group 1-2* Motor Data*.

6.2.50 ALARM 54, AMA Motor Too Small

Cause

The motor is too small for the AMA to operate.

Troubleshooting

- Check the settings in *parameter group 1-2* Motor Data*.

6.2.51 ALARM 55, AMA Parameter Out of Range

Cause

The AMA cannot run because the paramenter values of the motor are out of the acceptable range.

Troubleshooting

- Check the settings in *parameter group 1-2* Motor Data*.

6.2.52 ALARM 56, AMA Interrupted by User

Cause

The AMA is manually interrupted.

Troubleshooting

- Re-run the AMA calibration.

6.2.53 ALARM 57, AMA Internal Fault

Cause

Internal fault.

Troubleshooting

Try to restart the AMA. Repeated restarts can overheat the motor.

6.2.54 ALARM 58, AMA Internal Fault

Cause

Internal fault.

Troubleshooting

Contact the Danfoss supplier.

6.2.55 WARNING 59, Current Limit

Cause

The current is higher than the value in *parameter 4-18 Current Limit*.

Troubleshooting

- Ensure that the motor data in *parameters 1-20* to *1-25* is set correctly.
- Increase the current limit if necessary. Ensure that the system can operate safely at a higher limit.

6.2.56 WARNING 60, External Interlock

Cause

A digital input signal indicates a fault condition external to the drive. An external interlock has commanded the drive to trip.

Troubleshooting

- Clear the external fault condition.
- To resume normal operation, apply 24 V DC to the terminal programmed for external interlock.
- Reset the drive.

6.2.57 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.*

6.2.58 WARNING 62, Output Frequency at Maximum Limit

Cause

The output frequency has reached the value set in *parameter 4-19 Max Output Frequency*.

Troubleshooting

- Check the application for possible causes.
- Increase the output frequency limit. Be sure that the system can operate safely at a higher output frequency.

The warning clears when the output drops below the maximum limit.

6.2.59 ALARM 63, Mechanical Brake Low

Cause

The actual motor current has not exceeded the release brake current within the start delay time window.

6.2.60 WARNING 64, Voltage Limit

Cause

The load and speed combination demands a motor voltage higher than the actual DC-link voltage.

6.2.61 WARNING/ALARM 65, Control Card Overtemperature

Cause

The cutout temperature of the control card has exceeded the upper limit.

Troubleshooting

- Check that the ambient operating temperature is within the limits.
- Check for clogged filters.
- Check fan operation.
- Check the control card.

6.2.62 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*.

6.2.63 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.

6.2.64 ALARM 68, Safe Stop Activated

Cause

Safe Torque Off (STO) has been activated.

Troubleshooting

- To resume normal operation, apply 24 V DC to terminal 37, then send a reset signal (via bus, digital I/O, or by pressing [Reset]).

6.2.65 ALARM 69, Power Card Temperature

Cause

The internal temperature has exceeded the allowed operating limits.

Troubleshooting

- Check that the ambient operating temperature is within the limits.
- Check for clogged filters.
- Check fan operation.
- Check the power card.

6.2.66 ALARM 70, Illegal FC Configuration

Cause

The control card and power card are incompatible.

Troubleshooting

- To check compatibility, contact the Danfoss supplier with the type code from the unit nameplate and the part numbers on the cards.

6.2.67 ALARM 71, PTC 1 Safe Stop

Cause

Because the motor is too warm, the VLT® PTC Thermistor Card MCB 112 activated the Safe Torque Off (STO).

Troubleshooting

- Once the motor temperature reaches an acceptable level and the digital input from MCB 112 is deactivated, perform 1 of the following:
  - Send a reset signal via bus or digital I/O.
  - Press [Reset].

6.2.68 ALARM 72, Dangerous Failure

Cause

Safe Torque Off (STO) with trip lock.

