MAKING MODERN LIVING POSSIBLE

Programming Guide
VLT® AutomationDrive FC 360

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VLT® THE REAL DRIVE

Contents

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1 Introduction

1.1 How to Read This Programming Guide

1.1.1 Purpose of the Manual

The FC 360 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 the FC 360 frequency converter.
Read the instructions before programming and follow the procedures in this manual.
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1.1.2 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
MG06C5	Replaces MG06C4	1.4X

Table 1.1 Document and Software Version

1.1.3 Abbreviations and Conventions

AC	Alternating current
AEO	Automatic energy optimisation
ACP	Application control processor
AWG	American wire gauge
AMA	Automatic motor adaptation
°C	Degrees Celsius
DC	Direct current
EEPROM	Electrically erasable programmable read-only memory
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ETR	Electronic thermal relay
$f_{M,N}$	Nominal motor frequency
FC	Frequency converter
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	d-axis inductance
LCP	Local control panel
MCP	Motor control processor
N.A.	Not applicable
$P_{M,N}$	Nominal motor power
PCB	Printed circuit board
PE	Protective earth
PELV	Protective extra low voltage
PWM	Pulse width modulated
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	Main reactance

Table 1.2 Abbreviations

Conventions

- Numbered lists indicate procedures.
- Bullet lists indicate other information.
- Italicised text indicates
  - cross reference
  - link
  - parameter name
- All dimensions are in mm (inch).
- * indicates default setting of a parameter.

1.1.4 Approvals

CE

Illustration 1.1 Approval

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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 LCP and digital inputs.
Functions are divided into 2 groups.

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

Group 1	Reset, coasting stop, reset and coasting stop, quick-stop, DC braking, stop, and [OFF].
Group 2	Start, pulse start, reversing, start reversing, jog, and freeze output.

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).

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).

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

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

n_s
Synchronous motor speed

$$ns = \frac{2 \times par.\ 1-23 \times 60\ s}{par.\ 1-39}$$

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).

Breakaway torque

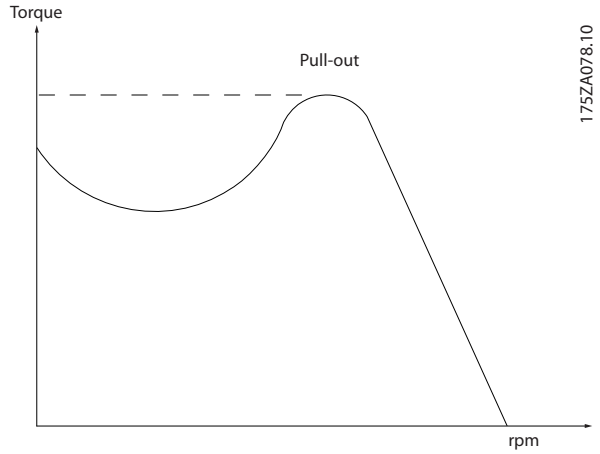

Illustration 1.2 Breakaway Torque

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 stop command belonging to the group 1 control commands. See *chapter 1.2.2 Input* for more details.

Stop command
A stop command belonging to the group 1 control commands. See *chapter 1.2.2 Input* 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 to 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.

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 *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 *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 to +10 V DC

Analog outputs
The analog outputs can supply a signal of 0–20 mA, 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 braking power increases the intermediate circuit 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.

DSP
Digital signal processor.

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*.

Initialising
If initialising is carried out (*parameter 14-22 Operation Mode*), 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 control panel is detachable and can be installed up to 3 m from the frequency converter, i.e. in a front panel with the installation kit option.

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 display 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. Press [OK] to activate changes to off-line parameters.

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

PCD
Process control data

Power cycle
Switch off the mains until display (LCP) is dark, then turn power on again.

Power factor
The power factor is the relation between I_1 and I_{RMS}.

$$Power\ factor = \frac{\sqrt{3} \times U \times I1 \times \cos\varphi 1}{\sqrt{3} \times U \times IRMS}$$

For FC 360 frequency converters, $\cos\phi 1$=1, therefore:

$$Power\ factor = \frac{I1 \times \cos\varphi 1}{IRMS} = \frac{I1}{IRMS}$$

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.

$$IRMS = \sqrt{I_1^2 + I_5^2 + I_7^2 + .. + I_n^2}$$

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In addition, a high power factor indicates that the different harmonic currents are low.
The built-in DC coils produce a high power factor minimising 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 2 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 associated user-defined events are evaluated as true by the smart logic controller (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 to be monitored (frequency converter or motor).

Trip
A state entered in fault situations, e.g. if the frequency converter is subject to an overtemperature 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 cancelled by activating reset or, in some cases, by being programmed to reset automatically. Do not use trip for personal safety.

Trip locked
A state entered in fault situations when the frequency converter is protecting itself and requiring physical intervention, e.g. if the frequency converter is subject to a short circuit on the output. A locked trip can only be cancelled by cutting off mains, removing the cause of the fault, and reconnecting the frequency converter. Restart is prevented until the trip state is cancelled by activating reset or, in some cases, by being programmed to reset automatically. Do not use trip locked 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*.

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1.3 Electrical Wiring - Control Cables

