ENGINEERING TOMORROW

Programming Guide
VLT® AutomationDrive FC 361

90–315 kW, Enclosure Sizes J8–J9

vlt-drives.danfoss.com

Contents

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1 Introduction

1.1 How to Read This Programming Guide

1.1.1 Purpose of the Manual

This programming guide provides information about controlling the frequency converter, parameter access, programming, and troubleshooting.
The programming guide is intended for use by qualified personnel who are familiar with VLT® AutomationDrive FC 361.
Read the instructions before programming and follow the procedures in this manual.
VLT® is a registered trademark.

1.1.2 Additional Resources

Additional resources include:

- *VLT® AutomationDrive FC 361 Operating Guide* provides the necessary information for getting the frequency converter up and running.
- *VLT® AutomationDrive FC 361 Design Guide* provides detailed technical information about the frequency converter and customer design and applications.

Contact the local Danfoss supplier for the documentation.

1.1.3 Document and Software Version

This manual is regularly reviewed and updated. All suggestions for improvement are welcome. *Table 1.1* shows the document version and the corresponding software version.

Edition	Remarks	Software version
MG06J2	Update parameter descriptions and manual cover.	1.0x

Table 1.1 Document and Software Version

°C	Degrees Celsius
°F	Degrees Fahrenheit
AC	Alternating current
AEO	Automatic energy optimization
ACP	Application control processor
AWG	American wire gauge
AMA	Automatic motor adaptation
DC	Direct current
EEPROM	Electrically erasable programmable read-only memory
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ESD	Electrostatic discharge
ETR	Electronic thermal relay
$f_{M,N}$	Nominal motor frequency
FC	Frequency converter
IGBT	Insulated-gate bipolar transistor
IP	Ingress protection
I_{LIM}	Current limit
I_{INV}	Rated inverter output current
$I_{M,N}$	Nominal motor current
$I_{VLT,MAX}$	Maximum output current
$I_{VLT,N}$	Rated output current supplied by the frequency converter
L_d	Motor d-axis inductance
L_q	Motor q-axis inductance
LCP	Local control panel
LED	Light-emitting diode
MCP	Motor control processor
N.A.	Not applicable
NEMA	National Electrical Manufacturers Association
$P_{M,N}$	Nominal motor power
PCB	Printed circuit board
PE	Protective earth
PELV	Protective extra low voltage
PWM	Pulse width modulation
R_s	Stator resistance
Regen	Regenerative terminals
RPM	Revolutions per minute
RFI	Radio frequency interference
SCR	Silicon controlled rectifier
SMPS	Switch mode power supply
T_{LIM}	Torque limit
$U_{M,N}$	Nominal motor voltage
X_h	Motor main reactance

Table 1.2 Abbreviations

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1.1.4 Approvals and Certifications

CE

1.2 Definitions

1.2.1 Frequency Converter

Coast
The motor shaft is in free mode. No torque on the motor.

$I_{VLT,MAX}$
Maximum output current.

$I_{VLT,N}$
Rated output current supplied by the frequency converter.

$U_{VLT,MAX}$
Maximum output voltage.

1.2.2 Input

Control commands
Start and stop the connected motor with the LCP and digital inputs.
Functions are divided into 2 groups.

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

Group 1	Coast stop, reset and coast stop, quick stop, DC braking, stop, and [OFF].
Group 2	Start, latched start, start reversing, jog, freeze output, and [Hand On].

Table 1.3 Function Groups

1.2.3 Motor

Motor running
Torque generated on the output shaft and speed from 0 RPM to maximum speed on the motor.

f_{JOG}
Motor frequency when the jog function is activated (via digital terminals or bus).

f_M
Motor frequency.

f_{MAX}
Maximum motor frequency.

f_{MIN}
Minimum motor frequency.

$f_{M,N}$
Rated motor frequency (nameplate data).

I_M
Motor current (actual).

$I_{M,N}$
Nominal motor current (nameplate data).

$n_{M,N}$
Nominal motor speed (nameplate data).

n_s
Synchronous motor speed.

$$n_s = \frac{2 \times Parameter\ 1\text{–}23 \times 60\ s}{Parameter\ 1\text{–}39}$$

n_{slip}
Motor slip.

$P_{M,N}$
Rated motor power (nameplate data in kW or hp).

$T_{M,N}$
Rated torque (motor).

U_M
Instantaneous motor voltage.

$U_{M,N}$
Rated motor voltage (nameplate data).

Break-away torque

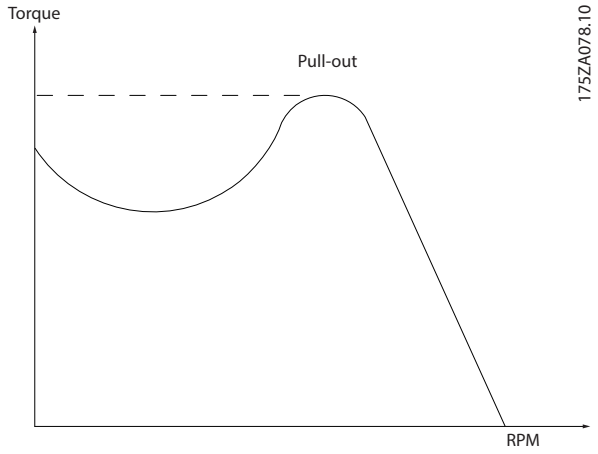

Illustration 1.1 Break-away Torque

η_{VLT}
The efficiency of the frequency converter is defined as the ratio between the power output and the power input.

Start-disable command
A start-disable command belonging to the control commands in group 1. See *Table 1.3* for more details.

Stop command
A stop command belonging to the control commands in group 1. See *Table 1.3* for more details.

1.2.4 References

Analog reference
A signal transmitted to the analog inputs 53 or 54 can be voltage or current.

Binary reference
A signal transmitted via the serial communication port.

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. Selection of 4 preset references via the bus.

Pulse reference
A pulse frequency signal transmitted to the digital inputs (terminal 29 or 33).

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*.

1.2.5 Miscellaneous

Analog inputs
The analog inputs are used for controlling various functions of the frequency converter.
There are 2 types of analog inputs:

- Current input: 0–20 mA and 4–20 mA.
- Voltage input: 0–10 V DC.

Analog outputs
The analog outputs can supply a signal of 0–20 mA, or 4–20 mA.

Automatic motor adaptation, AMA
The AMA algorithm determines the electrical parameters for the connected motor at standstill.

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.

CT characteristics
Constant torque characteristics used for all applications such as conveyor belts, displacement pumps, and cranes.

Digital inputs
The digital inputs can be used for controlling various functions of the frequency converter.

Digital outputs
The frequency converter features 2 solid-state outputs that can supply a 24 V DC (maximum 40 mA) signal.

ETR
Electronic thermal relay is a thermal load calculation based on present load and time. Its purpose is to estimate the motor temperature.

FC standard bus
Includes RS485 bus with FC protocol or MC protocol. See *parameter 8-30 Protocol*.

Initializing
If initializing is carried out (*parameter 14-22 Operation Mode* or 2-finger reset), the frequency converter 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.

LCP
The local control panel makes up a complete interface for control and programming of the frequency converter. The LCP is detachable. With the installation kit option, the LCP can be installed up to 3 m (9.8 ft) from the frequency converter in a front panel.

GLCP
The graphical local control panel interface for control and programming of the frequency converter. The display is graphical and the panel is used to show process values. The GLCP has storing and copy functions.

NLCP
The numerical local control panel interface for control and programming of the frequency converter. The display is numerical and the panel is used to show process values. The NLCP has storing and copy functions.

lsb
Least significant bit.

msb
Most significant bit.

MCM
Short for mille circular mil, an American measuring unit for cable cross-section. 1 MCM = 0.5067 mm^2.

On-line/off-line parameters
Changes to on-line parameters are activated immediately after the data value is changed. To activate changes to off-line parameters, press [OK].

Process PID
The PID control maintains speed, pressure, and temperature by adjusting the output frequency to match the varying load.

PCD
Process control data.

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}.

$$Power\ factor = \frac{\sqrt{3}\ x\ U\ x\ I_1\ cos\phi 1}{\sqrt{3}\ x\ U\ x\ I_{RMS}}$$

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For VLT® AutomationDrive FC 361 frequency converters, $cos\phi 1 = 1$, therefore:

$$Power\ factor = \frac{I1\ x\ cos\phi 1}{I_{RMS}} = \frac{I_1}{I_{RMS}}$$

The power factor indicates to which extent the frequency converter 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 built-in DC coils produce a high power factor, minimizing the imposed load on the mains supply.

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.

RCD
Residual current device.

Set-up
Save parameter settings in 4 set-ups. Change between the 2 parameter set-ups and edit 1 set-up while another set-up is active.

SFAVM
Acronym describing the switching pattern stator flux-oriented asynchronous vector modulation.

Slip compensation
The frequency converter compensates for the motor slip by giving the frequency a supplement that follows the measured motor load, keeping the motor speed almost constant.

Smart logic control (SLC)
The SLC is a sequence of user-defined actions executed when the smart logic controller evaluates the associated user-defined events as true (*parameter group 13-** Smart Logic Control*).

STW
Status word.

THD
Total harmonic distortion states the total contribution of harmonic distortion.

Thermistor
A temperature-dependent resistor placed where the temperature is monitored (frequency converter or motor).

Trip
A state entered in fault situations, for example if the frequency converter is subject to overvoltage or when it is protecting the motor, process, or mechanism. Restart is prevented until the cause of the fault has disappeared, and the trip state is canceled by activating reset or, sometimes, by being programmed to reset automatically. Do not use trip for personal safety.

Trip lock
Trip lock is a state entered in fault situations when the frequency converter is protecting itself and requiring physical intervention. An example causing a trip lock is the frequency converter being subject to a short circuit on the output. A locked trip can only be canceled by cutting off mains, removing the cause of the fault, and reconnecting the frequency converter. Restart is prevented until the trip state is canceled by activating reset or, sometimes, by being programmed to reset automatically. Do not use trip lock for personal safety.

VT characteristics
Variable torque characteristics used for pumps and fans.

VVC+
If compared with standard voltage/frequency ratio control, voltage vector control (VVC+) improves the dynamics and stability, both when the speed reference is changed and in relation to the load torque.

60° AVM
Refers to the switching pattern *60° asynchronous vector modulation*.

1.3 Electrical Wiring - Control Cables

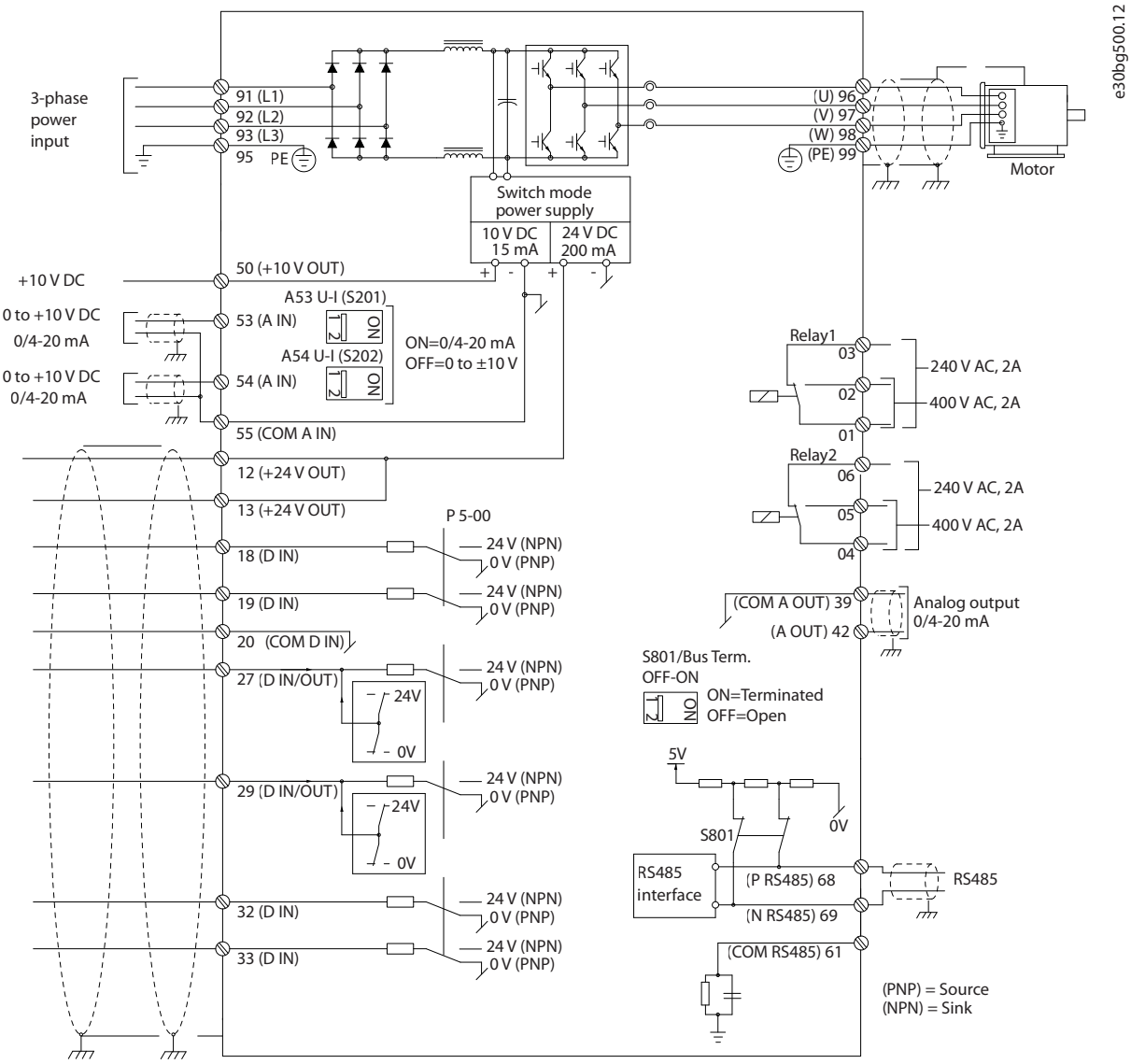

Illustration 1.2 Basic Wiring Schematic Drawing

A=Analog, D=Digital

Very long control cables and analog signals may in rare cases, and 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 frequency converter. For example, switching on the digital input may disturb the analog input signal.

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Input polarity of control terminals

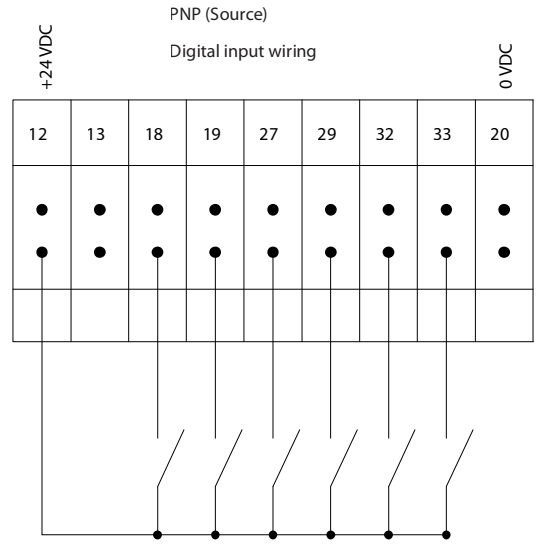


Illustration 1.3 PNP (Source)

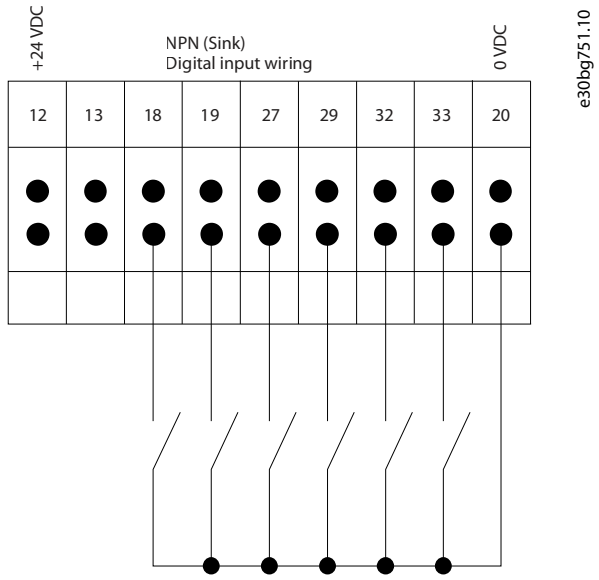


Illustration 1.4 NPN (Sink)

NOTICE

Control cables must be shielded/armored.

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

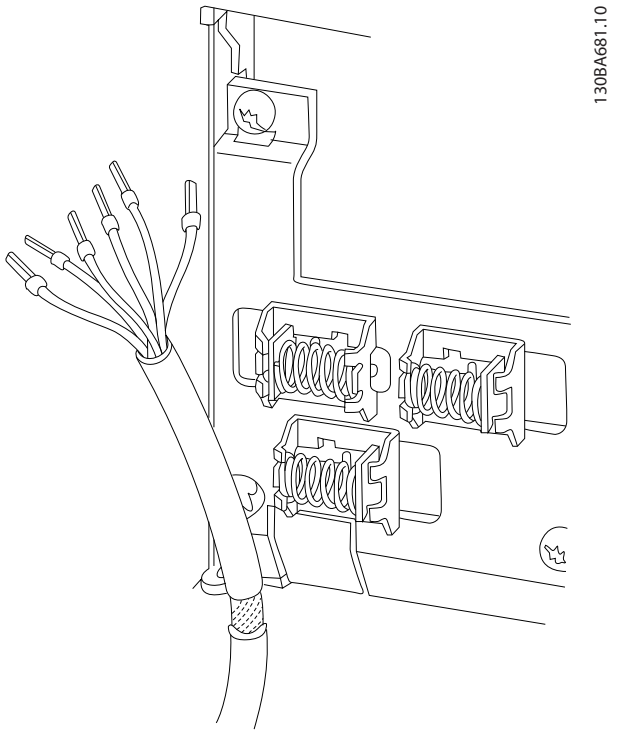
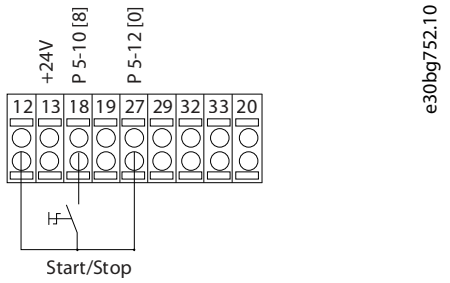


Illustration 1.5 Grounding of Shielded/Armored Control Cables

1.3.1 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*).



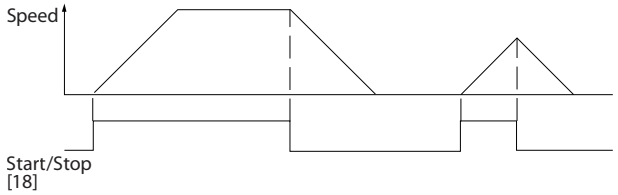
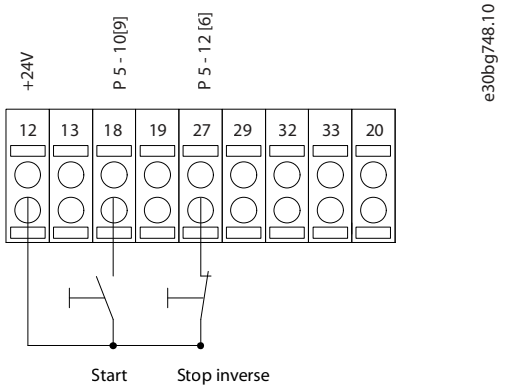


Illustration 1.6 Start/Stop

1.3.2 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*.



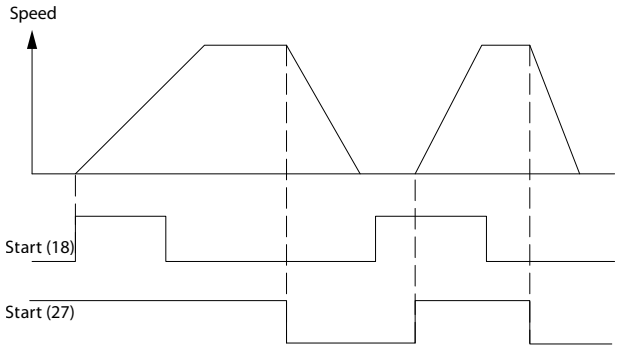


Illustration 1.7 Pulse Start/Stop

1.3.3 Speed up/Speed Down

Terminals 29/32 = Speed up/Speed down

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

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

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

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

NOTICE

Terminal 29 only in FC x02 (x=series type).

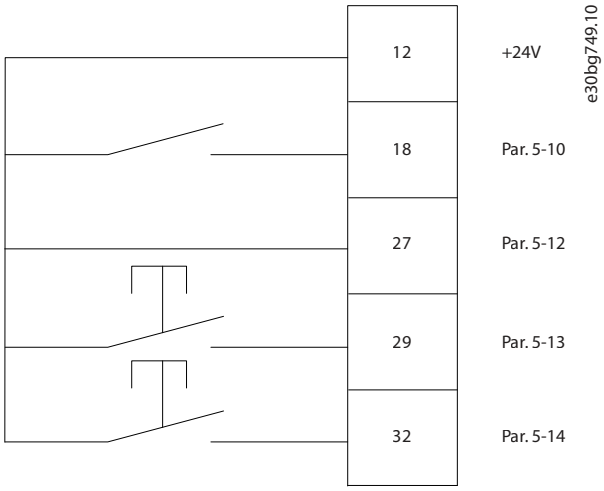


Illustration 1.8 Speed up/Speed down

1.3.4 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)

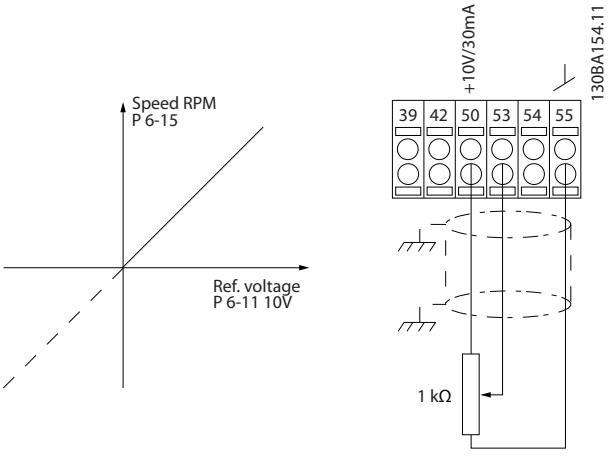


Illustration 1.9 Potentiometer Reference

2 Safety

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2.1 Safety Symbols

The following symbols are used in this guide:

⚠WARNING

Indicates a potentially hazardous situation that could result in death or serious injury.

⚠CAUTION

Indicates a potentially hazardous situation that could result in minor or moderate injury. It can also be used to alert against unsafe practices.

NOTICE

Indicates important information, including situations that can result in damage to equipment or property.

2.2 Qualified Personnel

Correct and reliable transport, storage, installation, operation, and maintenance are required for the trouble-free and safe operation of the frequency converter. Only qualified personnel are allowed to install and operate this equipment.

Qualified personnel are defined as trained staff, who are authorized to install, commission, and maintain equipment, systems, and circuits in accordance with pertinent laws and regulations. Also, the qualified personnel must be familiar with the instructions and safety measures described in this manual.

2.3 Safety Precautions

⚠WARNING

HIGH VOLTAGE

Drives contain high voltage when connected to AC mains input, DC supply, or load sharing. 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.**
- **Before performing any service or repair work, use an appropriate voltage measuring device to make sure that there is no remaining voltage on the drive.**

Safety regulations

- Disconnect mains supply to the frequency converter whenever repair work is to be carried out. Check that the mains supply has been disconnected and that the necessary time has elapsed before removing motor and mains supply plugs. See the warning of discharge time for more information.
- [Off] does not disconnect the mains supply and must not be used as a safety switch.
- Ground the equipment properly, protect the user against supply voltage, and protect the motor against overload in accordance with applicable national and local regulations.
- The ground leakage current exceeds 3.5 mA. Ensure correct grounding of the equipment by a certified electrical installer.
- Do not remove the plugs for the motor and mains supply while the frequency converter is connected to mains. Check that the mains supply has been disconnected and that the necessary time has elapsed before removing motor and mains plugs.
- The frequency converter has more voltage sources than L1, L2, and L3, when load sharing (linking of DC intermediate circuit) or external 24 V DC is installed. Check that all voltage sources have been disconnected and that the necessary time has elapsed before commencing repair work. See the warning of discharge time for more information.

⚠WARNING

UNINTENDED START

When the frequency converter is connected to AC mains, DC supply, or load sharing, the motor may start at any time. Unintended start during programming, service, or repair work can result in death, serious injury, or property damage. The motor can start via an external switch, a serial bus command, an input reference signal from the LCP, or after a cleared fault condition.
To prevent unintended motor start:

- **Disconnect the frequency converter from the mains.**
- **Press [Off/Reset] on the LCP before programming parameters.**
- **Completely wire and assemble the frequency converter, motor, and any driven equipment before connecting the frequency converter to AC mains, DC supply, or load sharing.**

⚠WARNING

DISCHARGE TIME

The frequency converter contains DC-link capacitors, which can remain charged even when the frequency converter is not powered. High voltage can be present even when the warning LED 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 AC mains and remote DC-link power supplies, including battery back-ups, UPS, and DC-link connections to other frequency converters.**
- **Disconnect or lock PM motor.**
- **Wait for the capacitors to discharge fully. The minimum waiting time is 20 minutes.**
- **Before performing any service or repair work, use an appropriate voltage measuring device to make sure that the capacitors are fully discharged.**

NOTICE

Control signals from, or internally within, the frequency converter 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 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.

Crane, lifts, and hoists

The controlling of external brakes must always have a redundant system. The frequency converter 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 frequency converter enters the protection mode. Protection mode means a change of the PWM strategy and a low switching frequency to minimize losses. This continues for 10 s after the last fault and increases the reliability and the robustness of the frequency converter while re-establishing full control of the motor.
In hoist applications, protection mode is not usable because the frequency converter is unable to leave this mode again and 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 frequency converter trips immediately if 1 of the hardware limits is exceeded.

NOTICE

Disabling protection mode in hoisting applications (*parameter 14-26 Trip Delay at Inverter Fault* = 0) is recommended.

3 Programming

3

3.1 Graphical and Numerical Local Control Panels

Easy programming of the frequency converter is done via the graphical LCP (LCP 102). For information about using the numerical local control panel (LCP 101), see *chapter 3.1.16 How to Program on the Numerical Local Control Panel*.

The LCP is divided into 4 functional groups:

1. Graphical display with status lines.
2. Menu keys and indicator lights - changing parameters and switching between display functions.
3. Navigation keys and indicator lights.
4. Operation keys and indicator lights.

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

Display lines:

a. **Status line:** Status messages showing icons and graphics.

b. **Line 1–2:** Operator data lines showing data defined or selected. Add up to 1 extra line by pressing [Status].

c. **Status line:** Status messages showing text.

NOTICE

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

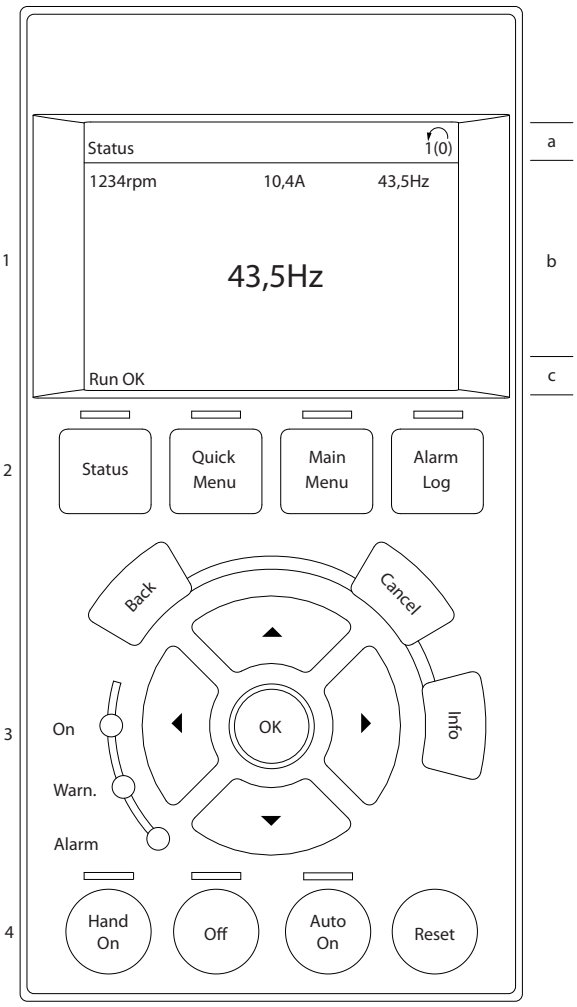

Illustration 3.1 LCP

3.1.1 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 set-up, and the programming set-up. The display is divided into 3 sections.

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

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 frequency converter in *Status* mode.

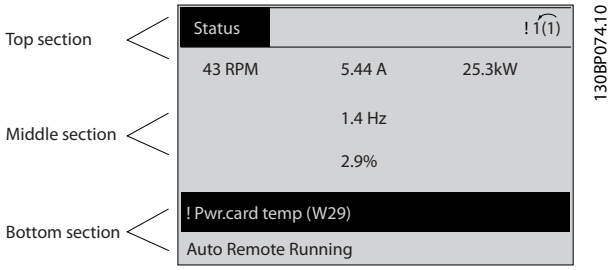

Illustration 3.2 Display

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

Display contrast adjustment
Press [Status] and [▲] for darker display.
Press [Status] and [▼] for brighter display.

Most parameter set-ups 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 frequency converter 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.

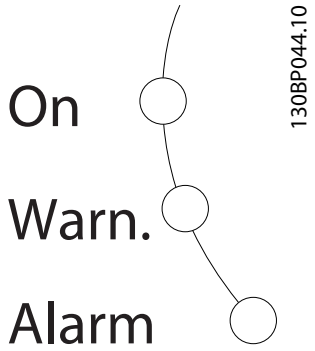

Illustration 3.3 Indicator Lights

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

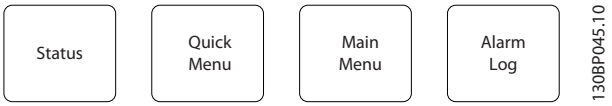

Illustration 3.4 LCP Keys

[Status]
Indicates the status of the frequency converter 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.

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[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 is shown about the condition of the frequency converter before it enters the alarm mode.

[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].

Illustration 3.5 Back

Illustration 3.6 Cancel

Illustration 3.7 Info

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 for selecting a parameter marked by the cursor and for enabling the change of a parameter.

Local control keys
Local control keys are at the bottom of the LCP.

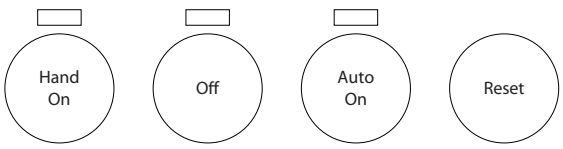


Illustration 3.8 Local Control Keys

[Hand On]
Enables control of the frequency converter 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.
- Set-up select bit 0 - Set-up select bit 1.
- Stop command from serial communication.
- Quick stop.
- DC brake.

[Off]
Stops the connected motor. The key can be selected as *[1] Enable* or *[0] Disable* via *parameter 0-41 [Off] Key on LCP*. If no external stop function is selected and the [Off] key is inactive, the motor can be stopped by disconnecting the voltage.

[Auto On]
Enables the frequency converter 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 frequency converter starts. The key can be selected as *[1] Enable* or *[0] Disable* via *parameter 0-42 [Auto on] Key on LCP*.

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 frequency converter 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.

3.1.2 Quick Transfer of Parameter Settings between Multiple Frequency Converters

Once the set-up of a frequency converter is complete, store the data in the LCP or on a PC via MCT 10 Set-up Software.

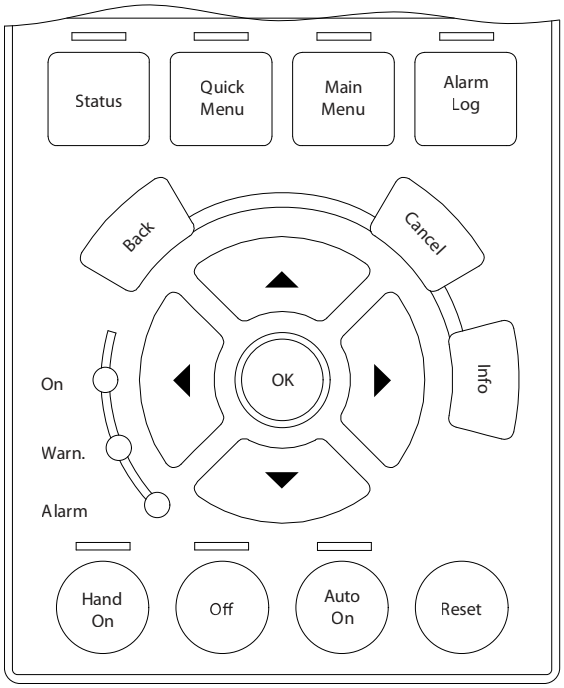


Illustration 3.9 LCP

Data storage in LCP

NOTICE

Stop the motor before performing this operation.

To store the data in the LCP:

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

All parameter settings are now stored in the LCP indicated by the progress bar. When 100% is reached, press [OK].

Connect the LCP to another frequency converter and copy the parameter settings to this frequency converter as well.

Data transfer from LCP to frequency converter

NOTICE

Stop the motor before performing this operation.

To transfer the data from the LCP to the frequency converter:

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

The parameter settings stored in the LCP are now transferred to the frequency converter indicated by the progress bar. When 100% is reached, press [OK].

3.1.3 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.

3.1.4 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 further in this section.

Table 3.1 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.

3

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 16-09 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 16-24 Calibrated Stator Resistance	
Parameter 16-30 DC Link Voltage	V
Parameter 16-34 Heatsink Temp.	°C
Parameter 16-35 Inverter Thermal	%
Parameter 16-36 Inv. Nom. Current	A
Parameter 16-37 Inv. Max. Current	A
Parameter 16-38 SL Controller State	
Parameter 16-39 Control Card Temp.	°C
Parameter 16-40 Logging Buffer Full	
Parameter 16-45 Motor Phase U Current	
Parameter 16-46 Motor Phase V Current	
Parameter 16-47 Motor Phase W Current	
Parameter 16-48 Speed Ref. After Ramp [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]	
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 16-75 Analog In X30/11	
Parameter 16-76 Analog In X30/12	
Parameter 16-77 Analog Out X30/8 [mA]	
Parameter 16-80 Fieldbus CTW 1	hex
Parameter 16-82 Fieldbus REF 1	hex
Parameter 16-84 Comm. Option STW	hex
Parameter 16-85 FC Port CTW 1	hex
Parameter 16-86 FC Port REF 1	hex
Parameter 16-87 Bus Readout Alarm/Warning	
Parameter 16-90 Alarm Word	
Parameter 16-91 Alarm Word 2	
Parameter 16-92 Warning Word	
Parameter 16-93 Warning Word 2	
Parameter 16-94 Ext. Status Word	
Parameter 16-95 Ext. Status Word 2	
Parameter 16-97 Alarm Word 3	
Parameter 16-98 Warning Word 3	

Table 3.1 Units

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 *Illustration 3.10*.

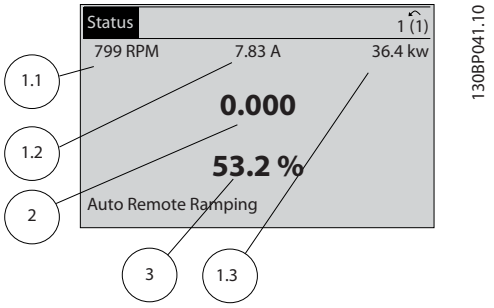


Illustration 3.10 Status View I

Status view II

See the operating variables (1.1, 1.2, 1.3, and 2) shown in *Illustration 3.11*.

In the example, speed, motor current, motor power, and frequency are selected as variables in the 1st and 2nd lines.

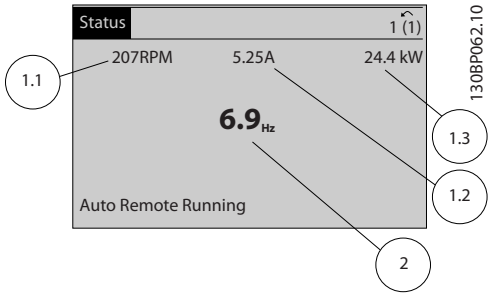


Illustration 3.11 Status View II

Status view III
This state shows the event and action of the smart logic control. For further information, see *chapter 4.12 Parameters: 13-** Smart Logic Control*.

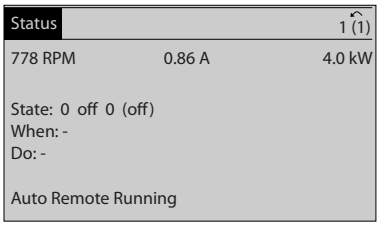


Illustration 3.12 Status View III

3.1.5 Parameter Set-up

The frequency converter can be used for practically all assignments and offers 2 programming mode options:

- 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 frequency converter. Change a parameter in either main menu mode or quick menu mode.

3.1.6 Quick Menu Key Functions

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

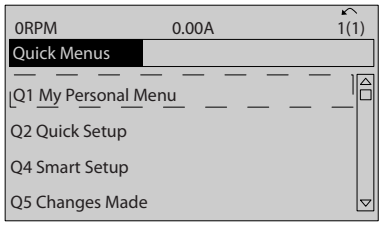


Illustration 3.13 Quick Menus

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 *Table 3.2* are accessible.

Parameter	Setting
Parameter 0-01 Language	
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 3-02 Minimum Reference	[RPM]

Table 3.2 Selection of Parameter

1) If terminal 27 is set to [0] No function, 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.

3.1.7 Initial Commissioning

The easiest way of carrying out the initial commissioning is by pressing [Quick Menu] and following the quick set-up procedure using LCP 102 (read *Table 3.3* from left to right). The example applies to open-loop applications.

3

Press				
Quick Menu	↓	Q2 Quick Menu.	OK	↓
Parameter 0-01 Language	OK	Set language.	↓	
Parameter 1-20 Motor Power [kW]	OK	Set motor nameplate power.	↓	
Parameter 1-22 Motor Voltage	OK	Set nameplate voltage.	↓	
Parameter 1-23 Motor Frequency	OK	Set nameplate frequency.	↓	
Parameter 1-24 Motor Current	OK	Set nameplate current.	↓	
Parameter 1-25 Motor Nominal Speed	OK	Set nameplate speed in RPM.	↓	
Parameter 5-12 Terminal 27 Digital Input	OK	If terminal default is *[2] Coast inverse*, it is possible to change this setting to *[0] No function*. No connection to terminal 27 is then needed for running AMA.	↓	
Parameter 1-29 Automatic Motor Adaptation (AMA)	OK	Set desired AMA function. Enable complete AMA is recommended.	↓	
Parameter 3-02 Minimum Reference	OK	Set the minimum speed of the motor shaft.	↓	
Parameter 3-03 Maximum Reference	OK	Set the maximum speed of the motor shaft.	↓	
Parameter 3-41 Ramp 1 Ramp Up Time	OK	Set the ramp-up time with reference to synchronous motor speed, n_s.	↓ ↓	
Parameter 3-42 Ramp 1 Ramp Down Time	OK	Set the ramp-down time with reference to synchronous motor speed, n_s.	↓	
Parameter 3-13 Reference Site	OK	Set the site from where the reference must work.	↓	

Table 3.3 Quick Set-up Procedure

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

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

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

The following 4 fieldbusses can be selected:

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

NOTICE

The frequency converter ignores the start conditions when SAS is active.

NOTICE

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

3.1.8 Main Menu Mode

Press [Main Menu] to enter the main menu mode. The readout in *Illustration 3.14* 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.

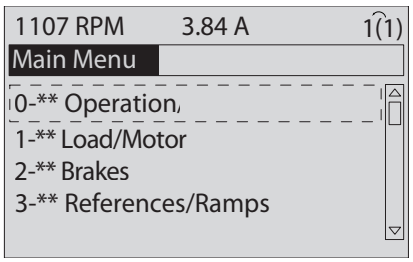


Illustration 3.14 Main Menu Mode

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

All parameters can be changed in the Main Menu. However, depending on the 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.

3.1.9 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.

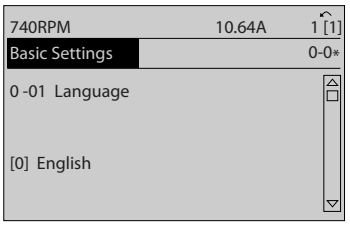


Illustration 3.15 Parameter Selection

3.1.10 Changing Data

The procedure for changing data is the same in the quick menu mode and the main menu mode. 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.

3.1.11 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].

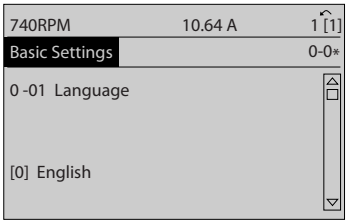


Illustration 3.16 Changing a Text Value

3

3.1.12 Changing a Data Value

If the selected parameter shows a numeric data value, change the selected data value with the [◄] [►] navigation keys and the [▲] [▼] navigation keys. Press [◄] [►] keys to move the cursor horizontally.

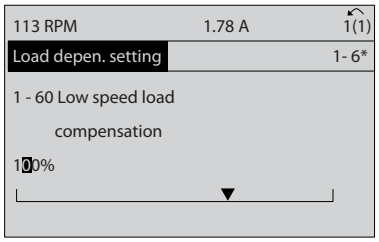


Illustration 3.17 Changing a Data Value

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

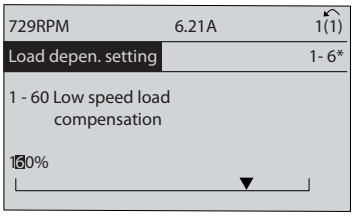


Illustration 3.18 Saving a Data Value

3.1.13 Infinitely Variable Change of Numeric Data Value

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

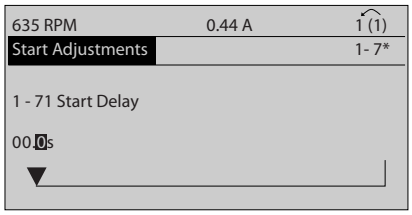


Illustration 3.19 Selecting a Digit

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

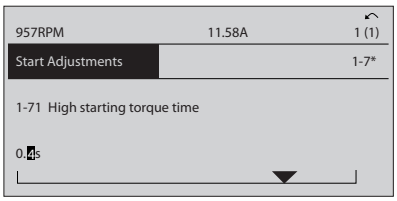


Illustration 3.20 Saving

3.1.14 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.

3.1.15 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.

For example, *parameter 3-10 Preset Reference* is changed as follows:

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.

3.1.16 How to Program on the Numerical Local Control Panel

The following instructions are valid for the numerical LCP (LCP 101).
The control panel is divided into 4 functional groups:

- Numerical display.
- Menu keys and indicator lights - changing parameters and switching between display functions.
- Navigation keys and indicator lights.
- 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.

LCP keys
[Menu]

Select 1 of the following modes:

- Status.
- Quick set-up.
- Main menu.

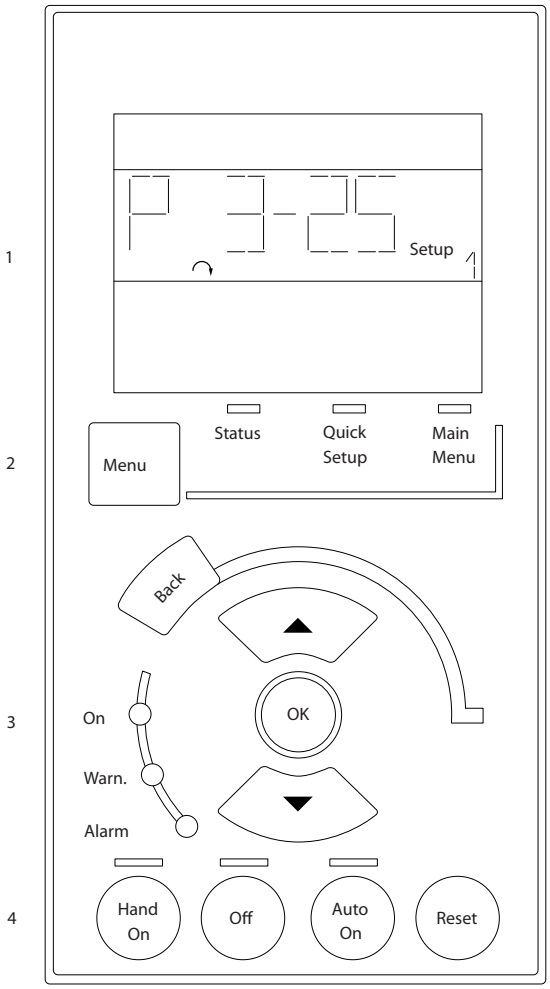


Illustration 3.21 LCP Keys

Status mode
Status mode shows the status of the frequency converter 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.

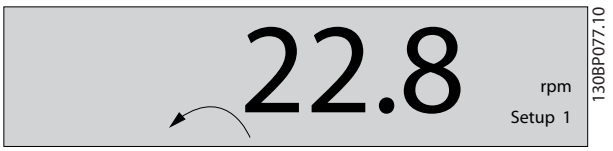


Illustration 3.22 Status Mode

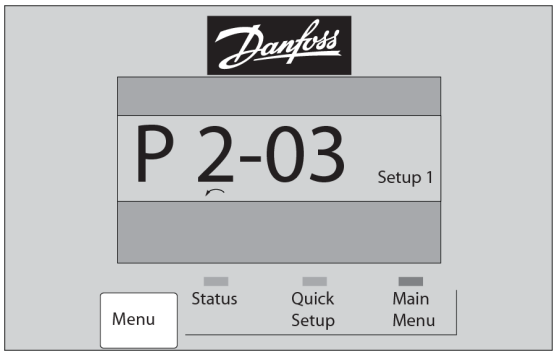
Illustration 3.23 Alarm

Main Menu/Quick Set-up
Used for programming all parameters or only the parameters in the Quick Menu (see also description of the LCP 102 in *chapter 3.1 Graphical and Numerical Local Control Panels*).
When the value flashes, press [▲] or [▼] to change parameter values.

1. Press [Main Menu] to select main menu.
2. Select the parameter group [xx-__] and press [OK].
3. Select the parameter [__-xx] and press [OK].
4. If the parameter is an array parameter, select the array number and press [OK].
5. Select the required data value and press [OK].

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 *chapter 4 Parameter Descriptions*.

[Back]
Used for stepping backwards.
[▲] [▼] are used for maneuvering between commands and within parameters.

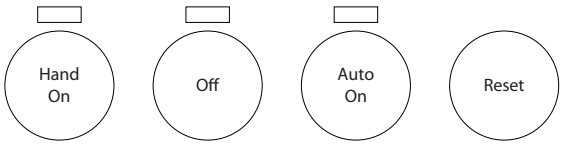


130BP079.10

Illustration 3.24 Main Menu/Quick Set-up

3.1.17 LCP Keys

Keys for local control are at the bottom of the LCP.



e30bp046.12

Illustration 3.25 LCP Keys

[Hand On]
Enables control of the frequency converter 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.
- Set-up select lsb - Set-up 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 no external stop function is selected and the [Off] key is inactive, stop the motor by disconnecting the voltage.

[Auto On]
Enables control of the frequency converter via the control terminals and/or serial communication. When a start signal is applied on the control terminals and/or the bus, the frequency converter starts. The key can be selected as *[1] Enable* or *[0] Disable* via *parameter 0-42 [Auto on] Key on LCP*.

NOTICE

An active HAND-OFF-AUTO signal via the digital inputs has higher priority than the control keys [Hand On] and [Auto On].

[Reset]
Used for resetting the frequency converter after an alarm (trip). It can be selected as *[1] Enable* or *[0] Disable* via *parameter 0-43 [Reset] Key on LCP*.

3.1.18 Initialization to Default Settings

Initialize the frequency converter to default settings in 2 ways.

Recommended initialization (via *parameter 14-22 Operation Mode*)

1. Select *parameter 14-22 Operation Mode*.
2. Press [OK].
3. Select *[2] initialization*.
4. Press [OK].
5. Disconnect the mains supply and wait until the display turns off.
6. Reconnect the mains supply. The frequency converter is now reset.

Parameter 14-22 Operation Mode initializes all except:

- *Parameter 14-50 RFI Filter*.
- *Parameter 8-30 Protocol*.
- *Parameter 8-31 Address*.
- *Parameter 8-32 FC Port Baud Rate*.
- *Parameter 8-35 Minimum Response Delay*.
- *Parameter 8-36 Max Response Delay*.
- *Parameter 8-37 Max Inter-Char Delay*.
- *Parameter 15-00 Operating hours* to *parameter 15-05 Over Volt's*.
- *Parameter 15-20 Historic Log: Event* to *parameter 15-22 Historic Log: Time*.
- *Parameter 15-30 Fault Log: Error Code* to *parameter 15-32 Alarm Log: Time*.

Manual initialization

1. Disconnect from mains and wait until the display turns off.
2. 2a Press [Status] - [Main Menu] - [OK] at the same time while powering up the LCP 102, graphical display.

   2b Press [Menu] - [OK] while powering up the LCP 101, numerical display.
3. Release the keys after 5 s.
4. The frequency converter is now programmed according to default settings.

This procedure initializes all except:

- *Parameter 15-00 Operating hours*.
- *Parameter 15-03 Power Up's*.
- *Parameter 15-04 Over Temp's*.
- *Parameter 15-05 Over Volt's*.

NOTICE

A manual initialization also resets serial communication, RFI filter settings (*parameter 14-50 RFI Filter*), and fault log settings.

4 Parameter Descriptions

4.1 Parameters: 0-** Operation and Display

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

4

4.1.1 0-0* Basic Settings

0-01 Language

Option:		Function:
		Defines the language to be used in the display.
[0] *	English	
[10]	Chinese	

0-02 Motor Speed Unit

Option:		Function:
		NOTICE **This parameter cannot be adjusted while the motor is running.** The information shown in the display depends on settings in *parameter 0-02 Motor Speed Unit*. The default settings of *parameter 0-02 Motor Speed Unit* depend on to which region of the world the frequency converter is supplied. ***NOTICE*** **Changing the motor speed unit resets certain parameters to their initial value. Select the motor speed unit before modifying other parameters.**
[0]	RPM	Select to show motor speed variables and parameters using motor speed (RPM).
[1] *	Hz	Select to show motor speed variables and parameters using output frequency (Hz).

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

Option:		Function:
		Select the operating mode upon reconnection of the frequency converter to mains voltage after power-down in hand-on mode.

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

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

4.1.2 0-1* Set-up Operations

Define and control the individual parameter set-ups.
The frequency converter has 4 parameter set-ups that can be programmed independently of each other. This makes the frequency converter very flexible and able to solve advanced control functionality problems, often saving the cost of external control equipment. Parameter set-ups can be used to program the frequency converter to operate according to 1 control scheme in 1 set-up (for example motor 1 for horizontal movement) and another control scheme in another set-up (for example motor 2 for vertical movement). Alternatively, parameter set-ups can be used by an OEM machine builder to identically program all their factory-fitted frequency converters for different machine types within a range to have the same parameters. During production/commissioning, simply select a specific set-up depending on which machine the frequency converter is installed on.
The active set-up (that is the set-up in which the frequency converter is currently operating) can be selected in *parameter 0-10 Active Set-up* and is shown in the LCP. By using multi set-up, it is possible to switch between set-ups with the frequency converter running, or it can be stopped via digital input or serial communication commands. If it is necessary to change set-ups while the frequency converter is running, ensure that *parameter 0-12 This Set-up Linked to* is programmed as required. By using *parameter 0-11 Edit Set-up*, it is possible to edit parameters within any of the set-ups while continuing the operation of the frequency converter in its active set-up, which can be a different set-up to the one being edited. By using *parameter 0-51 Set-up Copy*, it is possible to copy parameter settings between the set-ups to enable quicker commissioning if similar parameter settings are required in different set-ups.

0-10 Active Set-up		
Option:		**Function:**
		Select the set-up to control the frequency converter functions.
[0]	Factory setup	Cannot be changed. It contains the Danfoss data set and can be used as a data source when returning the other set-ups to a known state.
[1] *	Set-up 1	*[1] Set-up 1* to *[4] Set-up 4* are the 4 separate parameter set-ups within which all parameters can be programmed.
[2]	Set-up 2	
[3]	Set-up 3	
[4]	Set-up 4	
[9]	Multi Set-up	Remote set-up selections using digital inputs and the serial communication port. This set-up uses the settings from *parameter 0-12 This Set-up Linked to*. Stop the frequency converter before making changes to open and closed-loop functions.

Use *parameter 0-51 Set-up Copy* to copy a set-up to 1 or all other set-ups. Stop the frequency converter before switching between set-ups where parameters marked *not changeable during operation* have different values. To avoid conflicting settings of the same parameter within 2 different set-ups, link the set-ups together using *parameter 0-12 This Set-up Linked to*. Parameters which are *not changeable during operation* are marked FALSE in the parameter lists in *chapter 5 Parameter Lists*.

0-11 Edit Set-up		
Option:		**Function:**
		Select the set-up to be edited (that is programmed) during operation; either the active set-up or 1 of the inactive set-ups.
[0]	Factory setup	Cannot be edited but it is useful as a data source to return the other set-ups 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 set-up.
[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 set-up from a range of sources: LCP, FC RS485, FC USB, or up to 5 fieldbus sites.