Troubleshooting

An unexpected combination of STO commands has occurred:

- VLT® PTC Thermistor Card MCB 112 enables X44/10, but STO is not enabled.
- MCB 112 is the only device using STO (specified through selection *[4] PTC 1 alarm* or *[5] PTC 12 warning* in *parameter 5-19 Terminal 37 Safe Stop*). STO is activated, but X44/10 is not activated.

6.2.69 WARNING 73, Safe Stop Auto Restart

Cause

STO activated.

Troubleshooting

- With automatic restart enabled, the motor can start when the fault is cleared.

6.2.70 Warning 76, Power Unit Setup

Cause

The required number of power units does not match the detected number of active power units.

Troubleshooting

- When replacing a drive module, this warning can occur if the power-specific data in the module power card does not match the rest of the drive. Confirm that the spare part and its power card are the correct part number.

6.2.71 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.

6.2.72 ALARM 79, Illegal Power Section Configuration

Cause

The scaling card has an incorrect part number or is not installed. The MK102 connector on the power card could not be installed.

6.2.73 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.

6.2.74 ALARM 81, CSIV Corrupt

Cause

The CSIV file has syntax errors.

6.2.75 ALARM 82, CSIV Parameter Error

Cause

CSIV failed to initialize a parameter.

6.2.76 ALARM 88, Option Detection

Cause

A change in the option layout is detected. *Parameter 14-89 Option Detection* is set to *[0] Frozen configuration* and the option layout has been changed.

Troubleshooting

- To apply the change, enable option layout changes in *parameter 14-89 Option Detection*.
- Alternatively, restore the correct option configuration.

6.2.77 ALARM 90, Feedback Monitor

Troubleshooting

- Check the connection to the encoder/resolver option and, if necessary, replace the VLT® Encoder Input MCB 102 or VLT® Resolver Input MCB 103.

6.2.78 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.

6.2.79 ALARM 92, No Flow

A no-flow condition has been detected in the system. *Parameter 22-23 No-flow Function* is set for alarm.

Troubleshooting

- Troubleshoot the system.
- Reset the drive when the fault is cleared.

6.2.80 ALARM 93, Dry Pump

A no-flow condition in the system with the drive operating at high speed may indicate a dry pump. *Parameter 22-26 Dry Pump Function* is set for alarm.

Troubleshooting

- Troubleshoot the system.
- Reset the drive when the fault is cleared.

6.2.81 ALARM 94, End of Curve

Feedback is lower than the set point. This may indicate a leakage in the system. *Parameter 22-50 End of Curve Function* is set for alarm.

Troubleshooting

- Troubleshoot the system.
- Reset the drive when the fault is cleared.

6.2.82 ALARM 95, Broken Belt

Torque is below the torque level set for no load, indicating a broken belt. *Parameter 22-60 Broken Belt Function* is set for alarm.

Troubleshooting

- Troubleshoot the system.
- Reset the drive after the fault is cleared.

6.2.83 ALARM 96, Start Delayed

Motor start has been delayed due to short-cycle protection. *Parameter 22-76 Interval between Starts* is enabled.

Troubleshooting

- Troubleshoot the system.
- Reset the drive when the fault is cleared.

6.2.84 WARNING 97, Stop Delayed

Stopping the motor has been delayed due to short-cycle protection. *Parameter 22-76 Interval between Starts* is enabled.

Troubleshooting

- Troubleshoot the system.
- Reset the drive when the fault is cleared.

6.2.85 WARNING 98, Clock Fault

Time is not set or the RTC clock has failed.

Troubleshooting

- Reset the clock in *parameter 0-70 Date and Time*.

6.2.86 ALARM 99, Locked Rotor

Cause

The rotor is blocked.

Troubleshooting

- Check if the motor shaft is locked.
- Check if the start current triggers the current limit set in *parameter 4-18 Current Limit*.
- Check if it increases the value in *parameter 30-23 Locked Rotor Detection Time [s]*.

6.2.87 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.