1.3.1 Overview

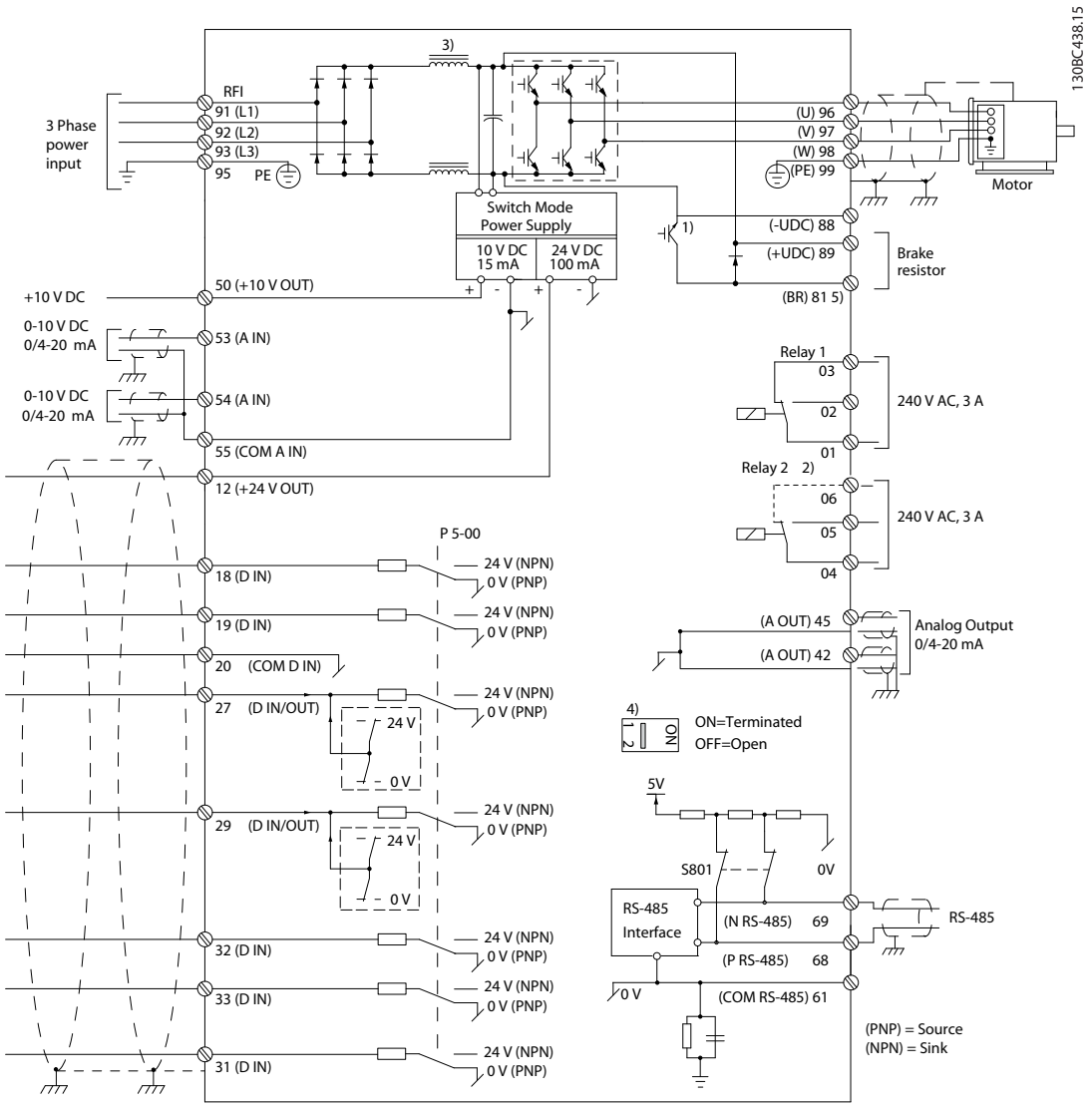

Illustration 1.3 Basic Wiring Schematic Drawing

A=Analog, D=Digital

1) Built-in brake chopper available from 0.37–22 kW.

2) Relay 2 is 2-pole for J1–J3 and 3-pole for J4–J7. Relay 2 of J4–J7 with terminal 4,5,6, same NO/NC logic as Relay 1. Relays are pluggable in J1–J5, and fixed in J6–J7.

3) Dual DC choke in 30–75 kW (J6–J7).

4) Switch S801 (bus terminal) can be used to enable termination on the RS485 port (terminals 68 and 69).

5) No BR for 30–75 kW (J6–J7).

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In rare cases, very long control cables and analog signals may result in 50/60 Hz ground loops due to noise from mains supply cables. If this occurs, break the screen or insert a 100 nF capacitor between screen and chassis.

The digital and analog inputs and outputs must be connected separately to the common inputs (terminal 20 and 55) of the frequency converter to avoid ground currents from both groups to affect other groups. For example, switching on the digital input may disturb the analog input signal.

Input polarity of control terminals

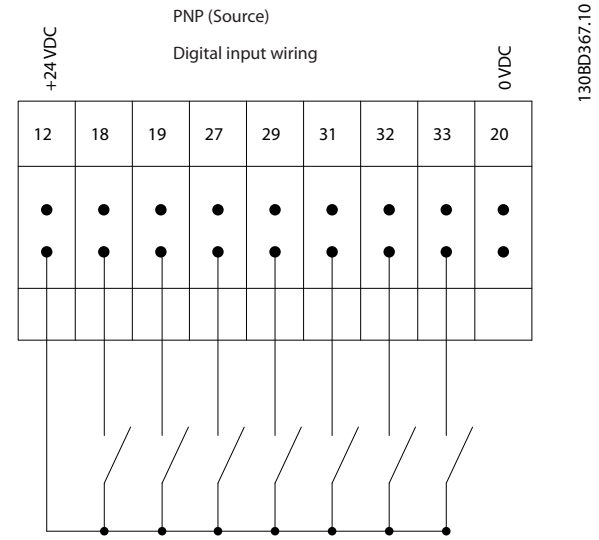


Illustration 1.4 PNP (Source)

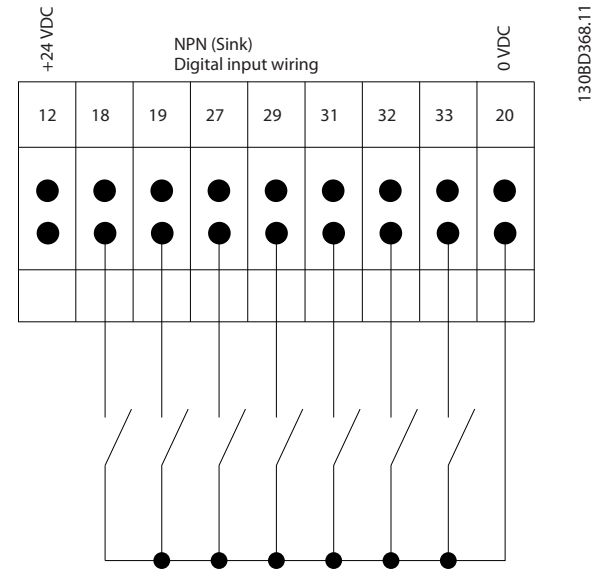


Illustration 1.5 NPN (Sink)

NOTICE

Control cables must be screened/armoured.

See the section *Using Screened Control Cables* in the Design Guide for the correct termination of control cables.

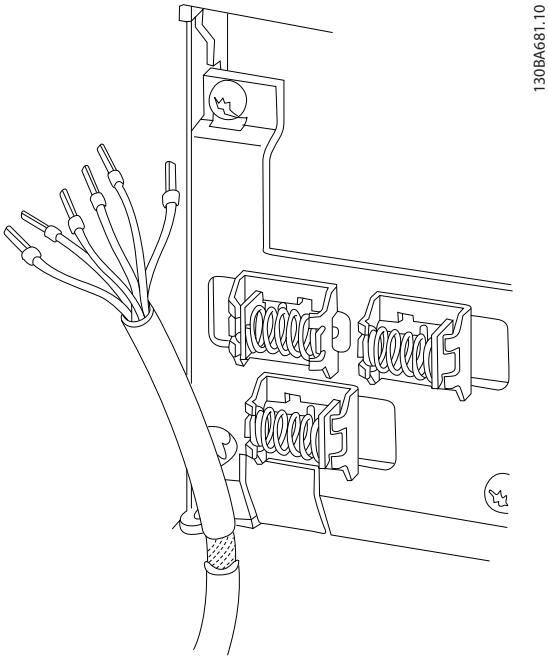


Illustration 1.6 Grounding of Screened/armoured Control Cables

1.3.2 Start/Stop

Terminal 18=*5-10 Terminal 18 Digital Input [8] Start*.
Terminal 27=*5-12 Terminal 27 Digital Input [0] No operation* (Default *coast inverse*).

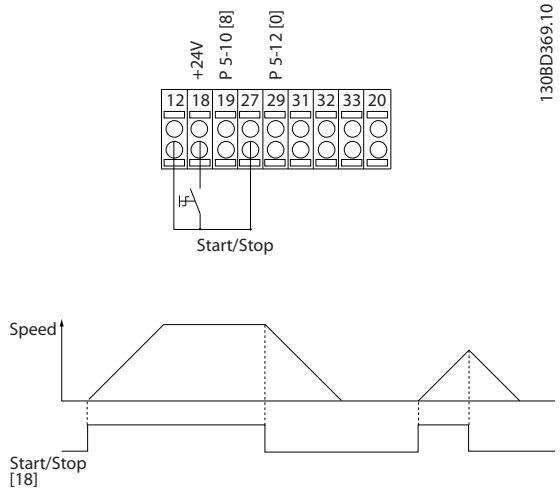
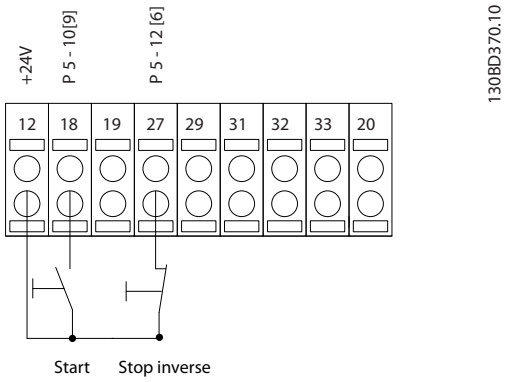


Illustration 1.7 Start/stop

1.3.3 Pulse Start/Stop

Terminal 18=*5-10 Terminal 18 Digital Input [9] Latched start*.
Terminal 27=*5-12 Terminal 27 Digital Input [6] Stop inverse*.