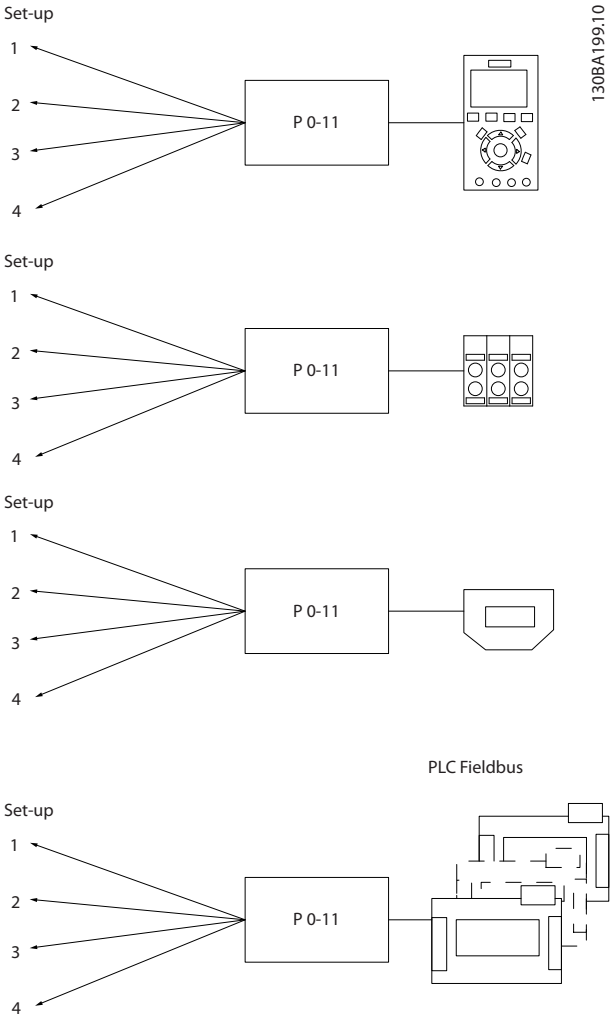
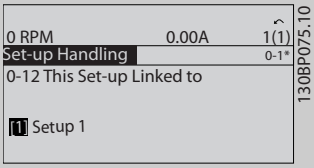
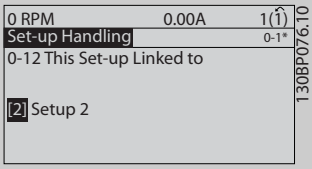


Illustration 4.1 Edit Set-up

4

0-12 This Set-up Linked to		
Option:		**Function:**
		To enable conflict-free changes from 1 set-up to another during operation, link set-ups containing parameters which are *not changeable during operation*. The link ensures synchronizing of the *not changeable during operation*-parameter values when moving from 1 set-up to another during operation. *Not changeable during operation*-parameters can be identified by the label FALSE in the parameter lists in *chapter 5 Parameter Lists*. *Parameter 0-12 This Set-up Linked to* is used by *[9] Multi set-up* in *parameter 0-10 Active Set-up*. Multi set-up is used to move from 1 set-up to another during operation (that is while the motor is running). Example: Use multi set-up to shift from set-up 1 to set-up 2 while the motor is running. Program in set-up 1 first, then ensure that set-up 1 and set-up 2 are synchronized (or linked). Synchronization can be performed in 2 ways: 1. Select the following options: • *[2] Set-up 2* in *parameter 0-11 Edit Set-up*. • *[1] Set-up 1* in *parameter 0-12 This Set-up Linked to*. This starts the linking (synchronizing) process.  **Illustration 4.2 Set-up 1** OR 2. While still in set-up 1, copy set-up 1 to set-up 2. Then set *parameter 0-12 This Set-up Linked to* to *[2] Set-up 2*. This starts the linking process.

0-12 This Set-up Linked to		
Option:		**Function:**
		 **Illustration 4.3 Set-up 2** When completed, *parameter 0-13 Readout: Linked Set-ups* reads {1,2} to indicate that all *not changeable during operation*-parameters are now the same in set-up 1 and set-up 2. If there are changes to a *not changeable during operation* parameter, for example *parameter 1-30 Stator Resistance (Rs)*, in set-up 2, they are also changed automatically in set-up 1. A switch between set-up 1 and set-up 2 during operation is now possible.
[0] *	Not linked	
[1]	Set-up 1	
[2]	Set-up 2	
[3]	Set-up 3	
[4]	Set-up 4	

0-13 Readout: Linked Set-ups		
Array [5]		
Range:		**Function:**
0*	[0 - 255]	View a list of all the set-ups linked by *parameter 0-12 This Set-up Linked to*. The parameter has 1 index for each parameter set-up. The value for each index shows which set-ups are linked to that parameter set-up.

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

Table 4.1 Set-up Link Example

0-14 Readout: Edit Set-ups / Channel		
Range:		**Function:**
0*	[-2147483648 - 2147483647]	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 set-up number; F means factory setting; and A means active set-up. The channels are, from right to left: LCP, FC bus, USB, HPFB1-5. Example: The number AAAAAA21h means the following: • The frequency converter received the setting set-up 2 via a fieldbus channel. This selection is reflected in *parameter 0-11 Edit Set-up*. • A user selected set-up 1 via the LCP. • All other channels are using the active set-up.

4.1.3 0-2* LCP Display

Define the variables shown in the LCP.

NOTICE

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

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

0-20 Display Line 1.1 Small		
Option:		**Function:**
		Select a variable for display in line 1, left position.
[0]	None	No display value selected.
[37]	Display Text 1	
[38]	Display Text 2	
[39]	Display Text 3	
[748]	FCD Feed Forward	
[953]	Profibus Warning Word	
[1500]	Operating Hours	
[1501]	Running Hours	
[1502]	kWh Counter	
[1580]	Fan Running Hours	

0-20 Display Line 1.1 Small		
Option:		**Function:**
[1600]	Control Word	Present control word.
[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 [%]	Actual value as a percentage.
[1609]	Custom Readout	
[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 frequency converter in Hz.
[1614]	Motor current	Phase current of the motor measured as effective value.
[1615]	Frequency [%]	Motor frequency, that is the output frequency from the frequency converter 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.
[1620]	Motor Angle	
[1621]	Torque [%] High Res.	
[1622]	Torque [%]	Present motor load as a percentage of the rated motor torque.
[1624]	Calibrated Stator Resistance	
[1630]	DC Link Voltage	DC-link voltage in the frequency converter.
[1631]	System Temp.	
[1632]	Brake Energy /s	Present brake power transferred to an external brake resistor. Stated as an instant value.
[1633]	Brake Energy Average	Brake power transferred to an external brake resistor. The mean power is calculated continuously for the most recent 120 s.
[1634]	Heatsink Temp.	Present heat sink temperature of the frequency converter. The cutout limit is 95 ±5 °C (203 ±9 °F); cutting back in occurs at 70 ±5 °C (203 ±9 °F).

4

0-20 Display Line 1.1 Small		
Option:		**Function:**
[1635]	Inverter Thermal	Percentage load of the inverters.
[1636]	Inv. Nom. Current	Nominal current of the frequency converter.
[1637]	Inv. Max. Current	Maximum current of the frequency converter.
[1638]	SL Controller State	State of the event executed by the control.
[1639]	Control Card Temp.	Temperature of the control card.
[1644]	Speed Error [RPM]	
[1645]	Motor Phase U Current	
[1646]	Motor Phase V Current	
[1647]	Motor Phase W Current	
[1648]	Speed Ref. After Ramp [RPM]	
[1650]	External Reference	Sum of the external reference as a percentage, that is the sum of analog/pulse/bus.
[1651]	Pulse Reference	Frequency in Hz connected to the digital inputs (18, 19 or 32, 33).
[1652]	Feedback[Unit]	Reference value from programmed digital inputs.
[1653]	Digi Pot Reference	
[1657]	Feedback [RPM]	
[1660]	Digital Input	Signal states from the 6 digital terminals (18, 19, 27, 29, 32, and 33). There are 16 bits in total, but only 6 of them are used. Input 18 corresponds to the far left of the used bits. Signal 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]	Freq. Input #29 [Hz]	Actual value of the frequency applied at terminal 29 as an impulse input.
[1668]	Freq. Input #33 [Hz]	Actual value of the frequency applied at terminal 33 as an impulse input.
[1669]	Pulse Output #27 [Hz]	Actual value of impulses applied to terminal 27 in digital output mode.

0-20 Display Line 1.1 Small		
Option:		**Function:**
[1670]	Pulse Output #29 [Hz]	Actual value of impulses applied to terminal 29 in digital output mode.
[1671]	Relay Output [bin]	
[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	Main 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	1 or more alarms in a hex code.
[1691]	Alarm Word 2	1 or more alarms in a hex code.
[1692]	Warning Word	1 or more warnings in a hex code.
[1693]	Warning Word 2	1 or more warnings in a hex code.
[1694]	Ext. Status Word	1 or more status conditions in a hex code.
[1695]	Ext. Status Word 2	1 or more status conditions in a hex code.
[1697]	Alarm Word 3	1 or more alarms in a hex code.
[1698]	Warning Word 3	1 or more warnings in a hex code.
[1890]	Process PID Error	
[1891]	Process PID Output	
[1892]	Process PID Clamped Output	
[1893]	Process PID Gain Scaled Output	
[2117]	Ext. 1 Reference [Unit]	
[2118]	Ext. 1 Feedback [Unit]	
[2119]	Ext. 1 Output [%]	

0-20 Display Line 1.1 Small

Option:		Function:
[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 [%]	

0-21 Display Line 1.2 Small

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

0-22 Display Line 1.3 Small

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

0-23 Display Line 2 Large

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

0-24 Display Line 3 Large

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

0-25 My Personal Menu

Range:		Function:
Size related*	[0 - 9999]	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.

4.1.4 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 unit selected in *parameter 0-30 Custom Readout Unit*).
- Display text. Text string stored in a parameter.

Custom readout

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

- *Parameter 0-30 Custom Readout Unit*.
- *Parameter 0-31 Custom Readout Min Value* (linear only).
- *Parameter 0-32 Custom Readout Max Value*.
- *Parameter 4-13 Motor Speed High Limit [RPM]*.
- *Parameter 4-14 Motor Speed High Limit [Hz]*.
- Actual speed.

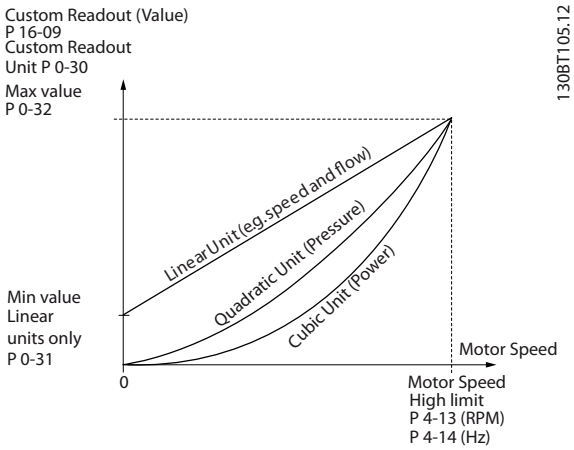


Illustration 4.4 Custom Readout

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

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

Table 4.2 Speed Relations for Different Unit Types

4

0-30 Unit for User-defined Readout		
Option:		**Function:**
		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 4.2*). 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*.
[0]	None	
[1] *	%	
[5]	PPM	
[10]	1/min	
[11]	rpm	
[12]	Pulse/s	
[20]	l/s	
[21]	l/min	
[22]	l/h	
[23]	m^3/s	
[24]	m^3/min	
[25]	m^3/h	
[30]	kg/s	
[31]	kg/min	
[32]	kg/h	
[33]	t/min	
[34]	t/h	
[40]	m/s	
[41]	m/min	
[45]	m	
[60]	°C	
[70]	mbar	
[71]	bar	
[72]	Pa	
[73]	kPa	
[74]	m WG	
[80]	kW	
[120]	GPM	
[121]	gal/s	
[122]	gal/min	
[123]	gal/h	
[124]	CFM	
[125]	ft^3/s	
[126]	ft^3/min	
[127]	ft^3/h	
[130]	lb/s	
[131]	lb/min	
[132]	lb/h	
[140]	ft/s	

0-30 Unit for User-defined Readout		
Option:		**Function:**
[141]	ft/min	
[145]	ft	
[160]	°F	
[170]	psi	
[171]	lb/in^2	
[172]	in WG	
[173]	ft WG	
[180]	HP	

0-31 Min Value of User-defined Readout		
Range:		**Function:**
0 Custom-ReadoutUnit*	[-999999.99 - par. 0-32 CustomReadoutUnit]	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.

0-32 Max Value of User-defined Readout		
Range:		**Function:**
100 Custom-ReadoutUnit*	[par. 0-31 - 999999.99 CustomReadoutUnit]	This parameter sets the maximum value to be shown when the speed of the motor has reached the set value for *parameter 4-13 Motor Speed High Limit [RPM]* or *parameter 4-14 Motor Speed High Limit [Hz]* (depends on setting in *parameter 0-02 Motor Speed Unit*).

0-37 Display Text 1		
Range:		**Function:**
0*	[0 - 25]	Enter a text which can be viewed in the graphical display by selecting *[37] Display Text 1* in • *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*, or • *Parameter 0-24 Display Line 3 Large*.

0-38 Display Text 2		
Range:		**Function:**
0*	[0 - 25]	Enter a text which can be viewed in the graphical display by selecting *[38] Display Text 2* in

0-38 Display Text 2		
Range:		**Function:**
		• *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*, or • *Parameter 0-24 Display Line 3 Large*.

0-39 Display Text 3		
Range:		**Function:**
0*	[0 - 25]	Enter a text which can be viewed in the graphical display by selecting *[39] Display Text 3* in • *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*, or • *Parameter 0-24 Display Line 3 Large*.

4.1.5 0-4* LCP Keypad

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

0-40 [Hand on] Key on LCP		
Option:		**Function:**
[0]	Disabled	No effect when [Hand On] is pressed. Select *[0] Disabled* to avoid accidental start of the frequency converter in hand-on mode.
[1] *	Enabled	The LCP switches to hand-on mode directly when [Hand On] is pressed.

0-41 [Off] Key on LCP		
Option:		**Function:**
[0]	Disabled	Avoids accidental stop of the frequency converter.
[1] *	Enabled	

0-42 [Auto on] Key on LCP		
Option:		**Function:**
[0]	Disabled	Avoids accidental start of the frequency converter in auto-on mode.
[1] *	Enabled	

0-43 [Reset] Key on LCP		
Option:		**Function:**
[0]	Disabled	No effect when [Reset] is pressed. Avoids accidental alarm reset.
[1] *	Enabled	

4.1.6 0-5* Copy/Save

Copy parameters from and to the LCP. Use these parameters for saving and copying set-ups from 1 frequency converter to another.

0-50 LCP Copy		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.**
[0] *	No copy	
[1]	All to LCP	Copies all parameters in all set-ups from the frequency converter memory to the LCP memory.
[2]	All from LCP	Copies all parameters in all set-ups from the LCP memory to the frequency converter memory.
[3]	Size indep. from LCP	Copy only the parameters that are independent of the motor size. The latter selection can be used to program several frequency converters with the same function without disturbing motor data.
[10]	Delete LCP copy data	Use to delete the copy after the transfer is complete.

0-51 Set-up Copy		
Option:		**Function:**
[0] *	No copy	No function.
[1]	Copy to set-up 1	Copies all parameters in the present programming set-up (defined in *parameter 0-11 Programming Set-up*) to set-up 1.
[2]	Copy to set-up 2	Copies all parameters in the present programming set-up (defined in *parameter 0-11 Programming Set-up*) to set-up 2.
[3]	Copy to set-up 3	Copies all parameters in the present programming set-up (defined in *parameter 0-11 Programming Set-up*) to set-up 3.
[4]	Copy to set-up 4	Copies all parameters in the present programming set-up (defined in *parameter 0-11 Programming Set-up*) to set-up 4.
[9]	Copy to all	Copies the parameters in the present set-up to each of the set-ups 1 to 4.

4.1.7 0-6* Password

0-60 Main Menu Password		
Range:		**Function:**
100*	[0 - 999]	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.

0-61 Access to Main Menu w/o Password		
Option:		**Function:**
[0] *	Full access	Disables password defined in *parameter 0-60 Main Menu Password*.
[1]	Read only	Prevent unauthorized editing of *Main Menu* parameters.
[2]	No access	Prevent unauthorized viewing and editing of *Main Menu* parameters.

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.

4.2 Parameters: 1-** Load and Motor

4.2.1 1-0* General Settings

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

1-00 Configuration Mode		
Option:		**Function:**
		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*.
[0]	Speed open loop	Enables speed control (without feedback signal from motor) with automatic slip compensation for almost constant speed at varying loads. Compensations are active, but can be disabled in *parameter group 1-0* General Settings*. Set the speed control parameters in *parameter group 7-0* Speed PID Ctrl.*
[1]	Speed closed loop	Enables speed closed-loop control with feedback. Obtain full holding torque at 0 RPM. For increased speed accuracy, provide a feedback signal and set the speed PID control. Set the speed control parameters in *parameter group 7-0* Speed PID Ctrl.*
[3]	Process	Enables the use of process control in the frequency converter. Set the process control parameters in *parameter groups 7-2* Process Ctrl. Feedb.* and *7-3* Process PID Ctrl.*
[4]	Torque open loop	Enables the use of torque open loop in VVC+ mode (*parameter 1-01 Motor Control Principle*). Set the torque PID parameters in *parameter group 7-1* Torque PI Control.*
[7]	Extended PID Speed OL	Specific parameters in *parameter groups 7-2* Process Ctrl. Feedb.* to *7-5* Ext. Process PID Ctrl.*

1-01 Motor Control Principle		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** Select the motor control principle.
[0]	U/f	Special motor mode, for parallel connected motors in special motor applications. When U/f is selected, the characteristic of the control principle can be edited in *parameter 1-55 U/f Characteristic - U* and *parameter 1-56 U/f Characteristic - F*.
[1] *	VVC+	Voltage vector control principle is suitable for most applications. The main benefit of VVC+ operation is that it uses a robust motor model.

1-03 Torque Characteristics		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** Select the torque characteristic required. VT and AEO are both energy-saving operations.
[0] *	Constant torque	Motor shaft output provides constant torque under variable speed control.
[1]	Variable torque	Motor shaft output provides variable torque under variable speed control. Set the variable torque level in *parameter 14-40 VT Level*.
[2]	Auto Energy Optim.	Automatically optimizes energy consumption by minimizing magnetization and frequency via *parameter 14-41 AEO Minimum Magnetisation* and *parameter 14-42 Minimum AEO Frequency*.

1-04 Overload Mode		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** Use this parameter to configure the frequency converter for either high or normal overload. When selecting the frequency converter size, always review the technical data in the *operating guide* or the *design guide* to know the available output current.
[0]	High torque	Allows up to 160% over torque.
[1] *	Normal torque	For oversized motor - allows up to 110% over torque.

1-05 Local Mode Configuration		
Option:		**Function:**
		Select which application configuration mode (*parameter 1-00 Configuration Mode*), that is application control principle, to use when a local (LCP) reference is active. A local reference can be active only when *parameter 3-13 Reference Site* is set to *[0] Linked to Hand/Auto* or *[2] Local*. By default the local reference is active in hand-on mode only.
[0]	Speed open loop	
[1]	Speed Closed Loop	
[2] *	As mode par 1-00	

1-06 Clockwise Direction		
Option:		**Function:**
		NOTICE **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.
[0] *	Normal	The motor shaft turns in clockwise direction when the frequency converter is connected U⇒U, V⇒V, and W⇒W to the motor.
[1]	Inverse	Motor shaft turns in counter-clockwise direction when the frequency converter is connected U⇒U, V⇒V, and W⇒W to the motor.

4.2.2 1-1* Special Settings

NOTICE

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

1-10 Motor Construction		
Option:		**Function:**
		Select the motor design type.
[0] *	Asynchron	Use for asynchronous motors.
[1]	PM, non salient SPM	Use for salient or non-salient PM motors. PM motors are divided into 2 groups, with either surface-mounted (SPM)/non-salient magnets or interior-mounted (IPM)/ salient magnets.

1-14 Damping Gain		
Range:		**Function:**
140 %*	[0 - 250 %]	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.

1-14 Damping Gain		
Range:		**Function:**
		If the damping gain is too high or low, the control becomes unstable.

1-15 Low Speed Filter Time Const.		
Range:		**Function:**
Size related*	[0.01 - 20 s]	This time constant is used below 10% rated speed. Obtain quick control through a short damping time constant. However, if this value is too short, the control becomes unstable.

1-16 High Speed Filter Time Const.		
Range:		**Function:**
Size related*	[0.01 - 20 s]	This time constant is used above 10% rated speed. Obtain quick control through a short damping time constant. However, if this value is too short, the control becomes unstable.

1-17 Voltage filter time const.		
Range:		**Function:**
Size related*	[0.001 - 2 s]	Reduces the influence of high frequency ripple and system resonance in the calculation of supply voltage. Without this filter, the ripples in the currents can distort the calculated voltage and affect the stability of the system.

1-18 Min. Current at No Load		
Range:		**Function:**
0 %*	[0 - 50 %]	Adjust this parameter to achieve a smoother motor operation.

4.2.3 1-2* Motor Data

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

NOTICE

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

NOTICE

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

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

1-20 Motor Power [kW]		
Range:		**Function:**
Size related*	[0.09 - 3000.00 kW]	***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 frequency converter.

1-22 Motor Voltage		
Range:		**Function:**
Size related*	[10 - 1000 V]	Enter the nominal motor voltage according to the motor nameplate data. The default value corresponds to the nominal rated output of the unit.

1-23 Motor Frequency		
Range:		**Function:**
Size related*	[20 - 1000 Hz]	Select the motor frequency value from the motor nameplate data.

1-24 Motor Current		
Range:		**Function:**
Size related*	[0.10 - 10000.00 A]	Enter the nominal motor current value from the motor nameplate data. The data is used for calculating torque, motor overload protection, and so on.

1-25 Motor Nominal Speed		
Range:		**Function:**
Size related*	[10 - 60000 RPM]	Enter the nominal motor speed value from the motor nameplate data. The data is used for calculating motor compensations. $n_{m,n} = n_s - n_{slip}$.

1-26 Motor Cont. Rated Torque		
Range:		**Function:**
Size related*	[0.1 - 100000.0 Nm]	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.

1-29 Automatic Motor Adaptation (AMA)		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** The AMA function optimizes dynamic motor performance by automatically optimizing the advanced motor parameters (*parameter 1-30 Stator Resistance (Rs)* to *parameter 1-35 Main Reactance (Xh)*) 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 frequency converter is ready for operation. ***NOTICE*** **Ensure that a value is set in *parameter 14-43 Motor Cosphi* before running AMA II.**
[0] *	Off	
[1]	Enable Complete AMA	Performs

1-29 Automatic Motor Adaptation (AMA)		
Option:		**Function:**
		• 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. 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 used between the frequency converter and the motor.
[3]	Enable Complete AMA II	Use this option with special motors (for example, S3 motors) and high-power motors. The functionality is similar to option *[1] Enable Complete AMA*, but the optimization is done based on torque calibration.
[4]	Enable Reduced AMA II	Use this option with special motors (for example, S3 motors) and high-power motors. The functionality is similar to option *[2] Enable Reduced AMA*, but the optimization is done based on torque calibration.

NOTICE

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

NOTICE

It is important to set motor *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.

NOTICE

Avoid generating external torque during AMA.

NOTICE

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

NOTICE

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 frequency converter size.

4.2.4 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 frequency converter 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 X1 + Xh 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)]/I_{NL} = X1 + Xh, see *Illustration 4.5*. These values are important to magnetize the motor properly. For high-pole motors, it is highly recommended to perform this check.

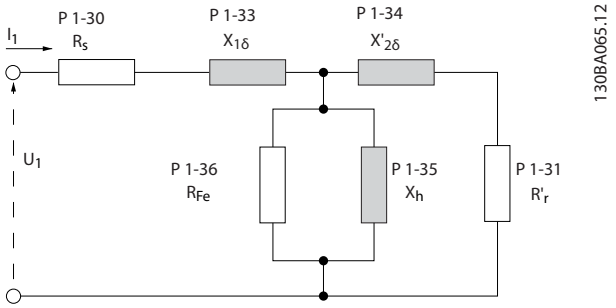


Illustration 4.5 Motor Equivalent Diagram of an Asynchronous Motor

1-30 Stator Resistance (Rs)		
Range:		**Function:**
Size related*	[0.0140 - 140.0000 Ohm]	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*.**

1-31 Rotor Resistance (Rr)		
Range:		**Function:**
Size related*	[0.0100 - 100.0000 Ohm]	***NOTICE*** ***Parameter 1-31 Rotor Resistance (Rr)* does not have effect when *parameter 1-10 Motor Construction* is set to *[1] PM, non-salient SPM*.**

1-31 Rotor Resistance (Rr)		
Range:		**Function:**
		Set the rotor resistance value R_r to improve shaft performance using 1 of these methods: • Run an AMA on a cold motor. The frequency converter 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 frequency converter establishes the setting based on the motor nameplate data.

1-33 Stator Leakage Reactance (X1)		
Range:		**Function:**
Size related*	[0.0400 - 400.0000 Ohm]	***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 frequency converter 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 frequency converter establishes the setting based on the motor nameplate data. See *Illustration 4.5*. ***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*.**

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1-34 Rotor Leakage Reactance (X2)

Range:		Function:
Size related*	[0.0400 - 400.0000 Ohm]	**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 frequency converter 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 frequency converter establishes the setting based on the motor nameplate data. See *Illustration 4.5*. **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*.**

1-35 Main Reactance (Xh)

Range:		Function:
Size related*	[1.0000 - 10000.0000 Ohm]	Set the main reactance of the motor using 1 of these methods: 1. Run an AMA on a cold motor. The frequency converter measures the value from the motor. 2. Enter the X_h value manually. Obtain the value from the motor supplier. 3. Use the X_h default setting. The frequency converter establishes the setting based on the motor nameplate data.

1-36 Iron Loss Resistance (Rfe)

Range:		Function:
Size related*	[0 - 10000.000 Ohm]	Enter the equivalent iron loss resistance (R_{Fe}) value to compensate for iron loss in the motor. The R_{Fe} value cannot be found by performing an AMA. The R_{Fe} value is especially important in torque control applications. If R_{Fe} is unknown, leave *parameter 1-36 Iron Loss Resistance (Rfe)* on default setting.

1-37 d-axis Inductance (Ld)

Range:		Function:
Size related*	[0.000 - 1000.000 mH]	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). For a selection with 1 decimal, use this parameter. **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*.**

1-38 q-axis Inductance (Lq)

Range:		Function:
Size related*	[0.000 - 1000 mH]	Set the value of the q-axis inductance. See the motor datasheet.

1-39 Motor Poles

Range:		Function:
Size related*	[2 - 132]	Enter the number of motor poles.

Poles	~n_n@ 50 Hz	~n_n@ 60 Hz
2	2700–2880	3250–3460
4	1350–1450	1625–1730
6	700–960	840–1153

Table 4.3 Pole Number for Normal Speed Ranges

Table 4.3 shows the pole number for normal speed ranges of various motor types. Define motors designed for other frequencies separately. The motor pole value is always an even number because it refers to the total pole number, not pairs of poles. The frequency converter creates the initial setting of *parameter 1-39 Motor Poles* based on *parameter 1-23 Motor Frequency* and *parameter 1-25 Motor Nominal Speed*.

1-40 Back EMF at 1000 RPM

Range:		Function:
Size related*	[0 - 9000 V]	***NOTICE*** **This parameter is only active when *parameter 1-10 Motor Construction* is set to options that enable PM (permanent magnet) motors.** Set the nominal back EMF for the motor when running at 1000 RPM. Back EMF is the voltage generated by a PM motor when no frequency converter 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. If back EMF is for example 320 V at 1800 RPM, it can be calculated at 1000 RPM: **Example** Back EMF 320 V at 1800 RPM. Back EMF=(Voltage/RPM)*1000=(320/1800)*1000=178. ***NOTICE*** **When using PM motors, it is recommended to use brake resistors.**

1-41 Motor Angle Offset

Range:		Function:
0*	[-32768 - 32767]	***NOTICE*** **This parameter is only active when *parameter 1-10 Motor Construction* is set to *[1] PM, non-salient SPM* (Permanent Magnet Motor).** Enter the correct offset angle between the PM motor and the index position (single-turn) of the attached encoder or resolver. The value range of 0–32768 corresponds to 0–2 x pi (radians). To obtain the offset angle value: After frequency converter start-up, apply DC hold and enter the value of *parameter 16-20 Motor Angle* into this parameter.

1-46 Position Detection Gain

Range:		Function:
100 %*	[20 - 200 %]	Adjusts the amplitude of the test pulse during position detection at start. Adjust this parameter to improve the position measurement.

1-47 Torque Calibration

Option:		Function:
		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 frequency converter. When this parameter is active, the frequency converter 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 frequency converter to compensate for the cable length, frequency converter losses, and the temperature deviation on the motor.
[0]	Off	

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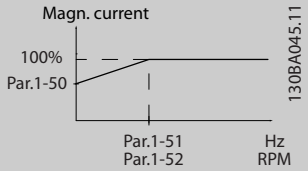
1-47 Torque Calibration		
Option:		**Function:**
[1]	1st start after pwr-up	Calibrates at the first start-up after power-up and keeps this value until reset by a power cycle.
[2]	Every start	Calibrates at every start-up, compensating for a possible change in motor temperature since last start-up. The value is reset after a power cycle.
[3]	1st start with store	The frequency converter calibrates the torque at the first 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 frequency converter calibrates the torque at every start-up, compensating for a possible change in motor temperature since last start-up. This option is used to update motor parameters: • *Parameter 1-30 Stator Resistance (Rs).* • *Parameter 1-33 Stator Leakage Reactance (X1).* • *Parameter 1-34 Rotor Leakage Reactance (X2).* • *Parameter 1-37 d-axis Inductance (Ld).*

4.2.5 1-5* Load Indep. Setting

1-50 Motor Magnetisation at Zero Speed		
This parameter is not visible on the LCP.		
Range:		**Function:**
100 %*	[0 - 300 %]	***NOTICE*** ***Parameter 1-50 Motor Magnetisation at Zero Speed* has no effect when *parameter 1-10 Motor Construction = [1] PM, non-salient 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 4.6 Motor Magnetization**

1-50 Motor Magnetisation at Zero Speed		
This parameter is not visible on the LCP.		
Range:		**Function:**
		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 4.6 Motor Magnetization**

1-51 Min Speed Normal Magnetising [RPM]		
This parameter is not visible on the LCP.		
Range:		**Function:**
Size related*	[10 - 600 RPM]	***NOTICE*** ***Parameter 1-51 Min Speed Normal Magnetising [RPM]* has no effect when *parameter 1-10 Motor Construction = [1] PM, non-salient 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*. See *Table 4.3*.

1-52 Min Speed Normal Magnetising [Hz]		
Range:		**Function:**
Size related*	[0 - 250.0 Hz]	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.

1-52 Min Speed Normal Magnetising [Hz]		
Range:		**Function:**
		Use this parameter along with *parameter 1-50 Motor Magnetisation at Zero Speed*. See *Illustration 4.6*.

1-55 U/f Characteristic - U		
Array [6]		
Range:		**Function:**
Size related*	[0 - 1000 V]	Enter the voltage at each frequency point to form a U/f characteristic manually matching the motor. The frequency points are defined in *parameter 1-56 U/f Characteristic - F*. This parameter is an array parameter [0-5] and is only accessible when *parameter 1-01 Motor Control Principle* is set to *[0] U/f*.

1-56 U/f Characteristic - F		
Array [6]		
Range:		**Function:**
Size related*	[0 - 1000.0 Hz]	Enter the frequency points to form a U/f characteristic manually matching the motor. The voltage at each point is defined in *parameter 1-55 U/f Characteristic - U*. This parameter is an array parameter [0–5] and is only accessible when *parameter 1-01 Motor Control Principle* is set to *[0] U/f*.

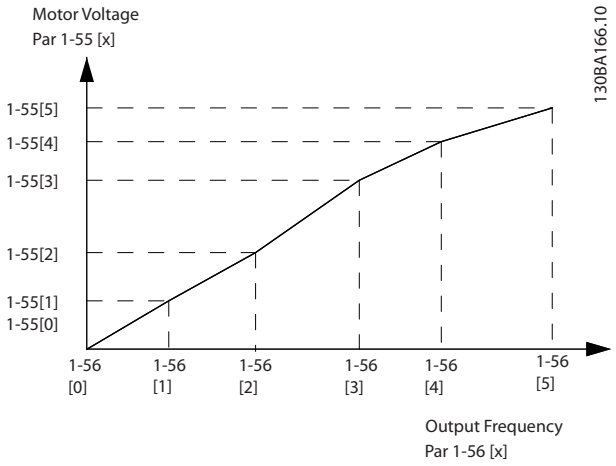


Illustration 4.7 U/f Characteristic

1-58 Flying Start Test Pulses Current		
Range:		**Function:**
Size related*	[0 - 200 %]	***NOTICE*** **This parameter is only available in VVC+.** ***NOTICE*** **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.

1-59 Flying Start Test Pulses Frequency		
Range:		**Function:**
Size related*	[0 - 500 %]	Asynchronous motor: Set the frequency of the flying start test pulses that are used to detect the motor direction. For asynchronous motors, the value 100% means that the slip is doubled. Increase this value to reduce the generated torque. For synchronous motors, this value is the percentage $n_{m,n}$ of the free-running motor. Above this value, flying start is always performed. Below this value, the start mode is selected in *parameter 1-70 Start Mode*

4.2.6 1-6* Load Depend. Setting

1-60 Low Speed Load Compensation		
Range:		**Function:**
100 %*	[0 - 300 %]	Enter the % value to compensate voltage in relation to load when the motor is running at low speed and obtain the optimum U/f characteristic. The motor size determines the frequency range within which this parameter is active.

Motor size	Changeover
0.25–7.5 kW	<10 Hz

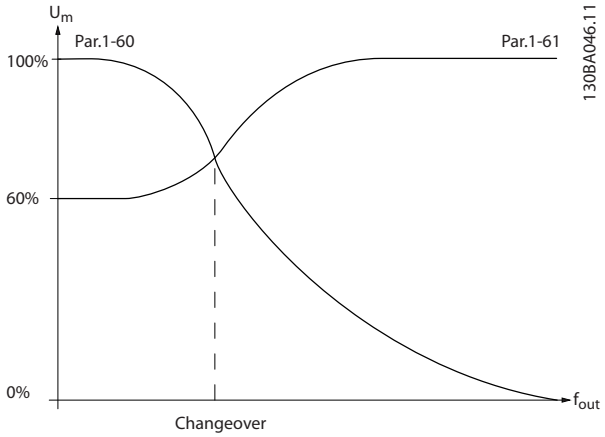


Illustration 4.8 Changeover

1-61 High Speed Load Compensation		
Range:		**Function:**
100 %*	[0 - 300 %]	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

Table 4.4 Changeover Frequency

1-62 Slip Compensation		
Range:		**Function:**
Size related*	[-500 - 500 %]	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 $n_{M,N}$.

1-62 Slip Compensation		
Range:		**Function:**
		This function is not active when *parameter 1-00 Configuration Mode* is set to *[1] Speed closed loop* or when *parameter 1-01 Motor Control Principle* is set to *[0] U/f* special motor mode.

1-63 Slip Compensation Time Constant		
Range:		**Function:**
Size related*	[0.05 - 5 s]	***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.

1-64 Resonance Damping		
Range:		**Function:**
Size related*	[0 - 1000 %]	***NOTICE*** ***Parameter 1-64 Resonance Dampening* has no effect when *parameter 1-10 Motor Construction = [1] PM*, non-salient SPM.** Enter the resonance damping value. Set *parameter 1-64 Resonance Dampening* and *parameter 1-65 Resonance Dampening Time Constant* to help eliminate high frequency resonance problems. To reduce resonance oscillation, increase the value of *parameter 1-64 Resonance Dampening*.

1-65 Resonance Damping Time Constant		
Range:		**Function:**
5 ms*	[1 - 50 ms]	***NOTICE*** ***Parameter 1-65 Resonance Dampening Time Constant* has no effect when *parameter 1-10 Motor Construction = [1] PM, non-salient SPM*.** Set *parameter 1-64 Resonance Dampening* and *parameter 1-65 Resonance Dampening Time Constant* to help eliminate high-frequency resonance problems. Enter the time constant that provides the best dampening.

1-66 Min. Current at Low Speed		
Range:		**Function:**
Size related*	[1 - 200 %]	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 frequency converter runs with constant current through motor for speeds below 10 Hz. *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.

4.2.7 1-7* Start Adjustments

1-70 Start Mode		
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:		**Function:**
[0] *	Rotor Detection	Estimates the electrical angle of the rotor and uses this as a starting point. Standard selection for VLT® AutomationDrive 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	

1-71 Start Delay		
Range:		**Function:**
0 s*	[0 - 25.5 s]	This parameter refers to the start function selected in *parameter 1-72 Start Function*. Enter the time delay required before commencing acceleration.

1-72 Start Function		
Option:		**Function:**
		Select the start function during start delay. This parameter is linked to *parameter 1-71 Start Delay*.
[0]	DC Hold/delay time	Energizes motor with a DC hold current (*parameter 2-00 DC Hold Current*) during the start delay time.
[2] *	Coast/delay time	Motor coasted during the start delay time (inverter off).
[3]	Start speed cw	Only possible with VVC+. Connect the function described in *parameter 1-74 Start Speed [RPM]* and *parameter 1-76 Start Current* in the start delay time. Regardless of the value applied by the reference signal, the output speed applies the setting of the start speed in *parameter 1-74 Start Speed [RPM]* or *parameter 1-75 Start Speed [Hz]*, and the output current corresponds to the setting of the

4

1-72 Start Function		
Option:		**Function:**
		start current in *parameter 1-76 Start Current*. This function is typically used in hoisting applications without counterweight and especially in applications with a cone-motor where the start is clockwise, followed by rotation in the reference direction.
[4]	Horizontal operation	Only possible with VVC+. For obtaining the function described in *parameter 1-74 Start Speed [RPM]* and *parameter 1-76 Start Current* during the start delay time. The motor rotates in the reference direction. If the reference signal equals 0, *parameter 1-74 Start Speed [RPM]* is ignored and the output speed equals 0. The output current corresponds to the setting of the start current in *parameter 1-76 Start Current*.
[5]	VVC+ clockwise	For the function described in *parameter 1-74 Start Speed [RPM]* only. The start current is calculated automatically. This function uses the start speed in the start delay time only. Regardless of the value set by the reference signal, the output speed equals the setting of the start speed in *parameter 1-74 Start Speed [RPM]*. *[3] Start speed/current clockwise* and *[5] VVC+ clockwise* are typically used in hoisting applications. *[4] Start speed/current in reference direction* is particularly used in applications with counterweight and horizontal movement.
[7]	VVC+ counter-cw	

1-73 Flying Start	
Option:	**Function:**
	NOTICE **This parameter cannot be adjusted while the motor is running.** This function makes it possible to catch a motor which is spinning freely due to a mains dropout.

1-73 Flying Start		
Option:		**Function:**
[0]	Disabled	No function.
[1]	Enabled	Enables the frequency converter to catch and control a spinning motor. When *parameter 1-73 Flying Start* is enabled, *parameter 1-71 Start Delay* and *parameter 1-72 Start Function* have no function. When *parameter 1-73 Flying Start* is enabled, *parameter 1-58 Flying Start Test Pulses Current* and *parameter 1-59 Flying Start Test Pulses Frequency* are used for specifying the conditions for the flying start.
[2]	Enabled Always	
[3]	Enabled Ref. Dir.	
[4]	Enab. Always Ref. Dir.	

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.

1-74 Start Speed [RPM]		
Range:		**Function:**
Size related*	[0 - 600 RPM]	Set a motor start speed. After the start signal, the output speed leaps to set value. Set the start function in *parameter 1-72 Start Function* to *[3] Start speed cw*, *[4] Horizontal operation*, or *[5] VVC+ clockwise*, and set a start delay time in *parameter 1-71 Start Delay*.

1-75 Start Speed [Hz]		
Range:		**Function:**
Size related*	[0 - 500.0 Hz]	This parameter can be used for hoist applications (cone rotor). Set a motor start speed. After the start signal, the output speed leaps to the set value. Set the start function in *parameter 1-72 Start Function* to *[3] Start speed cw*, *[4] Horizontal operation*, or *[5] VVC+ clockwise*, and set a start delay time in *parameter 1-71 Start Delay*.

1-76 Start Current		
Range:		**Function:**
0 A*	[0 - par. 1-24 A]	Some motors, for example cone rotor motors, need extra current/ starting speed to disengage the rotor. To obtain this boost, set the required current in *parameter 1-76 Start Current*. Set *parameter 1-74 Start Speed [RPM]*. Set *parameter 1-72 Start Function* to *[3] Start speed cw* or *[4] Horizontal operation*, and set a start delay time in *parameter 1-71 Start Delay*. This parameter can be used for hoist applications (cone rotor).

1-77 Compressor Start Max Speed [RPM]		
Range:		**Function:**
Size related*	[0 - par. 4-13 RPM]	Use this parameter to set the speed range for high starting torque. Above the set speed, normal torque and current limits are used. Setting the parameter value to zero disables the function.

1-78 Compressor Start Max Speed [Hz]		
Range:		**Function:**
Size related*	[0 - par. 4-14 Hz]	Use this parameter to set the speed range for high starting torque. Above the set speed, normal torque and current limits are used. Setting the parameter value to zero disables the function.

1-79 Compressor Start Max Time to Trip		
Range:		**Function:**
5 s*	[0 - 10 s]	This parameter refers to the start function selected in *parameter 1-72 Start Function*. Enter the time delay required before commencing acceleration. This parameter enables a trip if compressor starting takes too long time. If the speed cannot reach the value set in *parameter 1-77 Compressor Start Max Speed [RPM]* within the specified time, the rotor is considered blocked and the frequency converter trips. The time includes any time set in *parameter 1-71 Start Delay*.

4.2.8 1-8* Stop Adjustments

1-80 Function at Stop		
Option:		**Function:**
		Select the frequency converter 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]*.
[0] *	Coast	Leaves motor in free mode. The motor is disconnected from the frequency converter.
[1]	DC hold	Energizes the motor with a DC hold current (see *parameter 2-00 DC Hold Current*).

[3]	Pre-magnetizing	Builds up a magnetic field while the motor is stopped. This allows the motor to produce torque quickly at subsequent start commands (asynchronous motors only). This premagnetizing function does not help the very first start command.
		Two different solutions are available to premagnetize the machine for the first start command:
		• Start the frequency converter with a 0 RPM reference and wait 2-4 rotor time constants before increasing the speed reference.
		• Use the start delay with DC hold:
		  • Set *parameter 1-71 Start Delay* to the required premagnetizing time (2–4 rotor time constants). See the time constants description further in this section).
		  • Set *parameter 1-72 Start Function* to either *[0] DC hold* or *[1] DC Brake*.
		  • Set the DC hold or DC brake

4

1-80 Function at Stop		
Option:		**Function:**
		current magnitude (*parameter 2-00 D C Hold Current* or *parameter 2-01 D C Brake Current*) to be equal to I_pre-mag = Unom/(1.73 x Xh) Sample rotor time constants = (Xh+X2)/(6.3*Freq_nom*Rr) 1 kW = 0.2 s 10 kW = 0.5 s 100 kW = 1.7 s 1000 kW = 2.5 s
[4]	DC Voltage U0	When the motor is stopped, the *parameter 1-55 U/f Characteristic - U* [0] defines the voltage at 0 Hz.

1-81 Min Speed for Function at Stop [RPM]		
Range:		**Function:**
Size related*	[0 - 600 RPM]	Set the speed at which to activate *parameter 1-80 Function at Stop*.

1-82 Min Speed for Function at Stop [Hz]		
Range:		**Function:**
Size related*	[0 - 500.0 Hz]	Set the output frequency at which to activate *parameter 1-80 Function at Stop*.

4.2.9 1-9* Motor Temperature

1-90 Motor Thermal Protection		
Option:		**Function:**
		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 Source*). See *chapter 4.2.10 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 *chapter 4.2.11 ETR*. • Via a mechanical thermal switch (Klixon type). See *chapter 4.2.12 Klixon*. For the North American market: The ETR functions provide class 20 motor overload protection in accordance with NEC.
[0]	No protection	Continuously overloaded motor when no warning or trip of the frequency converter is required.
[1]	Thermistor warning	Activates a warning when the connected thermistor or KTY sensor in the motor reacts in the event of motor overtemperature.
[2]	Thermistor trip	Stops (trips) the frequency converter when connected thermistor or KTY sensor in the motor reacts in the event of motor overtemperature. The thermistor cutout value must be more than 3 kΩ. Integrate a thermistor (PTC sensor) in the motor for winding protection.
[3]	ETR warning 1	Calculates the load when set-up 1 is active and activates a warning on the display when the motor is overloaded. Program a warning signal via 1 of the digital outputs.
[4]	ETR trip 1	Calculates the load when set-up 1 is active and stops (trips) the frequency converter 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 frequency converter trips (thermal warning).
[5]	ETR warning 2	
[6]	ETR trip 2	
[7]	ETR warning 3	
[8]	ETR trip 3	
[9]	ETR warning 4	
[10]	ETR trip 4	

4.2.10 PTC Thermistor Connection

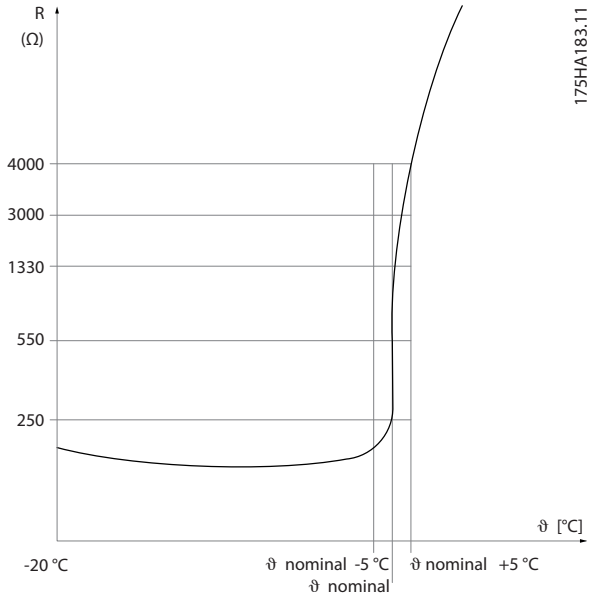


Illustration 4.9 PTC Profile

Using a digital input and 10 V as supply:
Example: The frequency converter trips when the motor temperature is too high.
Parameter set-up:

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

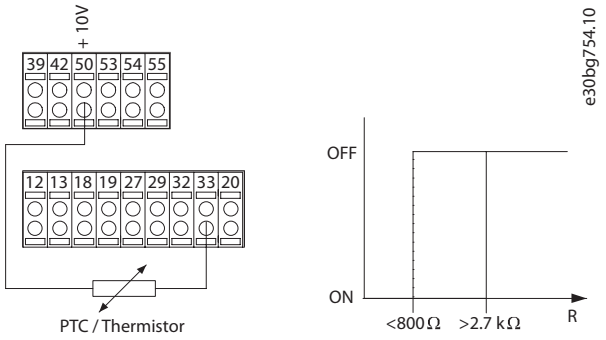


Illustration 4.10 PTC Thermistor Connection - Digital Input

Using an analog input and 10 V as supply:
Example: The frequency converter trips when the motor temperature is too high.
Parameter set-up:

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

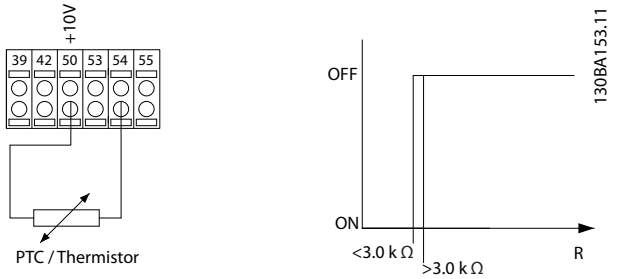


Illustration 4.11 PTC Thermistor Connection - Analog Input

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

Table 4.5 Threshold Cutout Values

NOTICE

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

4.2.11 ETR

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

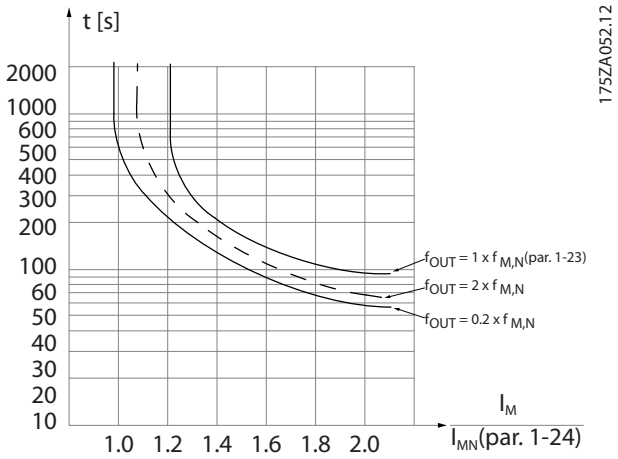


Illustration 4.12 ETR Profile

4.2.12 Klixon

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

Using a digital input and 24 V as supply:
Example: The frequency converter trips when the motor temperature is too high.

Parameter set-up:

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

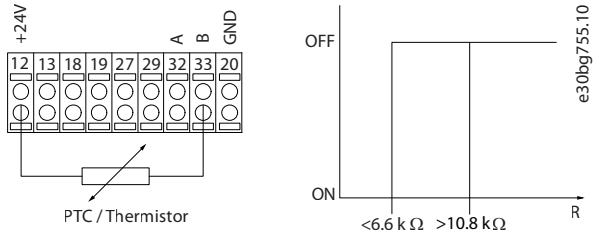


Illustration 4.13 Thermistor Connection

1-91 Motor External Fan		
Option:		**Function:**
[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 4.12* (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.

1-93 Thermistor Source		
Option:		**Function:**
		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*.** 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 1 Source*, *parameter 3-16 Reference 2 Source*, or *parameter 3-17 Reference 3 Source*). When using VLT® PTC Thermistor Card MCB 112, always select *[0] None*.
[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	

4.3 Parameters: 2-** Brakes

4.3.1 2-0* DC brakes

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

2-00 DC Hold Current		
Range:		**Function:**
50 %*	[0 - 160 %]	***NOTICE*** **The maximum value depends on the rated motor current. Avoid 100% current for too long. It may damage the motor.** **Low values of DC hold produce larger than expected currents with larger motor power sizes. This error increases as the motor power increases.** 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]*.

2-01 DC Brake Current		
Range:		**Function:**
50 %*	[0 - 1000 %]	***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*.

2-02 DC Braking Time		
Range:		**Function:**
10 s*	[0 - 60 s]	Set the duration of the DC brake current set in *parameter 2-01 DC Brake Current*, once activated.

2-03 DC Brake Cut In Speed [RPM]		
Range:		**Function:**
Size related*	[0 - par. 4-13 RPM]	Set the DC brake cut-in speed for activation of the DC brake current set in *parameter 2-01 DC Brake Current*, upon a stop command.

2-04 DC Brake Cut In Speed [Hz]		
Range:		**Function:**
Size related*	[0 - par. 4-14 Hz]	***NOTICE*** ***Parameter 2-04 DC Brake Cut In Speed [Hz]* is not effective when *parameter 1-10 Motor Construction = [1] PM, non-salient SPM*.** Set the DC brake cut-in speed for activation of the DC brake current set in *parameter 2-01 DC Brake Current* after a stop command.

2-06 Parking Current		
Range:		**Function:**
50 %*	[0 - 1000 %]	Set current as percentage of rated motor current, *parameter 1-24 Motor Current*. Is used when enabled in *parameter 1-70 Start Mode*.

2-07 Parking Time		
Range:		**Function:**
3 s*	[0.1 - 60 s]	Set the duration of the parking current set in *parameter 2-06 Parking Current*, once activated.

4.3.2 2-1* Brake Energy Funct.

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

2-10 Brake Function		
Option:		**Function:**
[0] *	Off	No brake resistor is installed.
[2]	AC brake	Improves braking without using a brake resistor. This parameter controls an overmagnetization of the motor when running with a generatoric load. This function can improve the OVC function. Increasing the electrical losses in the motor allows the OVC function to increase the braking torque without exceeding the overvoltage limit. ***NOTICE*** **The AC brake is not as efficient as dynamic braking with resistor.** **AC brake is for VVC+ mode in both open and closed loop.**

2-16 AC brake Max. Current		
Range:		**Function:**
100 %*	[0 - 1000.0 %]	Enter the maximum allowed current when using AC braking to avoid overheating of motor windings.

NOTICE

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

2-17 Over-voltage Control		
Option:		**Function:**
		Overvoltage control (OVC) reduces the risk of the frequency converter tripping due to an overvoltage on the DC-link caused by generative power from the load.
[0] *	Disabled	No OVC required.
[1]	Enabled (not at stop)	Activates OVC except when using a stop signal to stop the frequency converter.
[2]	Enabled	Activates OVC.

NOTICE

Do not enable OVC in hoisting applications.

2-19 Over-voltage Gain		
Range:		**Function:**
100 %*	[10 - 200 %]	Select overvoltage gain.

4.4 Parameters: 3-** Reference/Ramps

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

4.4.1 3-0* Reference Limits

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

3-01 Reference/Feedback Unit		
Option:		**Function:**
		Select the unit to be used in process PID control references and feedbacks. *Parameter 1-00 Configuration Mode* must be either *[3] Process*.
[0]	None	
[1]	%	
[2]	RPM	
[3]	Hz	
[4]	Nm	
[5]	PPM	
[10]	1/min	
[12]	Pulse/s	
[20]	l/s	
[21]	l/min	
[22]	l/h	
[23]	m^3/s	
[24]	m^3/min	
[25]	m^3/h	
[30]	kg/s	
[31]	kg/min	
[32]	kg/h	
[33]	t/min	
[34]	t/h	
[40]	m/s	
[41]	m/min	
[45]	m	
[60]	°C	
[70]	mbar	
[71]	bar	
[72]	Pa	
[73]	kPa	
[74]	m WG	
[80]	kW	
[120]	GPM	
[121]	gal/s	
[122]	gal/min	
[123]	gal/h	
[124]	CFM	
[125]	ft^3/s	
[126]	ft^3/min	
[127]	ft^3/h	
[130]	lb/s	
[131]	lb/min	
[132]	lb/h	
[140]	ft/s	
[141]	ft/min	
[145]	ft	
[150]	lb ft	
[160]	°F	
[170]	psi	
[171]	lb/in^2	

3-01 Reference/Feedback Unit		
Option:		**Function:**
[172]	in WG	
[173]	ft WG	
[180]	HP	

3-02 Minimum Reference		
Range:		**Function:**
Size related*	[-999999.999 - par. 3-03 Reference-FeedbackUnit]	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 unit selected in *parameter 3-01 Reference/Feedback Unit*.