6.2.88 WARNING/ALARM 122, Mot. Rotat. Unexp.

Cause

The drive performs a function that requires the motor to be at standstill, for example DC hold for PM motors.

6.2.89 ALARM 144, Inrush supply

Cause

A supply voltage on the inrush card is out of range. See the bit field result report value for more details.

- Bit 2: Vcc high
- Bit 3: Vcc low
- Bit 4: Vdd high
- Bit 5: Vdd low

6.2.90 ALARM 145, External SCR disable

Cause

The alarm indicates a series DC-link capacitor voltage imbalance.

6.2.91 WARNING/ALARM 146, Mains voltage

Cause

Mains voltage is outside valid operating range. The following report values provide more details.

- Voltage too low: 0=R-S, 1=S-T, 2=T-R
- Voltage too high: 3=R-S, 4=S-T, 5=T-R

6.2.92 WARNING/ALARM 147, Mains frequency

Cause

Mains frequency is outside valid operating range. Report value provides more details.

- 0: frequency too low.
- 1: frequency too high.

6.2.93 WARNING/ALARM 148, System Temp

Cause

One or more of the system temperature measurements is too high.

6.2.94 WARNING/ALARM 154, D.out Overload

Cause

Digital output overloaded.

6.2.95 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.

6.2.96 ALARM 164, ATEX ETR Cur.Lim.Alarm

Cause

Running above the characteristic curve for more than 60 s within a period of 600 s activates the alarm, and the drive trips.

6.2.97 WARNING 165, ATEX ETR Freq.Lim.Warning

Cause

The drive has run for more than 50 s below the allowed minimum frequency (*parameter 1-98 ATEX ETR Interpol. Points Freq.*).

6.2.98 ALARM 166, ATEX ETR Freq.Lim.Alarm

Cause

The drive has run for more than 60 s (in a period of 600 s) below the allowed minimum frequency (*parameter 1-98 ATEX ETR Interpol. Points. Freq.*).

6.2.99 WARNING 200, Fire Mode

Cause

Fire mode has been activated.

Troubleshooting

- The warning clears when fire mode is removed.
- See the fire mode data in the alarm log.

6.2.100 WARNING 201, Fire Mode was Active

- Cycle power to the unit to remove the warning. See the fire mode data in the alarm log.

6.2.101 WARNING 202, Fire Mode Limits Exceeded

While operating in fire 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 the warning. See the fire mode data in the alarm log.

6.2.102 WARNING 203, Missing Motor

A multi-motor underload situation is detected. This warning could indicate that there is a missing motor.

Troubleshooting

- Inspect the system for proper operation.

6.2.103 WARNING 204, Locked Rotor

An overload condition is detected for a drive operating multi-motors. This could indicate a locked rotor.

Troubleshooting

- Inspect the motor proper operation.

6.2.104 WARNING 220, Configuration File Version not Supported

Cause

The drive does not support the current configuration file version. Customization is aborted.

6.2.105 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 the 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.

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).

6.2.106 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, Heat Sink Temp*.

Troubleshooting

Check for the following:

- Ambient temperature too high.
- Motor cables too long.
- Incorrect airflow clearance above or below the AC drive.
- Blocked airflow around the unit.
- Damaged heat sink fan.
- Dirty heat sink.

6.2.107 ALARM 245, 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. 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 left.
- 3 = Third drive module from left (in 4-module systems).
- 4 = Fourth drive module from left (in 4-module systems).

Troubleshooting

Check the following:

- Power card.
- Gate drive card.
- Ribbon cable between the power card and the gate drive card.

6.2.108 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).

6.2.109 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).

6.2.110 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 following:

- The current scaling cards on the MDCIC.

6.2.111 WARNING 249, Rect. Low Temperature

Cause

The temperature of the rectifier heat sink is too low, which indicates that the temperature sensor may be defect.

6.2.112 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.

6.2.113 WARNING 251, New Typecode

Cause

The power card or other components have been replaced, and the typecode has changed.