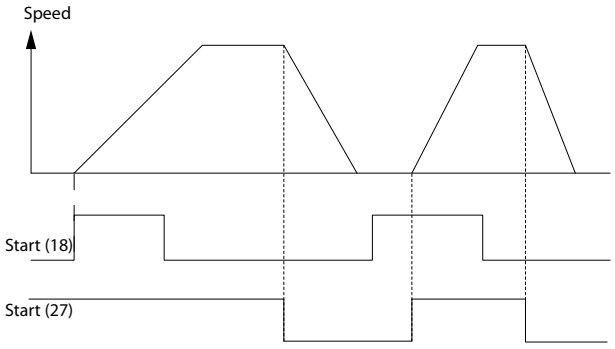


Illustration 1.8 Pulse Start/stop

1.3.4 Speed Up/Down

Terminals 29/32=Speed up/down

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

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

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

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

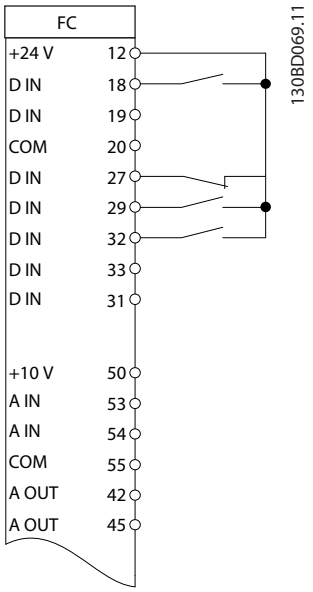


Illustration 1.9 Speed Up/down

1.3.5 Potentiometer Reference

Voltage reference via a potentiometer

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

Terminal 53, low voltage=0 V.

Terminal 53, high voltage=10 V.

Terminal 53, low ref./feedback=0.

Terminal 53, high ref./feedback=1500.

6-19 Terminal 53 mode=[1] Voltage.

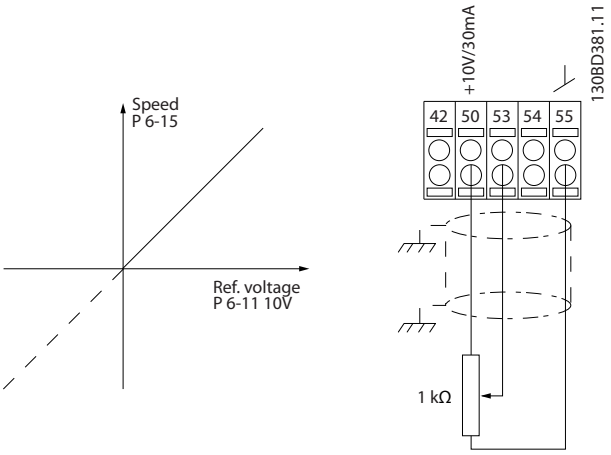


Illustration 1.10 Potentiometer Reference

2 Safety

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2.1 Safety Symbols

The following symbols are used in this document:

⚠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 or operate this equipment.

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

2.3 Safety Precautions

⚠WARNING

HIGH VOLTAGE

Frequency converters 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.

- **Installation, start-up, and maintenance must be performed by qualified personnel only.**

⚠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.**
- **Fully wire and assembly 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. Failure to wait the specified time after power has been removed before performing service or repair work, could result in death or serious injury.

1. **Stop the motor.**
2. **Disconnect AC mains, permanent magnet type motors, and remote DC-link power supplies, including battery back-ups, UPS, and DC-link connections to other frequency converters.**
3. **Wait for the capacitors to discharge fully, before performing any service or repair work. The duration of waiting time is specified in *Table 2.1*.**

Voltage [V]	Minimum waiting time (minutes)	
	4	15
380–480	0.37–7.5 kW	11–75 kW
High voltage may be present even when the warning LEDs are off.		

Table 2.1 Discharge Time

⚠WARNING

LEAKAGE CURRENT HAZARD

Leakage currents exceed 3.5 mA. Failure to ground the frequency converter properly can result in death or serious injury.

- **Ensure the correct grounding of the equipment by a certified electrical installer.**

⚠WARNING

EQUIPMENT HAZARD

Contact with rotating shafts and electrical equipment can result in death or serious injury.

- **Ensure that only trained and qualified personnel perform installation, start up, and maintenance.**
- **Ensure that electrical work conforms to national and local electrical codes.**
- **Follow the procedures in this document.**

⚠CAUTION

INTERNAL FAILURE HAZARD

An internal failure in the frequency converter can result in serious injury, when the frequency converter is not properly closed.

- **Ensure that all safety covers are in place and securely fastened before applying power.**

NOTICE

HIGH ALTITUDES

For installation at altitudes above 2000 m, contact Danfoss regarding PELV.

NOTICE

Use on Isolated Mains

For details about the use of the frequency converter on isolated mains, refer to section *RFI Switch* in the *Design Guide*.

Follow the recommendations regarding the installation on IT-mains. Use relevant monitoring devices for IT-mains to avoid damage.

3 Programming

3.1 Overview

3

3.1.1 Programming with the Numerical Local Control Panel (LCP 21)

The FC 360 supports graphic and numerical local control panels as well as blind covers. This chapter covers programming with the numerical local control panel (LCP 21).

The frequency converter can also be programmed from a PC via RS485 com-port by installing the MCT-10 Set-up Software. This software can either be ordered using code number 130B1000 or downloaded from: *www.danfoss.com/BusinessAreas/DrivesSolutions/softwaredownload*.

3.1.2 Numerical Local Control Panel LCP 21

The numerical local control panel (LCP 21) is divided into 4 functional sections.

A. Numeric display.

B. Menu key.

C. Navigation keys and indicator lights (LEDs).

D. Operation keys and indicator lights (LEDs).

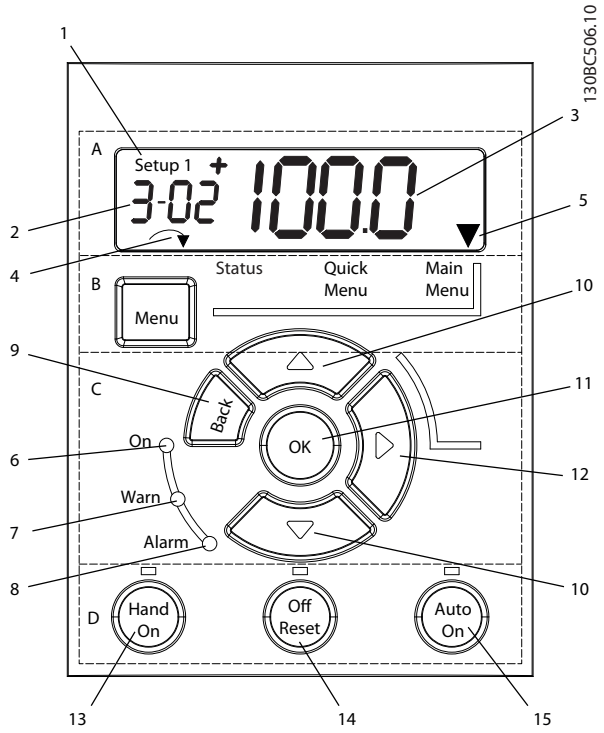


Illustration 3.1 View of the LCP 21

A. Numeric display

The LCD-display is back-lit with 1 numeric line. All data is displayed in the LCP.