3-03 Maximum Reference		
Range:		**Function:**
Size related*	[par. 3-02 - 999999.999 Reference-FeedbackUnit]	Enter the maximum reference. The maximum reference is the highest value obtainable by summing all references. The maximum reference unit matches the unit selected in *parameter 3-00 Reference Range*.

3-04 Reference Function		
Option:		**Function:**
[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.

4.4.2 3-1* References

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

3-10 Preset Reference		
Array [8] Range: 0-7		
Range:		**Function:**
0 %*	[-100 - 100 %]	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}

3-10 Preset Reference		
Array [8] Range: 0-7		
Range:		**Function:**
		(*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*.

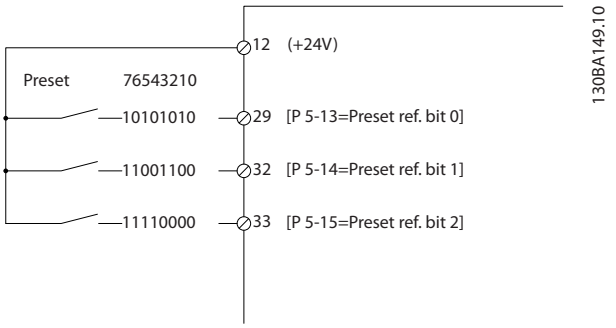


Illustration 4.14 Preset Reference

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 4.6 Preset Reference Bits

3-11 Jog Speed [Hz]		
Range:		**Function:**
Size related*	[0 - par. 4-14 Hz]	The jog speed is a fixed output speed at which the frequency converter is running when the jog function is activated. See also *parameter 3-80 Jog Ramp Time*.

4

3-12 Catch up/slow Down Value

Range:		Function:
0 %*	[0 - 100 %]	Enter a percentage (relative) value to be either added to or deducted from the actual reference for catch up or slow down. If *catch up* is selected via 1 of the digital inputs (*parameter 5-10 Terminal 18 Digital Input* to *parameter 5-15 Terminal 33 Digital Input*), the percentage (relative) value is added to the total reference. If *slow down* is selected via 1 of the digital inputs (*parameter 5-10 Terminal 18 Digital Input* to *parameter 5-15 Terminal 33 Digital Input*), the percentage (relative) value is deducted from the total reference. Obtain extended functionality with the DigiPot function. See *parameter group 3-9* Digital Potentiometer*.

3-13 Reference Site

Option:		Function:
		Select which reference site to activate.
[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 mode and auto-on mode. ***NOTICE*** **When set to *[2] Local*, the frequency converter starts with this setting again after a power-down.**

3-14 Preset Relative Reference

Range:		Function:
0 %*	[-200 - 200 %]	The actual reference, X, is increased or decreased with the percentage Y, set in *parameter 3-14 Preset Relative Reference*. This results in the actual reference Z. Actual reference (X) is the sum of the inputs selected in: • *Parameter 3-15 Reference 1 Source.* • *Parameter 3-16 Reference 2 Source.* • *Parameter 3-17 Reference 3 Source.* • *Parameter 8-02 Control Source.*

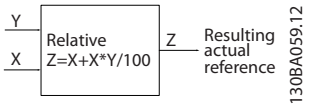


Illustration 4.15 Preset Relative Reference

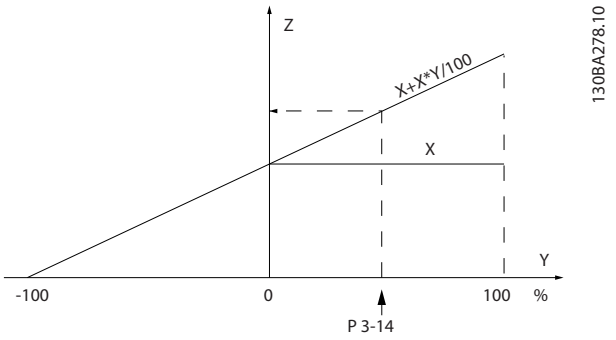


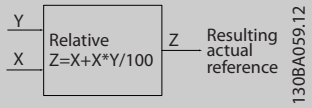
Illustration 4.16 Actual Reference

3-15 Reference Resource 1

Option:		Function:
		Select the reference input to be used for the 1st reference signal. *Parameter 3-15 Reference Resource 1*, *parameter 3-16 Reference Resource 2*, and *parameter 3-17 Reference Resource 3* define up to 3 different reference signals. The sum of these reference signals defines the actual reference.
[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 pot.meter	
[21]	Analog input X30/11	VLT® General Purpose I/O MCB 101
[22]	Analog input X30/12	VLT® General Purpose I/O MCB 101
[30]	Option Reference	
[32]	Bus PCD	

3-16 Reference Resource 2		
Option:		**Function:**
		Select the reference input to be used for the 2nd reference signal. *Parameter 3-15 Reference Resource 1*, *parameter 3-16 Reference Resource 2*, and *parameter 3-17 Reference Resource 3* define up to 3 different reference signals. The sum of these reference signals defines the actual reference.
[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 pot.meter	
[21]	Analog input X30/11	
[22]	Analog input X30/12	
[32]	Bus PCD	

3-17 Reference Resource 3		
Option:		**Function:**
		Select the reference input to be used for the 3rd reference signal. *Parameter 3-15 Reference Resource 1*, *parameter 3-16 Reference Resource 2*, and *parameter 3-17 Reference Resource 3* define up to 3 different reference signals. The sum of these reference signals defines the actual reference.
[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 pot.meter	
[21]	Analog input X30/11	
[22]	Analog input X30/12	
[32]	Bus PCD	

3-18 Relative Scaling Reference Resource		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** Select a variable value to be added to the fixed value (defined in *parameter 3-14 Preset Relative Reference*). The sum of the fixed and variable values (labeled Y in *Illustration 4.17*) is multiplied by the actual reference (labeled X in *Illustration 4.17*). This product is then added to the actual reference (X+X*Y/100) to give the resulting actual reference.  **Illustration 4.17 Resulting Actual Reference**
[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 pot.meter	
[21]	Analog input X30/11	
[22]	Analog input X30/12	
[32]	Bus PCD	

3-19 Jog Speed [RPM]		
Range:		**Function:**
Size related*	[0 - par. 4-13 RPM]	Enter a value for the jog speed n_{JOG}, which is a fixed output speed. The frequency converter 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 Ramp Time*.

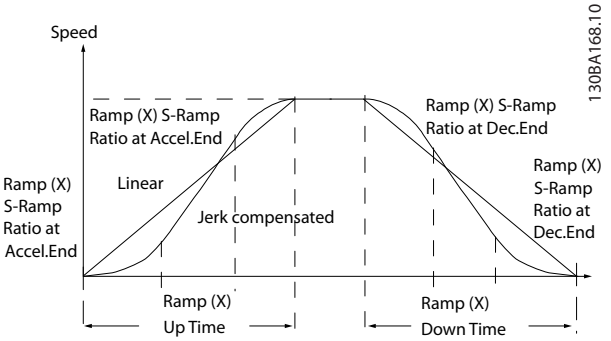


Illustration 4.19 Linear Ramping Times

4.4.3 3-4* Ramp 1

For each of the 4 ramps (*parameter groups 3-4* Ramp 1*, *3-5* Ramp 2*, *3-6* Ramp 3*, and *3-7* Ramp 4*) configure the ramp parameters:

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

Start by setting the linear ramping times corresponding to *Illustration 4.18* and *Illustration 4.19*.

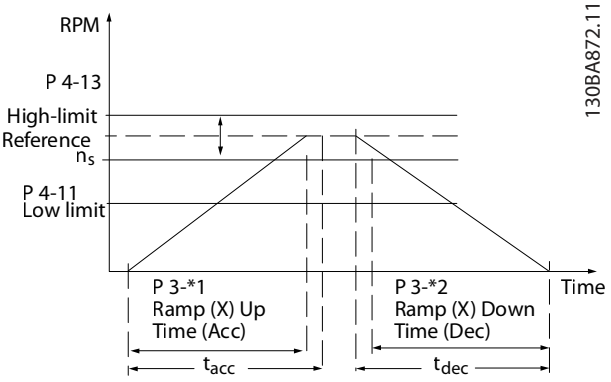


Illustration 4.18 Linear Ramping Times

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.

3-40 Ramp 1 Type		
Option:		**Function:**
		NOTICE **If *[1] S-ramp Const Jerk* is selected and the reference during ramping is changed, the ramp time may be prolonged to realize a jerk-free movement, which may result in a longer start or stop time. Extra adjustment of the S-ramp ratios or switching initiators may be necessary.** Select the ramp type, depending on requirements for acceleration/ deceleration. A linear ramp gives constant acceleration during ramping. An S-ramp gives non-linear acceleration, compensating for jerk in the application.
[0] *	Linear	
[1]	S-ramp Const Jerk	Acceleration with lowest possible jerk.
[2]	S-ramp Const Time	S-ramp based on the values set in *parameter 3-41 Ramp 1 Ramp Up Time* and *parameter 3-42 Ramp 1 Ramp Down Time*.

3-41 Ramp 1 Ramp Up Time		
Range:		**Function:**
Size related*	[0.01 - 3600 s]	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*. $Par.\ 3-41 = \frac{t_{acc}\ [s]\ x\ n_s\ [RPM]}{ref\ [RPM]}$

3-42 Ramp 1 Ramp Down Time		
Range:		**Function:**
Size related*	[0.01 - 3600 s]	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*. $Par.\ 3-42 = \frac{t_{dec}\ [s]\ x\ n_s\ [RPM]}{ref\ [RPM]}$

3-45 Ramp 1 S-ramp Ratio at Accel. Start		
Range:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total ramp-up time (*parameter 3-41 Ramp 1 Ramp Up Time*) in which the acceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks occurring in the application.

3-46 Ramp 1 S-ramp Ratio at Accel. End		
Range:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total ramp-up time (*parameter 3-41 Ramp 1 Ramp Up Time*) in which the acceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

3-47 Ramp 1 S-ramp Ratio at Decel. Start		
Range:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total ramp-down time (*parameter 3-42 Ramp 1 Ramp Down Time*) where the deceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

3-48 Ramp 1 S-ramp Ratio at Decel. End		
Range:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total ramp-down time (*parameter 3-42 Ramp 1 Ramp Down Time*) where the deceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

4

4

4.4.4 3-5* Ramp 2

To select ramp parameters, see *parameter group 3-4* Ramp 1*.

3-50 Ramp 2 Type		
Option:		**Function:**
		Select the ramp type, depending on requirements for acceleration/ deceleration. A linear ramp gives constant acceleration during ramping. An S-ramp gives non-linear acceleration, compensating for jerk in the application.
[0] *	Linear	
[1]	S-ramp Const Jerk	Acceleration with lowest possible jerk.
[2]	S-ramp Const Time	S-ramp based on the values set in *parameter 3-51 Ramp 2 Ramp Up Time* and *parameter 3-52 Ramp 2 Ramp Down Time*.

NOTICE

If *[1] S-ramp Const Jerk* is selected and the reference during ramping is changed, the ramp time may be prolonged to realize a jerk-free movement, which may result in a longer start or stop time.
Additional adjustment of the S-ramp ratios or switching initiators may be necessary.

3-51 Ramp 2 Ramp Up Time		
Range:		**Function:**
Size related*	[0.01 - 3600 s]	Enter the ramp-up time, that is the acceleration time from 0 RPM to the nominal motor speed n_s. 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*. $Par.\ 3-51 = \frac{t_{acc}\,[s] \times n_s\,[RPM]}{ref\,[RPM]}$

3-52 Ramp 2 Ramp Down Time		
Range:		**Function:**
Size related*	[0.01 - 3600 s]	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 frequency converter due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in *parameter 4-18 Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See ramp-up time in *parameter 3-51 Ramp 2 Ramp Up Time*. $Par.\ 3-52 = \frac{t_{dec}\,[s] \times n_s\,[RPM]}{ref\,[RPM]}$

3-55 Ramp 2 S-ramp Ratio at Accel. Start		
Range:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total ramp-up time (*parameter 3-51 Ramp 2 Ramp Up Time*) in which the acceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

3-56 Ramp 2 S-ramp Ratio at Accel. End		
Range:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total ramp-up time (*parameter 3-51 Ramp 2 Ramp Up Time*) in which the acceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

3-57 Ramp 2 S-ramp Ratio at Decel. Start		
Range:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total ramp-down time (*parameter 3-52 Ramp 2 Ramp Down Time*) where the deceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

3-58 Ramp 2 S-ramp Ratio at Decel. End		
Range:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total ramp-down time (*parameter 3-52 Ramp 2 Ramp Down Time*) where the deceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

4.4.5 3-6* Ramp 3

Configure ramp parameters, see *parameter group 3-4* Ramp 1*.

3-60 Ramp 3 Type		
Option:		**Function:**
		Select the ramp type, depending on requirements for acceleration and deceleration. A linear ramp gives constant acceleration during ramping. An S-ramp gives non-linear acceleration, compensating for jerk in the application.
[0] *	Linear	
[1]	S-ramp Const Jerk	Accelerates with lowest possible jerk.
[2]	S-ramp Const Time	S-ramp based on the values set in *parameter 3-61 Ramp 3 Ramp up Time* and *parameter 3-62 Ramp 3 Ramp down Time*.

NOTICE

If *[1] S-ramp Const Jerk* is selected and the reference during ramping is changed, the ramp time may be prolonged to realize a jerk-free movement, which may result in a longer start or stop time.
Extra adjustment of the S-ramp ratios or switching initiators may be necessary.

3-61 Ramp 3 Ramp up Time		
Range:		**Function:**
Size related*	[0.01 - 3600 s]	Enter the ramp-up time, which is the acceleration time from 0 RPM to the nominal motor speed n_s. Select a ramp-up time such that the output current does not exceed the current limit in *parameter 4-18 Current Limit* during ramping. The value 0.00 corresponds to 0.01 s in speed mode. See ramp-down time in *parameter 3-62 Ramp 3 Ramp down Time*.

3-61 Ramp 3 Ramp up Time		
Range:		**Function:**
		parameter 3-62 Ramp 3 Ramp down Time.

3-62 Ramp 3 Ramp down Time		
Range:		**Function:**
Size related*	[0.01 - 3600 s]	Enter the ramp-down time, which 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 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 3-61 Ramp 3 Ramp up Time*. $Par.\ 3-62 = \frac{t_{dec}\,[s]\ x\ n_s\,[RPM]}{ref\,[RPM]}$

3-65 Ramp 3 S-ramp Ratio at Accel. Start		
Range:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total ramp-up time (*parameter 3-61 Ramp 3 Ramp up Time*) in which the acceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

3-66 Ramp 3 S-ramp Ratio at Accel. End		
Range:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total ramp-up time (*parameter 3-61 Ramp 3 Ramp up Time*) in which the acceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

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3-67 Ramp 3 S-ramp Ratio at Decel. Start		
Range:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total ramp-down time (*parameter 3-62 Ramp 3 Ramp down Time*) where the deceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

3-68 Ramp 3 S-ramp Ratio at Decel. End		
Range:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total ramp-down decel time (*parameter 3-62 Ramp 3 Ramp down Time*) where the deceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

4.4.6 3-7* Ramp 4

Configure ramp parameters, see *parameter group 3-4* Ramp 1*.

3-70 Ramp 4 Type		
Option:		**Function:**
		Select the ramp type, depending on requirements for acceleration and deceleration. A linear ramp gives constant acceleration during ramping. An S-ramp gives non-linear acceleration, compensating for jerk in the application.
[0] *	Linear	
[1]	S-ramp Const Jerk	Accelerates with lowest possible jerk.
[2]	S-ramp Const Time	S-ramp based on the values set in *parameter 3-71 Ramp 4 Ramp up Time* and *parameter 3-72 Ramp 4 Ramp Down Time*.

NOTICE

If *[1] S-ramp Const Jerk* is selected and the reference during ramping is changed, the ramp time may be prolonged to realize a jerk-free movement, which may result in a longer start or stop time.
More adjustments of the S-ramp ratios or switching initiators may be necessary.

3-71 Ramp 4 Ramp up Time		
Range:		**Function:**
Size related*	[0.01 - 3600 s]	Enter the ramp-up time, which is the acceleration time from 0 RPM to the rated motor speed n_s. Select a ramp-up time such that the output current does not exceed the current limit in *parameter 4-18 Current Limit* during ramping. The value 0.00 corresponds to 0.01 s in speed mode. See ramp-down time in *parameter 3-72 Ramp 4 Ramp Down Time*. $Par.\ 3-71 = \frac{t_{acc}\,[s] \times n_s\,[RPM]}{ref\,[RPM]}$

3-72 Ramp 4 Ramp Down Time		
Range:		**Function:**
Size related*	[0.01 - 3600 s]	Enter the ramp-down time, which 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 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 3-71 Ramp 4 Ramp up Time*. $Par.\ 3-72 = \frac{t_{dec}\,[s] \times n_s\,[RPM]}{ref\,[RPM]}$

3-75 Ramp 4 S-ramp Ratio at Accel. Start		
Range:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total ramp-up time (*parameter 3-71 Ramp 4 Ramp up Time*) in which the acceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

3-76 Ramp 4 S-ramp Ratio at Accel. End		
Range:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total ramp-up time (*parameter 3-71 Ramp 4 Ramp up Time*) in which the acceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

3-77 Ramp 4 S-ramp Ratio at Decel. Start		
Range:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total ramp-down time (*parameter 3-72 Ramp 4 Ramp Down Time*) where the deceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

3-78 Ramp 4 S-ramp Ratio at Decel. End		
Range:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total ramp-down time (*parameter 3-72 Ramp 4 Ramp Down Time*) where the deceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

4.4.7 3-8* Other Ramps

3-80 Jog Ramp Time		
Range:		**Function:**
Size related*	[0.01 - 3600 s]	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.

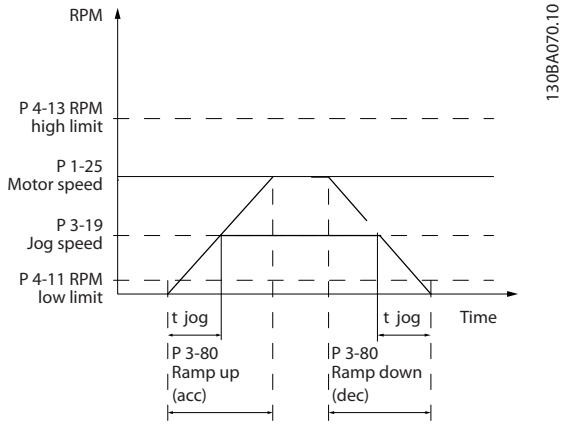

Illustration 4.20 Jog Ramp Time

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

3-81 Quick Stop Ramp Time		
Range:		**Function:**
Size related*	[0.01 - 3600 s]	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.

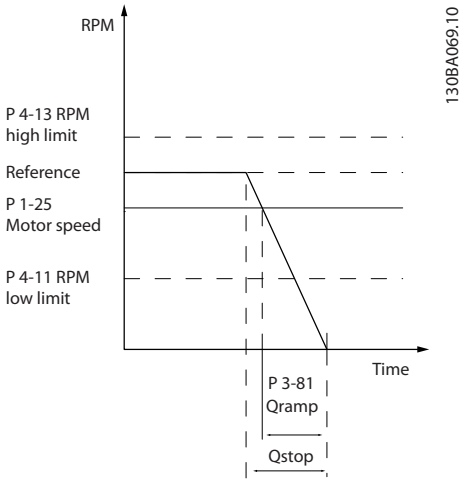

Illustration 4.21 Quick Stop Ramp Time

3-82 Starting Ramp Up Time		
Range:		**Function:**
Size related*	[0.01 - 3600 s]	The ramp-up time is the acceleration time from 0 rpm to the nominal motor speed set in *parameter 1-25 Motor Nominal Speed* when high starting torque is active.

4.4.8 3-9* Digital Pot.Meter

The digital potentiometer enables increase or decrease of the actual reference by adjusting the set-up 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.

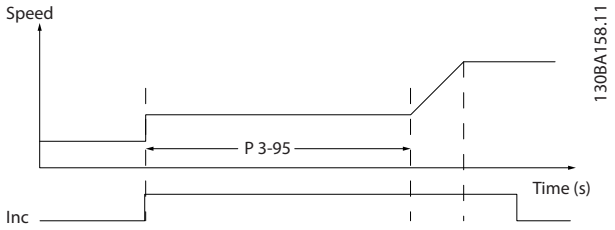

Illustration 4.22 Increase Actual Reference

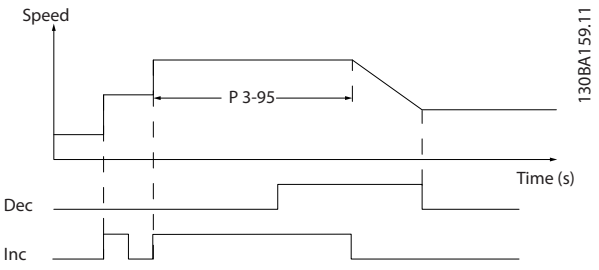

Illustration 4.23 Increase/Decrease Actual Reference

3-90 Step Size		
Range:		**Function:**
0.10 %*	[0.01 - 200 %]	Enter the increment size required for increase/decrease as a percentage of the synchronous motor speed, n_s. If increase/decrease is activated, the resulting reference is increased or decreased by the value set in this parameter.

3-91 Ramp Time		
Range:		**Function:**
1 s*	[0 - 3600 s]	Enter the ramp time, that is the time for adjustment of the reference 0–100% of the specified digital potentiometer function (increase, decrease, or clear). If increase/decrease is activated for longer than the ramp delay period specified in *parameter 3-95 Ramp Delay*, the actual reference is ramped up/down according to this ramp time. The ramp time is defined as the time used to adjust the reference by the step size specified in *parameter 3-90 Step Size*.

3-92 Power Restore		
Option:		**Function:**
[0] *	Off	Resets the digital potentiometer reference to 0% after power-up.
[1]	On	Restores the most recent digital potentiometer reference at power-up.

3-93 Maximum Limit		
Range:		**Function:**
100 %*	[-200 - 200 %]	Set the maximum allowed value for the resulting reference. This is recommended if the digital potentiometer is used for fine-tuning of the resulting reference.

3-94 Minimum Limit		
Range:		**Function:**
-100 %*	[-200 - 200 %]	Set the minimum allowed value for the resulting reference. This is recommended if the digital potentiometer is used for fine-tuning of the resulting reference.

3-95 Ramp Delay		
Range:		**Function:**
Size related*	[0 - 0]	Enter the delay required from activation of the digital potentiometer function until the frequency converter 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*.

4.5 Parameters: 4-** Limits/Warnings

4.5.1 4-1* Motor Limits

Define torque, current, and speed limits for the motor, and the reaction of the frequency converter 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 frequency converter stops and generates an alarm message.

4-10 Motor Speed Direction		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** Select the motor speed direction(s) 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]*.
[0]	Clockwise	The reference is set to CW rotation. Reversing input (default terminal 19) must be open.
[1]	Counter clockwise	The reference is set to CCW rotation. Reversing input (default terminal 19) must be closed. If reversing is required with *reverse* input open, the motor direction can be changed by *parameter 1-06 Clockwise Direction*.
[2]	Both directions	Allows the motor to rotate in both directions.

4-11 Motor Speed Low Limit [RPM]		
Range:		**Function:**
Size related*	[0 - par. 4-13 RPM]	Enter the minimum limit for motor speed. The motor speed low limit can be set to correspond to the manufacturer's recommended minimum motor speed. The motor speed low limit must not exceed the setting in *parameter 4-13 Motor Speed High Limit [RPM]*.

4-12 Motor Speed Low Limit [Hz]		
Range:		**Function:**
Size related*	[0 - par. 4-14 Hz]	Enter the minimum limit for motor speed. The motor speed low limit can be set to correspond to the minimum output frequency of the motor shaft. The motor speed low limit must not exceed the setting in *parameter 4-14 Motor Speed High Limit [Hz]*.

4-13 Motor Speed High Limit [RPM]		
Range:		**Function:**
Size related*	[par. 4-11 - 60000 RPM]	Enter the maximum limit for motor speed. The motor speed high limit can be set to correspond to the manufacturer's maximum nominal motor speed. The motor speed high limit must exceed the setting in *parameter 4-11 Motor Speed Low Limit [RPM]*.

4-14 Motor Speed High Limit [Hz]		
Range:		**Function:**
Size related*	[par. 4-12 - par. 4-19 Hz]	Enter the maximum limit for motor speed in Hz. *Parameter 4-14 Motor Speed High Limit [Hz]* can be set to correspond to the manufacturer's recommended maximum motor speed. The motor speed high limit must exceed the value in *parameter 4-12 Motor Speed Low Limit [Hz]*. The output frequency must not exceed 10% of the switching frequency (*parameter 14-01 Switching Frequency*).

4-16 Torque Limit Motor Mode		
Range:		**Function:**
Size related* Application dependent*	[0 - 1000.0 %] [Application dependent]	This function limits the torque on the shaft to protect the mechanical installation.

NOTICE

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.

NOTICE

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 that torque is filtered.

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4-17 Torque Limit Generator Mode		
Range:		**Function:**
100 %*	[0 - 1000.0 %]	This function limits the torque on the shaft to protect the mechanical installation.

4-18 Current Limit		
Range:		**Function:**
Size related*	[1.0 - 1000.0 %]	**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.

4-19 Max Output Frequency		
Range:		**Function:**
Size related*	[1 - 590 Hz]	**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*).

4-19 Max Output Frequency		
Range:		**Function:**
		all configurations (independent of the setting in *parameter 1-00 Configuration Mode*).

4.5.2 4-2* Limit Factors

4-20 Torque Limit Factor Source		
Option:		**Function:**
		Select an analog input for scaling the settings in *parameter 4-16 Torque Limit Motor Mode* and *parameter 4-17 Torque Limit Generator Mode* 0–100% (or inverse). The signal levels corresponding to 0% and 100% are defined in the analog input scaling, for example *parameter group 6-1* Analog Input 1*. This parameter is only active when *parameter 1-00 Configuration Mode* is in *Speed Open Loop* or *Speed Closed Loop*.
[0] *	No function	
[2]	Analog in 53	
[4]	Analog in 53 inv	
[6]	Analog in 54	
[8]	Analog in 54 inv	
[10]	Analog in X30-11	
[12]	Analog in X30-11 inv	
[14]	Analog in X30-12	
[16]	Analog in X30-12 inv	

4-21 Speed Limit Factor Source		
Option:		**Function:**
		Select an analog input for scaling the settings in *parameter 4-19 Max Output Frequency* 0–100% (or the other way around). The signal levels corresponding to 0% and 100% are defined in the analog input scaling, for example *parameter group 6-1* Analog Input 1*. This parameter is only active when *parameter 1-00 Configuration Mode* is in *[4] Torque Open Loop*.
[0] *	No function	

4-21 Speed Limit Factor Source		
Option:		**Function:**
[2]	Analog in 53	
[4]	Analog in 53 inv	
[6]	Analog in 54	
[8]	Analog in 54 inv	
[10]	Analog in X30-11	
[12]	Analog in X30-11 inv	
[14]	Analog in X30-12	
[16]	Analog in X30-12 inv	

4.5.3 4-3* Motor Feedback Monitoring

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

4-30 Motor Feedback Loss Function		
Option:		**Function:**
		This function is used to monitor consistency in the feedback signal, that is if the feedback signal is available. Select which action the frequency converter should take if a feedback fault is detected. The selected action is to take place when the feedback signal differs from the output speed by the value set in *parameter 4-31 Motor Feedback Speed Error* for longer than the value set in *parameter 4-32 Motor Feedback Loss Timeout*.
[0]	Disabled	
[1]	Warning	
[2]	Trip	
[3]	Jog	
[4]	Freeze Output	
[5]	Max Speed	
[6]	Switch to Open Loop	
[7]	Select Setup 1	
[8]	Select Setup 2	
[9]	Select Setup 3	
[10]	Select Setup 4	
[11]	Stop & Trip	

Warning 90, Feedback monitor is active as soon as the value in *parameter 4-31 Motor Feedback Speed Error* is exceeded, regardless of the setting in *parameter 4-32 Motor Feedback Loss Timeout*. *Warning/Alarm 61, Feedback Error* is related to the motor feedback loss function.

4-31 Motor Feedback Speed Error		
Range:		**Function:**
300 RPM*	[1 - 600 RPM]	Select the maximum allowed error in speed (output speed vs. feedback).

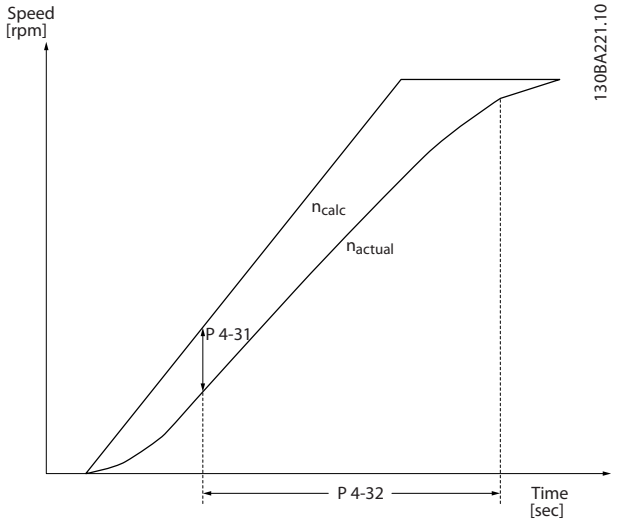

Illustration 4.24 Motor Feedback Speed Error

4-32 Motor Feedback Loss Timeout		
Range:		**Function:**
Size related*	[0 - 60 s]	Set the timeout value allowing the speed error set in *parameter 4-31 Motor Feedback Speed Error* to be exceeded before enabling the function selected in *parameter 4-30 Motor Feedback Loss Function*.

4.5.4 4-4* Speed Monitor

4-40 Warning Freq. Low		
Range:		**Function:**
Size related*	[0 - par. 4-41 Hz]	When the motor speed falls below this limit, the display reads SPEED LOW. The LCP warning light is not turned on when this parameter set limit is reached. Warning bit 10 is set in *parameter 16-94 Ext. Status Word*, the output relay or the digital output can be configured to indicate this warning.

4-41 Warning Freq. High		
Range:		**Function:**
Size related*	[par. 4-40 - par. 4-14 Hz]	Use this parameter to set a high limit for the frequency range. When the motor speed is above this limit, the display reads SPEED HIGH. The LCP warning light is not turned on when this parameter set limit is reached. Warning bit 9 is set in *parameter 16-94 Ext. Status Word*. The output relay or the digital output can be configured to indicate this warning.

4.5.5 4-5* Adjustable Warnings

Use these parameters to adjust 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.

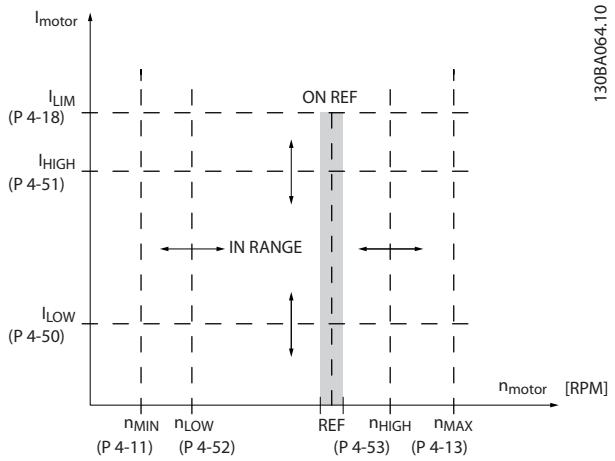

Illustration 4.25 Adjustable Warnings

4-50 Warning Current Low		
Range:		**Function:**
0 A*	[0 - par. 4-51 A]	Enter the I_{LOW} value. When the motor current falls 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 4.25*.

4-51 Warning Current High		
Range:		**Function:**
Size related*	[par. 4-50 - par. 16-37 A]	Enter the I_{HIGH} value. When the motor current exceeds this limit, the display reads *Current High*. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02. Refer to *Illustration 4.25*.

4-52 Warning Speed Low		
Range:		**Function:**
Size related*	[0 - par. 4-53 RPM]	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.

4-53 Warning Speed High		
Range:		**Function:**
Size related*	[par. 4-52 - 60000 RPM]	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 4.25*.

4-54 Warning Reference Low		
Range:		**Function:**
-999999.999*	[-999999.999 - par. 4-55]	Enter the lower reference limit. When the actual reference drops below this limit, the display indicates *Ref$_{LOW}$*. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02.

4-55 Warning Reference High		
Range:		**Function:**
999999.999*	[par. 4-54 - 999999.999]	Enter the upper reference limit. When the actual reference exceeds this limit, the display reads Ref$_{high}$. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02.

4-56 Warning Feedback Low		
Range:		**Function:**
Size related*	[-999999.999 - par. 4-57 Reference-FeedbackUnit]	Enter the lower feedback limit. When the feedback drops below this limit, the display reads $Feedb_{Low}$. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02.

4-57 Warning Feedback High		
Range:		**Function:**
Size related*	[par. 4-56 - 999999.999 Reference-FeedbackUnit]	Enter the upper feedback limit. When the feedback exceeds this limit, the display reads $Feedb_{High}$. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02.

4-58 Missing Motor Phase Function		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** The missing motor phase function detects whether the motor phase is missing during motor rotation. Shows alarm 30, 31, or 32 in the event of a missing motor phase. Enable this function to avoid motor damage.
[0]	Disabled	The frequency converter does not issue a missing motor phase alarm. Not recommended due to risk of motor damage.
[1]	Trip 100 ms	For a quick detection time and alarm in the event of a missing motor phase.
[2] *	Trip 1000 ms	
[3]	Trip 100ms 3ph detec.	Special option relevant for crane applications when lowering a small load that lets the frequency converter avoid false detections of missing motor phase. This option is a reduced version of option *[1] Trip 100 ms*. 1-phase missing is handled as in option *[1] Trip 100 ms*. 3-phase detection is reduced compared to option *[1] Trip 100 ms*. The 3-phase detection is only working at start-up and in the low speed range where a significant current is running, avoiding false trips during small motor current.

4-58 Missing Motor Phase Function		
Option:		**Function:**
		speed range where a significant current is running, avoiding false trips during small motor current.

4.5.6 4-6* Speed Bypass

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

4-60 Bypass Speed From [RPM]		
Array [4]		
Range:		**Function:**
Size related*	[0 - par. 4-13 RPM]	Some systems call for avoiding certain output speeds due to resonance problems in the system. Enter the lower limits of the speeds to be avoided.

4-61 Bypass Speed From [Hz]		
Array [4]		
Range:		**Function:**
Size related*	[0 - par. 4-14 Hz]	Some systems require that certain output frequencies or speeds are avoided due to resonance problems in the system. Enter the lower limits of the speeds to be avoided.

4-62 Bypass Speed To [RPM]		
Array [4]		
Range:		**Function:**
Size related*	[0 - par. 4-13 RPM]	Some systems call for avoiding certain output speeds due to resonance problems in the system. Enter the upper limits of the speeds to be avoided.

4-63 Bypass Speed To [Hz]		
Array [4]		
Range:		**Function:**
Size related*	[0 - par. 4-14 Hz]	Some systems call for avoiding certain output speeds due to resonance problems in the system. Enter the upper limits of the speeds to be avoided.

4.6 Parameters: 5-** Digital In/Out

4.6.1 5-0* Digital I/O Mode

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

5-00 Digital I/O Mode		
Option:		**Function:**
		NOTICE **Perform a power cycle to activate the parameter once it has been changed.** Digital inputs and programmed digital outputs are pre-programmable for operation either in PNP or NPN systems.
[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 frequency converter.

5-01 Terminal 27 Mode		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.**
[0] *	Input	Defines terminal 27 as a digital input.
[1]	Output	Defines terminal 27 as a digital output.

5-02 Terminal 29 Mode		
Option:		**Function:**
[0] *	Input	Defines terminal 29 as a digital input.
[1]	Output	Defines terminal 29 as a digital output.

The digital inputs are used for selecting various functions in the frequency converter. *Table 4.8* shows which functions can be assigned to digital inputs.

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

Group 1	Reset, coast stop, reset, and coast stop, quick stop, DC brake, stop, and the [Off] key.
Group 2	Start, latched start, reversing, start reversing, jog, and freeze output.

Table 4.7 Function Groups

Digital input function	Select	Terminal
No operation	[0]	All, terminal 32, 33
Reset	[1]	All
Coast inverse	[2]	All, terminal 27
Coast and reset inverse	[3]	All
Quick stop inverse	[4]	All
DC brake inverse	[5]	All
Stop inverse	[6]	All
Start	[8]	All, terminal 18
Latched start	[9]	All
Reversing	[10]	All, terminal 19
Start reversing	[11]	All
Enable start forward	[12]	All
Enable start reverse	[13]	All
Jog	[14]	All, terminal 29
Preset reference on	[15]	All
Preset ref bit 0	[16]	All
Preset ref bit 1	[17]	All
Preset ref bit 2	[18]	All
Freeze reference	[19]	All
Freeze output	[20]	All
Speed up	[21]	All
Speed down	[22]	All
Set-up select bit 0	[23]	All
Set-up select bit 1	[24]	All
Catch up	[28]	All
Slow down	[29]	All
Counter input	[30]	29, 33
Pulse input time based	[32]	29, 33
Ramp bit 0	[34]	All
Ramp bit 1	[35]	All
External interlock	[51]	–
DigiPot increase	[55]	All
DigiPot decrease	[56]	All
DigiPot clear	[57]	All
Counter A (up)	[60]	29, 33
Counter A (down)	[61]	29, 33
Reset Counter A	[62]	All
Counter B (up)	[63]	29, 33
Counter B (down)	[64]	29, 33
Reset counter B	[65]	All
PID error inv.	[72]	All
PID reset I-part	[73]	All
PID enable	[74]	All

Table 4.8 Digital Input Function

The standard terminals are 18, 19, 27, 29, 32, and 33. VLT® General Purpose I/O MCB 101 terminals are X30/2, X30/3, and X30/4. Terminal 29 functions as an output.

Functions dedicated to only 1 digital input are stated in the associated parameter.

All digital inputs can be programmed to these functions:

[0]	No operation	No reaction to signals transmitted to the terminal.
[1]	Reset	Resets frequency converter after a trip/alarm. Not all alarms can be reset.
[2]	Coast inverse	(Default digital input 27): Coast stop, inverted input (NC). The frequency converter leaves the motor in free mode. Logic 0⇒coast stop.
[3]	Coast and reset inverse	Reset and coast stop inverted input (NC). Leaves motor in free mode and resets frequency converter. Logic 0⇒coast stop and reset.
[4]	Quick stop inverse	Inverted input (NC). Generates a stop in accordance with quick stop ramp time set in *parameter 3-81 Quick Stop Ramp Time*. When the motor stops, the shaft is in free mode. Logic 0⇒quick stop.
[5]	DC brake inverse	Inverted input for DC brake (NC). Stops motor by energizing it with a DC current for a certain time period. See *parameter 2-01 DC Brake Current* to *parameter 2-03 DC Brake Cut In Speed [RPM]*. The function is only active when the value in *parameter 2-02 DC Braking Time* is different from 0. Logic 0⇒DC brake.
[6]	Stop inverse	Stop inverted function. Generates a stop function when the selected terminal goes from logical level 1 to logical level 0. The stop is performed according to the selected ramp time: • *Parameter 3-42 Ramp 1 Ramp Down Time*, • *Parameter 3-52 Ramp 2 Ramp Down Time*, • *Parameter 3-62 Ramp 3 Ramp down Time*, and • *Parameter 3-72 Ramp 4 Ramp Down Time*. ***NOTICE*** **When the frequency converter is at the torque limit and has received a stop command, it may not stop by itself. To ensure that the frequency converter stops, configure a digital output to *[27] Torque limit and stop*. Connect this digital output to a digital input that is configured as coast.**
[8]	Start	(Default digital input 18): Select start for a start/stop command. Logic 1 = start, logic 0 = stop.
[9]	Latched start	If a pulse is applied for minimum 2 ms, the motor starts. The motor stops when stop inverse is activated, or a reset command (via DI) is given.
[10]	Reversing	(Default digital input 19). Change the direction of motor shaft rotation. Select logic 1 to reverse. The reversing signal only changes the direction of rotation. It does not activate the start function. Select both directions in *parameter 4-10 Motor Speed Direction*. The function is not active in process closed loop.
[11]	Start reversing	Used for start/stop and for reversing on the same wire. Signals on start are not allowed at the same time.
[12]	Enable start forward	Disengages the counterclockwise movement and allows clockwise direction.
[13]	Enable start reverse	Disengages the clockwise movement and allows counterclockwise direction.
[14]	Jog	(Default digital input 29): Activate jog speed. See *parameter 3-11 Jog Speed [Hz]*.
[15]	Preset reference on	Shifts between external reference and preset reference. It is assumed that *[1] External/preset* has been selected in *parameter 3-04 Reference Function*. Logic 0 = external reference active; logic 1 = 1 of the 8 preset references is active.
[16]	Preset ref bit 0	Preset reference bit 0, 1, and 2 enable a choice between 1 of the 8 preset references according to *Table 4.9*.
[17]	Preset ref bit 1	Same as *[16] Preset ref bit 0*.
[18]	Preset ref bit 2	Same as *[16] Preset ref bit 0*.

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 4.9 Preset Reference Bit

[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 frequency converter cannot be stopped via a low *[8] Start* signal. Stop the frequency converter 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.

	Shut down	Catch up
Unchanged speed	0	0
Reduced by %-value	1	0
Increased by %-value	0	1
Reduced by %-value	1	1

Table 4.10 Shut Down/Catch Up

[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 Multi Set-up.
[24]	Set-up select bit 1	(Default digital input 32): Same as *[23] Set-up select bit 0*.
[28]	Catch up	Increases reference value by percentage (relative) set in *parameter 3-12 Catch up/slow Down Value*.
[29]	Slow down	Reduces reference value by percentage (relative) set in *parameter 3-12 Catch up/slow Down Value*.
[34]	Ramp bit 0	Enables a selection between 1 of the 4 ramps available, according to *Table 4.11*.
[35]	Ramp bit 1	Same as *[34] Ramp bit 0*.

Preset ramp bit	**1**	**0**
Ramp 1	0	0
Ramp 2	0	1
Ramp 3	1	0
Ramp 4	1	1

Table 4.11 Preset Ramp Bit

[51]	External interlock	This function makes it possible to give an external fault to the frequency converter. This fault is treated in the same way as an internally generated alarm.
[55]	DigiPot Increase	Increase signal to the digital potentiometer function described in *parameter group 3-9* Digital Pot. Meter*.
[56]	DigiPot Decrease	Decrease signal to the digital potentiometer function described in *parameter group 3-9* Digital Pot. Meter*.
[57]	DigiPot Clear	Clears the digital potentiometer reference described in *parameter group 3-9* Digital Pot. Meter*.
[62]	Reset Counter A	Input for reset of counter A.
[65]	Reset Counter B	Input for reset of counter B.
[66]	Sleep Mode	
[72]	PID error inverse	When enabled, this option inverts the resulting error from the process PID controller. Available only if *parameter 1-00 Configuration Mode* is set to *[7] Extended PID Speed OL*.
[73]	PID reset I-part	When enabled, this option resets the I-part of the process PID controller. Equivalent to *parameter 7-40 Process PID I-part Reset*. Available only if *parameter 1-00 Configuration Mode* is set to *[7] Extended PID Speed OL*.
[74]	PID enable	Enables the extended process PID controller. Equivalent to *parameter 7-50 Process PID Extended PID*. Available only if *parameter 1-00 Configuration Mode* is set to *[7] Extended PID Speed OL*.

5-10 Terminal 18 Digital Input

Option:		Function:
[8] *	Start	Functions are described in *parameter group 5-1* Digital Inputs*.

5-11 Terminal 19 Digital Input

Option:		Function:
[10] *	Reversing	Functions are described in *parameter group 5-1* Digital Inputs*.

5–12 Terminal 27 Digital Input

Option:		Function:
[2] *	Coast inverse	Functions are described in *parameter group 5-1* Digital Inputs*.

5-13 Terminal 29 Digital Input

Option:		Function:
		Select the function from the available digital input range and the additional options *[60] Counter A*, *[61] Counter A*, *[63] Counter B*, and *[64] Counter B*. Counters are used in smart logic control functions.
[14] *	Jog	Functions are described in *parameter group 5-1* Digital Inputs*.

5-14 Terminal 32 Digital Input

Option:		Function:
		Select the function from the available digital input range.
	No operation	Functions are described in *parameter group 5-1* Digital Inputs*.

5-15 Terminal 33 Digital Input

Option:		Function:
		Select the function from the available digital input range and the additional options *[60] Counter A*, *[61] Counter A*, *[63] Counter B* and *[64] Counter B*. Counters are used in smart logic control functions.
[0] *	No operation	Functions are described in *parameter group 5-1* Digital Inputs*.

5-16 Terminal X30/2 Digital Input

Option:		Function:
[0] *	No operation	This parameter is active when option module VLT® General Purpose I/O MCB 101 is installed in the frequency converter. Functions are described in *parameter group 5-1* Digital Inputs*.

5-17 Terminal X30/3 Digital Input

Option:		Function:
[0] *	No operation	This parameter is active when option module VLT® General Purpose I/O MCB 101 is installed in the frequency converter. Functions are described in *parameter group 5-1* Digital Inputs*.

5-18 Terminal X30/4 Digital Input

Option:		Function:
[0] *	No operation	This parameter is active when option module VLT® General Purpose I/O MCB 101 is installed in the frequency converter. Functions are described in *parameter group 5-1* Digital Inputs*.

4.6.2 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*.

NOTICE

These parameters cannot be adjusted while the motor is running.

[0]	No operation	Default for all digital outputs and relay outputs.
[1]	Control ready	The control card is ready, for example: Feedback from a frequency converter controlled by a 24 V external supply (VLT® 24 V DC Supply MCB 107) and the main power to the unit is not detected.
[2]	Drive ready	The frequency converter is ready for operation and applies a supply signal on the control board.
[3]	Drive ready/ remote control	The frequency converter is ready for operation and is in *auto-on* mode.
[4]	Enable/no warning	Ready for operation. No start or stop command has been given (start/disable). No warnings are active.
[5]	VLT running	The motor runs and shaft torque is present.
[6]	Running/no warning	The output speed is higher than the speed set in *parameter 1-81 Min Speed for Function at Stop [RPM]*. The motor runs and there are no warnings.
[7]	Run in range/no warning	Motor runs within the programmed current and speed ranges set in *parameter 4-50 Warning Current Low* to *parameter 4-53 Warning Speed High*. There are no warnings.
[8]	Run on reference/no warning	Motor runs at reference speed. No warnings.
[9]	Alarm	An alarm activates the output. There are 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	Motor current is lower than set in *parameter 4-50 Warning Current Low*.
[14]	Above current, high	Motor current is higher than set in *parameter 4-51 Warning Current High*.
[15]	Out of speed range	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	Output speed is higher than the setting in *parameter 4-53 Warning Speed High*.
[18]	Out of feedback 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	The thermal warning turns on when the temperature exceeds the limit in the motor, the frequency converter, the brake resistor, or the thermistor.
[22]	Ready, no thermal warning	Frequency converter is ready for operation, and there is no overtemperature warning.
[23]	Remote, ready, no thermal warning	Frequency converter is ready for operation and is in *auto-on* mode. There is no overtemperature warning.
[24]	Ready, Voltage OK	Frequency converter is ready for operation and the mains voltage is within the specified voltage range (see the section *General Specifications* in the frequency converter *design guide*).
[25]	Reverse	The motor runs (or is ready to run) clockwise when logic = 0 and counter-clockwise 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	Use in performing a coast stop and in torque limit condition. If the frequency converter has received a stop signal and is at the torque limit, the signal is logic 0.
[31]	Relay 123	Relay is activated when *[0] Control word* is selected in *parameter group 8-** Communications and Options*.
[35]	External Interlock	
[38]	Motor feedback error	
[40]	Out of ref range	Active when the actual speed is outside settings in *parameter 4-52 Warning Speed Low* to *parameter 4-55 Warning Reference High*.
[41]	Below reference low	Active when actual speed is below speed reference setting.

[42]	Above reference high	Active when actual speed is above speed reference setting.
[43]	Extended PID Limit	
[45]	Bus Ctrl	Controls output via bus. The state of the output is set in *parameter 5-90 Digital & Relay Bus Control*. If a bus timeout occurs, the output state is retained.
[46]	Bus ctrl, 1 if timeout	Controls output via bus. The state of the output is set in *parameter 5-90 Digital & Relay Bus Control*. If a bus timeout occurs, the output state is set high (on).
[47]	Bus ctrl, 0 if timeout	Controls output via bus. The state of the output is set in *parameter 5-90 Digital & Relay Bus Control*. If a bus timeout occurs, the output state is set low (off).
[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.
[70]	Logic Rule 0	See *parameter group 13-4* Logic Rules*. If logic rule 0 is evaluated as true, the output goes high. Otherwise, it is low.
[71]	Logic Rule 1	See *parameter group 13-4* Logic Rules*. If logic rule 1 is evaluated as true, the output goes high. Otherwise, it is low.
[72]	Logic Rule 2	See *parameter group 13-4* Logic Rules*. If logic rule 2 is evaluated as true, the output goes high. Otherwise, it is low.
[73]	Logic Rule 3	See *parameter group 13-4* Logic Rules*. If logic rule 3 is evaluated as true, the output goes high. Otherwise, it is low.
[74]	Logic Rule 4	See *parameter group 13-4* Logic Rules*. If logic rule 4 is evaluated as true, the output goes high. Otherwise, it is low.
[75]	Logic Rule 5	See *parameter group 13-4* Logic Rules*. If logic rule 5 is evaluated as true, the output goes high. Otherwise, it is low.

[80]	SL Digital Output A	See *parameter 13-52 SL Controller Action*. The output goes high whenever the smart logic action *[38] Set dig. out. A high* is executed. The output goes low whenever the smart logic action *[32] Set dig. out. A* low is executed.
[81]	SL Digital Output B	See *parameter 13-52 SL Controller Action*. The input goes high whenever the smart logic action *[39] Set dig. out. B high* is executed. The input 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 input goes high whenever the smart logic action *[40] Set dig. out. C high* is executed. The input 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 input goes high whenever the smart logic action *[41] Set dig. out. D* high is executed. The input 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 input goes high whenever the smart logic action *[42] Set dig. out. E high* is executed. The input 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 input goes high whenever the smart logic action *[43] Set dig. out. F high* is executed. The input goes low whenever the smart logic action *[37] Set dig. out. F low* is executed.
[120]	Local reference active	Output is high when *parameter 3-13 Reference Site = [2] Local*.

Reference site set in *parameter 3-13 Reference Site*	**Local reference active [120]**	**Remote reference active [121]**
Reference site: Local *parameter 3-13 Reference Site [2] Local*	1	0
Reference site: Remote *parameter 3-13 Reference Site [1] Remote*	0	1
Reference site: Linked to Hand/ Auto		

		Reference site set in *parameter 3-13 Reference Site*	Local reference active [120]	Remote reference active [121]
		Hand	1	0
		Hand⇒off	1	0
		Auto⇒off	0	0
		Auto	0	1

Table 4.12 Local Reference Active

[121]	Remote reference active	Output is high when *parameter 3-13 Reference Site = [1] Remote* or *[0] Linked to hand/auto* while the LCP is in *auto-on* mode. See *Table 4.12*.
[122]	No alarm	Output is high when no alarm is present.
[123]	Start command active	Output is high when there is an active start command (that is via digital input bus connection, hand-on, or auto-on), and no stop or start command is active.
[124]	Running reverse	Output is high when the frequency converter runs counterclockwise (the logical product of the status bits running AND reverse).
[125]	Drive in hand mode	Output is high when the frequency converter is in *hand-on* mode (as indicated by the LED light above [Hand On]).
[126]	Drive in Auto mode	Output is high when the frequency converter is in *auto-on* mode (as indicated by the LED light above [Auto On]).
[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).
[193]	Sleep Mode	The frequency converter/system has turned into 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*.
[221]	IGBT-cooling	Use this option for handling the overcurrent trips. When the frequency converter detects an overcurrent condition, it shows *alarm 13, Overcurrent* and triggers a reset. If the overcurrent condition occurs the 3rd time in a row, the frequency converter shows *alarm 13, Overcurrent* and initiates a 3-minute delay before the next reset.

5-30 Terminal 27 Digital Output

Option:		Function:
[0] *	No operation	Functions are described in *parameter group 5-3* Digital Outputs*.

5-31 Terminal 29 Digital Output

Option:		Function:
[0] *	No operation	Functions are described in *parameter group 5-3* Digital Outputs*.

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

Option:		Function:
[0] *	No operation	Functions are described in *parameter group 5-3* Digital Outputs*.

5-33 Term X30/7 Digi Out (MCB 101)

Option:		Function:
[0] *	No operation	Functions are described in *parameter group 5-3* Digital Outputs*.

4.6.3 5-4* Relays

Parameters for configuring the timing and the output functions for the relays.

5-40 Function Relay

Option:		Function:
		Relay 1 [0], Relay 2 [1]. VLT® Extended Relay Card MCB 113: Relay 3 [2], Relay 4 [3], Relay 5 [4], Relay 6 [5]. VLT® Relay Card MCB 105: Relay 7 [6], Relay 8 [7], Relay 9 [8].
[0]	No operation	All digital and relay outputs are by default set to *No Operation*.
[1]	Control Ready	The control card is ready, for example: Feedback from a frequency converter where the control is supplied by an external 24 V supply (VLT® 24 V DC Supply MCB 107) and the main power to frequency converter is not detected.
[2]	Drive ready	The frequency converter is ready to operate. Mains and control supplies are OK.
[3]	Drive rdy/rem ctrl	The frequency converter is ready for operation and is in *auto-on* mode.
[4]	Enable / no warning	Ready for operation. No start or stop commands have been applied (start/disable). No warnings are active.
[5]	Running	The motor is running, and shaft torque is present.
[6]	Running / no warning	Output speed is higher than the speed set in *parameter 1-81 Min Speed for Function at Stop [RPM]*. The motor runs and there are no warnings.