Troubleshooting

Reset the drive for normal operation.

6.2.114 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 it.

Troubleshooting

- Check wiring.
- Check the on-board temperture sensor.
- Replace fan power card.

6.2.115 ALARM 423, FPC Updating

Cause

The alarm is generated when the fan power card reports 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*.

6.2.116 ALARM 424, FPC Update Successful

Cause

This alarm is generated when the control card has successfully updated the fan power card PUD.

Troubleshooting

- Press [Reset] to stop the alarm.

6.2.117 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 fan power card.
- Contact supplier.

6.2.118 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 fan power card.

6.2.119 ALARM 427, FPC Supply

Cause

Supply voltage fault (5 V, 24 V, or 48 V) on fan power card is detected.

Troubleshooting

- Check fan power card wiring.
- Replace fan power card.

6.2.120 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 inrush card.

6.2.121 Warning 510, Motor Stator Winding Warning 1

Cause

Stator winding reached condition yellow. Early fault detected in motor.

Troubleshooting

- Check motor stator windings.

6.2.122 Alarm 510, Motor Stator Winding Alarm

Cause

Stator winding has reached condition red. Severe fault is detected in motor.

Troubleshooting

- Check motor stator windings.

6.2.123 Warning 511, Load Envelope Warning 1

Cause

Application load has reached condition yellow.

Troubleshooting

- Check root cause for high motor load.

6.2.124 Alarm 511, Load Envelope Alarm

Cause

Application load has reached condition red.

Troubleshooting

- Check root cause for excessive overload or underload.

Index

VLT Drives Glossary

6

60° AVM 60° asynchronous vector modulation (*parameter 14-00 Switching Pattern*).

A

Actual position The actual position from an encoder, or a value that the motor control calculates in open loop. The drive uses the actual position as feedback for position PI.

Analog reference A signal transmitted to the analog inputs 53 or 54 (voltage or current).

Analog inputs The analog inputs are used for controlling various functions of the drive.

There are 2 types of analog inputs:

Current input, 0–20 mA, and 4–20 mA

Voltage input, -10 V DC to +10 V DC.

Analog outputs The analog outputs can supply a signal of 0–20 mA, 4–20 mA.

Automatic motor adaptation, AMA AMA algorithm determines the electrical parameters for the connected motor at standstill.

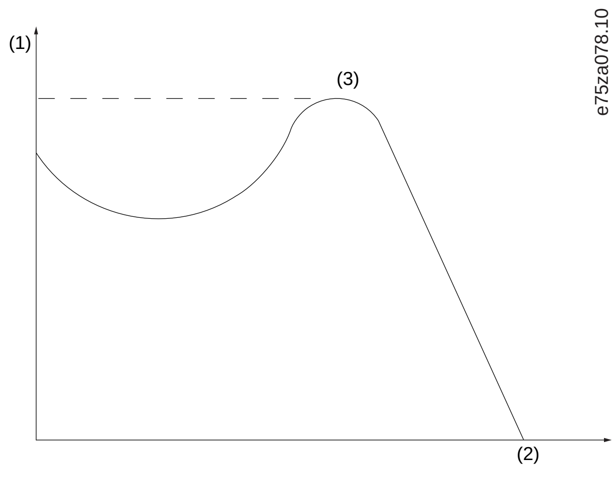
B

BDM A BDM is a drive module which consists of a power converter module and a control and regulating device for speed, torque, current, or voltage.

Binary reference A signal transmitted to the serial communication port.

Brake resistor The brake resistor is a module capable of absorbing the brake power generated in regenerative braking. This regenerative brake power increases the DC-link voltage and a brake chopper ensures that the power is transmitted to the brake resistor.

Break-away torque



C

CBM Condition Based Monitoring monitors the machine condition and performance when the drive is in service and detects mechanical, motor, or application failures in advance. Corrective actions can be performed before the process or application is impacted.