1	The set-up number shows the active set-up and the edit set-up. If the same set-up acts as both active and edit set-up, only that set-up number is shown (factory setting). When active and edit set-up differ, both numbers are shown in the display (set-up 12). The number flashing indicates the edit set-up.
2	Parameter number.
3	Parameter value.
4	Motor direction is shown in the bottom left of the display, indicated by a small arrow pointing either clockwise or counterclockwise.
5	The triangle indicates whether the LCP is in Status, Quick Menu, or Main Menu.

Table 3.1 Legend to *Illustration 3.1*, Section A

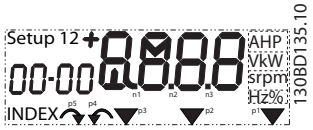


Illustration 3.2 Display Information

B. Menu key

Press [Menu] to select between Status, Quick Menu, or Main Menu.

C. Navigation keys and indicator lights (LEDs)

6	Green LED/On: Control section is working.
7	Yellow LED/Warn.: Indicates a warning.
8	Flashing Red LED/Alarm: Indicates an alarm.
9	[Back]: For moving to the previous step or layer in the navigation structure.
10	Arrows [▲] [▼]: For maneuvering between parameter groups, parameters and within parameters or increasing/decreasing parameter values. Arrows can also be used for setting local reference.
11	[OK]: For selecting a parameter and for accepting changes to parameter settings.
12	[►]: For moving from left to right within the parameter value to change each digit individually.

Table 3.2 Legend to *Illustration 3.1*, Section C

D. Operation keys and indicator lights (LEDs)

13	[Hand On]: Starts the motor and enables control of the frequency converter via the LCP. ***NOTICE*** ***5-12 Terminal 27 Digital Input* has coast inverse as the default setting. This means that [Hand On] does not start the motor if there is no 24 V to terminal 27.**
14	[Off/Reset]: Stops the motor (off). If in alarm mode, the alarm is reset.
15	[Auto On]: Frequency converter is controlled either via control terminals or serial communication.

Table 3.3 Legend to *Illustration 3.1*, Section D

⚠WARNING

HIGH VOLTAGE

Touching the frequency converter after pressing the [Off/Reset] key is still dangerous, because the key does not disconnect the frequency converter from the mains.

- Disconnect the frequency converter from the mains, and wait for the frequency converter to fully discharge. See the discharge time in *Table 2.1*.

3.1.3 The Right-key Function on LCP 21

Press [►] to edit any of the 4 digits on the display individually. When pressing [►] once, the cursor moves to the first digit and the digit starts flashing as shown in *Illustration 3.3*. Press the [▲] [▼] to change the value. Pressing [►] does not change the value of the digits or move the decimal point.

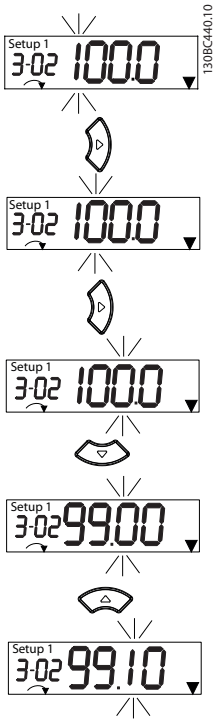


Illustration 3.3 Right-key Function

[►] can also be used for moving between parameter groups. When in Main Menu, press [►] to move to the first parameter in the next parameter group (e.g. move from *0-03 Regional Settings [0] International* to *parameter 1-00 Configuration Mode [0] Open loop*).

3.2 Quick Menu

The Quick Menu gives easy access to the most frequently used parameters.

1. To enter Quick Menu, press [Menu] until the indicator in display is placed above *Quick Menu*.
2. Press [▲] [▼] to select either QM1 or QM2, then press [OK].
3. Press [▲] [▼] to browse through the parameters in the Quick Menu.
4. Press [OK] to select a parameter.
5. Press [▲] [▼] to change the value of a parameter setting.
6. Press [OK] to accept the change.
7. To exit, press either [Back] twice (or 3 times if in QM2 and QM3) to enter Status, or press [Menu] once to enter Main Menu.

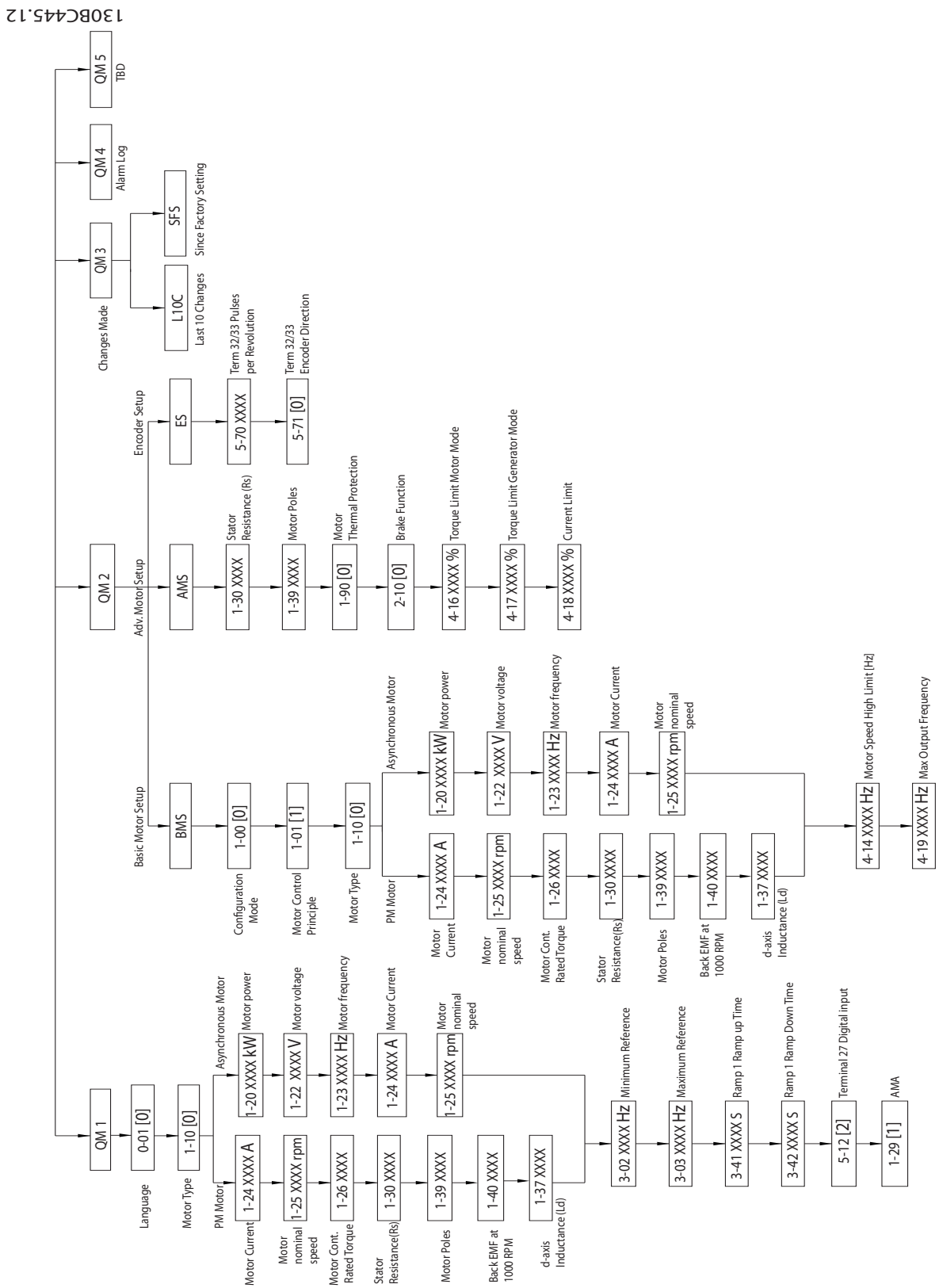


Illustration 3.4 Quick Menu Structure

3.3 Status Menu

After power-up, Status Menu is active. Press [Menu] to toggle between Status Menu, Quick Menu and Main Menu.