5-40 Function Relay		
Option:		**Function:**
[7]	Run in range/no warn	The motor runs within the programmed current and the speed ranges set in *parameter 4-50 Warning Current Low* and *parameter 4-53 Warning Speed High*. No warnings.
[8]	Run on ref/no warn	The motor runs at reference speed. No warnings.
[9]	Alarm	An alarm activates the output. No warnings.
[10]	Alarm or warning	An alarm or a warning activates the output.
[11]	At torque limit	The torque limit set in *parameter 4-16 Torque Limit Motor Mode* or *parameter 4-17 Torque Limit Generator Mode* has been exceeded.
[12]	Out of current range	The motor current is outside the range set in *parameter 4-18 Current Limit*.
[13]	Below current, low	The motor current is lower than set in *parameter 4-50 Warning Current Low*.
[14]	Above current, high	The motor current is higher than set in *parameter 4-51 Warning Current High*.
[15]	Out of speed range	Output speed/frequency is outside the frequency range set in *parameter 4-52 Warning Speed Low* and *parameter 4-53 Warning Speed High*.
[16]	Below speed, low	Output speed is lower than the setting in *parameter 4-52 Warning Speed Low*.
[17]	Above speed, high	Output speed is higher than the setting in *parameter 4-53 Warning Speed High*.
[18]	Out of feedb. range	Feedback is outside the range set in *parameter 4-56 Warning Feedback Low* and *parameter 4-57 Warning Feedback High*.
[19]	Below feedback, low	Feedback is below the limit set in *parameter 4-56 Warning Feedback Low*.
[20]	Above feedback, high	Feedback is above the limit set in *parameter 4-57 Warning Feedback High*.
[21]	Thermal warning	Thermal warning turns on when the temperature exceeds the limit either in motor, frequency converter, brake resistor, or connected thermistor.
[22]	Ready,no thermal W	The frequency converter is ready for operation and there is no overtemperature warning.
[23]	Remote,ready, no TW	The frequency converter is ready for operation and is in *auto-on* mode. There is no overtemperature warning.
[24]	Ready, Voltage OK	The frequency converter is ready for operation and the mains voltage is within the specified voltage range (see the *General Specifications* section in the *design guide*).
[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 frequency converter has received a stop signal and is in torque limit, the signal is logic 0.
[31]	Relay 123	Digital output/relay is activated when *[0] Control Word* is selected in *parameter group 8-** Comm. and Options*.
[35]	External Interlock	
[36]	Control word bit 11	Activate relay 1 by control word from fieldbus. No other functional impact in the frequency converter. 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 frequency converter. Typical application: Controlling auxiliary device from fieldbus. The function is valid when *[0] FC profile* in *parameter 8-10 Control Word Profile* is selected.
[38]	Motor feedback error	Failure in the speed feedback loop from motor running in closed loop. The output can eventually be used

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5-40 Function Relay		
Option:		**Function:**
		to prepare switching the frequency converter in open loop in an emergency case.
[40]	Out of ref range	Active when the actual speed is outside settings in *parameter 4-52 Warning Speed Low* to *parameter 4-55 Warning Reference High*.
[41]	Below reference, low	Active when actual speed is below speed reference setting.
[42]	Above ref, high	Active when actual speed is above speed reference setting.
[43]	Extended PID Limit	
[45]	Bus ctrl.	Controls digital output/relay via bus. The state of the output is set in *parameter 5-90 Digital & Relay Bus Control*. The output state is retained in the event of 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).
[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.
[70]	Logic rule 0	See *parameter group 13-4* Smart Logic Control*. 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* Smart Logic Control*. 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* Smart Logic Control*. 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* Smart Logic Control*. 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* Smart Logic Control*. 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* Smart Logic Control*. If logic rule 5 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]*. 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]*. 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]*. Output C is high on smart logic action *[40]*.
[83]	SL digital output D	See *parameter 13-52 SL Controller Action*. Output D is low on smart logic action *[35]*. 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]*. Output E is high on smart logic action *[42]*.

5-40 Function Relay		
Option:		**Function:**
[85]	SL digital output F	See *parameter 13-52 SL Controller Action*. Output F is low on smart logic action *[37]*. Output F is high on smart logic action *[43]*.
[120]	Local ref active	Output is high when *parameter 3-13 Reference Site = [2] Local* or when *parameter 3-13 Reference Site = [0] Linked to hand auto* at the same time as the LCP is in *hand-on* mode.
[121]	Remote ref active	Output is high when *parameter 3-13 Reference Site = [1] Remote* or *[0] Linked to hand/auto* while the LCP is in *auto-on* mode. See *Table 4.13*.
[122]	No alarm	Output is high when no alarm is present.
[123]	Start command activ	Output is high when the start command is high (that is via digital input, bus connection, [Hand On], or [Auto On]), and a stop has been last command.
[124]	Running reverse	Output is high when the frequency converter is running counter-clockwise (the logical product of the status bits *running* AND *reverse*).

Reference site set in *parameter 3-13 Reference Site*	**Local reference active [120]**	**Remote reference active [121]**
Reference site: Local *parameter 3-13 Reference Site [2] Local*	1	0
Reference site: Remote *parameter 3-13 Reference Site [1] Remote*	0	1
Reference site: Linked to Hand/ Auto		
Hand	1	0
Hand⇒off	1	0
Auto⇒off	0	0
Auto	0	1

Table 4.13 Local Reference Active

5-40 Function Relay		
Option:		**Function:**
[125]	Drive in hand mode	Output is high when the frequency converter is in *hand-on* mode (as indicated by the LED light above [Hand On]).
[126]	Drive in auto mode	Output is high when the frequency converter is in *auto-on* mode (as indicated by LED on above [Auto On]).
[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).
[193]	Sleep Mode	
[194]	Broken Belt	
[221]	IGBT-cooling	Use this option for handling the overcurrent trips. When the frequency converter detects an overcurrent condition, it shows *alarm 13, Overcurrent* and triggers a reset. If the overcurrent condition occurs the 3rd time in a row, the frequency converter shows *alarm 13, Overcurrent* and initiates a 3-minute delay before the next reset.

5-41 On Delay, Relay		
Array [20]		
Range:		**Function:**
0.01 s*	[0.01 - 600 s]	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.

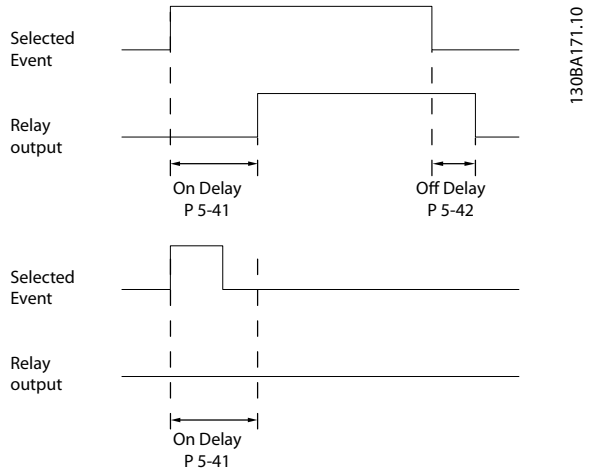

Illustration 4.26 On Delay, Relay

5-42 Off Delay, Relay		
Array[20]		
Range:		**Function:**
0.01 s*	[0.01 - 600 s]	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.

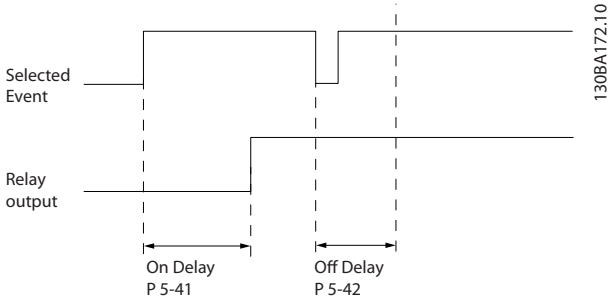

Illustration 4.27 Off Delay, Relay

If the selected event condition changes before the on delay or off delay timer expires, the relay output is unaffected.

4.6.4 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*.

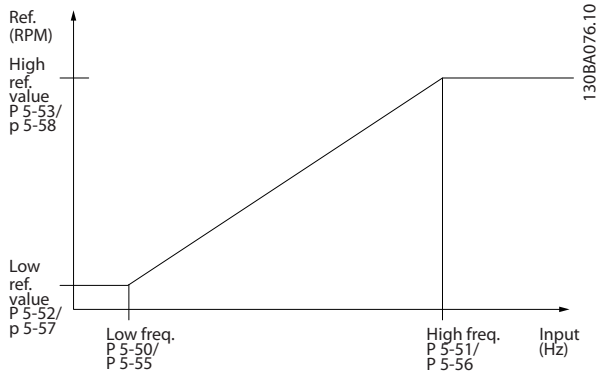

Illustration 4.28 Pulse Input

5-50 Term. 29 Low Frequency		
Range:		**Function:**
100 Hz*	[0 - 110000 Hz]	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 4.28*.

5-51 Term. 29 High Frequency		
Range:		**Function:**
Size related*	[0 - 110000 Hz]	Enter the high frequency limit corresponding to the high motor shaft speed (that is high reference value) in *parameter 5-53 Term. 29 High Ref./Feedb. Value*.

5-52 Term. 29 Low Ref./Feedb. Value		
Range:		**Function:**
0 ReferenceFeedbackUnit*	[-999999.999 - 999999.999 ReferenceFeedbackUnit]	Enter the low reference value limit for the motor shaft speed [RPM]. This is also the lowest feedback value, see also *parameter 5-57 Term. 33 Low Ref./Feedb. Value*. Set terminal 29 to digital input (*parameter 5-02 Terminal 29 Mode* = *[0] input* (default) and *parameter 5-13 Terminal 29 Digital Input* = applicable value).

5-53 Term. 29 High Ref./Feedb. Value		
Range:		**Function:**
Size related*	[-999999.999 - 999999.999 ReferenceFeedbackUnit]	Enter the high reference value [RPM] for the motor shaft speed and the high feedback value, see also *parameter 5-58 Term. 33 High Ref./Feedb. Value*. Select terminal 29 as a digital input (*parameter 5-02 Terminal 29 Mode* = *[0] input* (default) and *parameter 5-13 Terminal 29 Digital Input* = applicable value).

5-54 Pulse Filter Time Constant #29		
Range:		**Function:**
100 ms*	[5 - 1000 ms]	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.

5-55 Term. 33 Low Frequency		
Range:		**Function:**
100 Hz*	[0 - 110000 Hz]	Enter the low frequency corresponding to the low motor shaft speed (that is low reference value) in *parameter 5-57 Term. 33 Low Ref./Feedb. Value*.

5-56 Term. 33 High Frequency		
Range:		**Function:**
100 Hz*	[0 - 110000 Hz]	Enter the high frequency corresponding to the high motor shaft speed (that is high reference value) in *parameter 5-58 Term. 33 High Ref./Feedb. Value*.

5-57 Term. 33 Low Ref./Feedb. Value		
Range:		**Function:**
0 ReferenceFeedbackUnit*	[-999999.999 - 999999.999 ReferenceFeedbackUnit]	Enter the low reference value [RPM] for the motor shaft speed. This is also the low feedback value, see also *parameter 5-52 Term. 29 Low Ref./Feedb. Value*.

5-58 Term. 33 High Ref./Feedb. Value		
Range:		**Function:**
Size related*	[-999999.999 - 999999.999 ReferenceFeedbackUnit]	Enter the high reference value [RPM] for the motor shaft speed. See also *parameter 5-53 Term. 29 High Ref./Feedb. Value*.

5-59 Pulse Filter Time Constant #33		
Range:		**Function:**
100 ms*	[5 - 1000 ms]	***NOTICE*** **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.

NOTICE

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.

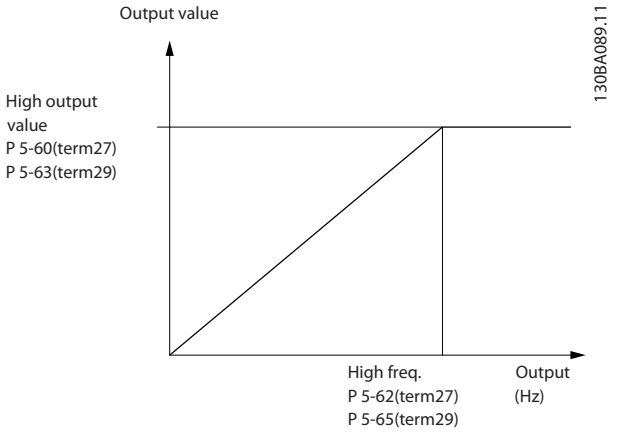

Illustration 4.29 Configuration of Pulse Outputs

Options for readout output variables:

		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	
[100]	Output frequency	
[101]	Reference	
[102]	Feedback	
[103]	Motor current	
[104]	Torque relative to limit	
[105]	Torque relative to rated	
[106]	Power	
[107]	Speed	
[108]	Torque	
[109]	Max. out freq	
[113]	Ext. Closed Loop 1	

5-60 Terminal 27 Pulse Output Variable		
Option:		**Function:**
[0]	No operation	Select the display output for terminal 27.
[45]	Bus ctrl.	
[48]	Bus ctrl., timeout	
[100]	Output frequency	
[101]	Reference	
[102]	Feedback	

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5-60 Terminal 27 Pulse Output Variable

Option:		Function:
[103]	Motor Current	
[104]	Torque rel to limit	
[105]	Torq relate to rated	
[106]	Power	
[107]	Speed	
[108]	Torque	
[109]	Max Out Freq	
[113]	Ext. Closed Loop 1	

5-62 Pulse Output Max Freq #27

Range:		Function:
Size related*	[0 - 32000 Hz]	Set the maximum frequency for terminal 27 corresponding to the output variable selected in *parameter 5-60 Terminal 27 Pulse Output Variable*.

5-63 Terminal 29 Pulse Output Variable

Option:		Function:
[0]	No operation	Select the display output for terminal 29.
[45]	Bus ctrl.	
[48]	Bus ctrl., timeout	
[100]	Output frequency	
[101]	Reference	
[102]	Feedback	
[103]	Motor Current	
[104]	Torque rel to limit	
[105]	Torq relate to rated	
[106]	Power	
[107]	Speed	
[108]	Torque	
[109]	Max Out Freq	
[113]	Ext. Closed Loop 1	

5-65 Pulse Output Max Freq #29

Range:		Function:
Size related*	[0 - 32000 Hz]	Set the maximum frequency for terminal 29 corresponding to the output variable set in *parameter 5-63 Terminal 29 Pulse Output Variable*.

5-66 Terminal X30/6 Pulse Output Variable

Select the variable for readout on terminal X30/6.

This parameter is active when VLT® General Purpose I/O MCB 101 is installed in the frequency converter.

Same options and functions as *parameter group 5-6* Pulse Outputs*.

Option:		Function:
[0] *	No operation	
[45]	Bus ctrl.	
[48]	Bus ctrl., timeout	
[100]	Output frequency	
[101]	Reference	
[102]	Feedback	
[103]	Motor Current	
[104]	Torque rel to limit	
[105]	Torq relate to rated	
[106]	Power	
[107]	Speed	
[108]	Torque	
[109]	Max Out Freq	
[113]	Ext. Closed Loop 1	

5-68 Pulse Output Max Freq #X30/6

Range:		Function:
5000 Hz*	[0 - 32000 Hz]	***NOTICE*** **This parameter cannot be adjusted while the motor is running.** Select the maximum frequency on terminal X30/6 referring to the output variable in *parameter 5-66 Terminal X30/6 Pulse Output Variable*. This parameter is active when VLT® General Purpose I/O MCB 101 is installed in the frequency converter.

4.6.5 5-7* 24 V Encoder Input

Connect the 24 V encoder to terminal 12 (24 V DC supply), terminal 32 (channel A), terminal 33 (channel B), and terminal 20 (GND). The digital inputs 32/33 are active for encoder inputs when *[1] 24 V encoder* is selected in *parameter 7-00 Speed PID Feedback Source*. The encoder used is a dual-channel (A and B) 24 V type. Maximum input frequency: 110 kHz.

Encoder connection to the frequency converter
24 V incremental encoder. Maximum cable length is 5 m (16.4 ft).

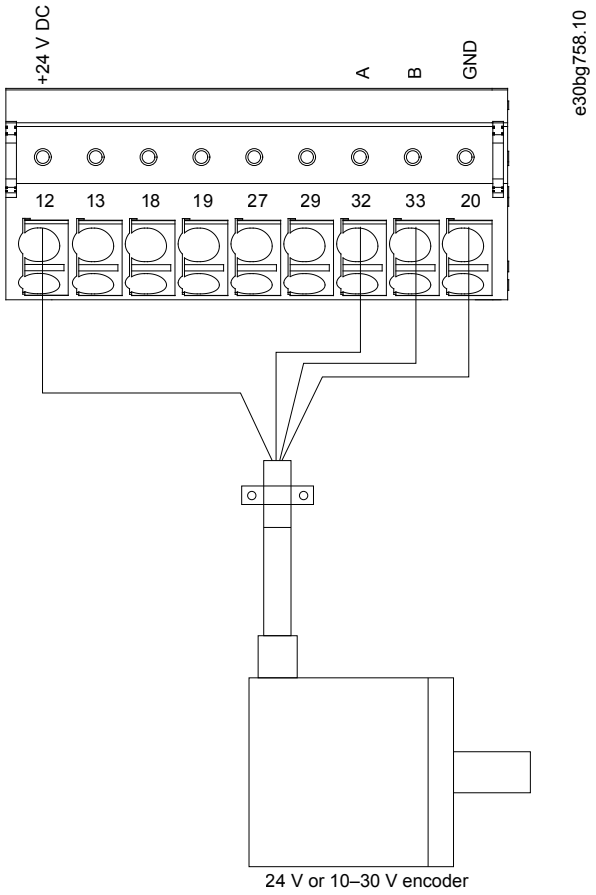

Illustration 4.30 Encoder Connection

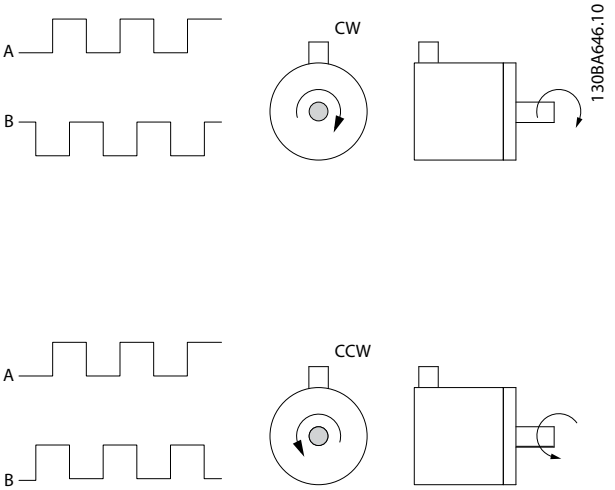

Illustration 4.31 Encoder Rotation Direction

5-70 Term 32/33 Pulses Per Revolution		
Range:		**Function:**
1024*	[1 - 4096]	Set the encoder pulses per revolution on the motor shaft. Read the correct value from the encoder.

5-71 Term 32/33 Encoder Direction		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** Change the detected encoder rotation direction without changing the wiring to the encoder.
[0] *	Clockwise	Sets channel A 90° (electrical degrees) behind channel B upon clockwise rotation of the encoder shaft.
[1]	Counter clockwise	Sets channel A 90° (electrical degrees) ahead of channel B upon clockwise rotation of the encoder shaft.

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4.6.6 5-9* Bus-controlled

This parameter group selects digital and relay outputs via a fieldbus setting.

5-90 Digital & Relay Bus Control		
Range:		**Function:**
0*	[0 - 2147483647]	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.

Bit 0	Digital output terminal 27
Bit 1	Digital output terminal 29
Bit 2	Digital output terminal X 30/6
Bit 3	Digital output terminal X 30/7
Bit 4	Relay 1 output terminal
Bit 5	Relay 2 output terminal
Bit 6	Option B relay 1 output terminal
Bit 7	Option B relay 2 output terminal
Bit 8	Option B relay 3 output terminal
Bit 9–15	Reserved for future terminals
Bit 16	Option C relay 1 output terminal
Bit 17	Option C relay 2 output terminal
Bit 18	Option C relay 3 output terminal
Bit 19	Option C relay 4 output terminal
Bit 20	Option C relay 5 output terminal
Bit 21	Option C relay 6 output terminal
Bit 22	Option C relay 7 output terminal
Bit 23	Option C relay 8 output terminal
Bit 24–31	Reserved for future terminals

Table 4.14 Bus-controlled Digital Outputs and Relays

5-93 Pulse Out #27 Bus Control		
Range:		**Function:**
0 %*	[0 - 100 %]	Set the output frequency transferred to output terminal 27 when the terminal is configured as *[45] Bus Controlled* in *parameter 5-60 Terminal 27 Pulse Output Variable*.

5-94 Pulse Out #27 Timeout Preset		
Range:		**Function:**
0 %*	[0 - 100 %]	Set the output frequency transferred to output terminal 27 when the terminal is configured as *[48] Bus Ctrl Timeout* in *parameter 5-60 Terminal 27 Pulse Output Variable* and a timeout is detected.

5-95 Pulse Out #29 Bus Control		
Range:		**Function:**
0 %*	[0 - 100 %]	Set the output frequency transferred to output terminal 29 when the terminal is configured as *[45] Bus Controlled* in *parameter 5-63 Terminal 29 Pulse Output Variable*.

5-96 Pulse Out #29 Timeout Preset		
Range:		**Function:**
0 %*	[0 - 100 %]	Set the output frequency transferred to output terminal 29 when the terminal is configured as *[48] Bus Ctrl Timeout* in *parameter 5-63 Terminal 29 Pulse Output Variable* and a timeout is detected.

5-97 Pulse Out #X30/6 Bus Control		
Range:		**Function:**
0 %*	[0 - 100 %]	Set the output frequency transferred to output terminal X30/6 when the terminal is configured as *[45] Bus ctrl.* in *parameter 5-66 Terminal X30/6 Pulse Output Variable*.

5-98 Pulse Out #X30/6 Timeout Preset		
Range:		**Function:**
0 %*	[0 - 100 %]	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.

4.7 Parameters: 6-** Analog In/Out

4.7.1 6-0* Analog I/O Mode

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

NOTICE

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

6-00 Live Zero Timeout Time		
Range:		**Function:**
10 s*	[0 - 99 s]	Enter the live zero timeout in s. Live zero timeout time is active for analog inputs, that is terminal 53 or terminal 54, used as reference or feedback sources. If the reference signal value associated with the selected current input drops below 50% of the value set in: • *Parameter 6-10 Terminal 53 Low Voltage* • *Parameter 6-12 Terminal 53 Low Current* • *Parameter 6-20 Terminal 54 Low Voltage* • *Parameter 6-22 Terminal 54 Low Current* for a time period longer than the time set in *parameter 6-00 Live Zero Timeout Time*, the function selected in *parameter 6-01 Live Zero Timeout Function* is activated.

6-01 Live Zero Timeout Function		
Option:		**Function:**
		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 frequency converter prioritizes the timeout functions as follows: 1. *Parameter 6-01 Live Zero Timeout Function.* 2. *Parameter 8-04 Control Word Timeout Function.*
[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.

4.7.2 6-1* Analog Input 1

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

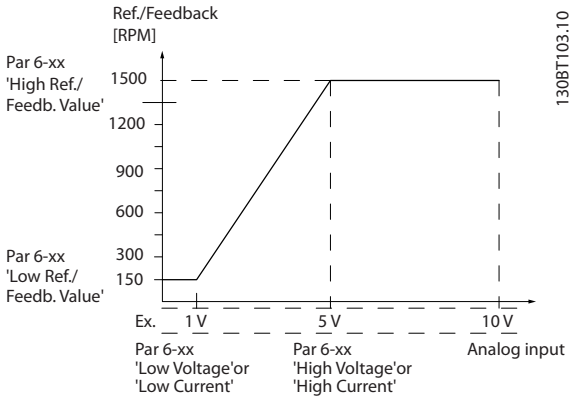

Illustration 4.32 Analog Input 1

6-10 Terminal 53 Low Voltage		
Range:		**Function:**
0.07 V*	[0 - par. 6-11 V]	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*.

4

6-11 Terminal 53 High Voltage		
Range:		**Function:**
10 V*	[par. 6-10 - 10 V]	Enter the high voltage value. This analog input scaling value should correspond to the high reference feedback value set in *parameter 6-15 Terminal 53 High Ref./Feedb. Value*.

6-12 Terminal 53 Low Current		
Range:		**Function:**
0.14 mA*	[0 - par. 6-13 mA]	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 in order to activate the live zero timeout function in *parameter 6-01 Live Zero Timeout Function*.

6-13 Terminal 53 High Current		
Range:		**Function:**
20 mA*	[par. 6-12 - 20 mA]	Enter the high current value corresponding to the high reference/feedback set in *parameter 6-15 Terminal 53 High Ref./Feedb. Value*.

6-14 Terminal 53 Low Ref./Feedb. Value		
Range:		**Function:**
0 ReferenceFeedbackUnit*	[-999999.999 - 999999.999 ReferenceFeedbackUnit]	Enter the analog input scaling value that corresponds to the low voltage/low current set in *parameter 6-10 Terminal 53 Low Voltage* and *parameter 6-12 Terminal 53 Low Current*.

6-15 Terminal 53 High Ref./Feedb. Value		
Range:		**Function:**
Size related*	[-999999.999 - 999999.999 ReferenceFeedbackUnit]	Enter the analog input scaling value that corresponds to the maximum reference feedback value set in *parameter 6-11 Terminal 53 High Voltage* and *parameter 6-13 Terminal 53 High Current*.

6-16 Terminal 53 Filter Time Constant		
Range:		**Function:**
0.01 s*	[0.01 - 10 s]	***NOTICE*** **This parameter cannot be adjusted while the motor is running.**

6-16 Terminal 53 Filter Time Constant		
Range:		**Function:**
		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.

4.7.3 6-2* Analog Input 2

Parameters for configuring the scaling and limits for analog input 2 (terminal 54).

6-20 Terminal 54 Low Voltage		
Range:		**Function:**
0.07 V*	[0 - par. 6-21 V]	Enter the low voltage value. This analog input scaling value should correspond to the minimum reference value set in *parameter 3-02 Minimum Reference*. See also *chapter 4.4 Parameters: 3-** Reference/Ramps*.

6-21 Terminal 54 High Voltage		
Range:		**Function:**
10 V*	[par. 6-20 - 10 V]	Enter the high voltage value. This analog input scaling value should correspond to the high reference feedback value set in *parameter 6-25 Terminal 54 High Ref./Feedb. Value*.

6-22 Terminal 54 Low Current		
Range:		**Function:**
Size related*	[0 - par. 6-23 mA]	Enter the low current value. This reference signal should correspond to the minimum reference value, set in *parameter 3-02 Minimum Reference*. Enter the value that exceeds 2 mA to activate the live zero timeout function in *parameter 6-01 Live Zero Timeout Function*.

6-23 Terminal 54 High Current		
Range:		**Function:**
20 mA*	[par. 6-22 - 20 mA]	Enter the high current value corresponding to the high reference feedback value set in *parameter 6-25 Terminal 54 High Ref./Feedb. Value*.

6-24 Terminal 54 Low Ref./Feedb. Value		
Range:		**Function:**
0*	[-999999.999 - 999999.999]	Enter the analog input scaling value that corresponds to the minimum reference feedback value set in *parameter 3-02 Minimum Reference*.

6-25 Terminal 54 High Ref./Feedb. Value		
Range:		**Function:**
Size related*	[-999999.999 - 999999.999]	Enter the analog input scaling value that corresponds to the maximum reference feedback value set in *parameter 3-03 Maximum Reference*.

6-26 Terminal 54 Filter Time Constant		
Range:		**Function:**
0.01 s*	[0.01 - 10 s]	***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.

4.7.4 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.

6-30 Terminal X30/11 Low Voltage		
Range:		**Function:**
0.07 V*	[0 - par. 6-31 V]	Sets the analog input scaling value to correspond to the low reference feedback value (set in *parameter 6-34 Term. X30/11 Low Ref./Feedb. Value*).

6-31 Terminal X30/11 High Voltage		
Range:		**Function:**
10 V*	[par. 6-30 - 10 V]	Sets the analog input scaling value to correspond to the high reference feedback value (set in *parameter 6-35 Term. X30/11 High Ref./Feedb. Value*).

6-34 Term. X30/11 Low Ref./Feedb. Value		
Range:		**Function:**
0*	[-999999.999 - 999999.999]	Sets the analog input scaling value to correspond to the low voltage value (set in *parameter 6-30 Terminal X30/11 Low Voltage*).

6-35 Term. X30/11 High Ref./Feedb. Value		
Range:		**Function:**
Size related*	[-999999.999 - 999999.999]	Sets the analog input scaling value to correspond to the high-voltage value (set in *parameter 6-31 Terminal X30/11 High Voltage*).

6-36 Term. X30/11 Filter Time Constant		
Range:		**Function:**
0.005 s*	[0.005 - 10 s]	***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 X30/11. A high value improves dampening but also increases the delay through the filter.

4.7.5 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.

6-40 Terminal X30/12 Low Voltage		
Range:		**Function:**
0.07 V*	[0 - par. 6-41 V]	Sets the analog input scaling value to correspond to the low reference feedback value set in *parameter 6-44 Term. X30/12 Low Ref./Feedb. Value*.

6-41 Terminal X30/12 High Voltage		
Range:		**Function:**
10 V*	[par. 6-40 - 10 V]	Sets the analog input scaling value to correspond to the high reference feedback value set in *parameter 6-45 Term. X30/12 High Ref./Feedb. Value*.

6-44 Term. X30/12 Low Ref./Feedb. Value		
Range:		**Function:**
0*	[-999999.999 - 999999.999]	Sets the analog output scaling value to correspond to the low voltage value set in *parameter 6-40 Terminal X30/12 Low Voltage*.

6-45 Term. X30/12 High Ref./Feedb. Value		
Range:		**Function:**
Size related*	[-999999.999 - 999999.999]	Sets the analog input scaling value to correspond to the high voltage value set in *parameter 6-41 Terminal X30/12 High Voltage*.

6-46 Term. X30/12 Filter Time Constant		
Range:		**Function:**
0.005 s*	[0.005 - 10 s]	***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 X30/12. A high value improves dampening but also increases the delay through the filter.

4.7.6 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: 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. Resolution on analog output is 12 bit.

6-50 Terminal 42 Output		
Option:		**Function:**
		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]*.
[0]	No operation	Indicates no signal on the analog output.
[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	

6-50 Terminal 42 Output		
Option:		**Function:**
[103]	Motor Current	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. Example: Inverter normal current (11 kW) is 24 A. 160 %=38.4 A. Motor normal current is 22 A, the readout is 11.46 mA. $\frac{20\ mA\ x\ 22\ A}{38.4\ A} = 11.46\ mA$ In case the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{VLT_{Max}}\ x\ 100}{I_{Motor_{Norm}}} = \frac{38.4\ x\ 100}{22} = 175\ \%$
[104]	Torque rel to limit	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[105]	Torq relate to rated	The torque is related to the motor torque setting.
[106]	Power	Taken from *parameter 1-20 Motor Power [kW]*.
[107]	Speed	Taken from *parameter 3-03 Maximum Reference*. 20 mA equals the value in *parameter 3-03 Maximum Reference*.
[109]	Max Out Freq	0 Hz = 0 mA, *parameter 4-19 Max Output Frequency* = 20 mA.
[113]	Ext. Closed Loop 1	
[130]	Output freq. 4-20mA	0 Hz = 4 mA, 100 Hz = 20 mA.
[131]	Reference 4-20mA	*Parameter 3-00 Reference Range* [Min-Max] 0% = 4 mA; 100% = 20 mA *Parameter 3-00 Reference Range* [-Max-Max] -100% = 4 mA; 0% = 12 mA; +100% = 20 mA.
[132]	Feedback 4-20mA	
[133]	Motor cur. 4-20mA	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. Example: Inverter normal current (11 kW) is 24 A. 160% = 38.4 A. Motor normal current is 22 A, the readout is 11.46 mA. $\frac{16\ mA\ x\ 22\ A}{38.4\ A} + 4\ mA = 13.17\ mA$ In case the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{VLT_{Max}}\ x\ 100}{I_{Motor_{Norm}}} = \frac{38.4\ x\ 100}{22} = 175\ \%$
[134]	Torq.% lim 4-20 mA	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[135]	Torq.% nom 4-20mA	The torque setting is related to the motor torque setting.
[136]	Power 4-20mA	Taken from *parameter 1-20 Motor Power [kW]*.

6-50 Terminal 42 Output

Option:		Function:
[137]	Speed 4-20mA	Taken from *parameter 3-03 Maximum Reference*. 20 mA = value in *parameter 3-03 Maximum Reference*.
[139]	Bus ctrl. 0-20 mA	An output value set from fieldbus process data. The output works independently of internal functions in the frequency converter.
[140]	Bus ctrl. 4-20 mA	An output value set from fieldbus process data. The output works independently of internal functions in the frequency converter.
[143]	Ext. CL 1 4-20mA	
[150]	Max Out Fr 4-20mA	0 Hz = 0 mA, *parameter 4-19 Max Output Frequency* = 20 mA.
[254]	DC Link 0-20mA	
[255]	DC Link 4-20mA	Enable the function of outputting the DC-link voltage on analog outputs. It scales the output according to the maximum and minimum voltage of the current drive size.

6-51 Terminal 42 Output Min Scale

Range:		Function:
0 %*	[0 - 200 %]	Scale for the minimum output (0 mA or 4 mA) of the analog signal at terminal 42. Set the value to be the percentage of the full range of the variable selected in *parameter 6-50 Terminal 42 Output*.

6-52 Terminal 42 Output Max Scale

Range:		Function:
100 %*	[0 - 200 %]	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:

$20\ mA / desired\ maximum\ current\ x\ 100\ \%$

$i.e.\ 10\ mA : \frac{20}{10} x\ 100\ =\ 200\ \%$

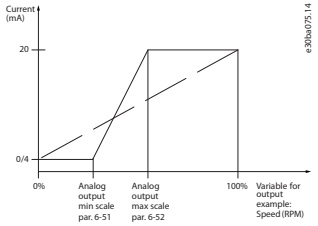

Illustration 4.33 Output Max. Scale

6-53 Terminal 42 Output Bus Control

Range:		Function:
0 %*	[0 - 100 %]	Holds the level of output 42 if controlled by bus.

6-54 Terminal 42 Output Timeout Preset

Range:		Function:
0 %*	[0 - 100 %]	Holds the preset level of output 42. If a timeout function is selected in *parameter 6-50 Terminal 42 Output*, the output is preset to this level if a fieldbus timeout occurs.

6-55 Analog Output Filter

Option:		Function:
		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:
[0] *	Off	Filter off.
[1]	On	Filter on.

Selection	0–20 mA	4–20 mA
Motor current (0–I_{max})	[103]	[133]
Torque limit (0–T_{lim})	[104]	[134]
Rated torque (0–T_{nom})	[105]	[135]
Power (0–P_{nom})	[106]	[136]
Speed (0–$Speed_{max}$)	[107]	[137]

Table 4.15 Readout Parameters

4.7.7 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 connection. Resolution on analog output is 12 bit.

6-60 Terminal X30/8 Output

Option:		Function:
		Select the function of terminal X30/8 as an analog current output. Depending on the selection, the output is either a 0–20 mA or 4–20 mA output. The current value can be read out in the LCP in *parameter 16-65 Analog Output 42 [mA]*.
[0]	No operation	When no signal on the analog output is present.
[100]	Output frequency	
[101]	Reference	*Parameter 3-00 Reference Range* [Min. - Max.] 0% = 0 mA; 100% = 20 mA. *Parameter 3-00 Reference Range* [-Max. - Max.] -100% = 0 mA; 0% = 10 mA; +100% = 20 mA
[102]	Feedback	
[103]	Motor Current	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. Example: Inverter normal current (11 kW) = 24 A. 160% = 38.4 A. Motor normal current = 22 A, readout is 11.46 mA. $\frac{20\ mA\ x\ 22\ A}{38.4\ A} = 11.46\ mA$ In case the normal motor current is equal to 20 mA, the output setting of *parameter 6-62 Terminal X30/8 Max. Scale* is: $\frac{I_{VLT_{Max.}}\ x\ 100}{I_{Motor_{Norm}}} = \frac{38.4\ x\ 100}{22} = 175\ \%$
[104]	Torque rel to limit	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[105]	Torq relate to rated	The torque is related to the motor torque setting.
[106]	Power	Taken from *parameter 1-20 Motor Power [kW]*.
[107]	Speed	Taken from *parameter 3-03 Maximum Reference*. 20 mA = value in *parameter 3-03 Maximum Reference*.
[109]	Max Out Freq	In relation to *parameter 4-19 Max Output Frequency*.
[130]	Output freq. 4-20mA	0 Hz = 4 mA, 100 Hz = 20 mA.
[131]	Reference 4-20mA	*Parameter 3-00 Reference Range* [Min-Max] 0% = 4 mA; 100% = 20 mA *Parameter 3-00 Reference Range* [-Max-Max] -100% = 4 mA; 0% = 12 mA; +100% = 20 mA.
[132]	Feedback 4-20mA	

6-60 Terminal X30/8 Output

Option:		Function:
[133]	Motor cur. 4-20mA	The value is taken from *parameter 16-37 Inv. Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. Example: Inverter normal current (11 kW) is 24 A. 160% = 38.4 A. Motor normal current is 22 A, the readout is 11.46 mA. $\frac{16\ mA\ x\ 22\ A}{38.4\ A} + 4\ mA = 13.17\ mA$ In case the normal motor current is equal to 20 mA, the output setting of *parameter 6-52 Terminal 42 Output Max Scale* is: $\frac{I_{VLT_{Max}}\ x\ 100}{I_{Motor_{Norm}}} = \frac{38.4\ x\ 100}{22} = 175\ \%$
[134]	Torq.% lim 4-20 mA	The torque setting is related to the setting in *parameter 4-16 Torque Limit Motor Mode*.
[135]	Torq.% nom 4-20mA	The torque setting is related to the motor torque setting.
[136]	Power 4-20mA	Taken from *parameter 1-20 Motor Power [kW]*.
[137]	Speed 4-20mA	Taken from *parameter 3-03 Maximum Reference*. 20 mA = value in *parameter 3-03 Maximum Reference*.
[139]	Bus ctrl. 0-20 mA	An output value set from fieldbus process data. The output works independently of internal functions in the frequency converter.
[140]	Bus ctrl. 4-20 mA	An output value set from fieldbus process data. The output works independently of internal functions in the frequency converter.
[150]	Max Out Fr 4-20mA	0 Hz = 0 mA, *parameter 4-19 Max Output Frequency* = 20 mA.
[255]	DC Link 4-20mA	Enable the function of outputting the DC link voltage on analog outputs. It scales the output according to the maximum and minimum voltage of the current drive size.

6-61 Terminal X30/8 Min. Scale

Range:		Function:
0 %*	[0 - 200 %]	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 frequency converter.

6-62 Terminal X30/8 Max. Scale		
Range:		**Function:**
100 %*	[0 - 200 %]	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 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: $20\ mA\ /\ desired\ maximum\ current\ x\ 100\,\%$ $i.e.\ 10\ mA: \frac{20-4}{10} x\ 100\ =\ 160\,\%$

6-63 Terminal X30/8 Bus Control		
Range:		**Function:**
0 %*	[0 - 100 %]	Holds the level of output X30/8 if controlled by bus.

6-64 Terminal X30/8 Output Timeout Preset		
Range:		**Function:**
0 %*	[0 - 100 %]	Holds the preset level of output X30/8. If there is a fieldbus timeout and a timeout function is selected in *parameter 6-60 Terminal X30/8 Output*, the output is preset to this level.

4.8 Parameters: 7-** Controllers

NOTICE

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

7-00 Speed PID Feedback Source		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** Select the encoder for closed-loop feedback. The feedback may come from a different encoder (typically mounted on the application itself) than the motor-mounted encoder.
[1] *	24V encoder	
[2]	MCB 102	
[3]	MCB 103	
[6]	Analog Input 53	
[7]	Analog Input 54	
[8]	Frequency input 29	
[9]	Frequency input 33	

7-02 Speed PID Proportional Gain		
Range:		**Function:**
Size related*	[0 - 1]	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. Use this parameter for values with 3 decimals. For values with 4 decimals, use *parameter 3-83 Quick Stop S-ramp Ratio at Decel. Start*.

4

7-03 Speed PID Integral Time

Range:		Function:
Size related*	[1.0 - 20000 ms]	Enter the speed controller integral time, which determines the time the internal PID control takes to correct errors. The greater the error, the more quickly the gain increases. The integral time causes a delay of the signal and therefore a dampening effect and can be used to eliminate steady-state speed error. Obtain quick control through a short integral time, though if the integral time is too short, the process becomes unstable. An excessively long integral time disables the integral action, leading to major deviations from the required reference, since the process regulator takes too long to regulate errors. This parameter is used with *[0] Speed open loop* and *[1] Speed closed loop* control, set in *parameter 1-00 Configuration Mode*.

7-04 Speed PID Differentiation Time

Range:		Function:
Size related*	[0 - 200 ms]	Enter the speed controller differentiation time. The differentiator does not react to constant error. It provides gain proportional to the rate of change of the speed feedback. The quicker the error changes, the stronger the gain from the differentiator. The gain is proportional with the speed at which errors change. Setting this parameter to 0 disables the differentiator. This parameter is used with *parameter 1-00 Configuration Mode [1] Speed closed loop* control.

7-05 Speed PID Diff. Gain Limit

Range:		Function:
5*	[1 - 20]	Set a limit for the gain provided by the differentiator. Consider limiting the gain at higher frequencies. For example, set up a pure D-link at low frequencies and a constant D-link at higher frequencies. This parameter is used with *parameter 1-00 Configuration Mode [1] Speed closed loop* control.

7-06 Speed PID Lowpass Filter Time

Range:		Function:
Size related*	[0.1 - 100 ms]	***NOTICE*** **Severe filtering can be detrimental to dynamic performance.** **This parameter is used with *parameter 1-00 Configuration Mode [1] Speed closed loop*.** 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, see *Illustration 4.34*. 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:

Encoder PPR	*Parameter 7-06 Speed PID Lowpass Filter Time*
512	10 ms
1024	5 ms
2048	2 ms
4096	1 ms

Table 4.16 Speed PID Lowpass Filter Time

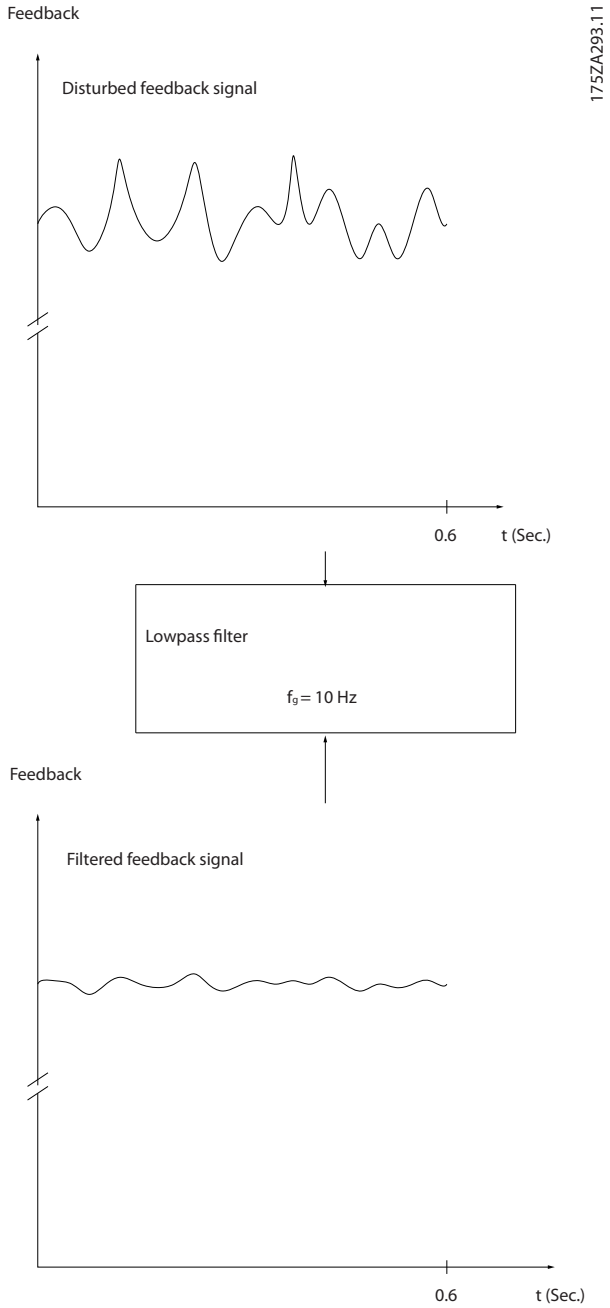

Illustration 4.34 Feedback Signal

7-07 Speed PID Feedback Gear Ratio		
Range:		**Function:**
1*	[0.0001 - 32.0000]	The frequency converter multiplies the speed feedback by this ratio.

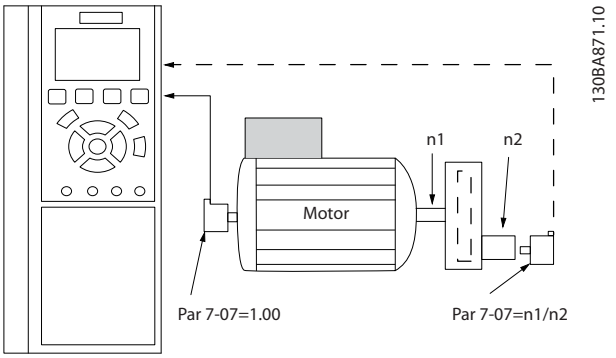

Illustration 4.35 Speed PID Feedback Gear Ratio

7-08 Speed PID Feed Forward Factor		
Range:		**Function:**
0 %*	[0 - 500 %]	The reference signal bypasses the speed controller by the amount specified. This feature increases the dynamic performance of the speed control loop.

4.8.1 7-1* Torque PI Control

Parameters for configuring the torque PI control.

7-12 Torque PI Proportional Gain		
Range:		**Function:**
100 %*	[0 - 500 %]	Enter the proportional gain value for the torque controller. Selection of a high value makes the controller react faster. Too high a setting leads to controller instability.

7-13 Torque PI Integration Time		
Range:		**Function:**
0.020 s*	[0.002 - 2 s]	Enter the integration time for the torque controller. Selection of a low value makes the controller react faster. Too low a setting leads to controller instability.

4

4.8.2 7-2* Process Ctrl. Feedb.

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

7-20 Process CL Feedback 1 Resource		
Option:		**Function:**
		The effective feedback signal is made up of the sum of up to 2 different input signals. Select which frequency converter input should be treated as the source of the 1st of these signals. The 2nd input signal is defined in *parameter 7-22 Process CL Feedback 2 Resource*.
[0] *	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[3]	Frequency input 29	
[4]	Frequency input 33	
[7]	Analog Input X30/11	
[8]	Analog Input X30/12	

7-22 Process CL Feedback 2 Resource		
Option:		**Function:**
		The effective feedback signal is made up of the sum of up to 2 different input signals. Select which frequency converter input should be treated as the source of the 2nd of these signals. The 1st input signal is defined in *parameter 7-20 Process CL Feedback 1 Resource*.
[0] *	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[3]	Frequency input 29	
[4]	Frequency input 33	
[7]	Analog Input X30/11	
[8]	Analog Input X30/12	

4.8.3 7-3* Process PID Ctrl.

7-30 Process PID Normal/ Inverse Control		
Option:		**Function:**
		Normal and inverse controls are implemented by introducing a difference between the reference signal and the feedback signal.
[0] *	Normal	Set process control to increase the output frequency.
[1]	Inverse	Set process control to decrease the output frequency.

7-31 Process PID Anti Windup		
Option:		**Function:**
[0]	Off	Continue regulation of an error even when the output frequency cannot be increased or decreased.
[1] *	On	Cease regulation of an error when the output frequency can no longer be adjusted.

7-32 Process PID Start Speed		
Range:		**Function:**
0 RPM*	[0 - 6000 RPM]	Enter the motor speed to be attained as a start signal for commencement of PID control. When the power is switched on, the frequency converter starts to ramp and then operates under speed open-loop control. When the process PID start speed is reached, the frequency converter changes to process PID control.

7-33 Process PID Proportional Gain		
Range:		**Function:**
0.01*	[0 - 10]	Enter the PID proportional gain. The proportional gain multiplies the error between the setpoint and the feedback signal.

7-34 Process PID Integral Time		
Range:		**Function:**
10000 s*	[0.01 - 10000 s]	Enter the PID integral time. The integrator provides an increasing gain at a constant error between the setpoint and the feedback signal. The integral time is the time needed by the integrator to reach the same gain as the proportional gain.

7-35 Process PID Differentiation Time		
Range:		**Function:**
0 s*	[0 - 10 s]	Enter the PID differentiation time. The differentiator does not react to a constant error, but provides a gain only when the error changes. The shorter the PID differentiation time, the stronger the gain from the differentiator.

7-36 Process PID Diff. Gain Limit		
Range:		**Function:**
5*	[1 - 50]	Enter a limit for the differentiator gain. If there is no limit, the differentiator gain increases when there are fast changes. To obtain a pure differentiator gain at slow changes and a constant differentiator gain where fast changes occur, limit the differentiator gain.

7-38 Process PID Feed Forward Factor		
Range:		**Function:**
0 %*	[0 - 200 %]	Enter the PID feed forward factor. The factor sends a constant fraction of the reference signal to bypass the PID control, so the PID control only affects the remaining fraction of the control signal. Any change to this parameter affects the motor speed. When the feed forward factor is activated, it provides less overshoot and high dynamics when changing the setpoint. *Parameter 7-38 Process PID Feed Forward Factor* is active when *parameter 1-00 Configuration Mode* is set to *[3] Process*.

7-39 On Reference Bandwidth		
Range:		**Function:**
5 %*	[0 - 200 %]	Enter the on-reference bandwidth. When the PID control error (the difference between the reference and the feedback) is less than the value of this parameter, the on-reference status bit is 1.

4.8.4 7-4* Advanced Process PID Ctrl.

This parameter group is only used if *parameter 1-00 Configuration Mode* is set to *[7] Extended PID speed CL*.

7-40 Process PID I-part Reset		
Option:		**Function:**
[0] *	No	
[1]	Yes	Select *[1] Yes* to reset the I-part of the process PID controller. The selection automatically returns to *[0] No*. Resetting the I-part makes it possible to start from a well-defined point after changing something in the process, for example changing a textile roll.

7-41 Process PID Output Neg. Clamp		
Range:		**Function:**
-100 %*	[-100 - par. 7-42 %]	Enter a negative limit for the process PID controller output.

7-42 Process PID Output Pos. Clamp		
Range:		**Function:**
100 %*	[par. 7-41 - 100 %]	Enter a positive limit for the process PID controller output.

7-43 Process PID Gain Scale at Min. Ref.		
Range:		**Function:**
100 %*	[0 - 100 %]	Enter a scaling percentage to apply to the process PID output when operating at the minimum reference. The scaling percentage is adjusted linearly between the scale at minimum reference (*parameter 7-43 Process PID Gain Scale at Min. Ref.*) and the scale at maximum reference (*parameter 7-44 Process PID Gain Scale at Max. Ref.*).

7-44 Process PID Gain Scale at Max. Ref.		
Range:		**Function:**
100 %*	[0 - 100 %]	Enter a scaling percentage to apply to the process PID output when operating at the maximum reference. The scaling percentage is adjusted linearly between the scale at minimum reference (*parameter 7-43 Process PID Gain Scale at Min. Ref.*) and the scale at maximum reference (*parameter 7-44 Process PID Gain Scale at Max. Ref.*).

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7-45 Process PID Feed Fwd Resource		
Option:		**Function:**
[0] *	No function	Select which frequency converter input should be used as the feed-forward factor. The factor is added to the output of the PID controller. This increases dynamic performance.
[1]	Analog Input 53	
[2]	Analog Input 54	
[7]	Frequency input 29	
[8]	Frequency input 33	
[11]	Local bus reference	
[32]	Bus PCD	Selects a fieldbus reference configured by *parameter 8-02 Control Word Source*. Change *parameter 8-42 PCD Write Configuration* for the bus used to make the feed forward available in *parameter 7-48 PCD Feed Forward*. Use index 1 for feed forward [748] (and index 2 for reference [1682]).

7-46 Process PID Feed Fwd Normal/ Inv. Ctrl.		
Option:		**Function:**
[0] *	Normal	Select *[0] Normal* to set the feed-forward factor to treat the FF resource as a positive value.
[1]	Inverse	Select *[1] Inverse* to treat the feed-forward resource as a negative value.

7-48 PCD Feed Forward		
Range:		**Function:**
0*	[0 - 65535]	This parameter contains the value of *parameter 7-45 Process PID Feed Fwd Resource [32] Bus PCD*.

7-49 Process PID Output Normal/ Inv. Ctrl.		
Option:		**Function:**
[0] *	Normal	Select *[0] Normal* to use the resulting output from the process PID controller as is.
[1]	Inverse	Select *[1] Inverse* to invert the resulting output from the process PID controller. This operation is performed after the feed-forward factor is applied.

4.8.5 7-5* Ext. Process PID Ctrl.

This parameter group is only used if *parameter 1-00 Configuration Mode* is set to *[7] Extended PID speed CL*.

7-50 Process PID Extended PID		
Option:		**Function:**
[0]	Disabled	Disable the extended parts of the process PID controller.
[1] *	Enabled	Enable the extended parts of the PID controller.

7-51 Process PID Feed Fwd Gain		
Range:		**Function:**
1*	[0 - 100]	The feed forward is used to obtain the required level based on a well-known signal available. The PID controller then only takes care of the smaller part of the control, necessary because of unknown characters. The standard feed-forward factor in *parameter 7-38 Process PID Feed Forward Factor* is always related to the reference, whereas *parameter 7-51 Process PID Feed Fwd Gain* has more options. In winder applications, the feed-forward factor is typically the line speed of the system.

7-52 Process PID Feed Fwd Ramp up		
Range:		**Function:**
0.01 s*	[0.01 - 10 s]	Controls the dynamics of the feed-forward signal when ramping up.

7-53 Process PID Feed Fwd Ramp down		
Range:		**Function:**
0.01 s*	[0.01 - 10 s]	Controls the dynamics of the feed-forward signal when ramping down.

7-56 Process PID Ref. Filter Time		
Range:		**Function:**
0.001 s*	[0.001 - 1 s]	Set a time constant for the reference first-order low-pass filter. The low-pass filter improves steady-state performance and dampens oscillations on the reference/ feedback signals. However, severe filtering can be detrimental to dynamic performance.