CDM A CDM is a drive system without the motor and without the measuring sensors, which are mechanically connected to the motor shaft. The drive system consists of, but is not restricted to, the BDM and extensions, such as the feed module and auxiliary equipment.

CT characteristics
Constant-torque characteristics used for all applications such as conveyor belts, displacement pumps, and cranes.

Commanded position
The actual position reference calculated by the profile generator. The drive uses the commanded position as setpoint for position PI.

Control command
Start and stop the connected motor with LCP and digital inputs.

Functions are divided into 2 groups.

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

Table 1: Function Groups

Group 1	Group 2
Reset, coast stop, reset and coast stop, quick stop, DC brake, stop, the LCP [OFF] key.	Start, pulse start, reversing, start reversing, jog, freeze output.

D

DSP
Digital signal processor.

Digital inputs
The digital inputs can be used for controlling various functions of the drive.

Digital outputs
The drive features 2 solid-state outputs that can supply a 24 V DC (maximum 40 mA) signal.

E

ETR
Electronic thermal relay is a thermal load calculation based on present load and time. Its purpose is to estimate the motor temperature.

F

FC standard bus
Includes RS485 bus with FC protocol or MC protocol. See *parameter 8-30 Protocol*.

f_M
Motor frequency.

$f_{M,N}$
Rated motor frequency (nameplate data).

f_{MAX}
Maximum motor frequency.

f_{MIN}
Minimum motor frequency.

f_{jog}
Motor frequency when the jog function is activated (via digital terminals).

H

Hiperface®
Hiperface® is a registered trademark by Stegmann.

I

I_M
Motor current (actual).

$I_{M,N}$
Rated motor current (nameplate data).

IMC
Integrated Motion Controller (IMC) is a functionality that enables an AC drive to perform high-precision positioning and synchronization operations without the need for additional modules or hardware.

$I_{VLT,MAX}$
Maximum output current.

$I_{VLT,N}$
Rated output current supplied by the drive.

Initializing
If initializing is carried out in *parameter 14-22 Operation Mode*, the drive returns to the default setting.

Intermittent duty cycle	An intermittent duty rating refers to a sequence of duty cycles. Each cycle consists of an on-load and an off-load period. The operation can be either periodic duty or non-periodic duty.

L

LCP	The local control panel makes up a complete interface for control and programming of the drive. The control panel is detachable and can be installed up to 3 m (10 ft) from the drive, that is, in a front panel with the installation kit option.
lsb	Least significant bit.

M

MCM	Short for "mille circular mil", an American measuring unit for cable cross-section. 1 MCM=0.5067 mm^2
Motor running	Torque generated on output shaft and speed from 0 RPM to maximum speed on motor.
msb	Most significant bit.

N

NLCP	Numerical local control panel interface for control and programming of the drive. The display is numerical and the panel is used to show process values. The NLCP has no storage and copy functions.
$n_{M,N}$	Nominal motor speed (nameplate data).
n_s	Synchronous motor speed. $n_s = \frac{2 \times \text{par. } 1-23 \times 60\, s}{\text{par. } 1-39}$
n_{slip}	Motor slip.

O

Online/offline parameters	Changes to online parameters are activated immediately after the data value is changed. Press [OK] to activate changes to off-line parameters.

P

PCD	Process-control data.
PDS	The PDS is a speed control system for an electric motor, including the CDM and motor, but without the equipment which it powers.
$P_{M,N}$	Rated motor power (nameplate data in kW or hp).
Position error	Position error is the difference between the actual position and the commanded position. The position error is the input for the position PI controller.
Position unit	The physical unit for position values.
Power cycle	Switch off the mains until the display (LCP) is dark, then turn power on again.
Power factor	The power factor is the relation between I_1 and I_{RMS}. $\text{Power factor} = \frac{\sqrt{3} \times U \times I_{1\cos\phi}}{\sqrt{3} \times U \times I_{RMS}}$ The power factor for 3-phase control:

$$\text{Power factor} = \frac{I_1 \times \cos\phi 1}{I_{RMS}} = \frac{I_1}{I_{RMS}} \text{ since } \cos\phi 1 = 1$$

The power factor indicates to which extent the drive imposes a load on the mains supply.