[▲] and [▼] toggle between the options in each menu.

The display indicates the status mode with a small arrow above Status.

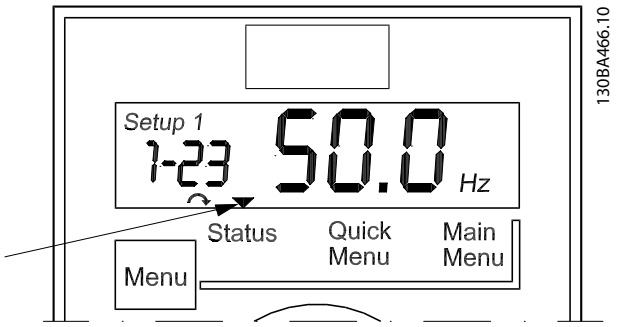


Illustration 3.5 Indicating Status Mode

3.4 Main Menu

Main Menu gives access to all parameters.

1. To enter Main Menu, press [Menu] until indicator in display is placed above Main Menu.
2. [▲] [▼]: Browse through the parameter groups.
3. Press [OK] to select a parameter group.
4. [▲] [▼]: Browse through the parameters in the specific group.
5. Press [OK] to select the parameter.
6. [►] and [▲] [▼]: Set/change the parameter value.
7. Press [OK] to accept the value.
8. To exit, press either [Back] twice (or 3 times for array parameters) to enter Main Menu, or press [Menu] once to enter Status.

See *Illustration 3.6*, *Illustration 3.7*, and *Illustration 3.8* for the principles of changing the value of continuous, enumerated and array parameters respectively. The actions in the illustrations are described in *Table 3.4*, *Table 3.5*, and *Table 3.6*.

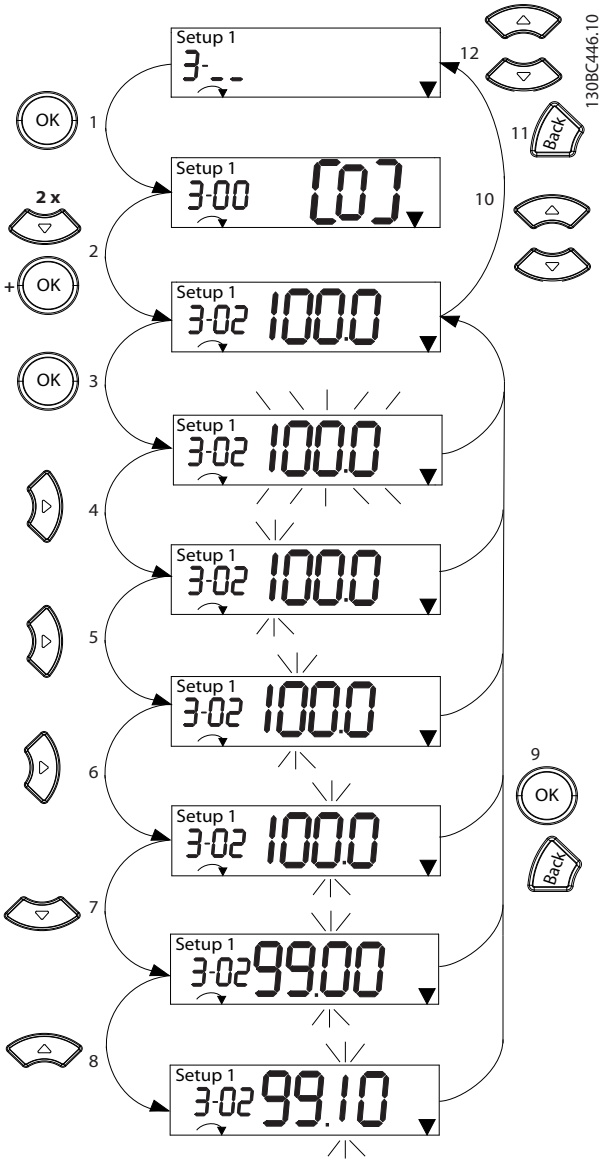


Illustration 3.6 Main Menu Interactions - Continuous Parameters

3

1	[OK]: The first parameter in the group is shown.
2	Press [▼] repeatedly to move down to the desired parameter.
3	Press [OK] to start editing.
4	[►]: First digit flashing (can be edited).
5	[►]: Second digit flashing (can be edited).
6	[►]: Third digit flashing (can be edited).
7	[▼]: Decreases the parameter value, the decimal point changes automatically.
8	[▲]: Increases the parameter value.
9	[Back]: Cancel changes, return to 2). [OK]: Accept changes, return to 2).
10	[▲][▼]: Select parameter within the group.
11	[Back]: Removes the value and shows the parameter group.
12	[▲][▼]: Select group.

Table 3.4 Changing Values in Continuous Parameters

For enumerated parameters, the interaction is similar, but the parameter value is shown in brackets, because of the LCP 21 digits limitation (4 large digits) and the enum can be greater than 99. When the enum value is greater than 99, the LCP 21 can only display the first part of the bracket.

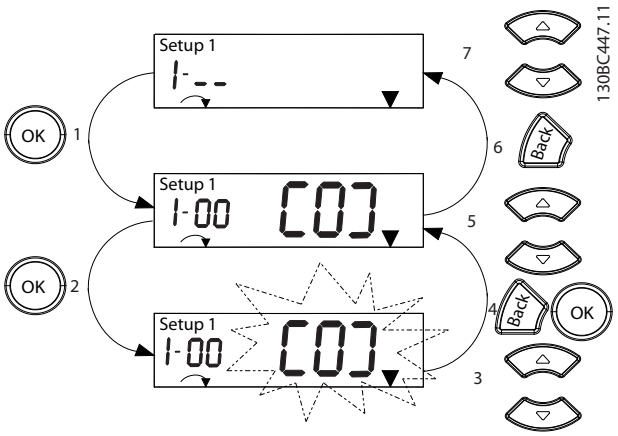


Illustration 3.7 Main Menu Interactions - Enumerated Parameters

1	[OK]: The first parameter in the group is shown.
2	Press [OK] to start editing.
3	[▲][▼]: Change parameter value (flashing).
4	Press [Back] to cancel changes or [OK] to accept changes (return to screen 2).
5	[▲][▼]: Select a parameter within the group.
6	[Back]: Removes the value and shows the parameter group.
7	[▲][▼]: Select a group.