7-57 Process PID Fb. Filter Time		
Range:		**Function:**
0.001 s*	[0.001 - 1 s]	Set a time constant for the feedback first-order low-pass filter. The low-pass filter improves steady-state performance and dampens oscillations on the reference/ feedback signals. However, severe filtering can be detrimental to dynamic performance.

7-60 Feedback 1 Conversion		
Select a conversion for the feedback 1 signal. Select *[0] Linear* to leave the feedback signal unchanged.		
Option:		**Function:**
[0] *	Linear	
[1]	Square root	

7-62 Feedback 2 Conversion		
Select a conversion for the feedback 2 signal. Select *[0] Linear* to leave the feedback signal unchanged.		
Option:		**Function:**
[0] *	Linear	
[1]	Square root	

4.9 Parameters: 8-** Communications and Options

4.9.1 8-0* General Settings

8-01 Control Site		
The setting in this parameter overrides the settings in *parameter 8-50 Coasting Select* to *parameter 8-56 Preset Reference Select*.		
Option:		**Function:**
[0]	Digital and ctrl.word	Use both digital input and control word.
[1]	Digital only	Use digital inputs only.
[2]	Controlword only	Use control word only.

8-02 Control Word Source		
Select the source of the control word: 1 of 2 serial interfaces or 4 installed options. During initial power-up, the frequency converter 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 frequency converter detects a configuration change, sets *parameter 8-02 Control Word Source* to default setting *[1] FC RS485*, and trips. If an option is installed after initial power-up, the setting of *parameter 8-02 Control Word Source* does not change, but the frequency converter trips and shows: *Alarm 67, Option Changed*. When retrofitting a bus option into a frequency converter 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:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.**
[0]	None	
[1]	FC RS485	
[2]	FC USB	
[3]	Option A	
[30]	External Can	

8-03 Control Word Timeout Time		
Range:		**Function:**
1 s*	[0.1 - 18000.0 s]	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.

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8-04 Control Word Timeout Function

Select the timeout function. The timeout function activates when the control word fails to be updated within the time period specified in *parameter 8-03 Control Word Timeout Time*.

Option:		Function:
		NOTICE **To change the set-up after a timeout, configure as follows:** **1. Set *parameter 0-10 Active Set-up* to *[9] Multi set-up*.** **2. Select the relevant link in *parameter 0-12 This Set-up Linked to*.**
[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 frequency converter to restart: • Via the fieldbus. • Via [Reset]. • Via a digital input.
[7]	Select setup 1	Changes the set-up after a control word timeout. If communication resumes after a timeout, *parameter 8-05 End-of-Timeout Function* either resumes the set-up used before the timeout, or retains the set-up endorsed by the timeout function.
[8]	Select setup 2	See *[7] Select set-up 1*.
[9]	Select setup 3	See *[7] Select set-up 1*.
[10]	Select setup 4	See *[7] Select set-up 1*.

8-05 End-of-Timeout Function

Select the action after receiving a valid control word following a timeout.

This parameter is active only when *parameter 8-04 Control Timeout Function* is set to:

- *[7] Set-up 1*.
- *[8] Set-up 2*.
- *[9] Set-up 3*.
- *[10] Set-up 4*.

Option:		Function:
[0]	Hold set-up	Retains the set-up selected in *parameter 8-04 Control Timeout Function* and shows a warning until *parameter 8-06 Reset Control Timeout* toggles. Then the frequency converter resumes its original set-up.
[1] *	Resume set-up	Resumes the set-up that was active before the timeout.

8-06 Reset Control Word Timeout

This parameter is active only when *[0] Hold set-up* has been selected in *parameter 8-05 End-of-Timeout Function*.

Option:		Function:
[0] *	Do not reset	Retains the set-up specified in *parameter 8-04 Control Word Timeout Function*, following a control word timeout.
[1]	Do reset	Restores the frequency converter to the original set-up following a control word timeout. The frequency converter performs the reset and then immediately reverts to the *[0] Do not reset* setting.

8-07 Diagnosis Trigger

This parameter has no function for DeviceNet.

Option:		Function:
[0] *	Disable	
[1]	Trigger on alarms	
[2]	Trigger alarm/ warn.	

8-08 Readout Filtering

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:		Function:
[0]	Motor Data Std-Filt.	Normal fieldbus readouts.

8-08 Readout Filtering

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:		Function:
[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.*

4.9.2 8-1* Ctrl. Word Settings

8-10 Control Word Profile

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 *design guide*.
For more guidelines in the selection of *[1] PROFIdrive profile*, refer to the *installation guide* for the installed fieldbus.

Option:		Function:
[0] *	FC profile	
[1]	PROFIdrive profile	

8-13 Configurable Status Word STW

This is an array parameter with 16 elements, 1 element for each bit in range 0–15. Elements 5 and 11–15 are configurable. Each of the bits can be configured to any of the following options.

Option:		Function:
[0]	No function	The input is always low.
[1] *	Profile Default	Depending on the profile set in *parameter 8-10 Control Profile*.
[2]	Alarm 68 Only	The input goes high whenever *alarm 68, Safe Torque Off activated* is active and goes low whenever *alarm 68, Safe Torque Off activated* is not active.
[3]	Trip excl Alarm 68	
[10]	T18 DI status	
[11]	T19 DI status	
[12]	T27 DI status	
[13]	T29 DI status	
[14]	T32 DI status	
[15]	T33 DI status	
[21]	Thermal warning	
[40]	Out of ref range	
[49]	Derate active	
[60]	Comparator 0	
[61]	Comparator 1	
[62]	Comparator 2	
[63]	Comparator 3	
[64]	Comparator 4	
[65]	Comparator 5	
[70]	Logic Rule 0	
[71]	Logic Rule 1	
[72]	Logic Rule 2	
[73]	Logic Rule 3	
[74]	Logic Rule 4	
[75]	Logic Rule 5	
[80]	SL digital out A	
[81]	SL digital out B	
[82]	SL digital out C	
[83]	SL digital out D	
[84]	SL digital out E	
[85]	SL digital out F	
[92]	IGBT-cooling	See *parameter group 5-3* Digital Outputs*.
[193]	Sleep Mode	
[194]	Broken Belt	

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8-14 Configurable Control Word CTW

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:		Function:
		This parameter is not valid in software versions before 4.93.
[0]	None	The frequency converter ignores the information in this bit.
[1] *	Profile default	The functionality of the bit depends on the selection in *parameter 8-10 Control Word Profile*.
[2]	CTW Valid, active low	If set to 1, the frequency converter ignores the remaining bits of the control word.
[4]	PID error inverse	Inverts the resulting error from the process PID controller. Available only if *parameter 1-00 Configuration Mode* is set to *[7] Extended PID Speed OL*.
[5]	PID reset I part	Resets the I-part of the process PID controller. Equivalent to *parameter 7-40 Process PID I-part Reset*. Available only if *parameter 1-00 Configuration Mode* is set to *[7] Extended PID Speed OL*.
[6]	PID enable	Enables the extended process PID controller. Equivalent to *parameter 7-50 Process PID Extended PID*. Available only if *parameter 1-00 Configuration Mode* is set to *[7] Extended PID Speed OL*.
[7]	External Interlock	
[66]	Sleep Mode	

8-19 Product Code

Range:		Function:
Size related*	[0 - 2147483647]	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.

4.9.3 8-3* FC Port Settings

8-30 Protocol

Option:		Function:
		Select the protocol to be used. Changing protocol is not effective until after powering off the frequency converter.
[0] *	FC	
[1]	FC MC	
[2]	Modbus RTU	

8-31 Address

Range:		Function:
1*	[1 - 247]	Enter the address for the frequency converter (standard) port. Valid range: Depends on selected protocol.

8-32 FC Port Baud Rate

Option:		Function:
[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	

8-33 Parity / Stop Bits

Option:		Function:
[0] *	Even Parity, 1 Stop Bit	
[1]	Odd Parity, 1 Stop Bit	
[2]	No Parity, 1 Stop Bit	
[3]	No Parity, 2 Stop Bits	

8-34 Estimated cycle time

Range:		Function:
0 ms*	[0 - 1000000 ms]	In noisy environments, the interface may be blocked due to overload or bad frames. This parameter specifies the time between 2 consecutive frames on the network. If the interface does not detect valid frames in that time, it flushes the receive buffer.

8-35 Minimum Response Delay

Range:		Function:
10 ms*	[1 - 10000 ms]	Specify the minimum delay time between receiving a request and transmitting a response. This is used for overcoming modem turnaround delays.

8-36 Max Response Delay		
Range:		**Function:**
Size related*	[11 - 10001 ms]	Specify the maximum allowed delay time between transmitting a request and receiving a response. If a response from the frequency converter is exceeding the time setting, then it is discarded.

8-37 Max Inter-Char Delay		
Range:		**Function:**
Size related*	[0.00 - 35.00 ms]	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.

4.9.4 8-4* FC MC Protocol Set

8-40 Telegram Selection		
Option:		**Function:**
[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.
[202]	Custom telegram 3	

8-41 Parameters for Signals		
Option:		**Function:**
[0] *	None	This parameter contains a list of signals available for selection in *parameter 8-42 PCD Write Configuration* and *parameter 8-43 PCD Read Configuration*.
[302]	Minimum Reference	
[303]	Maximum Reference	
[312]	Catch up/slow Down Value	

8-41 Parameters for Signals		
Option:		**Function:**
[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	
[597]	Pulse Out #X30/6 Bus Control	
[615]	Terminal 53 High Ref./ Feedb. Value	
[625]	Terminal 54 High Ref./ Feedb. Value	
[653]	Term 42 Output Bus Ctrl	

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8-41 Parameters for Signals		
Option:		**Function:**
[663]	Terminal X30/8 Bus Control	
[748]	PCD Feed Forward	
[890]	Bus Jog 1 Speed	
[891]	Bus Jog 2 Speed	
[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	
[1620]	Motor Angle	
[1621]	Torque [%] High Res.	
[1622]	Torque [%]	
[1624]	Calibrated Stator Resistance	
[1630]	DC Link Voltage	
[1634]	Heatsink Temp.	
[1635]	Inverter Thermal	
[1638]	SL Controller State	
[1639]	Control Card Temp.	
[1645]	Motor Phase U Current	
[1646]	Motor Phase V Current	

8-41 Parameters for Signals		
Option:		**Function:**
[1647]	Motor Phase W Current	
[1648]	Speed Ref. After Ramp [RPM]	
[1650]	External Reference	
[1651]	Pulse Reference	
[1652]	Feedback[Unit]	
[1653]	Digi Pot Reference	
[1657]	Feedback [RPM]	
[1660]	Digital Input	
[1661]	Terminal 53 Switch Setting	
[1662]	Analog Input 53	
[1663]	Terminal 54 Switch Setting	
[1664]	Analog Input 54	
[1665]	Analog Output 42 [mA]	
[1666]	Digital Output [bin]	
[1667]	Freq. Input #29 [Hz]	
[1668]	Freq. Input #33 [Hz]	
[1669]	Pulse Output #27 [Hz]	
[1670]	Pulse Output #29 [Hz]	
[1671]	Relay Output [bin]	
[1672]	Counter A	
[1673]	Counter B	
[1675]	Analog In X30/11	
[1676]	Analog In X30/12	
[1677]	Analog Out X30/8 [mA]	
[1680]	Fieldbus CTW 1	
[1682]	Fieldbus REF 1	
[1684]	Comm. Option STW	
[1685]	FC Port CTW 1	
[1686]	FC Port REF 1	

8-41 Parameters for Signals		
Option:		**Function:**
[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	

8-42 PCD Write Configuration		
Range:		**Function:**
[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	

8-42 PCD Write Configuration		
Range:		**Function:**
[558]	Term. 33 High Ref./Feedb. Value	
[590]	Digital & Relay Bus Control	
[593]	Pulse Out #27 Bus Control	
[595]	Pulse Out #29 Bus Control	
[597]	Pulse Out #X30/6 Bus Control	
[615]	Terminal 53 High Ref./ Feedb. Value	
[625]	Terminal 54 High Ref./ Feedb. Value	
[653]	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	
[2013]	Minimum Reference/ Feedb.	
[2014]	Maximum Reference/ Feedb.	
[2021]	Setpoint 1	
[2022]	Setpoint 2	
[2023]	Setpoint 3	

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8-42 PCD Write Configuration		
Range:		**Function:**
[2643]	Terminal X42/7 Bus Control	
[2653]	Terminal X42/9 Bus Control	
[2663]	Terminal X42/11 Bus Control	
[3401]	PCD 1 Write to MCO	
[3402]	PCD 2 Write to MCO	
[3403]	PCD 3 Write to MCO	
[3404]	PCD 4 Write to MCO	
[3405]	PCD 5 Write to MCO	
[3406]	PCD 6 Write to MCO	
[3407]	PCD 7 Write to MCO	
[3408]	PCD 8 Write to MCO	
[3409]	PCD 9 Write to MCO	
[3410]	PCD 10 Write to MCO	
[3644]	Terminal X49/7 Bus Control	
[3654]	Terminal X49/9 Bus Control	
[3664]	Terminal X49/11 Bus Control	

8-43 PCD Read Configuration		
Range:		**Function:**
[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	

8-43 PCD Read Configuration		
Range:		**Function:**
[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	
[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	

8-43 PCD Read Configuration		
Range:		**Function:**
[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]	Pulse Input #29 [Hz]	
[1668]	Pulse 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]	

8-43 PCD Read Configuration		
Range:		**Function:**
[1684]	Comm. Option STW	
[1685]	FC Port CTW 1	
[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	
[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]	
[1860]	Digital Input 2	
[3421]	PCD 1 Read from MCO	

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8-43 PCD Read Configuration		
Range:		**Function:**
[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	

4.9.5 8-5* Digital/Bus

Parameters for configuring the control word merging.

NOTICE

These parameters are active only when *parameter 8-01 Control Site* is set to *[0] Digital and control word*.

8-50 Coasting Select		
Select the trigger for the coasting function.		
Option:		**Function:**
[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.

8-51 Quick Stop Select		
Select the trigger for the quick stop function.		
Option:		**Function:**
[0]	Digital input	
[1]	Bus	
[2]	Logic AND	
[3] *	Logic OR	

8-52 DC Brake Select		
Select control of the DC brake via the terminals (digital input) and/or via the fieldbus.		
Option:		**Function:**
		NOTICE **When *parameter 1-10 Motor Construction* is set to *[1] PM non-salient SPM*, only selection *[0] Digital input* is available.**
[0]	Digital input	Activate a start command via a digital input.
[1]	Bus	Activate a start command via the serial communication port or fieldbus option.
[2]	Logic AND	Activate a start command via the fieldbus/serial communication port and also via 1 of the digital inputs.
[3]	Logic OR	Activate a start command via the fieldbus/serial communication port or via 1 of the digital inputs.

8-53 Start Select		
Select the trigger for the start function.		
Option:		**Function:**
[0]	Digital input	A digital input triggers the start function.
[1]	Bus	A serial communication port or the fieldbus triggers the start function.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the start function.
[3] *	Logic OR	The fieldbus/serial communication port or a digital input triggers the start function.

8-54 Reversing Select		
Select the trigger for the reversing function.		
Option:		**Function:**
[0]	Digital input	A digital input triggers the reversing function.
[1]	Bus	A serial communication port or the fieldbus triggers the reversing function.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the reversing function.
[3]	Logic OR	The fieldbus/serial communication port or a digital input triggers the reversing function.

8-55 Set-up Select		
Select the trigger for the set-up selection.		
Option:		**Function:**
[0]	Digital input	A digital input triggers the set-up selection.
[1]	Bus	A serial communication port or the fieldbus triggers the set-up selection.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the set-up selection.
[3] *	Logic OR	The fieldbus/serial communication port or a digital input triggers the set-up selection.

8-56 Preset Reference Select		
Option:		**Function:**
		Select the trigger for the preset reference selection.
[0]	Digital input	A digital input triggers the preset reference selection.
[1]	Bus	A serial communication port or the fieldbus triggers the preset reference selection.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the preset reference selection.
[3] *	Logic OR	The fieldbus/serial communication port or a digital input triggers the preset reference selection.

8-57 Profidrive OFF2 Select		
Select control of the frequency converter OFF2 selection via the terminals (digital input) and/or via the fieldbus. This parameter is active only when *parameter 8-01 Control Site* is set to *[0] Digital and ctrl. word* and *parameter 8-10 Control Word Profile* is set to *[1] PROFIdrive profile*.		
Option:		**Function:**
[0]	Digital input	
[1]	Bus	
[2]	Logic AND	
[3] *	Logic OR	

8-58 Profidrive OFF3 Select		
Select control of the frequency converter OFF3 selection via the terminals (digital input) and/or via the fieldbus. This parameter is active only when *parameter 8-01 Control Site* is set to *[0] Digital and ctrl. word,* and *parameter 8-10 Control Word Profile* is set to *[1] PROFIdrive profile*.		
Option:		**Function:**
[0]	Digital input	
[1]	Bus	
[2]	Logic AND	
[3] *	Logic OR	

4.9.6 8-8* FC Port Diagnostics

These parameters are used for monitoring the bus communication via the frequency converter RS485 port terminals 68-69.

8-80 Bus Message Count		
Range:		**Function:**
0*	[0 - 0]	This parameter shows the number of valid telegrams detected on the bus.

8-81 Bus Error Count		
Array [6]		
Range:		**Function:**
0*	[0 - 0]	This parameter shows the number of telegrams with faults (for example CRC fault) detected on the bus.

8-82 Slave Messages Rcvd		
Range:		**Function:**
0*	[0 - 0]	This parameter shows the number of valid telegrams addressed to the slave sent by the frequency converter.

8-83 Slave Error Count		
Range:		**Function:**
0*	[0 - 0]	This parameter shows the number of error telegrams, which are not executed by the frequency converter.

8-84 Slave Messages Sent		
Range:		**Function:**
0*	[0 - 0]	This parameter shows the number of messages sent from the slave.

8-85 Slave Timeout Errors		
Range:		**Function:**
0*	[0 - 0]	This parameter shows the number of slave timeout errors.

8-88 Reset FC port Diagnostics		
Reset all FC port diagnostic counters.		
Option:		**Function:**
[0] *	Do not reset	
[1]	Reset counter	

4.9.7 8-9* Bus Jog

8-90 Bus Jog 1 Speed		
Range:		**Function:**
Size related*	[0 - par. 4-13 RPM]	Enter the jog speed. Activate this fixed jog speed via the serial port or fieldbus option.

8-91 Bus Jog 2 Speed		
Range:		**Function:**
Size related*	[0 - par. 4-13 RPM]	Enter the jog speed. Activate this fixed jog speed via the serial port or fieldbus option.

4.10 Parameters: 9-** PROFIBUS

9-00 Setpoint		
Range:		**Function:**
0*	[0 - 65535]	This parameter receives cyclic reference from a Master Class 2. If the control priority is set to Master Class 2, the reference for the frequency converter is taken from this parameter, whereas the cyclic reference is ignored.

9-07 Actual Value		
Range:		**Function:**
0*	[0 - 65535]	This parameter delivers the MAV for a Master Class 2. This parameter is valid if the control priority is set to Master Class 2.

9-15 PCD Write Configuration		
Array [10]		
Option:		**Function:**
		Select the parameters to be assigned to PCD 3–10 of the telegrams. The number of available PCDs depends on the telegram type. The values in PCD 3–10 are then written to the selected parameters as data values. Alternatively, specify a standard PROFIBUS telegram in *parameter 9-22 Telegram Selection*.
[0]	None	
[302]	Minimum Reference	
[303]	Maximum Reference	
[312]	Catch up/slow Down Value	
[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	

9-15 PCD Write Configuration		
Array [10]		
Option:		**Function:**
[590]	Digital & Relay Bus Control	
[593]	Pulse Out #27 Bus Control	
[595]	Pulse Out #29 Bus Control	
[597]	Pulse Out #X30/6 Bus Control	
[615]	Terminal 53 High Ref./ Feedb. Value	
[625]	Terminal 54 High Ref./ Feedb. Value	
[653]	Term 42 Output Bus Ctrl	
[663]	Terminal X30/8 Bus Control	
[748]	PCD Feed Forward	
[890]	Bus Jog 1 Speed	
[891]	Bus Jog 2 Speed	
[1680]	Fieldbus CTW 1	
[1682]	Fieldbus REF 1	
[1685]	FC Port CTW 1	
[1686]	FC Port REF 1	

9-16 PCD Read Configuration		
Array [10]		
Option:		**Function:**
		Select the parameters to be assigned to PCD 3–10 of the telegrams. The number of available PCDs depends on the telegram type. PCDs 3–10 contain the actual data values of the selected parameters. For standard PROFIBUS telegram, see *parameter 9-22 Telegram Selection*.
[0]	None	
[1500]	Operating hours	
[1501]	Running Hours	
[1502]	kWh Counter	
[1600]	Control Word	

9-16 PCD Read Configuration		
Array [10]		
Option:		**Function:**
[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	
[1620]	Motor Angle	
[1621]	Torque [%] High Res.	
[1622]	Torque [%]	
[1624]	Calibrated Stator Resistance	
[1630]	DC Link Voltage	
[1634]	Heatsink Temp.	
[1635]	Inverter Thermal	
[1638]	SL Controller State	
[1639]	Control Card Temp.	
[1645]	Motor Phase U Current	
[1646]	Motor Phase V Current	
[1647]	Motor Phase W Current	
[1648]	Speed Ref. After Ramp [RPM]	
[1650]	External Reference	
[1651]	Pulse Reference	
[1652]	Feedback[Unit]	
[1653]	Digi Pot Reference	
[1657]	Feedback [RPM]	

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9-16 PCD Read Configuration

Array [10]

Option:		Function:
[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]	
[1684]	Comm. Option STW	
[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	

9-18 Node Address

Range:		Function:
126*	[1 - 126]	Enter the address in this parameter or in the hardware switch. In order to adjust the station address in this parameter, the hardware switch must be set to 126 or 127. Otherwise this parameter shows the actual setting of the switch.

9-19 Drive Unit System Number

Range:		Function:
1034*	[0 - 65535]	Manufacturer specific system ID.

9-22 Telegram Selection

Option:		Function:
		This parameter shows the selected standard PROFIBUS telegram that the PROFINET IO controller has sent to the frequency converter. At power-up, or if a non-supported telegram is sent from the IO controller, this parameter shows *None* in the display.
[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	

9-23 Parameters for Signals		
Array [1000] Read only		
Option:		**Function:**
		This parameter contains a list of signals available for selection in *parameter 9-15 PCD Write Configuration* and *parameter 9-16 PCD Read Configuration*.
[0] *	None	
[302]	Minimum Reference	
[303]	Maximum Reference	
[312]	Catch up/slow Down Value	
[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	

9-23 Parameters for Signals		
Array [1000] Read only		
Option:		**Function:**
[595]	Pulse Out #29 Bus Control	
[597]	Pulse Out #X30/6 Bus Control	
[615]	Terminal 53 High Ref./ Feedb. Value	
[625]	Terminal 54 High Ref./ Feedb. Value	
[653]	Term 42 Output Bus Ctrl	
[663]	Terminal X30/8 Bus Control	
[748]	PCD Feed Forward	
[890]	Bus Jog 1 Speed	
[891]	Bus Jog 2 Speed	
[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	
[1620]	Motor Angle	
[1621]	Torque [%] High Res.	
[1622]	Torque [%]	

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9-23 Parameters for Signals		
Array [1000] Read only		
Option:		**Function:**
[1624]	Calibrated Stator Resistance	
[1630]	DC Link Voltage	
[1634]	Heatsink Temp.	
[1635]	Inverter Thermal	
[1638]	SL Controller State	
[1639]	Control Card Temp.	
[1645]	Motor Phase U Current	
[1646]	Motor Phase V Current	
[1647]	Motor Phase W Current	
[1648]	Speed Ref. After Ramp [RPM]	
[1650]	External Reference	
[1651]	Pulse Reference	
[1652]	Feedback[Unit]	
[1653]	Digi Pot Reference	
[1657]	Feedback [RPM]	
[1660]	Digital Input	
[1661]	Terminal 53 Switch Setting	
[1662]	Analog Input 53	
[1663]	Terminal 54 Switch Setting	
[1664]	Analog Input 54	
[1665]	Analog Output 42 [mA]	
[1666]	Digital Output [bin]	
[1667]	Freq. Input #29 [Hz]	
[1668]	Freq. Input #33 [Hz]	
[1669]	Pulse Output #27 [Hz]	

9-23 Parameters for Signals		
Array [1000] Read only		
Option:		**Function:**
[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]	
[1680]	Fieldbus CTW 1	
[1682]	Fieldbus REF 1	
[1684]	Comm. Option STW	
[1685]	FC Port CTW 1	
[1686]	FC Port REF 1	
[1687]	Bus Readout Alarm/Warning	
[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	

9-27 Parameter Edit		
Option:		**Function:**
		Parameters can be edited via PROFIBUS, the standard RS485 interface, or the LCP.
[0]	Disabled	Disable editing via PROFIBUS.
[1] *	Enabled	Enable editing via PROFIBUS.

9-28 Process Control		
Option:		**Function:**
		Process control (setting of control word, speed reference, and process data) is possible via either PROFINET 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 8-58 Profidrive OFF3 Select*.
[0]	Disable	Disable process control via PROFINET and enable process control via standard fieldbus or PROFINET IO supervisor.
[1] *	Enable cyclic master	Enable process control via IO controller and disable process control via standard fieldbus or PROFINET IO supervisor.

9-44 Fault Message Counter		
Range:		**Function:**
0*	[0 - 65535]	This parameter shows the number of error events stored in *parameter 9-45 Fault Code* and *parameter 9-47 Fault Number*. The maximum buffer capacity is eight error events. The buffer and counter are set to 0 upon reset or power-up.

9-45 Fault Code		
Range:		**Function:**
0*	[0 - 0]	This buffer contains the alarm word for all alarms and warnings that have occurred since last reset or power-up. The maximum buffer capacity is 8 error events.

9-47 Fault Number		
Range:		**Function:**
0*	[0 - 0]	This buffer contains the alarm number (for example, 2 for live zero error, 4 for mains phase loss) for all alarms and warnings that have occurred since last reset or power-up. The maximum buffer capacity is 8 error events.

9-52 Fault Situation Counter		
Range:		**Function:**
0*	[0 - 1000]	This parameter shows the number of error events that have occurred since last reset or power-up.

9-53 Profibus Warning Word		
Read only		
Range:		**Function:**
0*	[0 - 65535]	This parameter shows PROFINET communication warnings.

Bit	Condition when bit is active
0	Connection with IO controller is not OK.
1	Reserved for status of connection with second IO controller.
2	Not used.
3	Clear data command received.
4	Actual value is not updated.
5	No link on both ports.
6	Not used.
7	Initializing of PROFINET is not OK.
8	Frequency converter is tripped.
9	Internal CAN error.
10	Wrong configuration data from IO controller.
11	Not used.
12	Internal error occurred.
13	Not configured.
14	Timeout active.
15	Warning 34 active.

Table 4.17 PROFINET Communication Warnings

This parameter shows the actual PROFIBUS baud rate. The PROFIBUS master automatically sets the baud rate.

9-63 Actual Baud Rate		
Option:		**Function:**
[0]	9,6 kbit/s	
[1]	19,2 kbit/s	
[2]	93,75 kbit/s	
[3]	187,5 kbit/s	
[4]	500 kbit/s	
[6]	1500 kbit/s	

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9-63 Actual Baud Rate

Option:		Function:
[7]	3000 kbit/s	
[8]	6000 kbit/s	
[9]	12000 kbit/s	
[10]	31,25 kbit/s	
[11]	45,45 kbit/s	
[255] *	No baudrate found	

9-64 Device Identification

Range:		Function:
0*	[0 - 0]	Device identification parameter.

9-65 Profile Number

Range:		Function:
0*	[0 - 0]	This parameter contains the profile identification. Byte 1 contains the profile number and byte 2 the version number of the profile.

9-67 Control Word 1

Range:		Function:
0*	[0 - 65535]	This parameter accepts the control word from a master class 2 in the same format as PCD 1.

9-68 Status Word 1

Range:		Function:
0*	[0 - 65535]	This parameter delivers the status word for a master class 2 in the same format as PCD 2.

9-70 Programming Set-up

This parameter is unique for LCP and fieldbus. See *parameter 0-11 Programming Set-up*.

Option:		Function:
		Select the set-up to edit.
[0]	Factory setup	Uses default data. This option can be used as a data source to return the other set-ups to a known state.
[1]	Set-up 1	Edits set-up 1.
[2]	Set-up 2	Edits set-up 2.
[3]	Set-up 3	Edits set-up 3.
[4]	Set-up 4	Edits set-up 4.
[9] *	Active Set-up	Follows the active set-up selected in *parameter 0-10 Active Set-up*.

9-71 Profibus Save Data Values

Option:		Function:
		Parameter values changed via PROFINET are not automatically stored in the 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.
[0] *	Off	Deactivate the non-volatile storage function.
[1]	Store all setups	Store all parameter values for all set-ups in the non-volatile memory. When all parameter values have been stored, the selection returns to *[0] Off*.
[2]	Store all setups	Store all parameter values for all set-ups in the non-volatile memory. When all parameter values have been stored, the selection returns to *[0] Off*.

9-72 ProfibusDriveReset

Option:		Function:
[0] *	No action	
[1]	Power-on reset	Reset frequency converter upon power-up, as for power cycle.
[2]	Power-on reset prep	Prepare for resetting frequency converter upon power-up.
[3]	Comm option reset	Reset the PROFINET option only, the PROFINET option goes through a power-up sequence. When reset, the frequency converter disappears from the fieldbus, which may cause a communication error from the master.

9-75 DO Identification

Range:		Function:
0*	[0 - 65535]	Provides information about the DO (Drive Object).

9-80 Defined Parameters (1)

Array [116]
No LCP access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the defined frequency converter parameters available for PROFINET.

9-81 Defined Parameters (2)

Array [116]
No LCP access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the defined frequency converter parameters available for PROFINET.

9-82 Defined Parameters (3)

Array [116]
No LCP access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the defined frequency converter parameters available for PROFINET.

9-83 Defined Parameters (4)

Array [116]
No LCP access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the defined frequency converter parameters available for PROFINET.

9-84 Defined Parameters (5)

Array [115]
No LCP access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the defined frequency converter parameters available for PROFINET.

9-85 Defined Parameters (6)

Array [116]
No LCP access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the defined frequency converter parameters available for PROFINET.

9-90 Changed Parameters (1)

Array [116]
No LCP access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the frequency converter parameters deviating from default setting.

9-91 Changed Parameters (2)

Array [116]
No LCP access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the frequency converter parameters deviating from default setting.

9-92 Changed Parameters (3)

Array [116]
No LCP access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the frequency converter parameters deviating from default setting.

9-93 Changed Parameters (4)

Array [116]
No LCP access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the frequency converter parameters deviating from default setting.

9-94 Changed Parameters (5)

Array [116]
No LCP Address
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the frequency converter parameters deviating from default setting.

9-99 Profibus Revision Counter

Range:		Function:
0*	[0 - 65535]	Readout of revision count.

4.11 Parameters: 12-** Ethernet

4.11.1 12-0* IP Settings

12-00 IP Address Assignment		
Option:		**Function:**
		Select the IP address assignment method.
[0]	MANUAL	IP address can be set in *parameter 12-01 IP Address* IP Address.
[1]	DHCP	IP address is assigned via DHCP server.
[2]	BOOTP	IP address is assigned via BOOTP server.
[10] *	DCP	DCP is assigned via the DCP protocol.
[20]	From node ID	

12-01 IP Address		
Range:		**Function:**
0*	[0 - 4294967295]	Configure the IP address of the option. Read-only, if *parameter 12-00 IP Address Assignment* is set to DHCP or BOOTP. In POWERLINK, the IP address follows the *parameter 12-60 Node ID* last byte and the first part is fixed to 192.168.100 (node ID).

12-02 Subnet Mask		
Range:		**Function:**
0*	[0 - 4294967295]	Configure the IP subnet mask of the option. Read-only, if *parameter 12-00 IP Address Assignment* is set to DHCP or BOOTP. In POWERLINK, it is fixed to 255.255.255.0.

12-03 Default Gateway		
Range:		**Function:**
0*	[0 - 2147483647]	Configure the IP default gateway of the option. Read-only, if *parameter 12-00 IP Address Assignment* is set to DHCP or BOOTP. In a non-routed network, this address is set to the IP address of the IO Device.

12-04 DHCP Server		
Range:		**Function:**
0*	[0 - 2147483647]	Read-only. Show the IP address of the found DHCP or BOOTP server.

12-05 Lease Expires		
Range:		**Function:**
Size related*	[0 - 0]	Read-only. Show the lease time left for the current DHCP-assigned IP address.

12-06 Name Servers		
Range:		**Function:**
0*	[0 - 2147483647]	IP addresses of domain name servers. Can be automatically assigned when using DHCP.

12-07 Domain Name		
Range:		**Function:**
0	[0 - 48]	Domain name of the attached network. Can be automatically assigned when using DHCP network.

12-08 Host Name		
Range:		**Function:**
0*	[0 - 48]	Logical (given) name of option. ***NOTICE*** **The display of the frequency converter only shows the first 19 characters, but the remaining characters are stored in the frequency converter. If hardware switches are different from all ON or all OFF, the switches have priority.**

12-09 Physical Address		
Range:		**Function:**
0*	[0 - 17]	Read-only. Show the physical (MAC) address of the option.

4.11.2 12-1* Ethernet Link Parameters

Apply to the whole parameter group.

Index [0] is used for port 1, and index [1] is used for port 2.

12-10 Link Status		
Read-only. Shows the link status of the Ethernet ports.		
Option:		**Function:**
[0] *	No Link	
[1]	Link	

12-11 Link Duration		
Range:		**Function:**
Size related*	[0 - 0]	Read-only. Show the duration of the present link on each port in dd:hh:mm:ss.

12-12 Auto Negotiation		
Option:		**Function:**
		Configure auto negotiation of Ethernet link parameters, for each port: ON or OFF.
[0]	Off	*Link Speed* and *Link Duplex* can be configured in *parameter 12-13 Link Speed* and *parameter 12-14 Link Duplex*.
[1] *	On	

12-13 Link Speed		
Force the link speed for each port in 10 Mbps or 100 Mbps. If *parameter 12-12 Auto Negotiation* is set to *[1] On*, this parameter is read-only and shows the actual link speed. If no link is present, *[0] None* is shown.		
Option:		**Function:**
		NOTICE **In POWERLINK, this parameter is locked to 100 Mbps.**
[0] *	None	
[1]	10 Mbps	
[2]	100 Mbps	

12-14 Link Duplex		
Force 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:		**Function:**
		NOTICE **In POWERLINK, this parameter is locked to half duplex.**
[0]	Half Duplex	
[1]	Full Duplex	

12-18 Supervisor MAC		
Range:		**Function:**
0*	[0 - 2147483647]	Show the MAC address of currently active supervisor.

12-19 Supervisor IP Addr.		
Range:		**Function:**
0*	[0 - 2147483647]	Show the IP address of currently active supervisor.

4.11.3 12-8* Other Ethernet Services

12-80 FTP Server		
Enables/disables the built-in FTP server.		
Option:		**Function:**
[0] *	Disabled	Disable the built-in FTP server.
[1]	Enabled	Enable the built-in FTP server.

12-81 HTTP Server		
Enables/disables the built-in HTTP (web) server.		
Option:		**Function:**
[0] *	Disabled	Disable the built-in HTTP (web) server.
[1]	Enabled	Enable the built-in HTTP (web) server.

12-82 SMTP Service		
Enables/disables the SMTP (e-mail) service on the option.		
Option:		**Function:**
[0] *	Disabled	Disable the SMTP (e-mail) service on the option.
[1]	Enabled	Enable the SMTP (e-mail) service on the option.

12-83 SNMP Agent		
Option:		**Function:**
[0]	Disabled	Disable the local SNMP agent.
[1] *	Enabled	Enable the local SNMP agent.

12-84 Address Conflict Detection		
Option:		**Function:**
[0]	Disabled	Disable the function which detects and resolves IP address conflicts with this device in the network.
[1] *	Enabled	Enable the function which detects and resolves IP address conflicts with this device in the network.

12-85 ACD Last Conflict		
Range:		**Function:**
0*	[0 - 2147483647]	The contested IP address of the most recent address conflict.

12-89 Transparent Socket Channel Port		
Range:		**Function:**
Size related*	[0 - 65535]	Configure the TCP port number for the transparent socket channel. This configuration enables FC telegrams to be sent transparently on Ethernet via TCP. Default value is 4000, 0 means disabled.

4.11.4 12-9* Advanced Ethernet Settings

12-90 Cable Diagnostic

Enable/disable 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 of disable after the diagnostics have finished.

Option:		Function:
		NOTICE **The cable diagnostics function is only issued on ports where there is no link (see *parameter 12-10 Link Status*).**
[0] *	Disabled	Disable the cable diagnostic function.
[1]	Enabled	Enable the cable diagnostic function.

12-91 Auto Cross Over

Option:		Function:
[0]	Disabled	Disable the auto-crossover function.
[1] *	Enabled	Enable the auto-crossover function.

12-92 IGMP Snooping

This function prevents flooding of the Ethernet protocol stack by only forwarding multicast packets to ports that are members of the multicast group.

Option:		Function:
[0]	Disabled	Disable the IGMP Snooping function.
[1] *	Enabled	Enable the IGMP Snooping function.

12-93 Cable Error Length

Range:		Function:
0*	[0 - 65535]	If cable diagnostics is enabled in *parameter 12-90 Cable Diagnostic*, the built-in switch is possible via time domain reflectometry (TDR). This measurement technique 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 (6.56 ft). The value 0 means that no errors are detected.

12-94 Broadcast Storm Protection

Range:		Function:
-1 %*	[-1 - 20 %]	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 the percentage of the total bandwidth that is allowed for broadcast messages. Example: OFF means that the filter is disabled: All broadcast messages pass through. The value 0% means that no broadcast messages pass through. A value of 10% means that 10% of the total bandwidth is allowed for broadcast messages. If the number of broadcast messages increases above the 10% threshold, they are blocked.

12-95 Inactivity timeout

Range:		Function:
120*	[0 - 3600]	

12-96 Port Config

Enable/disable port-mirroring function. For troubleshooting with a network analyzer tool.

Option:		Function:
[0]	Normal	No port-mirroring.
[1]	Mirror Port 1 to 2	All network traffic on port 1 is mirrored to port 2.
[2]	Mirror Port 2 to 1	All network traffic on port 2 is mirrored to port 1.
[10]	Port 1 disabled	
[11]	Port 2 disabled	
[254]	Mirror Int. Port to 1	
[255]	Mirror Int. Port to 2	

12-97 QoS Priority

Range:		Function:
Size related*	[0 - 63]	Each index sets the DSCP value of different types of QoS prioritized messages. See the option manual for details.

12-98 Interface Counters		
Range:		**Function:**
4000*	[0 - 4294967295]	Read-only. Advanced interface counters from the built-in switch can be used for low-level trouble-shooting. The parameter shows a sum of port 1+port 2.

12-99 Media Counters		
Range:		**Function:**
0*	[0 - 4294967295]	Read-only. Advanced interface counters from the built-in switch can be used for low-level trouble-shooting. The parameter shows a sum of port 1+port 2.

4.12 Parameters: 13-** Smart Logic Control

Smart logic control (SLC) is a sequence of user-defined actions (see *parameter 13-52 SL Controller Action*) executed by the SLC when the associated user-defined event (see *parameter 13-51 SL Controller 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:

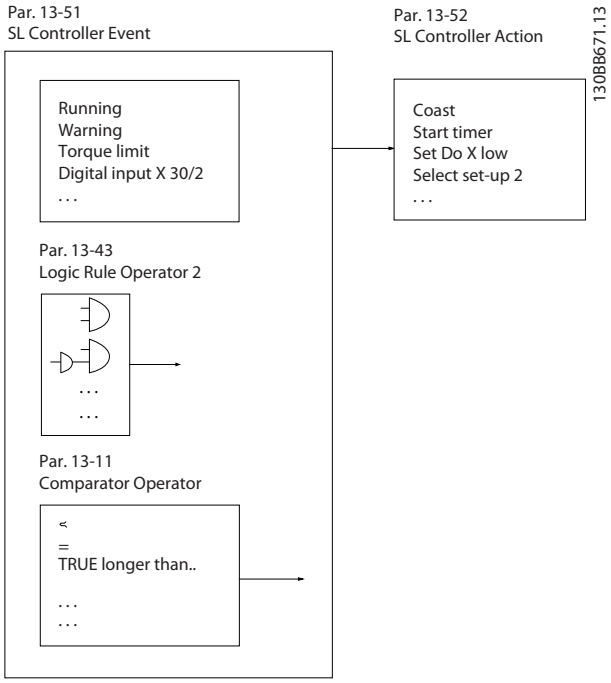

Illustration 4.36 Smart Logic Control (SLC)

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 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.
Illustration 4.37 shows an example with 3 events/actions:

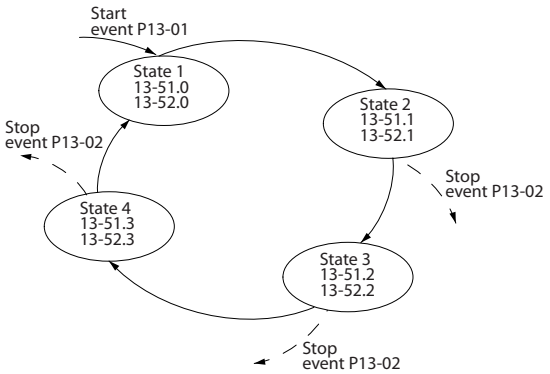

Illustration 4.37 Events and Actions

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.

4.12.1 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.

13-00 SL Controller Mode

Option:		Function:
[0]	Off	Disables the smart logic controller.
[1]	On	Enables the smart logic controller.

13-01 Start Event

Select the boolean (true or false) input to activate smart logic control.

Option:		Function:
[0]	False	Select the boolean (true or false) input to activate smart logic control. Enters the fixed value - false.
[1]	True	Enters the fixed value - true.
[2]	Running	The motor runs.
[3]	In range	The motor runs within the programmed current and speed ranges set in *parameter 4-50 Warning Current Low* to *parameter 4-53 Warning Speed High*.
[4]	On reference	The motor runs on reference.
[5]	Torque limit	The torque limit set in *parameter 4-16 Torque Limit Motor Mode* or *parameter 4-17 Torque Limit Generator Mode* is exceeded.
[6]	Current Limit	The motor current limit set in *parameter 4-18 Current Limit* is exceeded.
[7]	Out of current range	The motor current is outside the range set in *parameter 4-18 Current Limit*.
[8]	Below I low	The motor current is lower than set in *parameter 4-50 Warning Current Low*.
[9]	Above I high	The motor current is higher than set in *parameter 4-51 Warning Current High*.
[10]	Out of speed range	The speed is outside the range set in *parameter 4-52 Warning Speed Low* and *parameter 4-53 Warning Speed High*.
[11]	Below speed low	The output speed is lower than the setting in *parameter 4-52 Warning Speed Low*.

13-01 Start Event

Select the boolean (true or false) input to activate smart logic control.

Option:		Function:
[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 frequency converter, 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 frequency converter 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.

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13-01 Start Event

Select the boolean (true or false) input to activate smart logic control.

Option:		Function:
[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.
[40]	Drive stopped	A stop command (jog, stop, quick stop, coast) is issued – and not from the SLC itself.
[41]	Reset Trip	A reset is issued.
[42]	Auto-reset Trip	An auto reset is performed.
[43]	Ok key	[OK] is pressed. Only available on the graphical LCP.
[44]	Reset key	[Reset] is pressed. Only available on the graphical LCP.
[45]	Left key	[◄] is pressed. Only available on the graphical LCP.
[46]	Right key	[►] is pressed. Only available on the graphical LCP.
[47]	Up key	[▲] is pressed. Only available on the graphical LCP.
[48]	Down key	[▼] is pressed. Only available on the graphical LCP.
[50]	Comparator 4	Use the result of comparator 4.
[51]	Comparator 5	Use the result of comparator 5.
[60]	Logic rule 4	Use the result of logic rule 4.
[61]	Logic rule 5	Use the result of logic rule 5.
[76]	Digital input x30/2	Use the value of x30/2 (VLT® General Purpose I/O MCB 101).
[77]	Digital input x30/3	Use the value of x30/3 (VLT® General Purpose I/O MCB 101).
[78]	Digital input x30/4	Use the value of x30/4 (VLT® General Purpose I/O MCB 101).
[83]	Broken Belt	Use the value of broken belt.

13-02 Stop Event

Select the boolean (true or false) input to deactivate smart logic control.

Option:		Function:
[0]	False	For descriptions of options *[0] False–[61] Logic rule 5*, see *parameter 13-01 Start Event*.
[1]	True	
[2]	Running	
[3]	In range	

13-02 Stop Event

Select the boolean (true or false) input to deactivate smart logic control.

Option:		Function:
[4]	On reference	
[5]	Torque limit	
[6]	Current Limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL Time-out 0	
[31]	SL Time-out 1	
[32]	SL Time-out 2	
[33]	Digital input DI18	
[34]	Digital input DI19	
[35]	Digital input DI27	
[36]	Digital input DI29	
[37]	Digital input DI32	
[38]	Digital input DI33	

13-02 Stop Event		
Select the boolean (true or false) input to deactivate smart logic control.		
Option:		**Function:**
[39]	Start command	
[40]	Drive stopped	
[41]	Reset Trip	
[42]	Auto-reset Trip	
[43]	Ok key	[OK] is pressed. Only available on the graphical LCP.
[44]	Reset key	[Reset] is pressed. Only available on the graphical LCP.
[45]	Left key	[◄] is pressed. Only available on the graphical LCP.
[46]	Right key	[►] is pressed. Only available on the graphical LCP.
[47]	Up key	[▲] is pressed. Only available on the graphical LCP.
[48]	Down key	[▼] is pressed. Only available on the graphical LCP.
[50]	Comparator 4	
[51]	Comparator 5	
[60]	Logic rule 4	
[61]	Logic rule 5	
[70]	SL Time-out 3	Smart logic controller timer 3 is timed out.
[71]	SL Time-out 4	Smart logic controller timer 4 is timed out.
[72]	SL Time-out 5	Smart logic controller timer 5 is timed out.
[73]	SL Time-out 6	Smart logic controller timer 6 is timed out.
[74]	SL Time-out 7	Smart logic controller timer 7 is timed out.
[75]	Start command given	
[76]	Digital input x30/2	
[77]	Digital input x30/3	
[78]	Digital input x30/4	
[83]	Broken Belt	
[102]	Relay 1	
[103]	Relay 2	

13-03 Reset SLC		
Option:		**Function:**
[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* to default settings.

4.12.2 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.

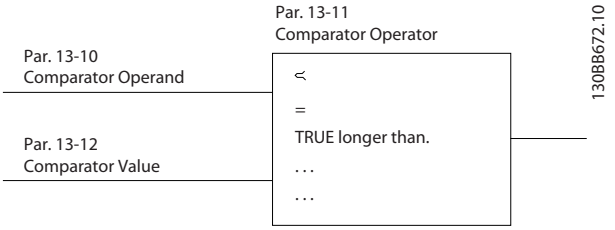

Illustration 4.38 Comparators

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 0–5. Select index 0 to program comparator 0, select index 1 to program comparator 1, and so on.

13-10 Comparator Operand		
Option:		**Function:**
		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*. Select the variable to be monitored by the comparator.
[0]	DISABLED	The comparator is disabled.
[1]	Reference %	The resulting remote reference in percent.
[2]	Feedback %	[RPM] or [Hz], as set in *parameter 0-02 Motor Speed Unit*.

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13-10 Comparator Operand		
Option:		**Function:**
[3]	Motor speed	[RPM] or [Hz], as set in *parameter 0-02 Motor Speed Unit*.
[4]	Motor Current	
[5]	Motor torque	
[6]	Motor power	
[7]	Motor voltage	
[8]	DC-link voltage	
[9]	Motor Thermal	Value is in percent.
[10]	Drive thermal	Value is in percent.
[11]	Heat sink temp.	Value is in percent.
[12]	Analog input AI53	Value is in percent.
[13]	Analog input AI54	Value is in percent.
[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	Value is in percent.
[19]	Pulse input FI33	Value is in percent.
[20]	Alarm number	The number of registered alarms.
[21]	Warning number	
[22]	Analog input x30 11	
[23]	Analog input x30 12	
[30]	Counter A	
[31]	Counter B	

13-11 Comparator Operator		
Option:		**Function:**
		Select the operator to be used in the comparison. This is an array parameter containing comparator operators 0–5.
[0]	<	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*

13-11 Comparator Operator		
Option:		**Function:**
		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]	>	Inverse logic of option *[0]* <.
[5]	TRUE longer than..	
[6]	FALSE longer than..	
[7]	TRUE shorter than..	
[8]	FALSE shorter than..	

13-12 Comparator Value		
Array [6]		
Range:		**Function:**
Size related*	[-100000 - 100000]	Enter the trigger level for the variable that is monitored by this comparator. This is an array parameter containing comparator values 0–5.

4.12.3 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 0–2. Select index 0 to program timer 0, select index 1 to program timer 1, and so on.

13-20 SL Controller Timer		
Range:		**Function:**
Size related*	[0 - 0]	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.

4.12.4 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*.

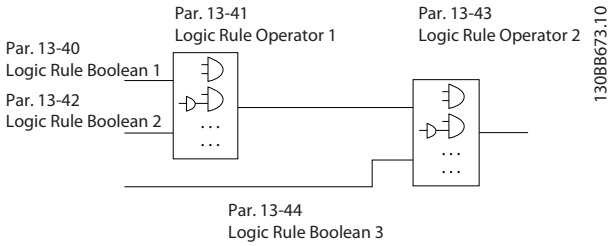

Illustration 4.39 Logic Rules

Priority of calculation

The results of *parameter 13-40 Logic Rule Boolean 1*, *parameter 13-41 Logic Rule Operator 1*, and *parameter 13-42 Logic Rule Boolean 2* are calculated first. The outcome (true/false) of this calculation is combined with the settings of *parameter 13-43 Logic Rule Operator 2* and *parameter 13-44 Logic Rule Boolean 3*, yielding the final result (true/false) of the logic rule.

13-40 Logic Rule Boolean 1		
Option:		**Function:**
[0]	False	Select the first 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)	
[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.

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13-40 Logic Rule Boolean 1		
Option:		**Function:**
[47]	Up key	[▲] is pressed. Only available on the graphical LCP.
[48]	Down key	[▼] is pressed. Only available on the graphical LCP.
[50]	Comparator 4	
[51]	Comparator 5	
[60]	Logic rule 4	
[61]	Logic rule 5	
[70]	SL Time-out 3	
[71]	SL Time-out 4	
[72]	SL Time-out 5	
[73]	SL Time-out 6	
[74]	SL Time-out 7	
[75]	Start command given	
[76]	Digital input x30/2	
[77]	Digital input x30/3	
[78]	Digital input x30/4	
[83]	Broken Belt	
[102]	Relay 1	
[103]	Relay 2	

13-41 Logic Rule Operator 1		
Array [6]		
Option:		**Function:**
		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*.
[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].

13-41 Logic Rule Operator 1		
Array [6]		
Option:		**Function:**
[3]	AND NOT	Evaluates the expression [13-40] AND NOT [13-42].
[4]	OR NOT	Evaluates the expression [13-40] OR NOT [13-42].
[5]	NOT AND	Evaluates the expression NOT [13-40] AND [13-42].
[6]	NOT OR	Evaluates the expression NOT [13-40] OR [13-42].
[7]	NOT AND NOT	Evaluates the expression NOT [13-40] AND NOT [13-42].
[8]	NOT OR NOT	Evaluates the expression NOT [13-40] OR NOT [13-42].

13-42 Logic Rule Boolean 2		
Option:		**Function:**
[0]	False	Select the 2nd boolean (true or false) input for the selected logic rule. See *parameter 13-01 Start Event* and *parameter 13-02 Stop Event* for more information.
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current Limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	

13-42 Logic Rule Boolean 2		
Option:		**Function:**
[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	
[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	

13-42 Logic Rule Boolean 2		
Option:		**Function:**
[75]	Start command given	
[76]	Digital input x30/2	
[77]	Digital input x30/3	
[78]	Digital input x30/4	
[83]	Broken Belt	
[102]	Relay 1	
[103]	Relay 2	

13-43 Logic Rule Operator 2		
Array [6]		
Option:		**Function:**
		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.*
[0]	DISABLED	Select this option to ignore *parameter 13-44 Logic Rule Boolean 3.*
[1]	AND	
[2]	OR	
[3]	AND NOT	
[4]	OR NOT	
[5]	NOT AND	
[6]	NOT OR	
[7]	NOT AND NOT	
[8]	NOT OR NOT	

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13-44 Logic Rule Boolean 3		
Array [6]		
Option:		**Function:**
[0]	False	Select the 3rd boolean (true or false) input for the selected logic rule. See *parameter 13-01 Start Event* (options *[0] False–[61] Logic rule 5*) and *parameter 13-02 Stop Event* (options *[70] SL Time-out 3–[75] Start command given*) for more information.
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current Limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[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	

13-44 Logic Rule Boolean 3		
Array [6]		
Option:		**Function:**
[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	
[51]	Comparator 5	
[60]	Logic rule 4	
[61]	Logic rule 5	
[70]	SL Time-out 3	
[71]	SL Time-out 4	
[72]	SL Time-out 5	
[73]	SL Time-out 6	
[74]	SL Time-out 7	
[75]	Start command given	
[76]	Digital input x30/2	
[77]	Digital input x30/3	
[78]	Digital input x30/4	
[83]	Broken Belt	
[102]	Relay 1	
[103]	Relay 2	

4.12.5 13-5* States

13-51 SL Controller Event		
Option:		**Function:**
[0]	False	Select the boolean input (true or false) to define the smart logic controller event. See *parameter 13-01 Start Event* (options *[0] False–[61] Logic rule 5*) and *parameter 13-02 Stop Event* (options *[70] SL Time-out 3–[74] SL Time-out 7*) for more information.
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current Limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL Time-out 0	
[31]	SL Time-out 1	
[32]	SL Time-out 2	

13-51 SL Controller Event		
Option:		**Function:**
[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	
[51]	Comparator 5	
[60]	Logic rule 4	
[61]	Logic rule 5	
[70]	SL Time-out 3	
[71]	SL Time-out 4	
[72]	SL Time-out 5	
[73]	SL Time-out 6	
[74]	SL Time-out 7	
[75]	Start command given	
[76]	Digital input x30/2	
[77]	Digital input x30/3	
[78]	Digital input x30/4	
[83]	Broken Belt	
[102]	Relay 1	
[103]	Relay 2	

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13-52 SL Controller Action		
Option:		**Function:**
		Select the action corresponding to the SLC event. Actions are executed when the corresponding event (defined in *parameter 13-51 SL Controller Event*) is evaluated as true.
[0]	DISABLED	
[1]	No action	
[2]	Select set-up 1	Changes the active set-up (*parameter 0-10 Active Set-up*) to 1. If the set-up is changed, it merges with other set-up commands coming from either the digital inputs or via a fieldbus.
[3]	Select set-up 2	Changes the active set-up (*parameter 0-10 Active Set-up*) to 2. If the set-up is changed, it merges with other set-up commands coming from either the digital inputs or via a fieldbus.
[4]	Select set-up 3	Changes the active set-up (*parameter 0-10 Active Set-up*) to 3. If the set-up is changed, it merges with other set-up commands coming from either the digital inputs or via a fieldbus.
[5]	Select set-up 4	Changes the active set-up (*parameter 0-10 Active Set-up*) to 4. If the set-up is changed, it merges with other set-up commands coming from either the digital inputs or via a fieldbus.
[10]	Select preset ref 0	Selects preset reference 0. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[11]	Select preset ref 1	Selects preset reference 1. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[12]	Select preset ref 2	Selects preset reference 2. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[13]	Select preset ref 3	Selects preset reference 3. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[14]	Select preset ref 4	Selects preset reference 4. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[15]	Select preset ref 5	Selects preset reference 5. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[16]	Select preset ref 6	Selects preset reference 6. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[17]	Select preset ref 7	Selects preset reference 7. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[18]	Select ramp 1	Selects ramp 1.
[19]	Select ramp 2	Selects ramp 2.
[20]	Select ramp 3	Selects ramp 3.
[21]	Select ramp 4	Selects ramp 4.
[22]	Run	Issues a start command to the frequency converter.
[23]	Run reverse	Issues a start reverse command to the frequency converter.
[24]	Stop	Issues a stop command to the frequency converter.
[25]	Qstop	Issues a quick stop command to the frequency converter.
[26]	Dcstop	Issues a DC stop command to the frequency converter.
[27]	Coast	The frequency converter coasts immediately. All stop commands including the coast command stop the SLC.
[28]	Freeze output	Freezes the output frequency of the frequency converter.