The lower the power factor, the higher the I_{RMS} for the same kW performance.

$$I_{RMS} = \sqrt{I_1^2 + I_5^2 + I_7^2 + .. + I_n^2}$$

In addition, a high-power factor indicates that the different harmonic currents are low.

The DC coils in the drive produce a high-power factor, which minimizes the imposed load on the mains supply.

Preset reference	A defined preset reference to be set from -100% to +100% of the reference range. Selection of 8 preset references via the digital terminals.
Process PID	The PID control maintains the required speed, pressure, temperature, and so on, by adjusting the output frequency to match the varying load.
Pulse input/incremental encoder	An external, digital pulse transmitter used for feeding back information on motor speed. The encoder is used in applications where great accuracy in speed control is required.
Pulse reference	A pulse frequency signal transmitted to the digital inputs (terminal 29 or 33).

R

RCD	Residual-current device.
Ref_{MAX}	Determines the relationship between the reference input at 100-% full scale value (typically 10 V, 20 mA) and the resulting reference. The maximum reference value is set in *parameter 3-03 Maximum Reference*.
Ref_{MIN}	Determines the relationship between the reference input at 0-% value (typically 0 V, 0 mA, 4 mA) and the resulting reference. The minimum reference value is set in *parameter 3-02 Minimum Reference*.

S

SFAVM	Switching pattern called stator flux-oriented asynchronous vector modulation (*parameter 14-00 Switching Pattern*).
SLC	The SLC (smart logic control) is a sequence of user-defined actions executed when the associated user-defined events are evaluated as true by the SLC. (See *parameter group 13-** Smart Logic Control*).
STW	Status word.
Safe Torque Off (STO)	The STO function brings the drive safely to a no-torque state.
Setup	Save parameter settings in 4 setups. Change between the 4 parameter setups and edit 1 setup, while another setup is active.
Slip compensation	The drive compensates for the motor slip by giving the frequency a supplement that follows the measured motor load keeping the motor speed almost constant.
Start-disable command	A start command belonging to Group 2 control commands, see the *table Function Groups* under *Control Command*.
Stop command	A stop command belonging to Group 1 control commands, see the *table Function Groups* under *Control Command*.

T

THD	Total harmonic distortion states the total contribution of harmonics.
$T_{M,N}$	Rated torque (motor).
Target position	The final target position specified by positioning commands. The profile generator uses this position to calculate the speed profile.
Thermistor	A temperature-dependent resistor placed on the drive or the motor.
Trip	A state entered in fault situations, for example, if the drive is subject to an overtemperature or when the drive is protecting the motor, process, or mechanism. The drive prevents a restart until the cause of the fault has disappeared. To cancel the trip state, restart the drive. Do not use the trip state for personal safety.
Trip lock	The drive enters this state in fault situations to protect itself. The drive requires physical intervention, for example when there is a short circuit on the output. A trip lock can only be canceled by disconnecting mains, removing the cause of the fault, and reconnecting the drive. Restart is prevented until the trip state is canceled by activating reset or, sometimes, by being programmed to reset automatically. Do not use the trip lock state for personal safety.

U

U_M	Motor voltage.
$U_{M,N}$	Rated motor voltage (nameplate data).
$U_{VLT,MAX}$	Maximum output voltage.

V

VT characteristics	Variable torque characteristics typical for many pumps and fans.
VVC^+	If compared with standard voltage/frequency ratio control, Voltage Vector Control (VVC^+) improves the dynamics and the stability, both when the speed reference is changed and in relation to the load torque.

H

η_{VLT}	The efficiency of the drive is defined as the ratio between the power output and the power input.

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