Table 3.5 Changing Values in Enumerated Parameters

Array parameters function as follows:

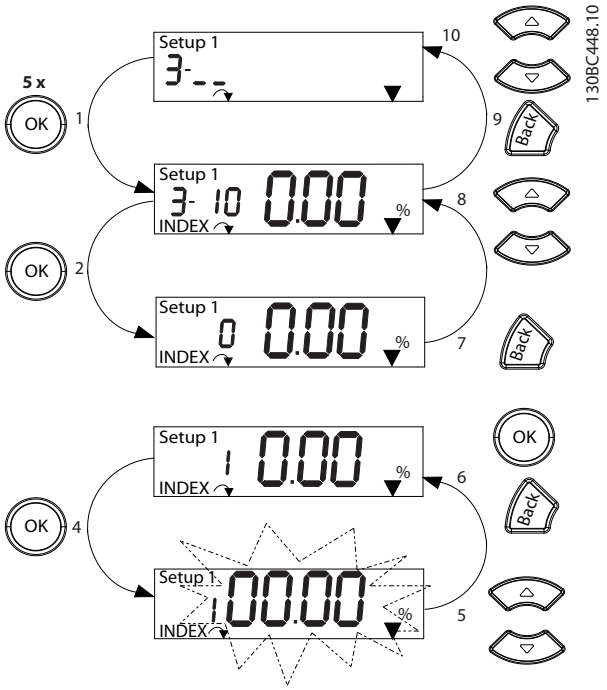


Illustration 3.8 Main Menu Interactions - Array Parameters

1	[OK]: Shows parameter numbers and the value in the first index.
2	[OK]: Index can be selected.
3	[▲][▼]: Select index.
4	[OK]: Value can be edited.
5	[▲][▼]: Change parameter value (flashing).
6	[Back]: Cancels changes. [OK]: Accepts changes.
7	[Back]: Cancels editing index, a new parameter can be selected.
8	[▲][▼]: Select parameter within the group.
9	[Back]: Removes parameter index value and shows the parameter group.
10	[▲][▼]: Select group.

Table 3.6 Changing Values in Array Parameters

4 Parameter Descriptions

4.1 Parameters: 0-** Operation and Display

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

4.1.1 0-0* Basic Settings

0-01 Language		
Option:		**Function:**
[0] *	English	
[10]	Chinese	

0-03 Regional Settings		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.**
[0] *	International	Activates *1-20 Motor Power [kW]* for setting the motor power in kW and sets the default value of *1-23 Motor Frequency* to 50 Hz.
[1]	US	Activates *1-20 Motor Power [kW]* for setting the motor power in hp and sets the default value of *1-23 Motor Frequency* to 60 Hz.

0-04 Operating State at Power-up (Hand)		
Option:		**Function:**
		Selects the operating mode upon reconnection of the frequency converter to mains voltage after power down in *Hand On* mode.
[0]	Resume	Restarts the frequency converter, maintaining the same start/stop settings (applied by [Hand On/Off]) as those selected before the power down of the frequency converter.
[1] *	Forced stop, ref=old	Restarts the frequency converter with a saved local reference, after mains voltage reappears, and after pressing [Hand On].
[2]	Forced stop, ref=0	Resets the local reference to 0 upon restarting the frequency converter.

0-06 GridType		
Option:		**Function:**
		Select the grid type of the supply voltage/frequency. ***NOTICE*** **Not all choices are supported in all power sizes.** IT grid is a supply mains, where the neutral point of secondary side of the transformer is not connected to ground. Delta is a supply mains where the secondary part of the transformer is delta-connected and 1 phase is connected to ground.
[10]	380-440V/50Hz/IT-grid	
[11]	380-440V/50Hz/Delta	
[12]	380-440V/50Hz	
[20]	440-480V/50Hz/IT-grid	
[21]	440-480V/50Hz/Delta	
[22]	440-480V/50Hz	
[110]	380-440V/60Hz/IT-grid	
[111]	380-440V/60Hz/Delta	
[112]	380-440V/60Hz	
[120]	440-480V/60Hz/IT-grid	
[121]	440-480V/60Hz/Delta	
[122]	440-480V/60Hz	

0-07 Auto DC Braking		
Option:		**Function:**
		Protective function against overvoltage at coast.
[0]	Off	Function is not active.
[1] *	On	Function is active.

4.1.2 0-1* Set-up Operations

Define and control the individual parameter set-ups.
The frequency converter has 2 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. For example these can be used to program the frequency converter to operate according to one control scheme in one 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, they 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 and then 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 *0-10 Active Set-up* and is displayed in the LCP. By selecting *Multi set-up*, it is possible to switch between set-ups with the frequency converter running or stopped, via digital input or serial communication commands. If it is necessary to change set-ups while running, ensure that *parameter 0-12 Link Setups* is set as required. By selecting *parameter 0-11 Programming Set-up*, it is possible to edit parameters within any of the set-ups while continuing the frequency converter operation in its active set-up, which can be a different set-up to that being edited. By selecting *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 in which the frequency converter is to operate. Select *parameter 0-51 Set-up Copy* to copy a set-up to 1 or all set-ups. To avoid conflicting settings of the same parameter within 2 different set-ups, link the set-ups together in *parameter 0-12 Link Setups*. Stop the frequency converter before switching between set-ups where the parameters marked *Not changeable during operation* have different values. Parameters which are *Not changeable during operation* are marked FALSE in the parameter lists in *chapter 5 Parameter Lists*.
[1] *	Set-up 1	Set-up 1 is active.
[2]	Set-up 2	Set-up 2 is active.
[9]	Multi Set-up	Is used for remote selection of set-ups using digital inputs and the serial communication port. This set-up uses the settings from *parameter 0-12 Link Setups*.

0-11 Programming Set-up

Option:		Function:
		Select the set-up to be programmed during operation; either the active set-up or the inactive set-up. The set-up number being edited flashes in the LCP.
[1]	Set-up 1	*[1] Set-up 1* to *[2] Set-up 2* can be edited freely during operation, independently of the active set-up.
[2]	Set-up 2	
[9] *	Active Set-up	The set-up in which the frequency conveter is operating can also be edited during operation.

0-12 Link Setups

Option:		Function:
		The link ensures synchronising of the *Not changeable during operation* parameter values enabling shift from 1 set-up to another during operation. If the set-ups are not linked, a change between them is not possible while the motor is running. Thus the set-up change does not occur until the motor is coasted.
[0]	Not linked	Leaves parameters unchanged in both set-ups and cannot be changed while the motor runs.
[20] *	Linked	Copies *Not changeable during operation* parameters from 1 set-up to the other, so they are identical in both set-ups.

0-16 Application Selection

Option:		Function:
[0] *	None	
[1]	Simple Process Closed Loop	
[2]	Local/Remote	
[3]	Speed Open Loop	
[4]	Simple Speed Closed Loop	
[5]	Multi Speed	
[6]	OGD Function	

0-20 Display Line 1.1 Small

Option:		Function:
[0]		
[37]	Display Text 1	
[38]	Display Text 2	
[39]	Display Text 3	
[748]	PCD Feed Forward	
[953]	Profibus Warning Word	
[1501]	Running Hours	
[1502]	kWh Counter	
[1600]	Control Word	
[1601]	Reference [Unit]	
[1602] *	Reference [%]	
[1603]	Status Word	

0-20 Display Line 1.1 Small		
Option:		**Function:**
[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]	
[1618]	Motor Thermal	
[1622]	Torque [%]	
[1630]	DC Link Voltage	
[1633]	Brake Energy /2 min	
[1634]	Heatsink Temp.	
[1635]	Inverter Thermal	
[1636]	Inv. Nom. Current	
[1637]	Inv. Max. Current	
[1638]	SL Controller State	
[1639]	Control Card Temp.	
[1650]	External Reference	
[1652]	Feedback[Unit]	
[1653]	Digi Pot Reference	
[1657]	Feedback [RPM]	
[1660]	Digital Input	
[1661]	Terminal 53 Setting	
[1662]	Analog Input 53	
[1663]	Terminal 54 Setting	
[1664]	Analog Input AI54	
[1665]	Analog Output 42 [mA]	
[1666]	Digital Output	
[1667]	Pulse Input 29[Hz]	
[1668]	Pulse Input 33 [Hz]	
[1669]	Pulse Output 27 [Hz]	
[1670]	Pulse Output 29 [Hz]	
[1671]	Relay Output	
[1672]	Counter A	
[1673]	Counter B	
[1679]	Analog Output AO45	
[1680]	Fieldbus CTW 1	
[1682]	Fieldbus REF 1	
[1684]	Comm. Option STW	
[1685]	FC Port CTW 1	
[1686]	FC Port REF 1	
[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	
[1890]	Process PID Error	
[1891]	Process PID Output	