13-52 SL Controller Action		
Option:		**Function:**
[29]	Start timer 0	Starts timer 0, see *parameter 13-20 SL Controller Timer* for further description.
[30]	Start timer 1	Starts timer 1, see *parameter 13-20 SL Controller Timer* for further description.
[31]	Start timer 2	Starts timer 2, see *parameter 13-20 SL Controller Timer* for further description.
[32]	Set digital out A low	Any output with smart logic output A is low.
[33]	Set digital out B low	Any output with smart logic output B is low.
[34]	Set digital out C low	Any output with smart logic output C is low.
[35]	Set digital out D low	Any output with smart logic output D is low.
[36]	Set digital out E low	Any output with smart logic output E is low.
[37]	Set digital out F low	Any output with smart logic output F is low.
[38]	Set digital out A high	Any output with smart logic output A is high.
[39]	Set digital out B high	Any output with smart logic output B is high.
[40]	Set digital out C high	Any output with smart logic output C is high.
[41]	Set digital out D high	Any output with smart logic output D is high.
[42]	Set digital out E high	Any output with smart logic output E is high.
[43]	Set digital out F high	Any output with smart logic output F is high.
[60]	Reset Counter A	Resets counter A to 0.
[61]	Reset Counter B	Resets counter B to 0.
[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.

13-52 SL Controller Action		
Option:		**Function:**
[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.
[80]	Sleep Mode	

4.13 Parameters: 14-** Special Functions

14-00 Switching Pattern		
Option:		**Function:**
		Select the switching pattern: 60° AVM or SFAVM. ***NOTICE*** **The frequency converter may adjust the switching pattern automatically to avoid a trip.**
[0]	60 AVM	
[1] *	SFAVM	

14-01 Switching Frequency

Select the frequency converter switching frequency. Changing the switching frequency reduces acoustic noise from the motor. Default values depend on power size.

Option:		**Function:**
		NOTICE **The output frequency value of the frequency converter 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 frequency converter can adjust the switching frequency automatically.**
[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	
[7]	5.0 kHz	

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14-01 Switching Frequency		
Select the frequency converter switching frequency. Changing the switching frequency reduces acoustic noise from the motor. Default values depend on power size.		
Option:		**Function:**
[8]	6.0 kHz	
[9]	7.0 kHz	
[10]	8.0 kHz	
[11]	10.0 kHz	
[12]	12.0kHz	
[13]	14.0 kHz	
[14]	16.0kHz	

14-03 Overmodulation		
Option:		**Function:**
[0]	Off	Select *[0] Off* to avoid torque ripple on the motor shaft.
[1]	On	Select *[1] On* to obtain extra DC-link voltage and torque on the motor shaft.

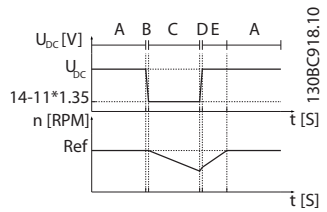
14-04 Acoustic Noise Reduction		
Option:		**Function:**
[0] *	Off	No change of the acoustic motor switching noise.
[1]	On	Select to reduce the acoustic noise from the motor.

14-06 Dead Time Compensation		
Option:		**Function:**
[0]	Off	No compensation.
[1] *	On	Activates dead-time compensation.

4.13.1 14-1* Mains On/Off

Parameters for configuring mains failure monitoring and handling. If a mains failure appears, the frequency converter tries to continue in a controlled way until the power in the DC link is exhausted.

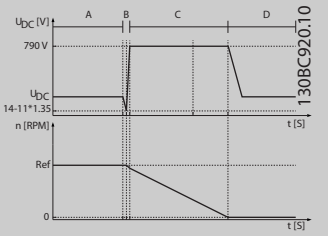
14-10 Mains Failure		
Option:		**Function:**
		NOTICE ***Parameter 14-10 Mains Failure* cannot be changed while the motor is running.** *Parameter 14-10 Mains Failure* is typically used where very short mains interruptions (voltage dips) are present. At 100% load and a short voltage interruption, the DC voltage on the main capacitors drops quickly. For larger frequency converters, 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 frequency converter must act when the threshold in *parameter 14-11 Mains Fault Voltage Level* is reached.
[0] *	No function	The frequency converter does not compensate for a mains interruption. The voltage on the DC-link drops quickly and motor control is lost within milliseconds to seconds. Trip lock is the result.
[1]	Ctrl. ramp-down	Control of the motor remains with the frequency converter, and the frequency converter 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-

14-10 Mains Failure		
Option:		**Function:**
		link disappears before the motor is ramped to 0, the motor is coasted. **Limitation:** See the introduction text in *parameter 14-10 Mains Failure*.
[2]	Ctrl. ramp-down, trip	The functionality is the same as in option *[1] Ctrl. ramp-down*, except in this option a reset is necessary for starting up after power-up.
[3]	Coasting	Centrifuges can run for 1 hour without supply. In those situations, it is possible to select a coast function at mains interruption, together with a flying start, which occurs when the mains is restored.
[4]	Kinetic back-up	Kinetic back-up ensures that the frequency converter 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 frequency converter 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.  A Normal operation B Mains failure C Kinetic back-up D Mains return E Normal operation: ramping **Illustration 4.40 Kinetic Back-up** The DC level during *[4] Kinetic back-up* equals *parameter 14-11 Mains Fault Voltage Level* x 1.35.

14-10 Mains Failure		
Option:		**Function:**
		If the mains does not return, U_{DC} is maintained as long as possible by ramping the speed down towards 0 RPM. Finally, the frequency converter 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 fulfil the criterion in point 1, and the frequency converter tries to reduce U_{DC} to *parameter 14-11 Mains Fault Voltage Level* x 1.35 by increasing the speed. This cannot be done as the mains cannot be lowered. • If running mechanically. The same mechanism as in point 2 applies, but the inertia prevents the speed from going above the reference speed. This leads to the motor running mechanically until the speed is above the reference speed and the situation in point 2 occurs. Instead of waiting for that criterion, point 3 is introduced.
[5]	Kinetic back-up, trip	The difference between kinetic back-up with and without trip is that the latter always ramps down to 0 RPM and trips, regardless of whether mains returns or not. The function does not detect if mains returns. This is the reason for

4

14-10 Mains Failure		
Option:		**Function:**
		the relatively high level on the DC-link during ramp down.

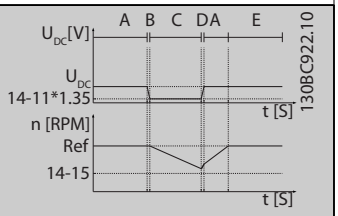


A	Normal operation
B	Mains failure
C	Kinetic back-up
D	Trip

Illustration 4.41 Kinetic Back-up Trip

[6]	Alarm	
[7]	Kin. back-up, trip w recovery	This option is valid in VVC+ only. Kinetic back-up with recovery combines the features of kinetic back-up and kinetic back-up with trip. This feature makes it possible to select between kinetic back-up and kinetic back-up with trip, based on a recovery speed, configurable in *parameter 14-15 Kin. Back-up Trip Recovery Level*. If mains does not return, the frequency converter 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] Kinetic back-up* is *parameter 14-11 Mains Fault Voltage Level* x 1.35.

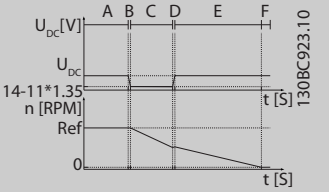
14-10 Mains Failure		
Option:		**Function:**



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

Illustration 4.42 Kinetic Back-Up, Trip with Recovery where Mains Returns above *Parameter 14-15 Kin. Back-up Trip Recovery Level*

If mains return while in kinetic back-up at a speed below *parameter 14-15 Kin. Back-up Trip Recovery Level*, the frequency converter 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).

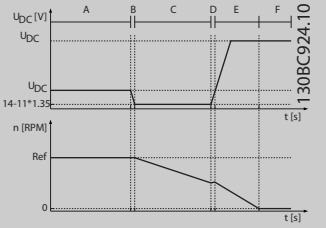


A	Normal operation
B	Mains failure
C	Kinetic back-up
D	Mains return
E	Kinetic back-up, ramping to trip
F	Trip

Illustration 4.43 Kinetic Back-Up, Trip with Recovery, Trip Slow Ramp where Mains Returns below *Parameter 14-15 Kin. Back-up Trip Recovery Level*, in this Illustration a Slow Ramp is Used

14-10 Mains Failure

Option:		Function:
		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.



A	Normal operation
B	Mains failure
C	Kinetic back-up
D	Mains return
E	Kinetic back-up ramping to trip
F	Trip

Illustration 4.44 Kinetic Back-Up, Trip with Recovery where Mains Returns below
***Parameter 14-15 Kin. Back-up Trip Recovery Level*, in this Illustration a Quick Ramp is Used**

14-11 Mains Fault Voltage Level

Range:		Function:
Size related*	[100 - 800 V]	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*x1.35).

14-11 Mains Fault Voltage Level

Range:		Function:
		NOTICE **Converting from VLT 5000 to FC 300:** **Even though the setting of the mains voltage at mains fault is the same for VLT 5000 and FC 300, the detection level is different. Use the following formula to obtain the same detection level as in VLT 5000: *Parameter 14-11 Mains Fault Voltage Level* (VLT 5000 level) = value used in VLT 5000 x1.35/sqrt(2).**

14-12 Response to Mains Imbalance

Operation under severe main 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).

Option:		Function:
[0] *	Trip	Trips the frequency converter.
[1]	Warning	Issues a warning.
[2]	Disabled	No action.
[3]	Derate	

14-14 Kin. Back-up Time-out

Range:		Function:
60 s*	[0 - 60 s]	This parameter defines the kinetic back-up timeout 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 frequency converter then automatically runs a controlled ramp-down profile before stop.

14-15 Kin. Back-up Trip Recovery Level

Range:		Function:
Size related*	[0 - 60000.000 Reference-FeedbackUnit]	This parameter specifies the kinetic back-up trip recovery level. The unit is defined in *parameter 0-02 Motor Speed Unit*.

14-16 Kin. Back-up Gain

Range:		Function:
100 %*	[0 - 500 %]	Enter the kinetic back-up gain value in percent.

4

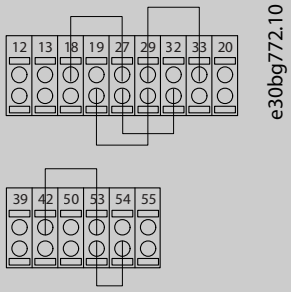
4.13.2 14-2* Trip Reset

Parameters for configuring auto reset handling, special trip handling, and control card self-test or initialization.

14-20 Reset Mode		
Option:		**Function:**
		Select the reset function after tripping. Once reset, the frequency converter can be restarted. ***NOTICE*** **The motor may start without warning. If the specified number of automatic resets is reached within 10 minutes, the frequency converter 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.** ***NOTICE*** **Automatic reset is also valid for resetting the Safe Torque Off function in firmware version 4.3x or earlier.**
[0] *	Manual reset	Select *[0] Manual reset* to perform a reset via [Reset] or via the digital inputs.
[1]	Automatic reset x 1	Select *[1]-[12] Automatic reset x 1… x20* to perform 1–20 automatic resets after tripping.
[2]	Automatic reset x 2	
[3]	Automatic reset x 3	
[4]	Automatic reset x 4	
[5]	Automatic reset x 5	
[6]	Automatic reset x 6	
[7]	Automatic reset x 7	
[8]	Automatic reset x 8	
[9]	Automatic reset x 9	
[10]	Automatic reset x 10	
[11]	Automatic reset x 15	
[12]	Automatic reset x 20	
[13]	Infinite auto reset	Select this option for continuous resetting after tripping.
[14]	Reset at power-up	

14-21 Automatic Restart Time		
Range:		**Function:**
Size related*	[0 - 3600 s]	Enter the time interval from trip to start of the automatic reset function. This parameter is active when *parameter 14-20 Reset Mode* is set to *[1]–[13] Automatic reset*.

14-22 Operation Mode		
Option:		**Function:**
		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 frequency converter. Select *[0] Normal operation* for normal operation of the frequency converter 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: 1. Select *[1] Control card test*. 2. Disconnect the mains supply and wait for the indicator light in the display to go out. 3. Set switches S201 (A53) and S202 (A54) to ON/I. 4. Insert the test plug (see *Illustration 4.45*).

14-22 Operation Mode		
Option:		**Function:**
		5. Connect to mains supply. 6. Carry out various tests. 7. The results are shown on the LCP and the frequency converter moves into an infinite loop. 8. *Parameter 14-22 Operation Mode* is automatically set to normal operation. Carry out a power cycle to start up in normal operation after a control card test. **If the test is OK** LCP readout: Control card OK. Disconnect the mains supply and remove the test plug. The green indicator light on the control card lights up. **If the test fails** LCP readout: Control card I/O failure. Replace the frequency converter 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 4.45 Test Plugs** Select *[2] Initialisation* to reset all parameter values to default settings, except for: *Parameter 15-03 Power Up's*, *parameter 15-04 Over Temp's*, and *parameter 15-05 Over Volt's*. The frequency converter resets during the next power-up. *Parameter 14-22 Operation Mode* also returns to the default setting *[0] Normal operation*.
[0] *	Normal operation	

14-22 Operation Mode		
Option:		**Function:**
[1]	Control card test	Remember to set switches S201 (A53) and S202 (A54) as specified in the parameter description when performing a control card test. Otherwise, the test fails.
[2]	Initialisation	Select this option to perform initialization. This option does not clear the service logs.
[3]	Boot mode	

14-24 Trip Delay at Current Limit		
Range:		**Function:**
60 s*	[0 - 60 s]	Enter the current limit trip delay in s. When the output current reaches the current limit (*parameter 4-18 Current Limit*), a warning is triggered. When the current limit warning has been continuously present for the period specified in this parameter, the frequency converter trips. To run continuously in current limit without tripping, set the parameter to 60 s. Thermal monitoring of the frequency converter remains active.

14-25 Trip Delay at Torque Limit		
Range:		**Function:**
60 s*	[0 - 60 s]	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 frequency converter trips. Disable the trip delay by setting the parameter to 60 s. Thermal monitoring of the frequency converter remains active.

14-26 Trip Delay at Inverter Fault		
Range:		**Function:**
Size related*	[0 - 35 s]	When the frequency converter detects an overvoltage in the set time, trip is effected after the set time. If value is 0, protection mode is disabled. ***NOTICE*** **Disable protection mode in hoisting applications.**

4.13.3 14-3* Current Limit Control

The frequency converter 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 frequency converter 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 frequency converter 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 frequency converter 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 frequency converter 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.

14-30 Current Lim Ctrl, Proportional Gain		
Range:		**Function:**
100 %*	[0 - 500 %]	Enter the proportional gain value for the current limit controller. Selection of a high value makes the controller react faster. Too high a setting leads to controller instability.

14-31 Current Lim Ctrl, Integration Time		
Range:		**Function:**
Size related*	[0.002 - 2 s]	Controls the current limit control integration time. Setting it to a lower value makes it react faster. A setting too low leads to controller instability.

14-32 Current Lim Ctrl, Filter Time		
Range:		**Function:**
Size related*	[1 - 100 ms]	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.

4.13.4 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*.

14-40 VT Level		
Range:		**Function:**
66 %*	[40 - 90 %]	***NOTICE*** **This parameter cannot be adjusted while the motor is running.** ***NOTICE*** **This parameter is not active when *parameter 1-10 Motor Construction* is set to *[1] PM non-salient SPM*.** Enter the level of motor magnetization at low speed. Selection of a low value reduces energy loss in the motor but also reduces load capability.

14-41 AEO Minimum Magnetisation		
Range:		**Function:**
Size related*	[30 - 200 %]	***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.

14-42 Minimum AEO Frequency		
Range:		**Function:**
Size related*	[0 - 40 Hz]	***NOTICE*** **This parameter is not active when *parameter 1-10 Motor Construction* is set to *[1] PM non-salient SPM*.** Enter the minimum frequency at which the automatic energy optimization (AEO) is to be active.

14-43 Motor Cosphi		
Range:		**Function:**
Size related*	[0.40 - 0.95]	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.

4.13.5 14-5* Environment

NOTICE

Perform a power cycle after changing any of the parameters in *parameter group 14-5* Environment*.

These parameters help the frequency converter to operate under special environmental conditions.

14-50 RFI Filter		
Turn the RFI filter on or off. The RFI filter ensures that the frequency converter complies with EMC standards. Select *[0] Off* only when the frequency converter is connected to an isolated mains source (IT mains).		
Option:		**Function:**
[0]	Off	
[1] *	On	

14-51 DC-Link Compensation		
Option:		**Function:**
		The rectified AC-DC voltage in the frequency converter's DC link 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.
[0]	Off	Disables DC-link compensation.
[1]	On	Enables DC-link compensation.

14-52 Fan Control		
Select minimum speed of the main fan.		
Option:		**Function:**
[0] *	Auto	Select *[0] Auto* to run fan only when internal temperature in frequency converter is in range 35 °C (95 °F) to approximately 55 °C (131 °F). 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 at around 0 °C as the frequency converter detects a sensor fault and thus protects the frequency converter while reporting *warning 66, Heat sink Temperature Low*. Option *[4] Auto (Low temp env.)* can be used in very cold environments and prevents the negative effects of this further cooling and avoids *warning 66, Heat sink Temperature Low*.

14-53 Fan Monitor		
Option:		**Function:**
		Select the frequency converter action if a fan fault is detected.
[0]	Disabled	
[1] *	Warning	
[2]	Trip	

14-55 Output Filter		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** ***NOTICE*** **Reset the frequency converter after selecting *[2] Sine-Wave Filter Fixed*.** **⚠CAUTION** **OVERHEATING OF FREQUENCY CONVERTER** **When using sine-wave filters, there is a risk of overheating of the frequency converter, which can result in personal injury and equipment damage. Always set *parameter 14-55 Output Filter* to *[2] Sine-wave fixed* when using a sine-wave filter.** Select the type of output filter connected.
[0] *	No Filter	This is the default setting and should be used with dU/dt filters or high frequency common mode (HF-CM) filters.
[1]	Sine-Wave Filter	This setting is only for backwards compatibility. It enables operation when *parameter 14-56 Capacitance Output Filter* and *parameter 14-57 Inductance Output Filter* are programmed with the output filter capacitance and inductance. It does not limit the range of the switching frequency.
[2]	Sine-Wave Filter Fixed	This parameter sets a minimum allowed limit to the switching frequency and ensures that the filter is operated within the safe range of switching frequencies.

14-55 Output Filter		
Option:		**Function:**
		Operation is possible with all control principles. The modulation pattern is set to SFAVM, which gives the lowest acoustic noise in the filter.

14-59 Actual Number of Inverter Units		
Range:		**Function:**
Size related*	[1 - 1]	Set the actual number of power units.

4.13.6 14-6* Auto Derate

This group contains parameters for derating the frequency converter if there is high temperature.

14-60 Function at Over Temperature		
Option:		**Function:**
		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 frequency converter should trip (trip lock) or derate the output current.
[0] *	Trip	The frequency converter 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.

4.13.7 No Trip at Inverter Overload

In some systems, the frequency converter 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 frequency converter. The frequency converter can yield 110% of the rated current continuously for 60 s. If still overloaded, the frequency converter normally trips (causing the motor to stop by coasting) and issues an alarm.

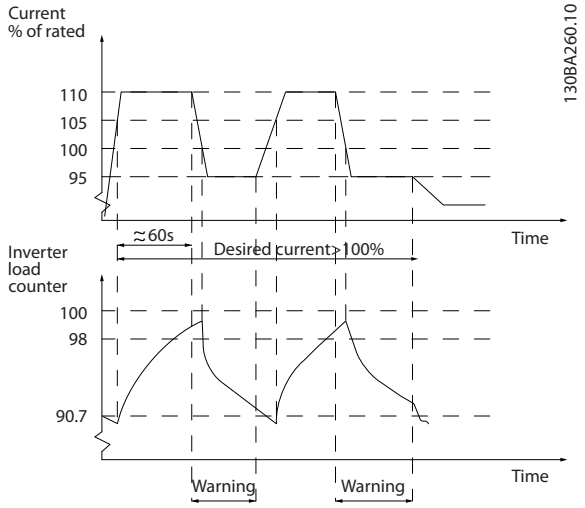


Illustration 4.46 Output Current in Overload Condition

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 frequency converter trip.

The frequency converter 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 frequency converter 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 frequency converter.

14-61 Function at Inverter Overload		
Option:		**Function:**
		Use in case of steady overload beyond the thermal limits (110% for 60 s).
[0] *	Trip	Select *[0] Trip* to make the frequency converter trip and issue an alarm.
[1]	Derate	Reduces the motor speed to decrease the load on the power section and allowing it to cool down.

14-62 Inv. Overload Derate Current		
Range:		**Function:**
95 %*	[50 - 100 %]	Enter the current level (in % of rated output current for the frequency converter) when running with reduced motor speed after load on the frequency converter has exceeded the allowable limit (110% for 60 s).

4.13.8 14-8* Options

14-89 Option Detection		
Selects the behavior of the frequency converter when a change in the option configuration is detected.		
Option:		**Function:**
[0] *	Protect Option Config.	Freezes the current settings and prevents unwanted changes when missing or defective options are detected.
[1]	Enable Option Change	Changes frequency converter settings and is used when modifying the system configuration. This parameter setting returns to *[0] Protect Option Config.* after an option change.

4.13.9 14-9* Fault Settings

14-90 Fault Level		
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:		**Function:**
[0]	Off	Use *[0] Off* with caution as it ignores all warnings and alarms for the selected source.
[1]	Warning	

14-90 Fault Level		
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:		**Function:**
[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 frequency converter has a hardware protection that issues a 3-minute recovery after 2 consecutive overcurrent incidents. This hardware protection cannot be overruled.
[3]	Trip Lock	

14-90 Fault Level		
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:		**Function:**
[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 frequency converter forces the 3-minute recovery time after 2 consecutive overcurrents (within a short time window).

Failure	Alarm	Element in *parameter 14-90 Fault Level*	Off	Warning	Trip	Trip Lock	Trip with delayed reset
10 V low	1	1490.0	X	D	–	–	–
24 V low	47	1490.1	X	–	–	D	–
1.8 V supply low	48	1490.2	X	–	–	D	–
Voltage limit	64	1490.3	X	D	–	–	–
Ground fault during ramping	14	1490.4	–	–	D	X	–
Ground fault 2 during cont. operation	45	1490.5	–	–	D	X	–
Torque limit	12	1490.6	X	D	–	–	–
Overcurrent	13	1490.7	–	–	X	D	–
Short circuit	16	1490.8	–	–	X	D	–
Heat sink temperature	29	1490.9	–	–	X	D	–
Heat sink sensor	39	1490.10	–	–	X	D	–
Control card temperature	65	1490.11	–	–	X	D	–
Power card temperature	69	1490.12	–	–	X	D	–
Heat sink temperature	244	1490.13	–	–	X	D	–
Heat sink sensor	245	1490.14	–	–	X	D	–
Power card temperature	247	1490.15	–	–	X	D	–
Motor phase missing	30–32	1490.16	–	–	X	D	–
Locked rotor	99	1490.20	–	–	D	X	–

Table 4.18 Selection of Action when Selected Alarm Appears

MCT 10 Set-up Software has the element numbers listed in the column ID. Use this table together with MCT 10 Set-up Software to get information about specific fault levels.

D stands for the default setting.

X stands for a possible option.

4.14 Parameters: 15-** Drive Information

4.14.1 15-0* Operating Data

15-00 Operating hours		
Range:		**Function:**
0 h*	[0 - 2147483647 h]	View how many hours the frequency converter has run. The value is saved when the frequency converter is turned off.

15-01 Running Hours		
Range:		**Function:**
0 h*	[0 - 2147483647 h]	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 frequency converter is turned off.

15-02 kWh Counter		
Range:		**Function:**
0 kWh*	[0 - 2147483647 kWh]	Register the power consumption of the motor as an average value over 1 hour. Reset the counter in *parameter 15-06 Reset kWh Counter*.

15-03 Power Up's		
Range:		**Function:**
0*	[0 - 2147483647]	View the number of times the frequency converter has been powered up.

15-04 Over Temp's		
Range:		**Function:**
0*	[0 - 65535]	View the number of frequency converter temperature faults.

15-05 Over Volt's		
Range:		**Function:**
0*	[0 - 65535]	View the number of frequency converter overvoltages.

15-06 Reset kWh Counter		
Option:		**Function:**
[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*).

15-07 Reset Running Hours Counter		
Option:		**Function:**
[0] *	Do not reset	
[1]	Reset counter	To reset the running hours counter to 0, select *[1] Reset* and press [OK] (see *parameter 15-01 Running Hours*). This parameter cannot be selected via the serial port, RS485. Select *[0] Do not reset* if no reset of the running-hours counter is required.

4.14.2 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.

15-10 Logging Source		
Option:		**Function:**
		Select which variables are to be logged.
[0] *	None	
[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	
[1621]	Torque [%] High Res.	
[1622]	Torque [%]	
[1624]	Calibrated Stator Resistance	
[1630]	DC Link Voltage	
[1634]	Heatsink Temp.	
[1635]	Inverter Thermal	
[1645]	Motor Phase U Current	
[1646]	Motor Phase V Current	

4

15-10 Logging Source

Option:		Function:
[1647]	Motor Phase W Current	
[1648]	Speed Ref. After Ramp [RPM]	
[1650]	External Reference	
[1651]	Pulse Reference	
[1652]	Feedback[Unit]	
[1657]	Feedback [RPM]	
[1660]	Digital Input	
[1662]	Analog Input 53	
[1664]	Analog Input 54	
[1665]	Analog Output 42 [mA]	
[1666]	Digital Output [bin]	
[1675]	Analog In X30/11	
[1676]	Analog In X30/12	
[1677]	Analog Out X30/8 [mA]	
[1687]	Bus Readout Alarm/Warning	
[1690]	Alarm Word	
[1692]	Warning Word	
[1694]	Ext. Status Word	
[1695]	Ext. Status Word 2	
[1697]	Alarm Word 3	
[1698]	Warning Word 3	

15-11 Logging Interval

Array [4]

Range:		Function:
Size related*	[0.000 - 0.000]	Enter the interval in ms between each sampling of the variables to be logged.

15-12 Trigger Event

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:		Function:
[0] *	False	
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current Limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[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	

15-12 Trigger Event		
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:		**Function:**
[37]	Digital input DI32	
[38]	Digital input DI33	
[50]	Comparator 4	
[51]	Comparator 5	
[60]	Logic rule 4	
[61]	Logic rule 5	

15-13 Logging Mode		
Option:		**Function:**
[0] *	Log always	Select *[0] Log always* for continuous logging.
[1]	Log once on trigger	Select *[1] Log once on trigger* to start and stop logging conditionally using *parameter 15-12 Trigger Event* and *parameter 15-14 Samples Before Trigger*.

15-14 Samples Before Trigger		
Range:		**Function:**
50*	[0 - 100]	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*.

4.14.3 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.

15-20 Historic Log: Event		
Array [50]		
Range:		**Function:**
0*	[0 - 255]	View the event type of the logged events.

15-21 Historic Log: Value		
Array [50]		
Range:		**Function:**
0*	[0 - 2147483647]	View the value of the logged event. Interpret the event values according to *Table 4.19*:

Digital input	Decimal value. See *parameter 16-60 Digital Input* for 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.

Table 4.19 Logged Events

15-22 Historic Log: Time		
Array [50]		
Range:		**Function:**
0 ms*	[0 - 2147483647 ms]	View the time at which the logged event occurred. Time is measured in ms since frequency converter start. The maximum value corresponds to approximately 24 days, which means that the count restarts at 0 after this time period.

4

4.14.4 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.

15-30 Fault Log: Error Code		
Range:		**Function:**
0*	[0 - 65535]	View the fault code and look up its meaning in *chapter 6 Trouble-shooting*.

15-31 Alarm Log: Value		
Array [10]		
Range:		**Function:**
0*	[-32767 - 32767]	View an extra description of the error. This parameter is mostly used with *alarm 38, internal fault*.

15-32 Alarm Log: Time		
Array [10]		
Range:		**Function:**
0 s*	[0 - 2147483647 s]	View the time when the logged event occurred. Time is measured in s from frequency converter start-up.

4.14.5 15-4* Drive Identification

Parameters containing read-only information about the hardware and software configuration of the frequency converter.

15-40 FC Type		
Range:		**Function:**
0*	[0 - 6]	View the frequency converter type. The readout is identical to the FC 300 power field of the type code definition, characters 1–6.

15-41 Power Section		
Range:		**Function:**
0*	[0 - 20]	View the frequency converter type. The readout is identical to the FC 300 power field of the type code definition, characters 7–10.

15-42 Voltage		
Range:		**Function:**
0*	[0 - 20]	View the frequency converter type. The readout is identical to the FC 300 power field of the type code definition, characters 11–12.

15-43 Software Version		
Range:		**Function:**
0*	[0 - 5]	View the combined SW version (or package version) consisting of power SW and control SW.

15-44 Ordered Typecode String		
Range:		**Function:**
0*	[0 - 40]	View the type code string used for reordering the frequency converter in its original configuration.

15-45 Actual Typecode String		
Range:		**Function:**
0*	[0 - 40]	View the actual type code string.

15-46 Frequency Converter Ordering No		
Range:		**Function:**
0*	[0 - 8]	View the 8-digit ordering number used for reordering the frequency converter in its original configuration. To restore the ordering number after the power card exchange, see *parameter 14-29 Service Code*.

15-47 Power Card Ordering No		
Range:		**Function:**
0*	[0 - 8]	View the power card ordering number.

15-48 LCP Id No		
Range:		**Function:**
0*	[0 - 20]	View the LCP ID number.

15-49 SW ID Control Card		
Range:		**Function:**
0*	[0 - 20]	View the control card software version number.

15-50 SW ID Power Card		
Range:		**Function:**
0*	[0 - 20]	View the power card software version number.

15-51 Frequency Converter Serial Number		
Range:		**Function:**
0*	[0 - 10]	View the frequency converter serial number.

15-53 Power Card Serial Number		
Range:		**Function:**
0*	[0 - 19]	View the power card serial number.

15-54 Config File Name		
Array [5]		
Range:		**Function:**
Size related*	[0 - 16]	Shows the special configuration filenames.

15-59 Filename		
Range:		**Function:**
Size related*	[0 - 16]	Shows the currently used customer-specific initial values (CSIV) filename.

4.14.6 15-6* Option Ident.

This read-only parameter group contains information about the hardware and software configuration of the options installed in slots A, B, C0, and C1.

15-60 Option Mounted		
Array [8]		
Range:		**Function:**
0*	[0 - 30]	Shows the type of the installed option.

15-61 Option SW Version		
Array [8]		
Range:		**Function:**
0*	[0 - 20]	View the installed option software version.

15-62 Option Ordering No		
Array [8]		
Range:		**Function:**
0*	[0 - 8]	Shows the ordering number for the installed options.

15-63 Option Serial No		
Array [8]		
Range:		**Function:**
0*	[0 - 18]	View the installed option serial number.

4.14.7 15-8* Operating Data II

15-80 Fan Running Hours		
Range:		**Function:**
0 h*	[0 - 2147483647 h]	View how many hours the heat sink fan has run (increments for every hour). The value is saved when the frequency converter is turned off.

15-81 Preset Fan Running Hours		
Range:		**Function:**
0 h*	[0 - 99999 h]	Enter the preset fan running hours counter, see *parameter 15-80 Fan Running Hours*. This parameter cannot be selected via the serial port, RS485.

4.14.8 15-9* Parameter Info

15-92 Defined Parameters		
Range:		**Function:**
0*	[0 - 9999]	View a list of all defined parameters in the frequency converter. The list ends with 0.

15-93 Modified Parameters		
Range:		**Function:**
0*	[0 - 9999]	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.

4.15 Parameters: 16-** Data Readouts

4.15.1 16-0* General Status

16-00 Control Word		
Range:		**Function:**
0*	[0 - 65535]	View the control word sent from the frequency converter via the serial communication port in hex code.

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16-01 Reference [Unit]		
Range:		**Function:**
0 ReferenceFeedbackUnit*	[-999999 - 999999 ReferenceFeedbackUnit]	View the present reference value applied on impulse or analog basis in the unit resulting from the configuration selected in *parameter 1-00 Configuration Mode* (Hz, Nm, or RPM).

16-02 Reference [%]		
Range:		**Function:**
0 %*	[-200 - 200 %]	View the total reference. The total reference is the sum of digital, analog, preset, bus, and freeze references, plus catch up and slow down.

16-03 Status Word		
Range:		**Function:**
0*	[0 - 65535]	View the status word sent from the frequency converter via the serial communication port in hex code.

16-05 Main Actual Value [%]		
Range:		**Function:**
0 %*	[-100 - 100 %]	View the 2-byte word sent with the status word to the fieldbus master reporting the main actual value.

16-09 Custom Readout		
Range:		**Function:**
0 CustomReadoutUnit*	[0 - 999999.99 CustomReadoutUnit]	View the value of custom readout from *parameter 0-30 Unit for User-defined Readout* to *parameter 0-32 Custom Readout Max Value*.

4.15.2 16-1* Motor Status

16-10 Power [kW]		
Range:		**Function:**
0 kW*	[0 - 10000 kW]	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.

16-11 Power [hp]		
Range:		**Function:**
0 hp*	[0 - 10000 hp]	View the motor power in hp. The value shown is calculated based on the actual motor voltage and motor current. The value is filtered, and therefore approximately 1.3 ms may pass from when an input value changes to when the data readout values change.

16-12 Motor Voltage		
Range:		**Function:**
0 V*	[0 - 6000 V]	View the motor voltage, a calculated value used for controlling the motor.

16-13 Frequency		
Range:		**Function:**
0 Hz*	[0 - 6500 Hz]	View the motor frequency without resonance damping.

16-14 Motor current		
Range:		**Function:**
0 A*	[0 - 10000 A]	View the motor current measured as an average value, I_{RMS}. The value is filtered, and thus approximately 1.3 s may pass from when an input value changes to when the data readout values change.

16-15 Frequency [%]		
Range:		**Function:**
0 %*	[-100 - 100 %]	View a 2-byte word reporting the actual motor frequency (without resonance damping) as a percentage (scale 0000–4000 hex) of *parameter 4-19 Max Output Frequency*. Set *parameter 9-16 PCD Read Configuration* index 1 to send it with the status word instead of the MAV.

16-16 Torque [Nm]		
Range:		**Function:**
0 Nm*	[-3000 - 3000 Nm]	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,

16-16 Torque [Nm]		
Range:		**Function:**
		and thus approximately 30 ms may pass from when an input changes value to when the data readout values change.

16-17 Speed [RPM]		
Range:		**Function:**
0 RPM*	[-30000 - 30000 RPM]	View the actual motor RPM. In open-loop or closed-loop process control, the motor RPM is estimated. In speed closed-loop modes, the motor RPM is measured.

16-18 Motor Thermal		
Range:		**Function:**
0 %*	[0 - 100 %]	View the calculated thermal load on the motor. The cutout limit is 100%. The basis for calculation is the ETR function selected in *parameter 1-90 Motor Thermal Protection*.

16-20 Motor Angle		
Range:		**Function:**
0*	[0 - 65535]	View the current encoder/resolver angle offset relative to the index position. The value range of 0–65535 corresponds to 0–2xpi (radian).

16-21 Torque [%] High Res.		
Range:		**Function:**
0 %*	[-200 - 200 %]	The value shown is the torque in percent of nominal torque, with sign and 0.1% resolution, applied to the motor shaft.

16-22 Torque [%]		
Range:		**Function:**
0 %*	[-200 - 200 %]	Value shown is the torque in percent of nominal torque, with sign, applied to the motor shaft.

16-24 Calibrated Stator Resistance		
Range:		**Function:**
0.0000 Ohm*	[0.0000 - 100.0000 Ohm]	Shows the calibrated stator resistance.

4.15.3 16-3* Drive Status

16-30 DC Link Voltage		
Range:		**Function:**
0 V*	[0 - 10000 V]	View a measured value. The value is filtered with a 30 ms time constant.

16-34 Heatsink Temp.		
Range:		**Function:**
0 °C*	[0 - 255 °C]	View the frequency converter heat sink temperature. The cutout limit is 90 ±5 °C (194 ±9 °F), and the motor cuts back in at 60 ±5 °C (140 ±9 °F).

16-35 Inverter Thermal		
Range:		**Function:**
0 %*	[0 - 100 %]	View the percentage load on the inverter.

16-36 Inv. Nom. Current		
Range:		**Function:**
Size related*	[0.01 - 10000 A]	View the inverter nominal current, which must match the nameplate data on the connected motor. The data is used for calculation of torque, motor overload protection, and so on.

16-37 Inv. Max. Current		
Range:		**Function:**
Size related*	[0.01 - 10000 A]	View the inverter maximum current, which must match the nameplate data on the connected motor. The data is used for calculation of torque, motor overload protection, and so on.

16-38 SL Controller State		
Range:		**Function:**
0*	[0 - 100]	View the state of the event under execution by the SL controller.

16-39 Control Card Temp.		
Range:		**Function:**
0 °C*	[0 - 100 °C]	View the temperature on the control card, stated in °C.

4

16-40 Logging Buffer Full		
Option:		**Function:**
		View whether the logging buffer is full (see *chapter 4.14.2 15-1* Data Log Settings*). The logging buffer is never full when *parameter 15-13 Logging Mode* is set to *[0] Log always*.
[0] *	No	
[1]	Yes	

16-45 Motor Phase U Current		
Range:		**Function:**
0 A*	[0 - 10000 A]	Shows the motor phase U_{RMS} current. Facilitates monitoring of imbalance in the motor currents, detection of weak motor cables or imbalance in motor windings.

16-46 Motor Phase V Current		
Range:		**Function:**
0 A*	[0 - 10000 A]	Shows the motor phase V_{RMS} current. Facilitates monitoring of imbalance in the motor currents, detection of weak motor cables or imbalance in motor windings.

16-47 Motor Phase W Current		
Range:		**Function:**
0 A*	[0 - 10000 A]	Shows the motor phase W_{RMS} current. Facilitates monitoring of imbalance in the motor currents, detection of weak motor cables or imbalance in motor windings.

16-48 Speed Ref. After Ramp [RPM]		
Range:		**Function:**
0 RPM*	[-30000 - 30000 RPM]	This parameter specifies the reference given to the frequency converter after the speed ramp.

16-49 Current Fault Source		
Range:		**Function:**
0*	[0 - 8]	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

4.15.4 16-5* Ref. & Feedb.

16-50 External Reference		
Range:		**Function:**
0*	[-200 - 200]	View the total reference, the sum of digital, analog, preset, fieldbus, and freeze references, plus catch up and slow down.

16-51 Pulse Reference		
Range:		**Function:**
0*	[-200 - 200]	View the reference value from programmed digital inputs. The readout can also reflect the impulses from an incremental encoder.

16-52 Feedback[Unit]		
Range:		**Function:**
0 ReferenceFeedbackUnit*	[-999999.999 - 999999.999 ReferenceFeedbackUnit]	View the feedback unit resulting from the selection of unit and scaling in *parameter 3-00 Reference Range*, *parameter 3-01 Reference/Feedback Unit*, *parameter 3-02 Minimum Reference*, and *parameter 3-03 Maximum Reference*.

16-53 Digi Pot Reference		
Range:		**Function:**
0*	[-200 - 200]	View the contribution of the digital potentiometer to the actual reference.

16-57 Feedback [RPM]		
Range:		**Function:**
0 RPM*	[-30000 - 30000 RPM]	Readout parameter where the actual motor RPM from the feedback source can be read in both closed loop and open loop. The feedback source is selected by *parameter 7-00 Speed PID Feedback Source*.

4.15.5 16-6* Inputs and Outputs

16-60 Digital Input

Range:		Function:
0*	[0 - 1023]	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).

Bit 0	Digital input terminal 33.
Bit 1	Digital input terminal 32.
Bit 2	Digital input terminal 29.
Bit 3	Digital input terminal 27.
Bit 4	Digital input terminal 19.
Bit 5	Digital input terminal 18.
Bit 6	Digital input terminal 37.
Bit 7	Digital input VLT® General Purpose I/O MCB 101 terminal X30/4.
Bit 8	Digital input VLT® General Purpose I/O MCB 101 terminal X30/3.
Bit 9	Digital input VLT® General Purpose I/O MCB 101 terminal X30/2.
Bit 10–63	Reserved for future terminals.

Table 4.20 Active Digital Inputs

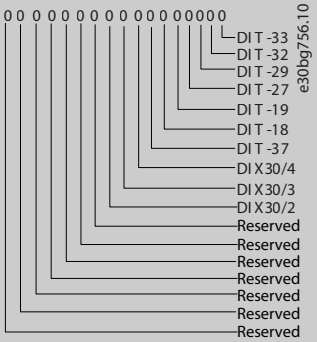

Illustration 4.47 Relay Settings

16-61 Terminal 53 Switch Setting

Option:		Function:
		View the setting of input terminal 53.
[0] *	Current	
[1]	Voltage	

16-62 Analog Input 53

Range:		Function:
0*	[-20 - 20]	View the actual value at input 53.

16-63 Terminal 54 Switch Setting

View the setting of input terminal 54.

Option:		Function:
[0] *	Current	
[1]	Voltage	

16-64 Analog Input 54

Range:		Function:
0*	[-20 - 20]	View the actual value at input 54.

16-65 Analog Output 42 [mA]

Range:		Function:
0*	[0 - 30]	View the actual value at output 42 in mA. The value shown reflects the selection in *parameter 6-50 Terminal 42 Output*.

16-66 Digital Output [bin]

Range:		Function:
0*	[0 - 15]	View the binary value of all digital outputs.

16-67 Pulse Input #29 [Hz]

Range:		Function:
0*	[0 - 130000]	View the actual frequency rate on terminal 29.

16-68 Freq. Input #33 [Hz]

Range:		Function:
0*	[0 - 130000]	View the actual value of the frequency applied at terminal 33 as an impulse input.

16-69 Pulse Output #27 [Hz]

Range:		Function:
0*	[0 - 40000]	View the actual value of pulses applied to terminal 27 in digital output mode.

16-70 Pulse Output #29 [Hz]		
Range:		**Function:**
0*	[0 - 40000]	View the actual value of pulses at terminal 29 in digital output mode.

16-71 Relay Output [bin]		
Range:		**Function:**
0*	[0 - 511]	View the settings of all relays.

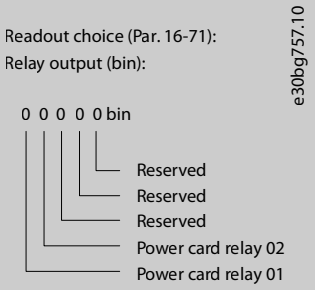

Illustration 4.48 Relay Settings

16-72 Counter A		
Range:		**Function:**
0*	[-2147483648 - 2147483647]	View the present value of counter A. Counters are useful as comparator operands, see *parameter 13-10 Comparator Operand*. Reset or change the value either via digital inputs (*parameter group 5-1* Digital Inputs*) or by using an SLC action (*parameter 13-52 SL Controller Action*).

16-73 Counter B		
Range:		**Function:**
0*	[-2147483648 - 2147483647]	View the present value of counter B. Counters are useful as comparator operands (*parameter 13-10 Comparator Operand*). Reset or change the value either via digital inputs (*parameter group 5-1* Digital Inputs*) or by using an SLC action (*parameter 13-52 SL Controller Action*).

16-75 Analog In X30/11		
Range:		**Function:**
0*	[-20 - 20]	View the actual value at input X30/11 of VLT® General Purpose I/O MCB 101.

16-76 Analog In X30/12		
Range:		**Function:**
0*	[-20 - 20]	View the actual value at input X30/12 of VLT® General Purpose I/O MCB 101.

16-77 Analog Out X30/8 [mA]		
Range:		**Function:**
0*	[0 - 30]	View the actual value at input X30/8 in mA.

4.15.6 16-8* Fieldbus & FC Port

Parameters for reporting the bus references and control words.

16-80 Fieldbus CTW 1		
Range:		**Function:**
0*	[0 - 65535]	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 Profile*. For more information, refer to the relevant fieldbus manual.

16-82 Fieldbus REF 1		
Range:		**Function:**
0*	[-200 - 200]	View the 2-byte word sent with the control word from the fieldbus master to set the reference value. For more information, refer to the relevant fieldbus manual.

16-84 Comm. Option STW		
Range:		**Function:**
0*	[0 - 65535]	Show the status word of the extended fieldbus communication option. For more information, refer to the relevant fieldbus manual.

16-85 FC Port CTW 1		
Range:		**Function:**
0*	[0 - 65535]	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 Profile*.

16-86 FC Port REF 1		
Range:		**Function:**
0*	[-200 - 200]	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 Profile*.

16-87 Bus Readout Alarm/Warning		
Range:		**Function:**
0*	[0 - 65535]	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 one that occurred after the last reset.

4.15.7 16-9* Diagnosis Readouts

NOTICE

When using MCT 10 Set-up Software, the readout parameters can only be read online, that is as the actual status. This means that the status is not stored in the MCT 10 Set-up Software file.

16-90 Alarm Word		
Range:		**Function:**
0*	[0 - 4294967295]	Show the alarm word sent via the serial communication port in hex code.

16-91 Alarm Word 2		
Range:		**Function:**
0*	[0 - 4294967295]	View the alarm word sent via the serial communication port in hex code.

16-92 Warning Word		
Range:		**Function:**
0*	[0 - 4294967295]	Show the warning word sent via the serial communication port in hex code.

16-93 Warning Word 2		
Range:		**Function:**
0*	[0 - 4294967295]	View the warning word sent via the serial communication port in hex code.

16-94 Ext. Status Word		
Range:		**Function:**
0*	[0 - 4294967295]	Returns the extended warning word sent via the serial communication port in hex code.

16-95 Ext. Status Word 2		
Range:		**Function:**
0*	[0 - 4294967295]	Returns the extended status word 2 sent via the serial communication port in hex code.

16-97 Alarm Word 3		
Range:		**Function:**
0*	[0 - 4294967295]	Show the alarm word 3 sent via the serial communication port in hex code.

16-98 Warning Word 3		
Range:		**Function:**
0*	[0 - 4294967295]	View the warning word sent via the serial communication port in hex code.

4.16 Parameters: 17-** Feedback

More parameters to configure the feedback from the encoder (VLT® Encoder Input MCB 102), resolver (VLT® Resolver Input MCB 103), or the frequency converter itself.

4.16.1 17-1* Inc. Enc. Interface

Parameters in this group configure the incremental interface of the VLT® Encoder Input MCB 102. Both the incremental and absolute interfaces are active at the same time.

NOTICE

These parameters cannot be adjusted while the motor is running.

17-10 Signal Type		
Select the incremental type (A/B channel) of the encoder in use. Find the information on the encoder datasheet. Select *[0] None* if the feedback sensor is an absolute encoder only.		
Option:		**Function:**
[0]	None	
[1] *	RS422 (5V TTL)	
[2]	Sinusoidal 1Vpp	

17-11 Resolution (PPR)		
Range:		**Function:**
1024*	[10 - 10000]	Enter the resolution of the incremental track, that is the number of pulses or periods per revolution.

4

4.16.2 17-5* Resolver Interface

This parameter group is used for setting parameters for the VLT® Resolver Input MCB 103.
Resolver parameters cannot be adjusted while the motor is running.

17-50 Poles		
Range:		**Function:**
2*	[2 - 8]	Set the pole number on the resolver. The value is stated in the datasheet for resolvers.

17-51 Input Voltage		
Range:		**Function:**
7 V*	[2 - 8 V]	Set the input voltage to the resolver. The voltage is stated as RMS value. The value is stated in the datasheet for resolvers.

17-52 Input Frequency		
Range:		**Function:**
10 kHz*	[2 - 15 kHz]	Set the input frequency to the resolver. The value is stated in the datasheet for resolvers.

17-53 Transformation Ratio		
Range:		**Function:**
0.5*	[0.1 - 1.1]	Set the transformation ratio for the resolver. The transformation ratio is: $T_{ratio} = \frac{V_{0ut}}{V_{In}}$ The value is stated in the datasheet for resolvers.

17-56 Encoder Sim. Resolution		
Set the resolution and activate the encoder emulation function (generation of encoder signals from the measured position from a resolver). Use this function to transfer the speed or position information from 1 frequency converter to another. To disable the function, select *[0] Disabled*.		
Option:		**Function:**
[0] *	Disabled	
[1]	512	
[2]	1024	
[3]	2048	
[4]	4096	

17-59 Resolver Interface		
Activate the VLT® Resolver Input MCB 103 when the resolver parameters are selected. To avoid damage to resolvers, adjust *parameter 17-50 Poles* and *parameter 17-53 Transformation Ratio* before enabling this parameter.		
Option:		**Function:**
[0] *	Disabled	
[1]	Enabled	

4.16.3 17-6* Monitoring and Application

This parameter group is for selecting extra functions when VLT® Encoder Input MCB 102 or VLT® Resolver Input MCB 103 is fitted into option slot B as speed feedback.
Monitoring and application parameters cannot be adjusted while the motor is running.

17-60 Feedback Direction		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** Change the detected encoder rotation direction without changing the wiring to the encoder.
[0] *	Clockwise	
[1]	Counter clockwise	

17-61 Feedback Signal Monitoring		
Select which action the frequency converter should take if a faulty encoder signal is detected. The encoder function in *parameter 17-61 Feedback Signal Monitoring* is an electrical check of the hardware circuit in the encoder system.		
Option:		**Function:**
[0]	Disabled	
[1] *	Warning	
[2]	Trip	
[3]	Jog	
[4]	Freeze Output	
[5]	Max Speed	
[6]	Switch to Open Loop	
[7]	Select Setup 1	
[8]	Select Setup 2	
[9]	Select Setup 3	
[10]	Select Setup 4	
[11]	Stop & Trip	
[12]	Trip/Warning	
[13]	Trip/Catch	

4.17 Parameters: 18-** Data Readouts 2

4.17.1 18-5* Active Alarms/Warnings

The parameters in this group show the numbers of currently active alarms or warnings.

18-55 Active Alarm Numbers		
Range:		**Function:**
0*	[0 - 65535]	This parameter contains an array of up to 20 alarms that are currently active. The value 0 means no alarm.

18-56 Active Warning Numbers		
Range:		**Function:**
0*	[0 - 65535]	This parameter contains an array of up to 20 warnings that are currently active. The value 0 means no warning.

18-90 Process PID Error		
Range:		**Function:**
0 %*	[-200 - 200 %]	Give the present error value used by the process PID controller.

18-91 Process PID Output		
Range:		**Function:**
0 %*	[-200 - 200 %]	Give the present raw output value from the process PID controller.

18-92 Process PID Clamped Output		
Range:		**Function:**
0 %*	[-200 - 200 %]	Give the present output value from the process PID controller after the clamp limits have been observed.

18-93 Process PID Gain Scaled Output		
Range:		**Function:**
0 %*	[-200 - 200 %]	Give the present output value from the process PID controller after the clamp limits have been observed, and the resulting value has been gain scaled.

4.18 Parameters: 21-** Ext. Closed Loop

21-10 Ext. 1 Ref./Feedback Unit	
Select the unit to be used with closed loop 1.	
Option:	**Function:**
[0]	None
[1] *	%
[5]	PPM
[10]	1/min
[11]	rpm
[12]	Pulse/s
[20]	l/s
[21]	l/min
[22]	l/h
[23]	m^3/s
[24]	m^3/min
[25]	m^3/h
[30]	kg/s
[31]	kg/min
[32]	kg/h
[33]	t/min
[34]	t/h
[40]	m/s
[41]	m/min
[45]	m
[60]	°C
[70]	mbar
[71]	bar
[72]	Pa
[73]	kPa
[74]	m WG
[80]	kW
[120]	GPM
[121]	gal/s
[122]	gal/min
[123]	gal/h
[124]	CFM
[125]	ft^3/s
[126]	ft^3/min
[127]	ft^3/h

4

21-10 Ext. 1 Ref./Feedback Unit

Select the unit to be used with closed loop 1.

Option:		Function:
[130]	lb/s	
[131]	lb/min	
[132]	lb/h	
[140]	ft/s	
[141]	ft/min	
[145]	ft	
[160]	°F	
[170]	psi	
[171]	lb/in²	
[172]	in WG	
[173]	ft WG	
[180]	HP	

21-11 Ext. 1 Minimum Reference

Range:		Function:
0 ExtPID1Unit*	[-999999.999 - par. 21-12 ExtPID1Unit]	This parameter sets the minimum value that can be obtained by the sum of the setpoint and reference.

21-12 Ext. 1 Maximum Reference

Range:		Function:
100 ExtPID1Unit	[par. 21-11 - 999999.999 ExtPID1Unit]	This parameter sets the maximum value that can be obtained by the sum of the setpoint and reference.

21-13 Ext. 1 Reference Source

This parameter defines which input on the frequency converter should be treated as the source of the reference signal.

Option:		Function:
[0] *	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[7]	Frequency input 29	
[8]	Frequency input 33	
[11]	Local bus reference	
[20]	Digital pot.meter	
[21]	Analog input X30/11	
[22]	Analog input X30/12	
[30]	Option Reference	
[32]	Bus PCD	

21-14 Ext. 1 Feedback Source

This parameter defines which input on the frequency converter should be treated as the source of the feedback signal.

Option:		Function:
[0] *	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[3]	Frequency input 29	
[4]	Frequency input 33	
[7]	Analog Input X30/11	
[8]	Analog Input X30/12	

21-15 Ext. 1 Setpoint

Range:		Function:
0 ExtPID1Unit*	[par. 21-11 - par. 21-12 ExtPID1Unit]	This parameter is used as the reference for comparing feedback values. The setpoint can be offset with digital, analog, or bus references.

21-17 Ext. 1 Reference [Unit]

Range:		Function:
0 ExtPID1Unit*	[-999999.999 - 999999.999 ExtPID1Unit]	Return the resulting reference value.

21-18 Ext. 1 Feedback [Unit]

Range:		Function:
0 ExtPID1Unit*	[-999999.999 - 999999.999 ExtPID1Unit]	Return the feedback value.

21-19 Ext. 1 Output [%]

Range:		Function:
0 %*	[0 - 100 %]	Return the extended closed loop 1 PID controller output value.

21-20 Ext. 1 Normal/Inverse Control

Select *[0] Normal* if the controller output should be reduced when the feedback is higher than the reference. Select *[1] Inverse* if the output should be increased when the feedback is higher than the reference.

Option:		Function:
[0] *	Normal	
[1]	Inverse	

21-21 Ext. 1 Proportional Gain		
Range:		**Function:**
0.01*	[0 - 10]	The proportional gain indicates the number of times the error between the setpoint and the feedback signal is to be applied.

21-22 Ext. 1 Integral Time		
Range:		**Function:**
10000 s*	[0.01 - 10000 s]	The integrator provides an increasing gain at a constant error between the setpoint and the feedback signal. The integral time is the time needed by the integrator to reach the same gain as the proportional gain.

21-23 Ext. 1 Differentation Time		
Range:		**Function:**
0 s*	[0 - 10 s]	The differentiator does not react to a constant error. It only provides a gain when the error changes. The quicker the error changes, the stronger the gain from the differentiator.

21-24 Ext. 1 Dif. Gain Limit		
Range:		**Function:**
5*	[1 - 50]	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 at slow changes and a constant differentiator gain where quick changes occur.

4.19 Parameters: 22-** Appl. Functions

4.19.1 22-0* Miscellaneous

22-00 External Interlock Delay		
Range:		**Function:**
0 s*	[0 - 600 s]	Set the time for delaying the external interlock command.

4.19.2 22-4* Sleep Mode

Sleep mode allows the frequency converter to stop itself in situations where the system is in balance. This function saves energy and prevents excessive pressure, water excessively cooled in cooling towers, and building pressurization problems in the system. This is also important as some applications prevent the frequency converter from adjusting the motor down to low speed. This might damage pumps, cause insufficient lubrication in gearboxes, and make fans unstable.

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.

To facilitate use of the sleep mode function, the action takes place at raising edge of the external digital input signal applied, and the sleep mode enable is level-based (programmed via the parameters for configuration of the digital inputs, *parameter group 5-1* Digital Inputs*). Then, the frequency converter judges the conditions for going into sleep mode or wake up automatically.

If digital input for sleep mode enable was removed during the sleep status, the frequency converter could still come out of wake up according to the real wake-up conditions for this time.

There are 2 different ways of using the sleep mode function after sleep mode function is enabled:

1) 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. Set *parameter 1-00 Configuration Mode* to *[0] Speed open loop*.

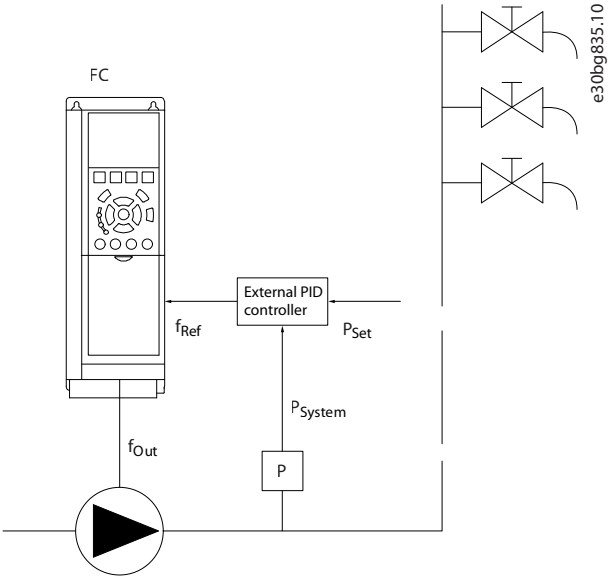

Illustration 4.49 Sleep Mode Function

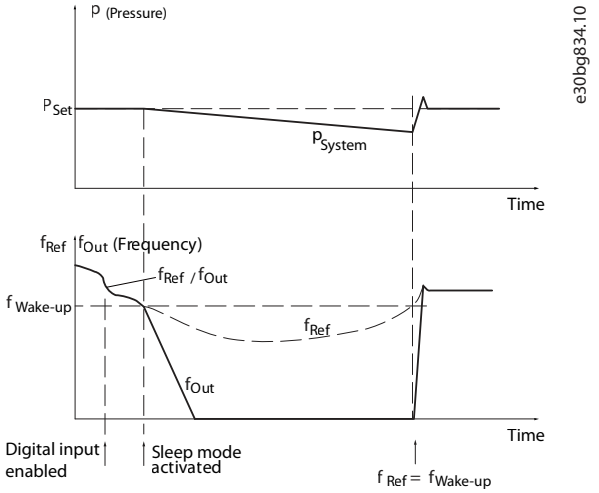

Illustration 4.50 Sequence Diagram

In the example above, the speed reference is set by an external reference signal from external PI controller. Desired pressure P_{set} is not known for the frequency converter. When low speed is detected, the motor is going into sleep mode and stopped, but the reference signal (f_{ref}) from the external controller is still monitored. Because of the low pressure created, the controller increases the reference signal to gain pressure. When the reference signal has reached a set value, f_{wake}, which is set in *parameter 22-42 Wake-up Speed [RPM]* or *parameter 22-43 Wake-up Speed [Hz]*, the motor restarts.

2) 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 frequency converter from a pressure transducer.

1. Set *parameter 1-00 Configuration Mode* to *[3] Process*.
2. Configure the PI controller for reference and feedback signals.

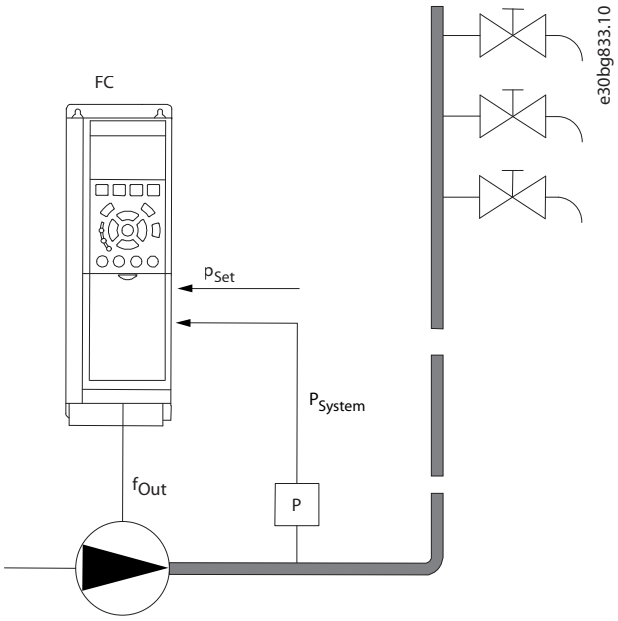

Illustration 4.51 Sleep Mode Function

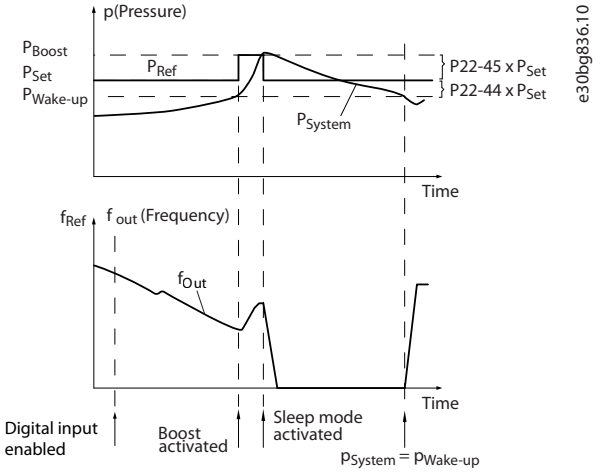

Illustration 4.52 Sequence Diagram

If the difference between pressure reference and feedback is smaller than the threshold, the boost function activates, which means the frequency converter increases the setpoint for pressure to ensure a slight overpressure in the system (the boost is set in *parameter 22-45 Setpoint Boost*). The feedback from the pressure transducer is monitored. When this pressure has dropped with a set percentage below the normal setpoint for pressure (P_{set}), the motor ramps up again. The pressure is then controlled for reaching the set value (P_{set}).

	External PI controller or manual control (*parameter 1-00 Configuration Mode*: Open loop)		Internal PI controller (*parameter 1-00 Configuration Mode*: Closed loop)	
	Sleep mode activated	**Wake up**	**Sleep mode activated**	**Wake up**
Pressure/temperature (transmitter connected)	–	–	Yes	Yes
Output frequency	Yes	Yes	–	–
Boost function	–	–	Yes	–
Sleep mode enable	External DI signal (*parameter group 5-1* Digital Inputs*)			

Table 4.21 Configuration Overview

The goal of the boost function is to keep the frequency converter in sleep mode as long as possible to avoid cycling the motor on and off frequently, and also keep the controlled system variable within the acceptable range. Boost is only to be used when *parameter 1-00 Configuration Mode* is set to *[3] Process*, and the integrated PI controller is used.

NOTICE

Sleep mode is not active when local reference is active (set speed manually with the navigation keys on the LCP). See *parameter 3-13 Reference Site*.
Does not work in hand-on mode. Carry out auto set-up in open loop before setting input/output in closed loop.

4

22-40 Minimum Run Time		
Range:		**Function:**
10 s*	[0 - 600 s]	Set the wanted minimum running time for the motor after a start command (digital input or bus) before entering sleep mode.

22-41 Minimum Sleep Time		
Range:		**Function:**
10 s*	[0 - 600 s]	Set the minimum time for staying in sleep mode. This time overrides any wake-up conditions.

22-42 Wake-up Speed [RPM]		
Range:		**Function:**
Size related*	[par. 4-11 - par. 4-13 RPM]	To be used if *parameter 0-02 Motor Speed Unit* has been set for *[0] RPM* (parameter not visible if *[1] Hz* is selected). Only to be used if *parameter 1-00 Configuration Mode* is set for *[0] Speed open loop* and an external controller applies speed reference. Set the reference speed at which the sleep mode should be activated or be cancelled.

22-43 Wake-up Speed [Hz]		
Range:		**Function:**
Size related*	[par. 4-12 - par. 4-14 Hz]	To be used if *parameter 0-02 Motor Speed Unit* has been set for *[1] Hz* (parameter not visible if *[0] RPM* is selected). Only to be used if *parameter 1-00 Configuration Mode* is set for *[0] Speed open loop* and speed reference is applied by an external controller controlling the pressure. Set the reference speed at which the sleep mode should be activated or be cancelled.

22-44 Wake-Up Ref./FB Diff		
Range:		**Function:**
10 %*	[0 - 100 %]	Only to be used if *parameter 1-00 Configuration Mode* is set to *[1] Speed 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 going into sleep mode and canceling the sleep mode.

22-44 Wake-Up Ref./FB Diff		
Range:		**Function:**
		If setting for 20%, the threshold is the difference between pressure reference and feedback as follows: $P_{\text{Wake - up}} = P_{\text{Set}} - P_{\text{Set}} \times 0.20$

22-45 Setpoint Boost		
Range:		**Function:**
0 %*	[-100 - 100 %]	Only to be used if *parameter 1-00 Configuration Mode* is set to *[1] Speed closed loop*, and the integrated PI controller is used. In systems with for example constant pressure control, it is advantageous to increase the 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 desired overpressure/ temperature in percentage of setpoint for the pressure (P_{set})/ temperature before entering the sleep mode. If set to 5%, the boost pressure is P_{set} x 1.05. The negative values can be used for cooling tower control where a negative change is needed.

22-46 Maximum Boost Time		
Range:		**Function:**
60 s*	[0 - 600 s]	Only to be used when *parameter 1-00 Configuration Mode* is set to *[1] Speed 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.

4.19.3 22-6* Broken-belt Detection

Use broken-belt detection in both closed-loop systems and open-loop systems for pumps and fans. If the estimated motor torque (current) is below the broken-belt torque (current) value (*parameter 22-61 Broken Belt Torque*), the frequency converter output frequency is above or equal to 15 Hz, and the condition has been active for *parameter 22-62 Broken Belt Delay*, *parameter 22-60 Broken Belt Function* is performed.

22-60 Broken Belt Function		
Option:		**Function:**
		Select the actions to be performed if the broken-belt condition is detected.
[0] *	Off	
[1]	Warning	The frequency converter continues to run, but activates *warning 95, Broken belt*. A frequency converter digital output or a serial communication bus communicates a warning to other equipment.
[2]	Trip	The frequency converter stops running and activates *alarm 95, Broken belt*. A frequency converter digital output or a serial communication bus communicates an alarm to other equipment.
[3]	Stop and Trip	

22-61 Broken Belt Torque		
Range:		**Function:**
10 %*	[0 - 100 %]	Set the broken-belt torque as a percentage of the rated motor torque.

22-62 Broken Belt Delay		
Range:		**Function:**
10 s*	[0 - 600 s]	Set the time for which the broken-belt conditions must be active before carrying out the action selected in *parameter 22-60 Broken Belt Function*.

4.20 Parameters: 30-** Special Features

4.20.1 30-2* Adv. Start Adjust

30-20 High Starting Torque Time [s]		
Range:		**Function:**
Size related*	[0 - 60 s]	This function is active together with speed control closed loop. In order to obtain a high starting torque, approximately 2 x $I_{VLT,N}$ for maximum 0.5 s. However, the current is limited by the protection limit of the frequency converter.

30-21 High Starting Torque Current [%]		
Range:		**Function:**
Size related*	[0 - 200.0 %]	High starting torque current for PM motor in VVC+ mode without feedback.

30-22 Locked Rotor Protection		
Option:		**Function:**
		Available for PM motors only, in VVC+ open-loop mode.
[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 frequency converter to protect the motor.

30-23 Locked Rotor Detection Time [s]		
Range:		**Function:**
Size related*	[0.05 - 1 s]	Time period for detecting the locked rotor condition. A low parameter value leads to faster detection.

30-24 Locked Rotor Detection Speed Error [%]		
Range:		**Function:**
25 %*	[0 - 100 %]	

4.21 Parameters: 40-** Special Settings

40-40 Fault Log: Ext. Reference		
Range:		**Function:**
0 %*	[-200 - 200 %]	View the present reference value applied on impulse or analog basis, when the logged event occurred.

40-41 Fault Log: Frequency		
Range:		**Function:**
0 Hz*	[0 - 6500 Hz]	View the actual motor frequency value, when the logged event occurred.

40-42 Fault Log: Current		
Range:		**Function:**
0 A*	[0 - 10000 A]	View the motor current measured when the logged event occurred.

40-43 Fault Log: Voltage		
Range:		**Function:**
0 V*	[0 - 6000 V]	View the motor voltage when the logged event occurred.

40-44 Fault Log: DC Link Voltage		
Range:		**Function:**
0 V*	[0 - 10000 V]	View the DC-Link voltage when the logged event occurred.

40-45 Fault Log: Control Word		
Range:		**Function:**
0*	[0 - 65535]	View the control word sent from the drive, when the logged event occurred.

40-46 Fault Log: Status Word		
Range:		**Function:**
0*	[0 - 65535]	View the status word sent from the drive, when the logged event occurred.

5 Parameter Lists

5.1 Introduction

Changes during operation
True means that the parameter can be changed while the frequency converter is in operation. False means that the frequency converter must be stopped before a change can be made.

4 set-up
All set-ups: The parameter can be set individually in each of the 4 set-ups, for example 1 single parameter can have 4 different data values.
1 set-up: The data value is the same in all set-ups.

Data type	Description	Type
2	Integer 8	Int8
3	Integer 16	Int16
4	Integer 32	Int32
5	Unsigned 8	Uint8
6	Unsigned 16	Uint16
7	Unsigned 32	Uint32
9	Visible string	VisStr
33	Normalized value 2 bytes	N2
35	Bit sequence of 16 boolean variables	V2
54	Time difference w/o date	TimD

Table 5.1 Data Type

5.1.1 Conversion

The various attributes of each parameter are shown in factory setting. Parameter values are transferred as whole numbers only. Conversion factors are therefore used to transfer decimals.

A conversion factor of 0.1 means that the value transferred is multiplied by 0.1. The value 100 is therefore read as 10.0.

Conversion index	Conversion factor
100	1
75	3600000
74	3600
70	60
67	1/60
6	1000000
5	100000
4	10000
3	1000
2	100
1	10
0	1
-1	0.1
-2	0.01
-3	0.001
-4	0.0001
-5	0.00001
-6	0.000001

Table 5.2 Conversion Table

5.2 Parameter Lists

5.2.1 0-** Operation / Display

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
0-0* Basic Settings						
0-01	Language	0 N/A	1 set-up	TRUE	–	Uint8
0-02	Motor Speed Unit	[1] Hz	4 set-ups	FALSE	–	Uint8
0-04	Operating State at Power-up (Hand)	[1] Forced stop, ref=old	All set-ups	TRUE	–	Uint8
0-1* Set-up Operations						
0-10	Active Set-up	[1] Set-up 1	1 set-up	TRUE	–	Uint8
0-11	Edit Set-up	[1] Set-up 1	All set-ups	TRUE	–	Uint8
0-12	This Set-up Linked to	[0] Not linked	All set-ups	FALSE	–	Uint8
0-13	Readout: Linked Set-ups	0 N/A	All set-ups	FALSE	0	Uint16
0-14	Readout: Edit Set-ups / Channel	0 N/A	All set-ups	TRUE	0	Int32
0-2* LCP Display						
0-20	Display Line 1.1 Small	1617	All set-ups	TRUE	–	Uint16
0-21	Display Line 1.2 Small	1614	All set-ups	TRUE	–	Uint16
0-22	Display Line 1.3 Small	1610	All set-ups	TRUE	–	Uint16
0-23	Display Line 2 Large	1613	All set-ups	TRUE	–	Uint16
0-24	Display Line 3 Large	1502	All set-ups	TRUE	–	Uint16
0-25	My Personal Menu	ExpressionLimit	1 set-up	TRUE	0	Uint16
0-3* LCP Custom Readout						
0-30	Unit for User-defined Readout	[1] %	All set-ups	TRUE	–	Uint8
0-31	Min Value of User-defined Readout	0 CustomReadoutUnit	All set-ups	TRUE	-2	Int32
0-32	Max Value of User-defined Readout	100 CustomReadoutUnit	All set-ups	TRUE	-2	Int32
0-37	Display Text 1	0 N/A	1 set-up	TRUE	0	VisStr[25]
0-38	Display Text 2	0 N/A	1 set-up	TRUE	0	VisStr[25]
0-39	Display Text 3	0 N/A	1 set-up	TRUE	0	VisStr[25]
0-4* LCP Keypad						
0-40	[Hand on] Key on LCP	[1] Enabled	All set-ups	TRUE	–	Uint8
0-41	[Off] Key on LCP	[1] Enabled	All set-ups	TRUE	–	Uint8
0-42	[Auto on] Key on LCP	[1] Enabled	All set-ups	TRUE	–	Uint8
0-43	[Reset] Key on LCP	[1] Enabled	All set-ups	TRUE	–	Uint8
0-5* Copy/Save						
0-50	LCP Copy	[0] No copy	All set-ups	FALSE	–	Uint8
0-51	Set-up Copy	[0] No copy	All set-ups	FALSE	–	Uint8
0-6* Password						
0-60	Main Menu Password	100 N/A	1 set-up	TRUE	0	Int16
0-61	Access to Main Menu w/o Password	[0] Full access	1 set-up	TRUE	–	Uint8

5.2.2 1-** Load and Motor

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
1-0* General Settings						
1-00	Configuration Mode	ExpressionLimit	All set-ups	TRUE	–	Uint8
1-01	Motor Control Principle	[1] VVC+	All set-ups	FALSE	–	Uint8
1-03	Torque Characteristics	[0] Constant torque	All set-ups	TRUE	–	Uint8

1-04	Overload Mode	[1] Normal torque	All set-ups	FALSE	–	Uint8
1-05	Local Mode Configuration	[2] As mode par 1-00	All set-ups	TRUE	–	Uint8
1-06	Clockwise Direction	[0] Normal	All set-ups	FALSE	–	Uint8
1-1* Special Settings						
1-10	Motor Construction	[0] Asynchron	All set-ups	FALSE	–	Uint8
1-14	Damping Gain	140 %	All set-ups	TRUE	0	Int16
1-15	Low Speed Filter Time Const.	ExpressionLimit	All set-ups	TRUE	-2	Uint16
1-16	High Speed Filter Time Const.	ExpressionLimit	All set-ups	TRUE	-2	Uint16
1-17	Voltage filter time const.	ExpressionLimit	All set-ups	TRUE	-3	Uint16
1-18	Min. Current at No Load	0 %	All set-ups	TRUE	0	Uint16
1-2* Motor Data						
1-20	Motor Power [kW]	ExpressionLimit	All set-ups	FALSE	1	Uint32
1-22	Motor Voltage	ExpressionLimit	All set-ups	FALSE	0	Uint16
1-23	Motor Frequency	ExpressionLimit	All set-ups	FALSE	0	Uint16
1-24	Motor Current	ExpressionLimit	All set-ups	FALSE	-2	Uint32
1-25	Motor Nominal Speed	ExpressionLimit	All set-ups	FALSE	67	Uint16
1-26	Motor Cont. Rated Torque	ExpressionLimit	All set-ups	FALSE	-1	Uint32
1-29	Automatic Motor Adaptation (AMA)	[0] Off	All set-ups	FALSE	–	Uint8
1-3* Adv. Motor Data						
1-30	Stator Resistance (Rs)	ExpressionLimit	All set-ups	FALSE	-4	Uint32
1-31	Rotor Resistance (Rr)	ExpressionLimit	All set-ups	FALSE	-4	Uint32
1-33	Stator Leakage Reactance (X1)	ExpressionLimit	All set-ups	FALSE	-4	Uint32
1-34	Rotor Leakage Reactance (X2)	ExpressionLimit	All set-ups	FALSE	-4	Uint32
1-35	Main Reactance (Xh)	ExpressionLimit	All set-ups	FALSE	-4	Uint32
1-36	Iron Loss Resistance (Rfe)	ExpressionLimit	All set-ups	FALSE	-3	Uint32
1-37	d-axis Inductance (Ld)	ExpressionLimit	All set-ups	FALSE	-3	Int32
1-38	q-axis Inductance (Lq)	ExpressionLimit	All set-ups	FALSE	-3	Int32
1-39	Motor Poles	ExpressionLimit	All set-ups	FALSE	0	Uint8
1-40	Back EMF at 1000 RPM	ExpressionLimit	All set-ups	FALSE	0	Uint16
1-41	Motor Angle Offset	0 N/A	All set-ups	TRUE	0	Int16
1-46	Position Detection Gain	100 %	All set-ups	TRUE	0	Uint16
1-47	Torque Calibration	ExpressionLimit	All set-ups	TRUE	–	Uint8
1-5* Load Indep. Setting						
1-50	Motor Magnetisation at Zero Speed	100 %	All set-ups	TRUE	0	Uint16
1-51	Min Speed Normal Magnetising [RPM]	ExpressionLimit	All set-ups	TRUE	0	Uint16
1-52	Min Speed Normal Magnetising [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
1-55	U/f Characteristic - U	ExpressionLimit	All set-ups	TRUE	0	Uint16
1-56	U/f Characteristic - F	ExpressionLimit	All set-ups	TRUE	0	Uint16
1-58	Flying Start Test Pulses Current	ExpressionLimit	All set-ups	FALSE	0	Uint16
1-59	Flying Start Test Pulses Frequency	ExpressionLimit	All set-ups	FALSE	0	Uint16
1-6* Load Depen. Setting						
1-60	Low Speed Load Compensation	100 %	All set-ups	TRUE	0	Int16
1-61	High Speed Load Compensation	100 %	All set-ups	TRUE	0	Int16
1-62	Slip Compensation	ExpressionLimit	All set-ups	TRUE	0	Int16
1-63	Slip Compensation Time Constant	ExpressionLimit	All set-ups	TRUE	-2	Uint16
1-64	Resonance Damping	ExpressionLimit	All set-ups	TRUE	0	Uint16
1-65	Resonance Damping Time Constant	5 ms	All set-ups	TRUE	-3	Uint8
1-66	Min. Current at Low Speed	ExpressionLimit	All set-ups	TRUE	0	Uint32
1-7* Start Adjustments						
1-70	Start Mode	[0] Rotor Detection	All set-ups	TRUE	–	Uint8
1-71	Start Delay	0 s	All set-ups	TRUE	-1	Uint8
1-72	Start Function	[2] Coast/delay time	All set-ups	TRUE	–	Uint8
1-73	Flying Start	ExpressionLimit	All set-ups	FALSE	–	Uint8
1-74	Start Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16

1-75	Start Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
1-76	Start Current	0 A	All set-ups	TRUE	-2	Uint32
1-77	Compressor Start Max Speed [RPM]	ExpressionLimit	All set-ups	TRUE	–	Uint16
1-78	Compressor Start Max Speed [Hz]	ExpressionLimit	All set-ups	TRUE	–	Uint16
1-79	Compressor Start Max Time to Trip	5 s	All set-ups	TRUE	0	Uint8
1-8* Stop Adjustments						
1-80	Function at Stop	[0] Coast	All set-ups	TRUE	–	Uint8
1-81	Min Speed for Function at Stop [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
1-82	Min Speed for Function at Stop [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
1-9* Motor Temperature						
1-90	Motor Thermal Protection	ExpressionLimit	All set-ups	TRUE	–	Uint8
1-91	Motor External Fan	ExpressionLimit	All set-ups	TRUE	–	Uint8
1-93	Thermistor Resource	[0] None	All set-ups	TRUE	–	Uint8

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5.2.3 2-** Brakes

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
2-0* DC-Brake						
2-00	DC Hold Current	50 %	All set-ups	TRUE	0	Uint8
2-01	DC Brake Current	50 %	All set-ups	TRUE	0	Uint16
2-02	DC Braking Time	10 s	All set-ups	TRUE	-1	Uint16
2-03	DC Brake Cut In Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
2-04	DC Brake Cut In Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
2-06	Parking Current	50 %	All set-ups	TRUE	0	Uint16
2-07	Parking Time	3 s	All set-ups	TRUE	-1	Uint16
2-1* Brake Energy Funct.						
2-10	Brake Function	ExpressionLimit	All set-ups	TRUE	–	Uint8
2-16	AC brake Max. Current	100 %	All set-ups	TRUE	-1	Uint32
2-17	Over-voltage Control	[0] Disabled	All set-ups	TRUE	–	Uint8
2-19	Over-voltage Gain	100 %	All set-ups	TRUE	0	Uint16

5.2.4 3-** Reference / Ramps

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
3-0* Reference Limits						
3-00	Reference Range	ExpressionLimit	All set-ups	TRUE	–	Uint8
3-01	Reference/Feedback Unit	ExpressionLimit	All set-ups	TRUE	–	Uint8
3-02	Minimum Reference	ExpressionLimit	All set-ups	TRUE	-3	Int32
3-03	Maximum Reference	ExpressionLimit	All set-ups	TRUE	-3	Int32
3-04	Reference Function	[0] Sum	All set-ups	TRUE	–	Uint8
3-1* References						
3-10	Preset Reference	0 %	All set-ups	TRUE	-2	Int16
3-11	Jog Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
3-12	Catch up/slow Down Value	0 %	All set-ups	TRUE	-2	Int16
3-13	Reference Site	[0] Linked to Hand / Auto	All set-ups	TRUE	–	Uint8
3-14	Preset Relative Reference	0 %	All set-ups	TRUE	-2	Int32
3-15	Reference Resource 1	[1] Analog Input 53	All set-ups	TRUE	–	Uint8
3-16	Reference Resource 2	ExpressionLimit	All set-ups	TRUE	–	Uint8

3-17	Reference Resource 3	ExpressionLimit	All set-ups	TRUE	–	Uint8
3-18	Relative Scaling Reference Resource	[0] No function	All set-ups	TRUE	–	Uint8
3-19	Jog Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
3-4* Ramp 1						
3-40	Ramp 1 Type	[0] Linear	All set-ups	TRUE	–	Uint8
3-41	Ramp 1 Ramp Up Time	ExpressionLimit	All set-ups	TRUE	-2	Uint32
3-42	Ramp 1 Ramp Down Time	ExpressionLimit	All set-ups	TRUE	-2	Uint32
3-45	Ramp 1 S-ramp Ratio at Accel. Start	50 %	All set-ups	TRUE	0	Uint8
3-46	Ramp 1 S-ramp Ratio at Accel. End	50 %	All set-ups	TRUE	0	Uint8
3-47	Ramp 1 S-ramp Ratio at Decel. Start	50 %	All set-ups	TRUE	0	Uint8
3-48	Ramp 1 S-ramp Ratio at Decel. End	50 %	All set-ups	TRUE	0	Uint8
3-5* Ramp 2						
3-50	Ramp 2 Type	[0] Linear	All set-ups	TRUE	–	Uint8
3-51	Ramp 2 Ramp Up Time	ExpressionLimit	All set-ups	TRUE	-2	Uint32
3-52	Ramp 2 Ramp Down Time	ExpressionLimit	All set-ups	TRUE	-2	Uint32
3-55	Ramp 2 S-ramp Ratio at Accel. Start	50 %	All set-ups	TRUE	0	Uint8
3-56	Ramp 2 S-ramp Ratio at Accel. End	50 %	All set-ups	TRUE	0	Uint8
3-57	Ramp 2 S-ramp Ratio at Decel. Start	50 %	All set-ups	TRUE	0	Uint8
3-58	Ramp 2 S-ramp Ratio at Decel. End	50 %	All set-ups	TRUE	0	Uint8
3-6* Ramp 3						
3-60	Ramp 3 Type	[0] Linear	All set-ups	TRUE	–	Uint8
3-61	Ramp 3 Ramp up Time	ExpressionLimit	All set-ups	TRUE	-2	Uint32
3-62	Ramp 3 Ramp down Time	ExpressionLimit	All set-ups	TRUE	-2	Uint32
3-65	Ramp 3 S-ramp Ratio at Accel. Start	50 %	All set-ups	TRUE	0	Uint8
3-66	Ramp 3 S-ramp Ratio at Accel. End	50 %	All set-ups	TRUE	0	Uint8
3-67	Ramp 3 S-ramp Ratio at Decel. Start	50 %	All set-ups	TRUE	0	Uint8
3-68	Ramp 3 S-ramp Ratio at Decel. End	50 %	All set-ups	TRUE	0	Uint8
3-7* Ramp 4						
3-70	Ramp 4 Type	[0] Linear	All set-ups	TRUE	–	Uint8
3-71	Ramp 4 Ramp up Time	ExpressionLimit	All set-ups	TRUE	-2	Uint32
3-72	Ramp 4 Ramp Down Time	ExpressionLimit	All set-ups	TRUE	-2	Uint32
3-75	Ramp 4 S-ramp Ratio at Accel. Start	50 %	All set-ups	TRUE	0	Uint8
3-76	Ramp 4 S-ramp Ratio at Accel. End	50 %	All set-ups	TRUE	0	Uint8
3-77	Ramp 4 S-ramp Ratio at Decel. Start	50 %	All set-ups	TRUE	0	Uint8
3-78	Ramp 4 S-ramp Ratio at Decel. End	50 %	All set-ups	TRUE	0	Uint8
3-8* Other Ramps						
3-80	Jog Ramp Time	ExpressionLimit	All set-ups	TRUE	-2	Uint32
3-81	Quick Stop Ramp Time	ExpressionLimit	2 set-ups	TRUE	-2	Uint32
3-82	Starting Ramp Up Time	ExpressionLimit	2 set-ups	TRUE	–	Uint32
3-9* Digital Pot.Meter						
3-90	Step Size	0.10 %	All set-ups	TRUE	-2	Uint16
3-91	Ramp Time	1 s	All set-ups	TRUE	0	Uint32
3-92	Power Restore	[0] Off	All set-ups	TRUE	–	Uint8
3-93	Maximum Limit	100 %	All set-ups	TRUE	0	Int16
3-94	Minimum Limit	-100 %	All set-ups	TRUE	0	Int16
3-95	Ramp Delay	ExpressionLimit	All set-ups	TRUE	-3	TimD

5.2.5 4-** Limits / Warnings

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
4-1* Motor Limits						
4-10	Motor Speed Direction	[2] Both directions	All set-ups	FALSE	–	Uint8
4-11	Motor Speed Low Limit [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
4-12	Motor Speed Low Limit [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
4-13	Motor Speed High Limit [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
4-14	Motor Speed High Limit [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
4-16	Torque Limit Motor Mode	ExpressionLimit	All set-ups	TRUE	-1	Uint16
4-17	Torque Limit Generator Mode	100 %	All set-ups	TRUE	-1	Uint16
4-18	Current Limit	ExpressionLimit	All set-ups	TRUE	-1	Uint32
4-19	Max Output Frequency	ExpressionLimit	All set-ups	FALSE	-1	Uint16
4-2* Limit Factors						
4-20	Torque Limit Factor Source	[0] No function	All set-ups	TRUE	–	Uint8
4-21	Speed Limit Factor Source	[0] No function	All set-ups	TRUE	–	Uint8
4-3* Motor Fb Monitor						
4-30	Motor Feedback Loss Function	ExpressionLimit	All set-ups	TRUE	–	Uint8
4-31	Motor Feedback Speed Error	300 RPM	All set-ups	TRUE	67	Uint16
4-32	Motor Feedback Loss Timeout	ExpressionLimit	All set-ups	TRUE	-2	Uint16
4-4* Speed Monitor						
4-40	Warning Freq. Low	ExpressionLimit	All set-ups	TRUE	–	Uint16
4-41	Warning Freq. High	ExpressionLimit	All set-ups	TRUE	–	Uint16
4-5* Adj. Warnings						
4-50	Warning Current Low	0 A	All set-ups	TRUE	-2	Uint32
4-51	Warning Current High	ImaxVLT (P1637 (16.00)) A	All set-ups	TRUE	-2	Uint32
4-52	Warning Speed Low	ExpressionLimit	All set-ups	TRUE	67	Uint16
4-53	Warning Speed High	ExpressionLimit	All set-ups	TRUE	67	Uint16
4-54	Warning Reference Low	-999999.999 N/A	All set-ups	TRUE	-3	Int32
4-55	Warning Reference High	999999.999 N/A	All set-ups	TRUE	-3	Int32
4-56	Warning Feedback Low	ExpressionLimit	All set-ups	TRUE	-3	Int32
4-57	Warning Feedback High	ExpressionLimit	All set-ups	TRUE	-3	Int32
4-58	Missing Motor Phase Function	[2] Trip 1000 ms	All set-ups	TRUE	–	Uint8
4-6* Speed Bypass						
4-60	Bypass Speed From [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
4-61	Bypass Speed From [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
4-62	Bypass Speed To [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
4-63	Bypass Speed To [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16

5.2.6 5-** Digital In/Out

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
5-0* Digital I/O mode						
5-00	Digital I/O Mode	[0] PNP	All set-ups	FALSE	–	Uint8
5-01	Terminal 27 Mode	[0] Input	All set-ups	TRUE	–	Uint8
5-02	Terminal 29 Mode	[0] Input	All set-ups	TRUE	–	Uint8
5-1* Digital Inputs						
5-10	Terminal 18 Digital Input	ExpressionLimit	All set-ups	TRUE	–	Uint8

5-11	Terminal 19 Digital Input	ExpressionLimit	All set-ups	TRUE	–	Uint8
5-12	Terminal 27 Digital Input	ExpressionLimit	All set-ups	TRUE	–	Uint8
5-13	Terminal 29 Digital Input	ExpressionLimit	All set-ups	TRUE	–	Uint8
5-14	Terminal 32 Digital Input	ExpressionLimit	All set-ups	TRUE	–	Uint8
5-15	Terminal 33 Digital Input	ExpressionLimit	All set-ups	TRUE	–	Uint8
5-16	Terminal X30/2 Digital Input	ExpressionLimit	All set-ups	TRUE	–	Uint8
5-17	Terminal X30/3 Digital Input	ExpressionLimit	All set-ups	TRUE	–	Uint8
5-18	Terminal X30/4 Digital Input	ExpressionLimit	All set-ups	TRUE	–	Uint8
5-3* Digital Outputs						
5-30	Terminal 27 Digital Output	ExpressionLimit	All set-ups	TRUE	–	Uint8
5-31	Terminal 29 Digital Output	ExpressionLimit	All set-ups	TRUE	–	Uint8
5-32	Term X30/6 Digi Out (MCB 101)	[0] No operation	All set-ups	TRUE	–	Uint8
5-33	Term X30/7 Digi Out (MCB 101)	[0] No operation	All set-ups	TRUE	–	Uint8
5-4* Relays						
5-40	Function Relay	ExpressionLimit	All set-ups	TRUE	–	Uint8
5-41	On Delay, Relay	0.01 s	All set-ups	TRUE	-2	Uint16
5-42	Off Delay, Relay	0.01 s	All set-ups	TRUE	-2	Uint16
5-5* Pulse Input						
5-50	Term. 29 Low Frequency	100 Hz	All set-ups	TRUE	0	Uint32
5-51	Term. 29 High Frequency	ExpressionLimit	All set-ups	TRUE	0	Uint32
5-52	Term. 29 Low Ref./Feedb. Value	0 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Int32
5-53	Term. 29 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
5-54	Pulse Filter Time Constant #29	100 ms	All set-ups	FALSE	-3	Uint16
5-55	Term. 33 Low Frequency	100 Hz	All set-ups	TRUE	0	Uint32
5-56	Term. 33 High Frequency	ExpressionLimit	All set-ups	TRUE	0	Uint32
5-57	Term. 33 Low Ref./Feedb. Value	0 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Int32
5-58	Term. 33 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
5-59	Pulse Filter Time Constant #33	100 ms	All set-ups	FALSE	-3	Uint16
5-6* Pulse Output						
5-60	Terminal 27 Pulse Output Variable	ExpressionLimit	All set-ups	TRUE	–	Uint8
5-62	Pulse Output Max Freq #27	ExpressionLimit	All set-ups	TRUE	0	Uint32
5-63	Terminal 29 Pulse Output Variable	ExpressionLimit	All set-ups	TRUE	–	Uint8
5-65	Pulse Output Max Freq #29	ExpressionLimit	All set-ups	TRUE	0	Uint32
5-66	Terminal X30/6 Pulse Output Variable	[0] No operation	All set-ups	TRUE	–	Uint8
5-68	Pulse Output Max Freq #X30/6	5000 Hz	All set-ups	TRUE	0	Uint32
5-7* 24V Encoder Input						
5-70	Term 32/33 Pulses Per Revolution	1024 N/A	All set-ups	FALSE	0	Uint16
5-71	Term 32/33 Encoder Direction	[0] Clockwise	All set-ups	FALSE	–	Uint8
5-9* Bus Controlled						
5-90	Digital & Relay Bus Control	0 N/A	All set-ups	TRUE	0	Uint32
5-93	Pulse Out #27 Bus Control	0 %	All set-ups	TRUE	-2	N2
5-94	Pulse Out #27 Timeout Preset	0 %	1 set-up	TRUE	-2	Uint16
5-95	Pulse Out #29 Bus Control	0 %	All set-ups	TRUE	-2	N2
5-96	Pulse Out #29 Timeout Preset	0 %	1 set-up	TRUE	-2	Uint16
5-97	Pulse Out #X30/6 Bus Control	0 %	All set-ups	TRUE	-2	N2
5-98	Pulse Out #X30/6 Timeout Preset	0 %	1 set-up	TRUE	-2	Uint16

5.2.7 6-** Analog In/Out

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
6-0* Analog I/O Mode						
6-00	Live Zero Timeout Time	10 s	All set-ups	TRUE	0	Uint8
6-01	Live Zero Timeout Function	[0] Off	All set-ups	TRUE	–	Uint8
6-1* Analog Input 1						
6-10	Terminal 53 Low Voltage	ExpressionLimit	All set-ups	TRUE	-2	Int16
6-11	Terminal 53 High Voltage	10 V	All set-ups	TRUE	-2	Int16
6-12	Terminal 53 Low Current	0.14 mA	All set-ups	TRUE	-5	Int16
6-13	Terminal 53 High Current	20 mA	All set-ups	TRUE	-5	Int16
6-14	Terminal 53 Low Ref./Feedb. Value	0 N/A	All set-ups	TRUE	-3	Int32
6-15	Terminal 53 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
6-16	Terminal 53 Filter Time Constant	0.01 s	All set-ups	TRUE	-2	Uint16
6-2* Analog Input 2						
6-20	Terminal 54 Low Voltage	ExpressionLimit	All set-ups	TRUE	-2	Int16
6-21	Terminal 54 High Voltage	10 V	All set-ups	TRUE	-2	Int16
6-22	Terminal 54 Low Current	ExpressionLimit	All set-ups	TRUE	-5	Int16
6-23	Terminal 54 High Current	20 mA	All set-ups	TRUE	-5	Int16
6-24	Terminal 54 Low Ref./Feedb. Value	0 N/A	All set-ups	TRUE	-3	Int32
6-25	Terminal 54 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
6-26	Terminal 54 Filter Time Constant	0.01 s	All set-ups	TRUE	-2	Uint16
6-3* Analog Input 3						
6-30	Terminal X30/11 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
6-31	Terminal X30/11 High Voltage	10 V	All set-ups	TRUE	-2	Int16
6-34	Term. X30/11 Low Ref./Feedb. Value	0 N/A	All set-ups	TRUE	-3	Int32
6-35	Term. X30/11 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
6-36	Term. X30/11 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
6-4* Analog Input 4						
6-40	Terminal X30/12 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
6-41	Terminal X30/12 High Voltage	10 V	All set-ups	TRUE	-2	Int16
6-44	Term. X30/12 Low Ref./Feedb. Value	0 N/A	All set-ups	TRUE	-3	Int32
6-45	Term. X30/12 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
6-46	Term. X30/12 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
6-5* Analog Output 1						
6-50	Terminal 42 Output	ExpressionLimit	All set-ups	TRUE	–	Uint8
6-51	Terminal 42 Output Min Scale	0 %	All set-ups	TRUE	-2	Int16
6-52	Terminal 42 Output Max Scale	100 %	All set-ups	TRUE	-2	Int16
6-53	Term 42 Output Bus Ctrl	0 %	All set-ups	TRUE	-2	N2
6-54	Terminal 42 Output Timeout Preset	0 %	1 set-up	TRUE	-2	Uint16
6-55	Analog Output Filter	[0] Off	1 set-up	TRUE	–	Uint8
6-6* Analog Output 2						
6-60	Terminal X30/8 Output	ExpressionLimit	All set-ups	TRUE	–	Uint8
6-61	Terminal X30/8 Min. Scale	0 %	All set-ups	TRUE	-2	Int16
6-62	Terminal X30/8 Max. Scale	100 %	All set-ups	TRUE	-2	Int16
6-63	Terminal X30/8 Bus Control	0 %	All set-ups	TRUE	-2	N2
6-64	Terminal X30/8 Output Timeout Preset	0 %	1 set-up	TRUE	-2	Uint16

5.2.8 7-** Controllers

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
7-0* Speed PID Ctrl.						
7-00	Speed PID Feedback Source	[1] 24V encoder	All set-ups	FALSE	–	Uint8
7-02	Speed PID Proportional Gain	ExpressionLimit	All set-ups	TRUE	-3	Uint16
7-03	Speed PID Integral Time	ExpressionLimit	All set-ups	TRUE	-4	Uint32
7-04	Speed PID Differentiation Time	ExpressionLimit	All set-ups	TRUE	-4	Uint16
7-05	Speed PID Diff. Gain Limit	5 N/A	All set-ups	TRUE	-1	Uint16
7-06	Speed PID Lowpass Filter Time	ExpressionLimit	All set-ups	TRUE	-4	Uint16
7-07	Speed PID Feedback Gear Ratio	1 N/A	All set-ups	FALSE	-4	Uint32
7-08	Speed PID Feed Forward Factor	0 %	All set-ups	FALSE	0	Uint16
7-1* Torque PI Ctrl.						
7-12	Torque PI Proportional Gain	100 %	All set-ups	TRUE	0	Uint16
7-13	Torque PI Integration Time	0.020 s	All set-ups	TRUE	-3	Uint16
7-2* Process Ctrl. Feedb						
7-20	Process CL Feedback 1 Resource	[0] No function	All set-ups	TRUE	–	Uint8
7-22	Process CL Feedback 2 Resource	[0] No function	All set-ups	TRUE	–	Uint8
7-3* Process PID Ctrl.						
7-30	Process PID Normal/ Inverse Control	[0] Normal	All set-ups	TRUE	–	Uint8
7-31	Process PID Anti Windup	[1] On	All set-ups	TRUE	–	Uint8
7-32	Process PID Start Speed	0 RPM	All set-ups	TRUE	67	Uint16
7-33	Process PID Proportional Gain	0.01 N/A	All set-ups	TRUE	-2	Uint16
7-34	Process PID Integral Time	10000 s	All set-ups	TRUE	-2	Uint32
7-35	Process PID Differentiation Time	0 s	All set-ups	TRUE	-2	Uint16
7-36	Process PID Diff. Gain Limit	5 N/A	All set-ups	TRUE	-1	Uint16
7-38	Process PID Feed Forward Factor	0 %	All set-ups	TRUE	0	Uint16
7-39	On Reference Bandwidth	5 %	All set-ups	TRUE	0	Uint8
7-4* Adv. Process PID I						
7-40	Process PID I-part Reset	[0] No	All set-ups	TRUE	–	Uint8
7-41	Process PID Output Neg. Clamp	-100 %	All set-ups	TRUE	0	Int16
7-42	Process PID Output Pos. Clamp	100 %	All set-ups	TRUE	0	Int16
7-43	Process PID Gain Scale at Min. Ref.	100 %	All set-ups	TRUE	0	Int16
7-44	Process PID Gain Scale at Max. Ref.	100 %	All set-ups	TRUE	0	Int16
7-45	Process PID Feed Fwd Resource	[0] No function	All set-ups	TRUE	–	Uint8
7-46	Process PID Feed Fwd Normal/ Inv. Ctrl.	[0] Normal	All set-ups	TRUE	–	Uint8
7-48	PCD Feed Forward	0 N/A	All set-ups	TRUE	0	Uint16
7-49	Process PID Output Normal/ Inv. Ctrl.	[0] Normal	All set-ups	TRUE	–	Uint8
7-5* Adv. Process PID II						
7-50	Process PID Extended PID	[1] Enabled	All set-ups	TRUE	–	Uint8
7-51	Process PID Feed Fwd Gain	1 N/A	All set-ups	TRUE	-2	Uint16
7-52	Process PID Feed Fwd Ramp up	0.01 s	All set-ups	TRUE	-2	Uint32
7-53	Process PID Feed Fwd Ramp down	0.01 s	All set-ups	TRUE	-2	Uint32
7-56	Process PID Ref. Filter Time	0.001 s	All set-ups	TRUE	-3	Uint16
7-57	Process PID Fb. Filter Time	0.001 s	All set-ups	TRUE	-3	Uint16
7-6* Feedback Conversion						
7-60	Feedback 1 Conversion	[0] Linear	All set-ups	TRUE	–	Uint8
7-62	Feedback 2 Conversion	[0] Linear	All set-ups	TRUE	–	Uint8

5.2.9 8-** Comm. and Options

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
8-0* General Settings						
8-01	Control Site	[0] Digital and ctrl.word	All set-ups	TRUE	–	Uint8
8-02	Control Word Source	ExpressionLimit	All set-ups	TRUE	–	Uint8
8-03	Control Word Timeout Time	1 s	1 set-up	TRUE	-1	Uint32
8-04	Control Word Timeout Function	ExpressionLimit	1 set-up	TRUE	–	Uint8
8-05	End-of-Timeout Function	[1] Resume set-up	1 set-up	TRUE	–	Uint8
8-06	Reset Control Word Timeout	[0] Do not reset	All set-ups	TRUE	–	Uint8
8-07	Diagnosis Trigger	[0] Disable	2 set-ups	TRUE	–	Uint8
8-08	Readout Filtering	ExpressionLimit	All set-ups	TRUE	–	Uint8
8-1* Ctrl. Word Settings						
8-10	Control Word Profile	[0] FC profile	All set-ups	TRUE	–	Uint8
8-13	Configurable Status Word STW	[1] Profile default	All set-ups	TRUE	–	Uint8
8-14	Configurable Control Word CTW	[1] Profile default	All set-ups	TRUE	–	Uint8
8-19	Product Code	ExpressionLimit	1 set-up	TRUE	0	Uint32
8-3* FC Port Settings						
8-30	Protocol	[0] FC	1 set-up	TRUE	–	Uint8
8-31	Address	1 N/A	1 set-up	TRUE	0	Uint8
8-32	FC Port Baud Rate	ExpressionLimit	1 set-up	TRUE	–	Uint8
8-33	Parity / Stop Bits	[0] Even Parity, 1 Stop Bit	1 set-up	TRUE	–	Uint8
8-34	Estimated cycle time	0 ms	2 set-ups	TRUE	-3	Uint32
8-35	Minimum Response Delay	10 ms	1 set-up	TRUE	-3	Uint16
8-36	Max Response Delay	ExpressionLimit	1 set-up	TRUE	-3	Uint16
8-37	Max Inter-Char Delay	ExpressionLimit	1 set-up	TRUE	-5	Uint16
8-4* FC MC protocol set						
8-40	Telegram Selection	[1] Standard telegram 1	2 set-ups	TRUE	–	Uint8
8-41	Parameters for Signals	0	All set-ups	FALSE	–	Uint16
8-42	PCD Write Configuration	ExpressionLimit	2 set-ups	TRUE	0	Uint16
8-43	PCD Read Configuration	ExpressionLimit	2 set-ups	TRUE	0	Uint16
8-5* Digital/Bus						
8-50	Coasting Select	[3] Logic OR	All set-ups	TRUE	–	Uint8
8-51	Quick Stop Select	[3] Logic OR	All set-ups	TRUE	–	Uint8
8-52	DC Brake Select	ExpressionLimit	All set-ups	TRUE	–	Uint8
8-53	Start Select	[3] Logic OR	All set-ups	TRUE	–	Uint8
8-54	Reversing Select	ExpressionLimit	All set-ups	TRUE	–	Uint8
8-55	Set-up Select	[3] Logic OR	All set-ups	TRUE	–	Uint8
8-56	Preset Reference Select	[3] Logic OR	All set-ups	TRUE	–	Uint8
8-57	Profidrive OFF2 Select	[3] Logic OR	All set-ups	TRUE	–	Uint8
8-58	Profidrive OFF3 Select	[3] Logic OR	All set-ups	TRUE	–	Uint8
8-8* FC Port Diagnostics						
8-80	Bus Message Count	0 N/A	All set-ups	TRUE	0	Uint32
8-81	Bus Error Count	0 N/A	All set-ups	TRUE	0	Uint32
8-82	Slave Messages Rcvd	0 N/A	All set-ups	TRUE	0	Uint32
8-83	Slave Error Count	0 N/A	All set-ups	TRUE	0	Uint32
8-84	Slave Messages Sent	0 N/A	All set-ups	TRUE	0	Uint32
8-85	Slave Timeout Errors	0 N/A	All set-ups	TRUE	0	Uint32
8-88	Reset FC port Diagnostics	[0] Do not reset	All set-ups	TRUE	–	Uint8
8-9* Bus Jog						
8-90	Bus Jog 1 Speed	ExpressionLimit	All set-ups	TRUE	67	Uint16