0-20 Display Line 1.1 Small		
Option:		**Function:**
[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 [%]	
[3401]	PCD 1 Write For Application	
[3402]	PCD 2 Write For Application	
[3403]	PCD 3 Write For Application	
[3404]	PCD 4 Write For Application	
[3405]	PCD 5 Write For Application	
[3406]	PCD 6 Write For Application	
[3407]	PCD 7 Write For Application	
[3408]	PCD 8 Write For Application	
[3409]	PCD 9 Write For Application	
[3410]	PCD 10 Write For Application	
[3421]	PCD 1 Read For Application	
[3422]	PCD 2 Read For Application	
[3423]	PCD 3 Read For Application	
[3424]	PCD 4 Read For Application	
[3425]	PCD 5 Read For Application	
[3426]	PCD 6 Read For Application	
[3427]	PCD 7 Read For Application	
[3428]	PCD 8 Read For Application	
[3429]	PCD 9 Read For Application	
[3430]	PCD 10 Read For Application	
[3450]	Actual Position	
[3456]	Track Error	

0-21 Display Line 1.2 Small		
Option:		**Function:**
[0]		
[37]	Display Text 1	
[38]	Display Text 2	
[39]	Display Text 3	
[748]	PCD Feed Forward	
[953]	Profibus Warning Word	
[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]	
[1618]	Motor Thermal	

4

0-21 Display Line 1.2 Small		
Option:		**Function:**
[1622]	Torque [%]	
[1630]	DC Link Voltage	
[1633]	Brake Energy /2 min	
[1634]	Heatsink Temp.	
[1635]	Inverter Thermal	
[1636]	Inv. Nom. Current	
[1637]	Inv. Max. Current	
[1638]	SL Controller State	
[1639]	Control Card Temp.	
[1650]	External Reference	
[1652]	Feedback[Unit]	
[1653]	Digi Pot Reference	
[1657]	Feedback [RPM]	
[1660]	Digital Input	
[1661]	Terminal 53 Setting	
[1662]	Analog Input 53	
[1663]	Terminal 54 Setting	
[1664]	Analog Input AI54	
[1665]	Analog Output 42 [mA]	
[1666]	Digital Output	
[1667]	Pulse Input 29[Hz]	
[1668]	Pulse Input 33 [Hz]	
[1669]	Pulse Output 27 [Hz]	
[1670]	Pulse Output 29 [Hz]	
[1671]	Relay Output	
[1672]	Counter A	
[1673]	Counter B	
[1679]	Analog Output AO45	
[1680]	Fieldbus CTW 1	
[1682]	Fieldbus REF 1	
[1684]	Comm. Option STW	
[1685]	FC Port CTW 1	
[1686]	FC Port REF 1	
[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	
[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 [%]	
[3401]	PCD 1 Write For Application	
[3402]	PCD 2 Write For Application	
[3403]	PCD 3 Write For Application	
[3404]	PCD 4 Write For Application	
[3405]	PCD 5 Write For Application	

0-21 Display Line 1.2 Small		
Option:		**Function:**
[3406]	PCD 6 Write For Application	
[3407]	PCD 7 Write For Application	
[3408]	PCD 8 Write For Application	
[3409]	PCD 9 Write For Application	
[3410]	PCD 10 Write For Application	
[3421]	PCD 1 Read For Application	
[3422]	PCD 2 Read For Application	
[3423]	PCD 3 Read For Application	
[3424]	PCD 4 Read For Application	
[3425]	PCD 5 Read For Application	
[3426]	PCD 6 Read For Application	
[3427]	PCD 7 Read For Application	
[3428]	PCD 8 Read For Application	
[3429]	PCD 9 Read For Application	
[3430]	PCD 10 Read For Application	
[3450]	Actual Position	
[3456]	Track Error	

0-22 Display Line 1.3 Small		
Option:		**Function:**
[0]		
[37]	Display Text 1	
[38]	Display Text 2	
[39]	Display Text 3	
[748]	PCD Feed Forward	
[953]	Profibus Warning Word	
[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]	
[1618]	Motor Thermal	
[1622]	Torque [%]	
[1630]	DC Link Voltage	
[1633]	Brake Energy /2 min	
[1634]	Heatsink Temp.	
[1635]	Inverter Thermal	
[1636]	Inv. Nom. Current	
[1637]	Inv. Max. Current	
[1638]	SL Controller State	
[1639]	Control Card Temp.	
[1650]	External Reference	

0-22 Display Line 1.3 Small		
Option:		**Function:**
[1652]	Feedback[Unit]	
[1653]	Digi Pot Reference	
[1657]	Feedback [RPM]	
[1660]	Digital Input	
[1661]	Terminal 53 Setting	
[1662]	Analog Input 53	
[1663]	Terminal 54 Setting	
[1664]	Analog Input AI54	
[1665]	Analog Output 42 [mA]	
[1666]	Digital Output	
[1667]	Pulse Input 29[Hz]	
[1668]	Pulse Input 33 [Hz]	
[1669]	Pulse Output 27 [Hz]	
[1670]	Pulse Output 29 [Hz]	
[1671]	Relay Output	
[1672]	Counter A	
[1673]	Counter B	
[1679]	Analog Output AO45	
[1680]	Fieldbus CTW 1	
[1682]	Fieldbus REF 1	
[1684]	Comm. Option STW	
[1685]	FC Port CTW 1	
[1686]	FC Port REF 1	
[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	
[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 [%]	
[3401]	PCD 1 Write For Application	
[3402]	PCD 2 Write For Application	
[3403]	PCD 3 Write For Application	
[3404]	PCD 4 Write For Application	
[3405]	PCD 5 Write For Application	
[3406]	PCD 6 Write For Application	
[3407]	PCD 7 Write For Application	
[3408]	PCD 8 Write For Application	
[3409]	PCD 9 Write For Application	
[3410]	PCD 10 Write For Application	
[3421]	PCD 1 Read For Application	
[3422]	PCD 2 Read For Application	
[3423]	PCD 3 Read For Application	
[3424]	PCD 4 Read For Application	
[3425]	PCD 5 Read For Application	

0-22 Display Line 1.3 Small		
Option:		**Function:**
[3426]	PCD 6 Read For Application	
[3427]	PCD 7 Read For Application	
[3428]	PCD 8 Read For Application	
[3429]	PCD 9 Read For Application	
[3430]	PCD 10 Read For Application	
[3450]	Actual Position	
[3456]	Track Error	

0-23 Display Line 2 Large		
Option:		**Function:**
[0]		
[37]	Display Text 1	
[38]	Display Text 2	
[39]	Display Text 3	
[748]	PCD Feed Forward	
[953]	Profibus Warning Word	
[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]	
[1618]	Motor Thermal	
[1622]	Torque [%]	
[1630]	DC Link Voltage	
[1633]	Brake Energy /2 min	
[1634]	Heatsink Temp.	
[1635]	Inverter Thermal	
[1636]	Inv. Nom. Current	
[1637]	Inv. Max. Current	
[1638]	SL Controller State	
[1639]	Control Card Temp.	
[1650]	External Reference	
[1652]	Feedback[Unit]	
[1653]	Digi Pot Reference	
[1657]	Feedback [RPM]	
[1660]	Digital Input	
[1661]	Terminal 53 Setting	
[1662]	Analog Input 53	
[1663]	Terminal 54 Setting	
[1664]	Analog Input AI54	
[1665]	Analog Output 42 [mA]	
[1666]	Digital Output	