8-91	Bus Jog 2 Speed	ExpressionLimit	All set-ups	TRUE	67	Uint16

5.2.10 9-** PROFIdrive

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
9-00	Setpoint	0 N/A	All set-ups	TRUE	0	Uint16
9-07	Actual Value	0 N/A	All set-ups	FALSE	0	Uint16
9-15	PCD Write Configuration	ExpressionLimit	1 set-up	TRUE	–	Uint16
9-16	PCD Read Configuration	ExpressionLimit	2 set-ups	TRUE	–	Uint16
9-18	Node Address	126 N/A	1 set-up	TRUE	0	Uint8
9-19	Drive Unit System Number	1034 N/A	All set-ups	TRUE	0	Uint16
9-22	Telegram Selection	[100] None	1 set-up	TRUE	–	Uint8
9-23	Parameters for Signals	0	All set-ups	TRUE	–	Uint16
9-27	Parameter Edit	[1] Enabled	2 set-ups	FALSE	–	Uint16
9-28	Process Control	[1] Enable cyclic master	2 set-ups	FALSE	–	Uint16
9-44	Fault Message Counter	0 N/A	All set-ups	TRUE	0	Uint16
9-45	Fault Code	0 N/A	All set-ups	TRUE	0	Uint16
9-47	Fault Number	0 N/A	All set-ups	TRUE	0	Uint16
9-52	Fault Situation Counter	0 N/A	All set-ups	TRUE	0	Uint16
9-53	Profibus Warning Word	0 N/A	All set-ups	TRUE	0	V2
9-63	Actual Baud Rate	[255] No baudrate found	All set-ups	TRUE	–	Uint8
9-64	Device Identification	0 N/A	All set-ups	TRUE	0	Uint16
9-65	Profile Number	0 N/A	All set-ups	TRUE	0	OctStr[2]
9-67	Control Word 1	0 N/A	All set-ups	TRUE	0	V2
9-68	Status Word 1	0 N/A	All set-ups	TRUE	0	V2
9-70	Edit Set-up	[9] Active Set-up	All set-ups	TRUE	–	Uint8
9-71	Profibus Save Data Values	[0] Off	All set-ups	TRUE	–	Uint8
9-72	ProfibusDriveReset	[0] No action	1 set-up	FALSE	–	Uint8
9-75	DO Identification	0 N/A	All set-ups	TRUE	0	Uint16
9-80	Defined Parameters (1)	0 N/A	All set-ups	FALSE	0	Uint16
9-81	Defined Parameters (2)	0 N/A	All set-ups	FALSE	0	Uint16
9-82	Defined Parameters (3)	0 N/A	All set-ups	FALSE	0	Uint16
9-83	Defined Parameters (4)	0 N/A	All set-ups	FALSE	0	Uint16
9-84	Defined Parameters (5)	0 N/A	All set-ups	FALSE	0	Uint16
9-85	Defined Parameters (6)	0 N/A	All set-ups	FALSE	0	Uint16
9-90	Changed Parameters (1)	0 N/A	All set-ups	FALSE	0	Uint16
9-91	Changed Parameters (2)	0 N/A	All set-ups	FALSE	0	Uint16
9-92	Changed Parameters (3)	0 N/A	All set-ups	FALSE	0	Uint16
9-93	Changed Parameters (4)	0 N/A	All set-ups	FALSE	0	Uint16
9-94	Changed Parameters (5)	0 N/A	All set-ups	FALSE	0	Uint16
9-99	Profibus Revision Counter	0 N/A	All set-ups	TRUE	0	Uint16

5.2.11 12-** Ethernet

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
12-0* IP Settings						
12-00	IP Address Assignment	ExpressionLimit	2 set-ups	TRUE	–	Uint8
12-01	IP Address	0 N/A	1 set-up	TRUE	0	OctStr[4]
12-02	Subnet Mask	0 N/A	1 set-up	TRUE	0	OctStr[4]
12-03	Default Gateway	0 N/A	1 set-up	TRUE	0	OctStr[4]
12-04	DHCP Server	0 N/A	2 set-ups	TRUE	0	OctStr[4]
12-05	Lease Expires	ExpressionLimit	All set-ups	TRUE	0	TimD
12-06	Name Servers	0 N/A	1 set-up	TRUE	0	OctStr[4]
12-07	Domain Name	0 N/A	1 set-up	TRUE	0	VisStr[48]
12-08	Host Name	0 N/A	1 set-up	TRUE	0	VisStr[48]
12-09	Physical Address	0 N/A	1 set-up	TRUE	0	VisStr[17]
12-1* Ethernet Link Parameters						
12-10	Link Status	[0] No Link	All set-ups	TRUE	–	Uint8
12-11	Link Duration	ExpressionLimit	All set-ups	TRUE	0	TimD
12-12	Auto Negotiation	ExpressionLimit	2 set-ups	TRUE	–	Uint8
12-13	Link Speed	ExpressionLimit	2 set-ups	TRUE	–	Uint8
12-14	Link Duplex	ExpressionLimit	2 set-ups	TRUE	–	Uint8
12-18	Supervisor MAC	0 N/A	2 set-ups	TRUE	0	OctStr[6]
12-19	Supervisor IP Addr.	0 N/A	2 set-ups	TRUE	0	OctStr[4]
12-8* Other Ethernet Services						
12-80	FTP Server	[0] Disabled	2 set-ups	TRUE	–	Uint8
12-81	HTTP Server	[0] Disabled	2 set-ups	TRUE	–	Uint8
12-82	SMTP Service	[0] Disabled	2 set-ups	TRUE	–	Uint8
12-83	SNMP Agent	[1] Enabled	2 set-ups	TRUE	–	Uint8
12-84	Address Conflict Detection	[1] Enabled	2 set-ups	TRUE	–	Uint8
12-85	ACD Last Conflict	0 N/A	2 set-ups	TRUE	0	OctStr[35]
12-89	Transparent Socket Channel Port	ExpressionLimit	2 set-ups	TRUE	0	Uint16
12-9* Advanced Ethernet Services						
12-90	Cable Diagnostic	[0] Disabled	2 set-ups	TRUE	–	Uint8
12-91	Auto Cross Over	[1] Enabled	2 set-ups	TRUE	–	Uint8
12-92	IGMP Snooping	[1] Enabled	2 set-ups	TRUE	–	Uint8
12-93	Cable Error Length	0 N/A	1 set-up	TRUE	0	Uint16
12-94	Broadcast Storm Protection	-1 %	2 set-ups	TRUE	0	Int8
12-95	Inactivity timeout	120 N/A	2 set-ups	TRUE	0	Uint16
12-96	Port Config	ExpressionLimit	2 set-ups	TRUE	–	Uint8
12-97	QoS Priority	ExpressionLimit	2 set-ups	TRUE	0	Int8
12-98	Interface Counters	4000 N/A	All set-ups	TRUE	0	Uint32
12-99	Media Counters	0 N/A	All set-ups	TRUE	0	Uint32

5.2.12 13-** Smart Logic

Parameter number	Paramete description	Default value	4 set-up	Change during operation	Conversion index	Type
13-0* SLC Settings						
13-00	SL Controller Mode	ExpressionLimit	2 set-ups	TRUE	–	Uint8
13-01	Start Event	ExpressionLimit	2 set-ups	TRUE	–	Uint8
13-02	Stop Event	ExpressionLimit	2 set-ups	TRUE	–	Uint8
13-03	Reset SLC	[0] Do not reset SLC	All set-ups	TRUE	–	Uint8
13-1* Comparators						
13-10	Comparator Operand	ExpressionLimit	2 set-ups	TRUE	–	Uint8
13-11	Comparator Operator	ExpressionLimit	2 set-ups	TRUE	–	Uint8
13-12	Comparator Value	ExpressionLimit	2 set-ups	TRUE	-3	Int32
13-2* Timers						
13-20	SL Controller Timer	ExpressionLimit	1 set-up	TRUE	–	TimD
13-4* Logic Rules						
13-40	Logic Rule Boolean 1	ExpressionLimit	2 set-ups	TRUE	–	Uint8
13-41	Logic Rule Operator 1	ExpressionLimit	2 set-ups	TRUE	–	Uint8
13-42	Logic Rule Boolean 2	ExpressionLimit	2 set-ups	TRUE	–	Uint8
13-43	Logic Rule Operator 2	ExpressionLimit	2 set-ups	TRUE	–	Uint8
13-44	Logic Rule Boolean 3	ExpressionLimit	2 set-ups	TRUE	–	Uint8
13-5* States						
13-51	SL Controller Event	ExpressionLimit	2 set-ups	TRUE	–	Uint8
13-52	SL Controller Action	ExpressionLimit	2 set-ups	TRUE	–	Uint8

5.2.13 14-** Special Functions

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
14-0* Inverter Switching						
14-00	Switching Pattern	[1] SFAVM	All set-ups	TRUE	–	Uint8
14-01	Switching Frequency	ExpressionLimit	All set-ups	TRUE	–	Uint8
14-03	Overmodulation	ExpressionLimit	All set-ups	FALSE	–	Uint8
14-04	Acoustic Noise Reduction	[0] Off	All set-ups	TRUE	–	Uint8
14-06	Dead Time Compensation	[1] On	All set-ups	TRUE	–	Uint8
14-1* Mains Failure						
14-10	Mains Failure	[0] No function	All set-ups	TRUE	–	Uint8
14-11	Mains Fault Voltage Level	ExpressionLimit	All set-ups	TRUE	0	Uint16
14-12	Response to Mains Imbalance	[0] Trip	All set-ups	TRUE	–	Uint8
14-14	Kin. Back-up Time-out	60 s	All set-ups	TRUE	0	Uint8
14-15	Kin. Back-up Trip Recovery Level	ExpressionLimit	All set-ups	TRUE	-3	Uint32
14-16	Kin. Back-up Gain	100 %	All set-ups	TRUE	0	Uint32
14-2* Trip Reset						
14-20	Reset Mode	[0] Manual reset	All set-ups	TRUE	–	Uint8
14-21	Automatic Restart Time	ExpressionLimit	All set-ups	TRUE	0	Uint16
14-22	Operation Mode	[0] Normal operation	All set-ups	TRUE	–	Uint8
14-24	Trip Delay at Current Limit	60 s	All set-ups	TRUE	0	Uint8
14-25	Trip Delay at Torque Limit	60 s	All set-ups	TRUE	0	Uint8
14-26	Trip Delay at Inverter Fault	ExpressionLimit	All set-ups	TRUE	0	Uint8
14-3* Current Limit Ctrl.						
14-30	Current Lim Ctrl, Proportional Gain	100 %	All set-ups	FALSE	0	Uint16
14-31	Current Lim Ctrl, Integration Time	ExpressionLimit	All set-ups	FALSE	-3	Uint16
14-32	Current Lim Ctrl, Filter Time	ExpressionLimit	All set-ups	TRUE	-1	Uint16
14-4* Energy Optimising						
14-40	VT Level	66 %	All set-ups	FALSE	0	Uint8
14-41	AEO Minimum Magnetisation	ExpressionLimit	All set-ups	TRUE	0	Uint8
14-42	Minimum AEO Frequency	ExpressionLimit	All set-ups	TRUE	0	Uint8
14-43	Motor Cosphi	ExpressionLimit	All set-ups	TRUE	-2	Uint16
14-5* Environment						
14-50	RFI Filter	[1] On	1 set-up	FALSE	–	Uint8
14-51	DC-Link Compensation	ExpressionLimit	All set-ups	TRUE	–	Uint8
14-52	Fan Control	[0] Auto	All set-ups	TRUE	–	Uint8
14-53	Fan Monitor	[1] Warning	All set-ups	TRUE	–	Uint8
14-55	Output Filter	[0] No Filter	All set-ups	FALSE	–	Uint8
14-59	Actual Number of Inverter Units	ExpressionLimit	1 set-up	FALSE	0	Uint8
14-6* Auto Derate						
14-60	Function at Over Temperature	[0] Trip	All set-ups	TRUE	–	Uint8
14-61	Function at Inverter Overload	[0] Trip	All set-ups	TRUE	–	Uint8
14-62	Inv. Overload Derate Current	95 %	All set-ups	TRUE	0	Uint16
14-8* Options						
14-89	Option Detection	[0] Protect Option Config.	1 set-up	TRUE	–	Uint8
14-9* Fault Settings						
14-90	Fault Level	ExpressionLimit	1 set-up	TRUE	–	Uint8

5.2.14 15-** Drive Information

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
15-0* Operating Data						
15-00	Operating hours	0 h	All set-ups	FALSE	74	Uint32
15-01	Running Hours	0 h	All set-ups	FALSE	74	Uint32
15-02	kWh Counter	0 kWh	All set-ups	FALSE	75	Uint32
15-03	Power Up's	0 N/A	All set-ups	FALSE	0	Uint32
15-04	Over Temp's	0 N/A	All set-ups	FALSE	0	Uint16
15-05	Over Volt's	0 N/A	All set-ups	FALSE	0	Uint16
15-06	Reset kWh Counter	[0] Do not reset	All set-ups	TRUE	–	Uint8
15-07	Reset Running Hours Counter	[0] Do not reset	All set-ups	TRUE	–	Uint8
15-1* Data Log Settings						
15-10	Logging Source	0	2 set-ups	TRUE	–	Uint16
15-11	Logging Interval	ExpressionLimit	2 set-ups	TRUE	-3	TimD
15-12	Trigger Event	[0] False	1 set-up	TRUE	–	Uint8
15-13	Logging Mode	[0] Log always	2 set-ups	TRUE	–	Uint8
15-14	Samples Before Trigger	50 N/A	2 set-ups	TRUE	0	Uint8
15-2* Historic Log						
15-20	Historic Log: Event	0 N/A	All set-ups	FALSE	0	Uint8
15-21	Historic Log: Value	0 N/A	All set-ups	FALSE	0	Uint32
15-22	Historic Log: Time	0 ms	All set-ups	FALSE	-3	Uint32
15-3* Fault Log						
15-30	Fault Log: Error Code	0 N/A	All set-ups	FALSE	0	Uint16
15-31	Fault Log: Value	0 N/A	All set-ups	FALSE	0	Int16
15-32	Fault Log: Time	0 s	All set-ups	FALSE	0	Uint32
15-4* Drive Identification						
15-40	FC Type	0 N/A	All set-ups	FALSE	0	VisStr[6]
15-41	Power Section	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-42	Voltage	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-43	Software Version	0 N/A	All set-ups	FALSE	0	VisStr[5]
15-44	Ordered Typecode String	0 N/A	All set-ups	FALSE	0	VisStr[40]
15-45	Actual Typecode String	0 N/A	All set-ups	FALSE	0	VisStr[40]
15-46	Frequency Converter Ordering No	0 N/A	All set-ups	FALSE	0	VisStr[8]
15-47	Power Card Ordering No	0 N/A	All set-ups	FALSE	0	VisStr[8]
15-48	LCP Id No	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-49	SW ID Control Card	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-50	SW ID Power Card	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-51	Frequency Converter Serial Number	0 N/A	All set-ups	FALSE	0	VisStr[10]
15-53	Power Card Serial Number	0 N/A	All set-ups	FALSE	0	VisStr[19]
15-54	Config File Name	ExpressionLimit	All set-ups	FALSE	0	VisStr[16]
15-59	Filename	ExpressionLimit	All set-ups	FALSE	0	VisStr[16]
15-6* Option Ident						
15-60	Option Mounted	0 N/A	All set-ups	FALSE	0	VisStr[30]
15-61	Option SW Version	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-62	Option Ordering No	0 N/A	All set-ups	FALSE	0	VisStr[8]
15-63	Option Serial No	0 N/A	All set-ups	FALSE	0	VisStr[18]
15-8* Operating Data II						
15-80	Fan Running Hours	0 h	All set-ups	TRUE	74	Uint32
15-81	Preset Fan Running Hours	0 h	All set-ups	TRUE	74	Uint32
15-9* Parameter Info						

15-92	Defined Parameters	0 N/A	All set-ups	FALSE	0	Uint16
15-93	Modified Parameters	0 N/A	All set-ups	FALSE	0	Uint16

5.2.15 16-** Data Readouts

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
16-0* General Status						
16-00	Control Word	0 N/A	All set-ups	FALSE	0	V2
16-01	Reference [Unit]	0 ReferenceFeedbackUnit	All set-ups	FALSE	-3	Int32
16-02	Reference %	0 %	All set-ups	FALSE	-1	Int16
16-03	Status Word	0 N/A	All set-ups	FALSE	0	V2
16-05	Main Actual Value [%]	0 %	All set-ups	FALSE	-2	N2
16-09	Custom Readout	0 CustomReadoutUnit	All set-ups	FALSE	-2	Int32
16-1* Motor Status						
16-10	Power [kW]	0 kW	All set-ups	FALSE	1	Int32
16-11	Power [hp]	0 hp	All set-ups	FALSE	-2	Int32
16-12	Motor Voltage	0 V	All set-ups	FALSE	-1	Uint16
16-13	Frequency	0 Hz	All set-ups	FALSE	-1	Uint16
16-14	Motor current	0 A	All set-ups	FALSE	-2	Int32
16-15	Frequency [%]	0 %	All set-ups	FALSE	-2	N2
16-16	Torque [Nm]	0 Nm	All set-ups	FALSE	-1	Int16
16-17	Speed [RPM]	0 RPM	All set-ups	FALSE	67	Int32
16-18	Motor Thermal	0 %	All set-ups	FALSE	0	Uint8
16-20	Motor Angle	0 N/A	All set-ups	TRUE	0	Uint16
16-21	Torque [%] High Res.	0 %	All set-ups	FALSE	-1	Int16
16-22	Torque [%]	0 %	All set-ups	FALSE	0	Int16
16-24	Calibrated Stator Resistance	0.0000 Ohm	All set-ups	TRUE	-4	Uint32
16-3* Drive Status						
16-30	DC Link Voltage	0 V	All set-ups	FALSE	0	Uint16
16-34	Heatsink Temp.	0 °C	All set-ups	FALSE	100	Uint8
16-35	Inverter Thermal	0 %	All set-ups	FALSE	0	Uint8
16-36	Inv. Nom. Current	ExpressionLimit	All set-ups	FALSE	-2	Uint32
16-37	Inv. Max. Current	ExpressionLimit	All set-ups	FALSE	-2	Uint32
16-38	SL Controller State	0 N/A	All set-ups	FALSE	0	Uint8
16-39	Control Card Temp.	0 °C	All set-ups	FALSE	100	Uint8
16-40	Logging Buffer Full	[0] No	All set-ups	TRUE	–	Uint8
16-45	Motor Phase U Current	0 A	All set-ups	TRUE	-2	Int32
16-46	Motor Phase V Current	0 A	All set-ups	TRUE	-2	Int32
16-47	Motor Phase W Current	0 A	All set-ups	TRUE	-2	Int32
16-48	Speed Ref. After Ramp [RPM]	0 RPM	All set-ups	FALSE	67	Int32
16-49	Current Fault Source	0 N/A	All set-ups	TRUE	0	Uint8
16-5* Ref. & Feedb.						
16-50	External Reference	0 N/A	All set-ups	FALSE	-1	Int16
16-51	Pulse Reference	0 N/A	All set-ups	FALSE	-1	Int16
16-52	Feedback[Unit]	0 ReferenceFeedbackUnit	All set-ups	FALSE	-3	Int32
16-53	Digi Pot Reference	0 N/A	All set-ups	FALSE	-2	Int16
16-57	Feedback [RPM]	0 RPM	All set-ups	FALSE	67	Int32
16-6* Inputs & Outputs						
16-60	Digital Input	0 N/A	All set-ups	FALSE	0	Uint16
16-61	Terminal 53 Switch Setting	[0] Current	All set-ups	FALSE	–	Uint8
16-62	Analog Input 53	0 N/A	All set-ups	FALSE	-3	Int32

16-63	Terminal 54 Switch Setting	[0] Current	All set-ups	FALSE	–	Uint8
16-64	Analog Input 54	0 N/A	All set-ups	FALSE	-3	Int32
16-65	Analog Output 42 [mA]	0 N/A	All set-ups	FALSE	-3	Int16
16-66	Digital Output [bin]	0 N/A	All set-ups	FALSE	0	Int16
16-67	Freq. Input #29 [Hz]	0 N/A	All set-ups	FALSE	0	Int32
16-68	Freq. Input #33 [Hz]	0 N/A	All set-ups	FALSE	0	Int32
16-69	Pulse Output #27 [Hz]	0 N/A	All set-ups	FALSE	0	Int32
16-70	Pulse Output #29 [Hz]	0 N/A	All set-ups	FALSE	0	Int32
16-71	Relay Output [bin]	0 N/A	All set-ups	FALSE	0	Int16
16-72	Counter A	0 N/A	All set-ups	TRUE	0	Int32
16-73	Counter B	0 N/A	All set-ups	TRUE	0	Int32
16-75	Analog In X30/11	0 N/A	All set-ups	FALSE	-3	Int32
16-76	Analog In X30/12	0 N/A	All set-ups	FALSE	-3	Int32
16-77	Analog Out X30/8 [mA]	0 N/A	All set-ups	FALSE	-3	Int16
16-8* Fieldbus & FC Port						
16-80	Fieldbus CTW 1	0 N/A	All set-ups	FALSE	0	V2
16-82	Fieldbus REF 1	0 N/A	All set-ups	FALSE	0	N2
16-84	Comm. Option STW	0 N/A	All set-ups	FALSE	0	V2
16-85	FC Port CTW 1	0 N/A	All set-ups	FALSE	0	V2
16-86	FC Port REF 1	0 N/A	All set-ups	FALSE	0	N2
16-87	Bus Readout Alarm/Warning	0 N/A	All set-ups	FALSE	0	Uint16
16-9* Diagnosis Readouts						
16-90	Alarm Word	0 N/A	All set-ups	FALSE	0	Uint32
16-91	Alarm Word 2	0 N/A	All set-ups	FALSE	0	Uint32
16-92	Warning Word	0 N/A	All set-ups	FALSE	0	Uint32
16-93	Warning Word 2	0 N/A	All set-ups	FALSE	0	Uint32
16-94	Ext. Status Word	0 N/A	All set-ups	FALSE	0	Uint32
16-95	Ext. Status Word 2	0 N/A	All set-ups	FALSE	0	Uint32
16-97	Alarm Word 3	0 N/A	All set-ups	FALSE	0	Uint32
16-98	Warning Word 3	0 N/A	All set-ups	FALSE	0	Uint32

5.2.16 17-** Position Feedback

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
17-1* Inc. Enc. Interface						
17-10	Signal Type	[1] RS422 (5V TTL)	All set-ups	FALSE	–	Uint8
17-11	Resolution (PPR)	1024 N/A	All set-ups	FALSE	0	Uint16
17-5* Resolver Interface						
17-50	Poles	2 N/A	1 set-up	FALSE	0	Uint8
17-51	Input Voltage	7 V	1 set-up	FALSE	-1	Uint8
17-52	Input Frequency	10 kHz	1 set-up	FALSE	2	Uint8
17-53	Transformation Ratio	0.5 N/A	1 set-up	FALSE	-1	Uint8
17-56	Encoder Sim. Resolution	[0] Disabled	1 set-up	FALSE	–	Uint8
17-59	Resolver Interface	[0] Disabled	2 set-ups	FALSE	–	Uint8
17-6* Monitoring and App.						
17-60	Feedback Direction	[0] Clockwise	All set-ups	FALSE	–	Uint8
17-61	Feedback Signal Monitoring	[1] Warning	All set-ups	TRUE	–	Uint8

5.2.17 18-** Data Readouts 2

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
18-5* Active Alarms/Warnings						
18-55	Active Alarm Numbers	0 N/A	All set-ups	TRUE	0	Uint16
18-56	Active Warning Numbers	0 N/A	All set-ups	TRUE	0	Uint16
18-9* PID Readouts						
18-90	Process PID Error	0 %	All set-ups	FALSE	-1	Int16
18-91	Process PID Output	0 %	All set-ups	FALSE	-1	Int16
18-92	Process PID Clamped Output	0 %	All set-ups	FALSE	-1	Int16
18-93	Process PID Gain Scaled Output	0 %	All set-ups	FALSE	-1	Int16

5.2.18 21-** Ext. Closed Loop

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
21-1* Ext. CL 1 Ref./Fb.						
21-10	Ext. 1 Ref./Feedback Unit	[1] %	All set-ups	TRUE	–	Uint8
21-11	Ext. 1 Minimum Reference	0 ExtPID1Unit	All set-ups	TRUE	–	Int32
21-12	Ext. 1 Maximum Reference	100 ExtPID1Unit	All set-ups	TRUE	–	Int32
21-13	Ext. 1 Reference Source	[0] No function	All set-ups	TRUE	–	Uint8
21-14	Ext. 1 Feedback Source	[0] No function	All set-ups	TRUE	–	Uint8
21-15	Ext. 1 Setpoint	0 ExtPID1Unit	All set-ups	TRUE	–	Int32
21-17	Ext. 1 Reference [Unit]	0 ExtPID1Unit	All set-ups	TRUE	–	Int32
21-18	Ext. 1 Feedback [Unit]	0 ExtPID1Unit	All set-ups	TRUE	–	Int32
21-19	Ext. 1 Output [%]	0 %	All set-ups	TRUE	–	Int32
21-2* Ext. CL 1 PID						
21-20	Ext. 1 Normal/Inverse Control	[0] Normal	All set-ups	TRUE	–	Uint8
21-21	Ext. 1 Proportional Gain	0.01 N/A	All set-ups	TRUE	-2	Uint16
21-22	Ext. 1 Integral Time	10000 s	All set-ups	TRUE	0	Uint32
21-23	Ext. 1 Differentation Time	0 s	All set-ups	TRUE	0	Uint16
21-24	Ext. 1 Dif. Gain Limit	5 N/A	All set-ups	TRUE	–	Uint16

5.2.19 22-** Appl. Functions

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
22-0* Miscellaneous						
22-00	External Interlock Delay	0 s	All set-ups	TRUE	0	Uint16
22-4* Sleep Mode						
22-40	Minimum Run Time	10 s	All set-ups	TRUE	0	Uint16
22-41	Minimum Sleep Time	10 s	All set-ups	TRUE	0	Uint16
22-42	Wake-up Speed [RPM]	Expressionlimit	All set-ups	TRUE	0	Uint16
22-43	Wake-up Speed [Hz]	Expressionlimit	All set-ups	TRUE	0	Uint16
22-44	Wake-up Ref./FB Difference	10 %	All set-ups	TRUE	0	Int8
22-45	Setpoint Boost	0 %	All set-ups	TRUE	0	Int8
22-46	Maximum Boost Time	60 s	All set-ups	TRUE	0	Uint16
22-6* Broken Belt Detection						
22-60	Broken Belt Function	[0] Off	All set-ups	TRUE	–	Uint8
22-61	Broken Belt Torque	10 %	All set-ups	TRUE	0	Uint8
22-62	Broken Belt Delay	10 s	All set-ups	TRUE	0	Uint16

5.2.20 30-** Special Features

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
30-2* Adv. Start Adjust						
30-20	High Starting Torque Time [s]	ExpressionLimit	All set-ups	TRUE	-2	Uint16
30-21	High Starting Torque Current [%]	ExpressionLimit	All set-ups	TRUE	-1	Uint32
30-22	Locked Rotor Protection	ExpressionLimit	All set-ups	TRUE	–	Uint8
30-23	Locked Rotor Detection Time [s]	ExpressionLimit	All set-ups	TRUE	-2	Uint8
30-24	Locked Rotor Detection Speed Error [%]	25 %	All set-ups	TRUE	-1	Uint32

5.2.21 40-** Special Settings

Parameter number	Parameter description	Default value	4 set-up	Change during operation	Conversion index	Type
40-4* Extend. Fault Log						
40-40	Fault Log: Ext. Reference	0 %	All set-ups	FALSE	-1	Int16
40-41	Fault Log: Frequency	0 Hz	All set-ups	FALSE	-1	Uint16
40-42	Fault Log: Current	0 A	All set-ups	FALSE	-2	Int32
40-43	Fault Log: Voltage	0 V	All set-ups	FALSE	-1	Uint16
40-44	Fault Log: DC Link Voltage	0 V	All set-ups	FALSE	0	Uint16
40-45	Fault Log: Control Word	0 N/A	All set-ups	FALSE	0	V2
40-46	Fault Log: Status Word	0 N/A	All set-ups	FALSE	0	V2

6 Troubleshooting

6.1 Status Messages

A warning or an alarm is signaled by the relevant indicator light on the front of the frequency converter 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 frequency converter 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 (see also *Table 6.1*).

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 frequency converter 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 *Table 6.1*, 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 frequency converter 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*.

Number	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference
1	10 volts low	X	–	–	–
2	Live zero error	(X)	(X)	–	*Parameter 6-01 Live Zero Timeout Function*
3	No motor	(X)	–	–	*Parameter 1-80 Function at Stop*
4	Mains phase loss	(X)	(X)	(X)	*Parameter 14-12 Response to Mains Imbalance*
5	DC-link voltage high	X	–	–	–
6	DC-link voltage low	X	–	–	–
7	DC overvoltage	X	X	–	–
8	DC undervoltage	X	X	–	–
9	Inverter overloaded	X	X	–	–
10	Motor ETR overtemperature	(X)	(X)	–	*Parameter 1-90 Motor Thermal Protection*
11	Motor thermistor overtemperature	(X)	(X)	–	*Parameter 1-90 Motor Thermal Protection*
12	Torque limit	X	X	–	–
13	Over current	X	X	X	–
14	Ground fault	X	X	–	–
15	Hardware mismatch	–	X	X	–
16	Short circuit	–	X	X	–
17	Control word timeout	(X)	(X)	–	*Parameter 8-04 Control Word Timeout Function*
18	Start failed	–	X	–	–
21	Param error	–		X	–
23	Internal fans	X	–	–	–
24	External fans	X	–	–	–
29	Heat sink temp	X	X	X	–
30	Motor phase U missing	(X)	(X)	(X)	*Parameter 4-58 Missing Motor Phase Function*
31	Motor phase V missing	(X)	(X)	(X)	*Parameter 4-58 Missing Motor Phase Function*
32	Motor phase W missing	(X)	(X)	(X)	*Parameter 4-58 Missing Motor Phase Function*
33	Inrush fault		X	X	–
34	Fieldbus communication fault	X	X	–	–
35	Option fault	–	–	X	–
36	Mains failure	X	X	–	–
37	Imbalance of supply voltage	–	X	–	–
38	Internal fault	–	X	X	–
39	Heat sink sensor	–	X	X	–
40	Overload of digital output terminal 27	(X)	–	–	*Parameter 5-00 Digital I/O Mode, parameter 5-01 Terminal 27 Mode*
41	Overload of digital output terminal 29	(X)	–	–	*Parameter 5-00 Digital I/O Mode, parameter 5-02 Terminal 29 Mode*
42	Ovrld X30/6-7	(X)	–	–	–
45	Ground fault 2	X	X	–	–
46	Pwr. card supply	–	X	X	–
47	24 V supply low	X	X	X	–
48	1.2 V supply low	–	X	X	–
49	Speed limit	X	–	–	–
50	AMA calibration failed	–	X	–	–
51	AMA check U_{nom} and I_{nom}	–	X	–	–
52	AMA low I_{nom}	–	X	–	–
53	AMA motor too big	–	X	–	–
54	AMA motor too small	–	X	–	–
55	AMA parameter out of range	–	X	–	–
56	AMA interrupted by user	–	X	–	–
57	AMA time-out	–	X	–	–

Number	Description	Warning	Alarm/ trip	Alarm/ trip lock	Parameter reference
58	AMA internal fault	X	X	–	–
59	Current limit	X		–	–
60	External interlock	X	X	–	–
61	Feedback error	(X)	(X)	–	*Parameter 4-30 Motor Feedback Loss Function*
62	Output frequency at maximum limit	X	X	–	–
63	Mechanical brake low		(X)	–	*Parameter 2-20 Release Brake Current*
64	Voltage limit	X	–	–	–
65	Control board overtemperature	X	X	X	–
66	Heat sink temperature low	X		–	–
67	Option configuration has changed	–	X	–	–
69	Pwr. card temp	–	X	X	–
70	Illegal FC configuration	–	–	X	–
76	Power unit setup	X	–	–	–
77	Reduced power mode	X	–	–	*Parameter 14-59 Actual Number of Inverter Units*
78	Tracking error	(X)	(X)	–	*Parameter 4-34 Tracking Error Function*
79	Illegal PS config	–	X	X	–
80	Frequency converter Initialized to default value	–	X	–	–
81	CSIV corrupt	–	X	–	–
82	CSIV parameter error	–	X	–	–
83	Illegal option combination	–	–	X	–
88	Option detection	–	–	X	–
90	Feedback monitor	(X)	(X)	–	*Parameter 17-61 Feedback Signal Monitoring*
91	Analog input 54 wrong settings	–	–	X	S202
95	Broken belt	–	X	–	–
99	Locked rotor	–	X	X	–
101	Speed monitor	X	X	–	–
104	Mixing fans	X	X	–	–
122	Mot. rotat. unexp.	–	X	–	–
148	System temp	X	X	–	–
154	D.out overload	X	X	–	–
244	Heat sink temperature	–	X	–	–
245	Heat sink sensor	–	X	–	–
246	Power card supply	–	X	–	–
247	Power card temperature	–	X	–	–
248	Illegal power section configuration	–	X	–	–
249	Rect. low temperature	X	–	–	–
250	New spare part	X	–	–	–
251	New type code	X	–	–	–

Table 6.1 Alarm/Warning Code List

(X) Dependent on parameter.

1) Cannot be auto reset via parameter 14-20 Reset Mode.

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 frequency converter or cause dangerous conditions. A trip lock is an action when an alarm occurs, which could damage the frequency converter or connected parts. A trip lock situation can only be reset by cycling power.

Warning	Yellow
Alarm	Flashing red
Trip locked	Yellow and red

Table 6.2 Indicator Light

Bit	Hex	Dec	Alarm word	Alarm word 2	Warning word	Warning word 2	Extended status word
Alarm Word Extended Status Word							
0	00000001	1	Brake check (A28)	Servicetrip, read/ write	Brake check (W28)	Start delayed	Ramping
1	00000002	2	Pwr.card temp (A69)	Servicetrip, (reserved)	Pwr.card temp (A69)	Stop delayed	AMA running
2	00000004	4	Earth fault (A14)	Servicetrip, typecode/spare part	Earth fault (W14)	Reserved	Start CW/CCW start_possible is active, when the DI selections [12] OR [13] are active and the requested direction matches the reference sign
3	00000008	8	Ctrl.card temp (A65)	Servicetrip, (reserved)	Ctrl.card temp (W65)	Reserved	Slow down slow down command active, for example via CTW bit 11 or DI
4	00000010	16	Ctrl. word TO (A17)	Servicetrip, (reserved)	Ctrl. word TO (W17)		Catch up catch up command active, for example via CTW bit 12 or DI
5	00000020	32	Overcurrent (A13)	Reserved	Overcurrent (W13)	Reserved	Feedback high feedback >*parameter 4-57 Warning Feedback High*
6	00000040	64	Torque limit (A12)	Reserved	Torque limit (W12)	Reserved	Feedback low feedback <*parameter 4-56 Warning Feedback Low*
7	00000080	128	Motor th over (A11)	Reserved	Motor th over (W11)	Reserved	Output current high current >*parameter 4-51 Warning Current High*
8	00000100	256	Motor ETR over (A10)	Reserved	Motor ETR over (W10)	Reserved	Output current low current <*parameter 4-50 Warning Current Low*
9	00000200	512	Inverter overld. (A9)	Discharge high	Inverter Overld (W9)	Discharge high	Output freq high speed >*parameter 4-53 Warning Speed High*
10	00000400	1024	DC under volt (A8)	Start failed	DC under volt (W8)	Multi-motor underload	Output freq low speed <*parameter 4-52 Warning Speed Low*
11	00000800	2048	DC over volt (A7)	Speed limit	DC over volt (W7)	Multi-motor overload	Brake check OK brake test NOT OK
12	00001000	4096	Short circuit (A16)	External interlock	DC voltage low (W6)	Compressor interlock	Braking max. BrakePower > Brakepowerlimit (2-12)
13	00002000	8192	Inrush fault (A33)	Illegal option combi.	DC voltage high (W5)	Mechanical brake sliding	Braking
14	00004000	16384	Mains ph. loss (A4)	No safety option	Mains ph. loss (W4)	Safe option warning	Out of speed range
15	00008000	32768	AMA not OK	Reserved	No motor (W3)	Auto DC braking	OVC active
16	00010000	65536	Live zero error (A2)	Reserved	Live zero error (W2)		AC brake

Bit	Hex	Dec	Alarm word	Alarm word 2	Warning word	Warning word 2	Extended status word
17	00020000	131072	Internal fault (A38)	KTY error	10 V low (W1)	KTY warn	Password timelock number of allowed password trials exceeded - timelock active
18	00040000	262144	Brake overload (A26)	Fans error	Brake overload (W26)	Fans warn	Password protection 0-61 = ALL_NO_ACCESS OR BUS_NO_ACCESS OR BUS_READONLY
19	00080000	524288	U phase loss (A30)	ECB error	Brake resistor (W25)	ECB warn	Reference high reference >*parameter 4-55 Warning Reference High*
20	00100000	1048576	V phase loss (A31)	Hoist mechanical brake (A22)	Brake IGBT (W27)	Hoist mechanical brake (W22)	Reference low reference <*parameter 4-54 Warning Reference Low*
21	00200000	2097152	W phase Loss (A32)	Reserved	Speed limit (W49)	Reserved	Local reference reference site = REMOTE -> auto on pressed & active
22	00400000	4194304	Fieldbus fault (A34)	Reserved	Fieldbus fault (W34)	Reserved	Protection mode notification
23	00800000	8388608	24 V supply low (A47)	Reserved	24 V supply Low (W47)	Reserved	Unused
24	01000000	16777216	Mains failure (A36)	Reserved	Mains failure (W36)	Reserved	Unused
25	02000000	33554432	1.8 V supply low (A48)	Current limit (A59)	Current limit (W59)	Power Limit Motor	Unused
26	04000000	67108864	Brake resistor (A25)	Motor rotating unexpectedly (A122)	Low temp (W66)	Power Limit Generator	Unused
27	08000000	134217728	Brake IGBT (A27)	Reserved	Voltage limit (W64)	Reserved	Unused
28	10000000	268435456	Option change (A67)	Reserved	Encoder loss (W90)	Reserved	Unused
29	20000000	536870912	Drive initialized (A80)	Encoder loss (A90)	Output freq. lim. (W62)	BackEMF too high	Unused
30	40000000	1073741824	Safe stop (A68)	PTC thermistor (A74)	Safe stop (W68)	PTC thermistor (W74)	Unused
31	80000000	2147483648	Mech. brake low (A63)	Dangerous failure (A72)	Extended status word		Protection mode

Table 6.3 Description of Alarm Word, Warning Word, and Extended Status Word

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*.

The following warning and alarm information defines each warning or alarm condition, provides the probable cause for the condition, and details a remedy or troubleshooting procedure.

WARNING 1, 10 Volts low
The control card voltage is less than 10 V from terminal 50. Remove some of the load from terminal 50, as the 10 V supply is overloaded. Maximum 15 mA or minimum 590 Ω.

A short circuit in a connected potentiometer or incorrect wiring of the potentiometer can cause this condition.

Troubleshooting

- Remove the wiring from terminal 50. If the warning clears, the problem is with the wiring. If the warning does not clear, replace the control card.

WARNING/ALARM 2, Live zero error
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.
- Check that the drive programming and switch settings match the analog signal type.
- Perform an input terminal signal test.

WARNING/ALARM 3, No motor
No motor has been connected to the output of the drive.

WARNING/ALARM 4, Mains phase loss
A phase is missing on the supply side, or the mains voltage imbalance is too high. This message also appears for a fault in the input rectifier. Options are programmed in *parameter 14-12 Response to Mains Imbalance*.

Troubleshooting

- Check the supply voltage and supply currents to the drive.

WARNING 5, DC link voltage high
The DC-link voltage (DC) is higher than the high-voltage warning limit. The limit depends on the drive voltage rating. The unit is still active.

WARNING 6, DC link voltage low
The DC-link voltage (DC) is lower than the low-voltage warning limit. The limit depends on the drive voltage rating. The unit is still active.

WARNING/ALARM 7, DC overvoltage
If the DC-link voltage exceeds the limit, the drive trips after a certain time.

Troubleshooting

- Connect a brake resistor.
- 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*).

WARNING/ALARM 8, DC under voltage
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.

WARNING/ALARM 9, Inverter overload
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.

WARNING/ALARM 10, Motor overload temperature
According to the electronic thermal protection (ETR), the motor is too hot.

Select 1 of these options:

- The drive issues a warning or an alarm when the counter is >90% if *parameter 1-90 Motor Thermal Protection* is set to warning options.
- The drive trips when the counter reaches 100% if *parameter 1-90 Motor Thermal Protection* is set to trip options.

The fault occurs when the motor runs with more than 100% overload for too long.

Troubleshooting

- Check for motor overheating.
- Check if the motor is mechanically overloaded.
- Check that the motor current set in *parameter 1-24 Motor Current* is correct.
- Ensure that the motor data in *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*.
- Running AMA in *parameter 1-29 Automatic Motor Adaptation (AMA)* tunes the drive to the motor more accurately and reduces thermal loading.

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WARNING/ALARM 11, Motor thermistor overtemp
Check whether the thermistor is disconnected. Select whether the drive issues a warning or an alarm in *parameter 1-90 Motor Thermal Protection*.

Troubleshooting

- Check for motor overheating.
- Check if the motor is mechanically overloaded.
- When using terminal 53 or 54, check that the thermistor is connected correctly between either terminal 53 or 54 (analog voltage input) and terminal 50 (+10 V supply). Also check that the terminal switch for 53 or 54 is set for voltage. Check that *parameter 1-93 Thermistor Resource* selects terminal 53 or 54.
- When using terminal 18, 19, 31, 32, or 33 (digital inputs), check that the thermistor is connected correctly between the digital input terminal used (digital input PNP only) and terminal 50. Select the terminal to use in *parameter 1-93 Thermistor Resource*.

WARNING/ALARM 12, Torque limit
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, 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.

WARNING/ALARM 13, Over current
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 the power and check if the motor shaft can be turned.
- Check that the motor size matches the drive.
- Check that the motor data is correct in *parameters 1-20* to *1-25*.

ALARM 14, Earth (ground) fault
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 transducers 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 transducers in the drive. Perform the manual initialization or perform a complete AMA. This method is most relevant after changing the power card.

ALARM 15, Hardware mismatch
A fitted option is not operational with the present control card hardware or software.

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).

ALARM 16, Short circuit
There is short-circuiting in the motor or motor wiring.

Troubleshooting
- Remove the power to the drive and repair the short circuit.

WARNING
HIGH VOLTAGE
Drives contain high voltage when connected to AC mains input, DC supply, or load sharing. Failure to use qualified personnel to install, start up, and maintain the drive can result in death or serious injury.

- **Disconnect power before proceeding.**

WARNING/ALARM 17, Control word timeout
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.

ALARM 18, Start failed
The speed cannot exceed the value set in *parameter 1-78 Compressor Start Max Speed [Hz]* during start within the allowed time, which is set in *parameter 1-79 Compressor Start Max Time to Trip*. The alarm may be caused by a blocked motor.

WARNING/ALARM 21, Parameter error
The parameter is out of range. The parameter number is shown in the display.

Troubleshooting
- Set the affected parameter to a valid value.

WARNING 23, Internal fan fault
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 alarm 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.

WARNING 24, External fan fault
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 alarm 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.

ALARM 29, Power module temp
The power module is above the temperature limit. If the enclosure is IP00 or IP20/NEMA 1, the cutout temperature of the heat sink is 90 °C (194 °F).

ALARM 30, Motor phase U missing
Motor phase U between the drive and the motor is missing.

WARNING
HIGH VOLTAGE
Drives contain high voltage when connected to AC mains input, DC supply, or load sharing. 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.**
- **Before performing any service or repair work, use an appropriate voltage measuring device to make sure that there is no remaining voltage on the drive.**

Troubleshooting
- Remove the power from the drive and check motor phase U.

ALARM 31, Motor phase V missing
Motor phase V between the drive and the motor is missing.

⚠WARNING

HIGH VOLTAGE

Drives contain high voltage when connected to AC mains input, DC supply, or load sharing. 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.**
- **Before performing any service or repair work, use an appropriate voltage measuring device to make sure that there is no remaining voltage on the drive.**

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Troubleshooting

- Remove the power from the drive and check motor phase V.

ALARM 32, Motor phase W missing

Motor phase W between the drive and the motor is missing.

⚠WARNING

HIGH VOLTAGE

Drives contain high voltage when connected to AC mains input, DC supply, or load sharing. 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.**
- **Before performing any service or repair work, use an appropriate voltage measuring device to make sure that there is no remaining voltage on the drive.**

Troubleshooting

- Remove the power from the drive and check motor phase W.

ALARM 33, Inrush fault

Too many power-ups have occurred within a short time period.

Troubleshooting

- Let the unit cool to operating temperature.
- Check potential DC-link fault to ground.

WARNING/ALARM 34, Fieldbus communication fault

The fieldbus on the communication option card is not working.

WARNING/ALARM 35, Option fault

An option alarm is received. The alarm is option-specific. The most likely cause is a power-up or a communication fault.

WARNING/ALARM 36, Mains failure

This warning/alarm is only active if the supply voltage to the drive is lost and *parameter 14-10 Mains Failure* is not set to *[0] No function*.

Troubleshooting

- Check the fuses to the drive and mains supply to the unit.

ALARM 37, Phase imbalance

There is a current imbalance between the power units.

ALARM 38, Internal fault

When an internal fault occurs, a code number defined in *Table 6.4* 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 directions.

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. 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.

Table 6.4 Internal Fault Codes

ALARM 39, Heat sink sensor
No feedback from the heat sink temperature sensor.

The signal from the IGBT thermal sensor is not available on the power card. The problem could be on the power card, on the gatedrive card, or the ribbon cable between the power card and gatedrive card.

WARNING 40, Overload of digital output terminal 27
Check the load connected to terminal 27 or remove the short-circuit connection. Check *parameter 5-00 Digital I/O Mode* and *parameter 5-01 Terminal 27 Mode*.

WARNING 41, Overload of digital output terminal 29
Check the load connected to terminal 29 or remove the short-circuit connection. Also check *parameter 5-00 Digital I/O Mode* and *parameter 5-02 Terminal 29 Mode*.

WARNING 42, Overload of digital output on X30/6 or overload of digital output on X30/7
For terminal X30/6, check the load connected to terminal X30/6 or remove the short-circuit connection. Also 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 terminal X30/7 or remove the short-circuit connection. Check *parameter 5-33 Term X30/7 Digi Out (MCB 101)* (VLT® General Purpose I/O MCB 101).

ALARM 45, Earth fault 2
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.

ALARM 46, Power card supply
The supply for the gate drive on the power card is out of range.

Troubleshooting

- Check for a defective power card.

WARNING 47, 24 V supply low
The 24 V DC is measured on the control card.

Troubleshooting

- Contact the Danfoss supplier or Danfoss service department.

WARNING 48, 1.2 V supply low
The 1.2 V DC supply used on the control card is outside of the allowable 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.

WARNING 49, Speed limit
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.

ALARM 50, AMA calibration failed
Contact the Danfoss supplier or Danfoss Service Department.

ALARM 51, AMA check U_{nom} and I_{nom}
The settings for motor voltage, motor current, and motor power are wrong.

Troubleshooting

- Check the settings in *parameters 1-20 to 1-25*.

ALARM 52, AMA low I_{nom}
The motor current is too low.

Troubleshooting

- Check the settings in *parameter 1-24 Motor Current*.

ALARM 53, AMA motor too big
The motor is too large for the AMA to operate.

ALARM 54, AMA motor too small
The motor is too small for the AMA to operate.

ALARM 55, AMA parameter out of range
The AMA cannot run because the parameter values of the motor are outside of the acceptable range.

ALARM 56, AMA interrupted by user
The AMA is manually interrupted.

ALARM 57, AMA internal fault
Try to restart the AMA. Repeated restarts can overheat the motor.

ALARM 58, AMA Internal fault
Contact the Danfoss supplier.

WARNING 59, Current limit
The current is higher than the value in *parameter 4-18 Current Limit*. 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.

WARNING 60, External interlock
A digital input signal indicates a fault condition external to the drive. An external interlock has commanded the drive to trip. Clear the external fault condition. To resume normal operation, apply 24 V DC to the terminal programmed for external interlock and reset the drive.

WARNING/ALARM 61, Feedback error
An error between calculated speed and speed measurement from feedback device.

Troubleshooting
- Check the settings for warning/alarm/disabling in *parameter 4-30 Motor Feedback Loss Function*.
- Set the tolerable error in *parameter 4-31 Motor Feedback Speed Error*.
- Set the tolerable feedback loss time in *parameter 4-32 Motor Feedback Loss Timeout*.

WARNING 62, Output frequency at maximum limit
If the output frequency reaches the value set in *parameter 4-19 Max Output Frequency*, the drive issues a warning. The warning ceases when the output drops below the maximum limit. If the drive is unable to limit the frequency, it trips and issues an alarm.

Troubleshooting
- Check the application for possible causes.
- Increase the output frequency limit. Ensure that the system can operate safely at a higher output frequency.

ALARM 63, Mechanical brake low
The actual motor current has not exceeded the release brake current within the start delay time window.

WARNING 64, Voltage Limit
The load and speed combination demands a motor voltage higher than the actual DC-link voltage.

WARNING/ALARM 65, Control card over temperature
The cutout temperature of the control card is 85 °C (185 °F).

Troubleshooting
- Check that the ambient operating temperature is within the limits.
- Check for clogged filters.
- Check the fan operation.
- Check the control card.

WARNING 66, Heat sink temperature low
The drive is too cold to operate. This warning is based on the temperature sensor in the IGBT module. Increase the ambient temperature of the unit. Also, a trickle amount of current can be supplied to the drive whenever the motor is stopped by setting *parameter 2-00 DC Hold/Preheat Current* to 5% and *parameter 1-80 Function at Stop*.

ALARM 67, Option module configuration has changed
One or more options have either been added or removed since the last power-down. Check that the configuration change is intentional and reset the unit.

ALARM 69, Power card temperature
The temperature sensor on the power card is either too hot or too cold.

Troubleshooting
- Check that the ambient operating temperature is within limits.
- Check for clogged filters.
- Check fan operation.
- Check the power card.

ALARM 70, Illegal FC configuration
The control card and power card are incompatible. To check compatibility, contact the Danfoss supplier with the type code from the unit nameplate and the part numbers of the cards.

WARNING 76, Power unit setup
The required number of power units does not match the detected number of active power units. When replacing an enclosure size F module, this warning occurs if the power-specific data in the module power card does not match the rest of the drive. If the power card connection is lost, the unit also triggers this warning.

Troubleshooting
- Confirm that the spare part and its power card are the correct part number.
- Ensure that the 44-pin cables between the MDCIC and power cards are mounted properly.

WARNING 77, Reduced power mode
This warning indicates that the drive is operating in reduced power mode (that is, less than the allowed number of inverter sections). This warning is generated on power cycle when the drive is set to run with fewer inverters and remains on.

ALARM 78, Tracking error
The difference between setpoint value and actual value exceeds the value in *parameter 4-35 Tracking Error*.

Troubleshooting
- Disable the function or select an alarm/warning in *parameter 4-34 Tracking Error Function*.
- Investigate the mechanics around the load and motor. Check feedback connections from motor encoder to drive.
- Select motor feedback function in *parameter 4-30 Motor Feedback Loss Function*.

- Adjust the tracking error band in *parameter 4-35 Tracking Error* and *parameter 4-37 Tracking Error Ramping*.

ALARM 79, Illegal power section configuration
The scaling card has an incorrect part number or is not installed. The MK102 connector on the power card could not be installed.

ALARM 80, Drive initialised to default value
Parameter settings are initialized to default settings after a manual reset. To clear the alarm, reset the unit.

ALARM 81, CSIV corrupt
CSIV file has syntax errors.

ALARM 82, CSIV parameter error
CSIV failed to initialize a parameter.

ALARM 83, Illegal option combination
The mounted options are incompatible.

ALARM 88, Option detection
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.

- To apply the change, enable option layout changes in *parameter 14-89 Option Detection*.
- Alternatively, restore the correct option configuration.

ALARM 90, Feedback monitor
Check the connection to encoder/resolver option and, if necessary, replace VLT® Encoder Input MCB 102 or VLT® Resolver Input MCB 103.

ALARM 91, Analog input 54 wrong settings
Set switch S202 in position OFF (voltage input) when a KTY sensor is connected to analog input terminal 54.

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 and reset the frequency converter after clearing the fault.

ALARM 99, Locked rotor
The rotor is blocked.

WARNING/ALARM 101, Speed monitor
The speed monitor is out of range.

WARNING/ALARM 104, Mixing fan fault
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 trip in *parameter 14-53 Fan Monitor*.

Troubleshooting

- Cycle power to the drive to determine if the warning/alarm returns.

WARNING/ALARM 122, Mot. rotat. unexp.
The drive performs a function that requires the motor to be at standstill, for example DC hold for PM motors.

WARNING/ALARM 148, System temp
One or more of the system temperature measurements is too high.

WARNING/ALARM 154, D.out overload
Digital output overloaded.

ALARM 244, Heat sink temperature
This alarm is equivalent to *ALARM 29, Power module temp*.

The report value in the alarm log indicates which power module generated the alarm:

1 = Leftmost inverter module.

2 = Middle inverter module.

2 = Right inverter module.

2 = Second drive from the left inverter module.

3 = Right inverter module.

3 = Third from the left inverter module.

4 = Far right inverter module.

5 = Rectifier module.

6 = Right rectifier module.

ALARM 245, Heat sink sensor
There is no feedback from the heat sink sensor.

The report value in the alarm log indicates which power module generated the alarm:

1 = Leftmost inverter module.

2 = Middle inverter module.

2 = Right inverter module.

2 = Second drive from the left inverter module.

3 = Right inverter module.

3 = Third from the left inverter module.

4 = Far right inverter module.

5 = Rectifier module.

6 = Right rectifier module.

ALARM 246, Power card supply
The supply on the power card is out of range.

The report value in the alarm log indicates which power module generated the alarm:

1 = Leftmost inverter module.

2 = Middle inverter module.

2 = Right inverter module.

2 = Second drive from the left inverter module.

3 = Right inverter module.

3 = Third from the left inverter module.

4 = Far right inverter module.

5 = Rectifier module.

6 = Right rectifier module.

ALARM 247, Power card temperature
The supply on the power card is out of range.

The report value in the alarm log indicates which power module generated the alarm:

1 = Leftmost inverter module.

2 = Middle inverter module.

2 = Right inverter module.

2 = Second drive from the left inverter module.

3 = Right inverter module.

3 = Third from the left inverter module.

4 = Far right inverter module.

5 = Rectifier module.

6 = Right rectifier module.

ALARM 248, Illegal power section configuration
Power size configuration fault on the power card.

The report value in the alarm log indicates which power module generated the alarm:

1 = Leftmost inverter module.

2 = Middle inverter module.

2 = Right inverter module.

2 = Second drive from the left inverter module.

3 = Right inverter module.

3 = Third from the left inverter module.

4 = Far right inverter module.

5 = Rectifier module.

6 = Right rectifier module.

WARNING 249, Rect. low temperature
The temperature of the rectifier heat sink is too low, which indicates that the temperature sensor may be defect.

WARNING 250, New spare part
The power or switch mode supply has been exchanged. Restore the drive type code in the EEPROM. Select the correct type code in *parameter 14-23 Typecode Setting* according to the label on the drive. Remember to select Save to EEPROM at the end.

WARNING 251, New typecode
The power card or other components are replaced, and the type code has changed.

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