4

0-23 Display Line 2 Large		
Option:		**Function:**
[1667]	Pulse Input 29[Hz]	
[1668]	Pulse Input 33 [Hz]	
[1669]	Pulse Output 27 [Hz]	
[1670]	Pulse Output 29 [Hz]	
[1671]	Relay Output	
[1672]	Counter A	
[1673]	Counter B	
[1679]	Analog Output AO45	
[1680]	Fieldbus CTW 1	
[1682]	Fieldbus REF 1	
[1684]	Comm. Option STW	
[1685]	FC Port CTW 1	
[1686]	FC Port REF 1	
[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	
[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 [%]	
[3401]	PCD 1 Write For Application	
[3402]	PCD 2 Write For Application	
[3403]	PCD 3 Write For Application	
[3404]	PCD 4 Write For Application	
[3405]	PCD 5 Write For Application	
[3406]	PCD 6 Write For Application	
[3407]	PCD 7 Write For Application	
[3408]	PCD 8 Write For Application	
[3409]	PCD 9 Write For Application	
[3410]	PCD 10 Write For Application	
[3421]	PCD 1 Read For Application	
[3422]	PCD 2 Read For Application	
[3423]	PCD 3 Read For Application	
[3424]	PCD 4 Read For Application	
[3425]	PCD 5 Read For Application	
[3426]	PCD 6 Read For Application	
[3427]	PCD 7 Read For Application	
[3428]	PCD 8 Read For Application	
[3429]	PCD 9 Read For Application	
[3430]	PCD 10 Read For Application	
[3450]	Actual Position	
[3456]	Track Error	

0-24 Display Line 3 Large		
Option:		**Function:**
[0]		
[37]	Display Text 1	
[38]	Display Text 2	
[39]	Display Text 3	
[748]	PCD Feed Forward	
[953]	Profibus Warning Word	
[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]	
[1618]	Motor Thermal	
[1622]	Torque [%]	
[1630]	DC Link Voltage	
[1633]	Brake Energy /2 min	
[1634]	Heatsink Temp.	
[1635]	Inverter Thermal	
[1636]	Inv. Nom. Current	
[1637]	Inv. Max. Current	
[1638]	SL Controller State	
[1639]	Control Card Temp.	
[1650]	External Reference	
[1652]	Feedback[Unit]	
[1653]	Digi Pot Reference	
[1657]	Feedback [RPM]	
[1660]	Digital Input	
[1661]	Terminal 53 Setting	
[1662]	Analog Input 53	
[1663]	Terminal 54 Setting	
[1664]	Analog Input AI54	
[1665]	Analog Output 42 [mA]	
[1666]	Digital Output	
[1667]	Pulse Input 29[Hz]	
[1668]	Pulse Input 33 [Hz]	
[1669]	Pulse Output 27 [Hz]	
[1670]	Pulse Output 29 [Hz]	
[1671]	Relay Output	
[1672]	Counter A	
[1673]	Counter B	
[1679]	Analog Output AO45	
[1680]	Fieldbus CTW 1	
[1682]	Fieldbus REF 1	

0-24 Display Line 3 Large		
Option:		**Function:**
[1684]	Comm. Option STW	
[1685]	FC Port CTW 1	
[1686]	FC Port REF 1	
[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	
[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 [%]	
[3401]	PCD 1 Write For Application	
[3402]	PCD 2 Write For Application	
[3403]	PCD 3 Write For Application	
[3404]	PCD 4 Write For Application	
[3405]	PCD 5 Write For Application	
[3406]	PCD 6 Write For Application	
[3407]	PCD 7 Write For Application	
[3408]	PCD 8 Write For Application	
[3409]	PCD 9 Write For Application	
[3410]	PCD 10 Write For Application	
[3421]	PCD 1 Read For Application	
[3422]	PCD 2 Read For Application	
[3423]	PCD 3 Read For Application	
[3424]	PCD 4 Read For Application	
[3425]	PCD 5 Read For Application	
[3426]	PCD 6 Read For Application	
[3427]	PCD 7 Read For Application	
[3428]	PCD 8 Read For Application	
[3429]	PCD 9 Read For Application	
[3430]	PCD 10 Read For Application	
[3450]	Actual Position	
[3456]	Track Error	

4.1.3 0-3* LCP Custom Readout

It is possible to customise the display elements for various purposes.

Custom readout
The calculated value to be displayed is based on settings in *0-30 Custom Readout Unit*, *0-31 Custom Readout Min Value* (linear only), *0-32 Custom Readout Max Value*, *4-14 Motor Speed High Limit [Hz]* and actual speed.

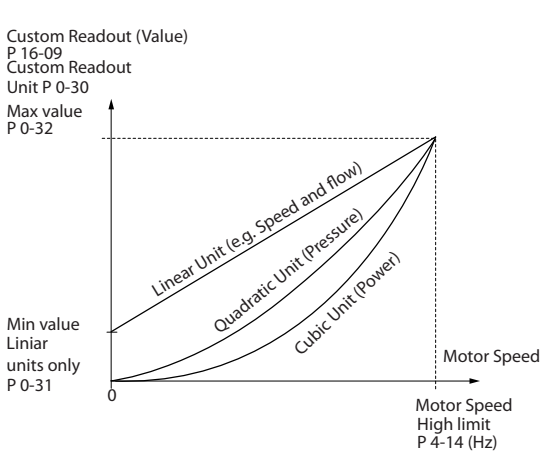


Illustration 4.1 Custom Readout

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

Unit Type	Speed Relation
Dimensionless	Linear
Speed	
Flow, volume	
Flow, mass	
Velocity	
Length	
Temperature	
Pressure	Quadratic
Power	Cubic

Table 4.1 Relation between Unit Type and Speed

0-30 Custom Readout Unit		
Option:		**Function:**
		Set a value to be shown in the LCP. The value has a linear, squared or cubed relation to speed. This relation depends on the unit selected. See *Table 4.1*. The actual calculated valued can be read in *parameter 16-09 Custom Readout*.
[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	

0-30 Custom Readout Unit	
Option:	**Function:**
[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
[127]	ft^3/h
[140]	ft/s
[141]	ft/min
[160]	°F
[170]	psi
[171]	lb/in2
[172]	in WG
[173]	ft WG
[180]	HP

0-31 Custom Readout Min Value		
Range:		**Function:**
0 CustomReadoutUnit*	[0 - 999999.99 CustomReadoutUnit]	This parameter sets the minimum value of the custom readout (occurs at zero speed). It is only possible to select a value different from 0 when selecting a linear unit in *parameter 0-30 Custom Readout Unit*. For quadratic and cubic units, the minimum value is 0.

0-32 Custom Readout Max Value		
Range:		**Function:**
100 CustomReadoutUnit*	[0.0 - 999999.99 CustomReadoutUnit]	This parameter sets the maximum value to be shown when the motor speed has reached the value set for *parameter 4-14 Motor Speed High Limit [Hz]*.

4.1.4 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	Avoid accidental start of the frequency converter in *Hand On* mode.
[1] *	Enabled	[Hand On] is enabled.

0-42 [Auto on] Key on LCP		
Option:		**Function:**
[0]	Disabled	Avoid accidental start of the freqeuncy converter from LCP.
[1] *	Enabled	[Hand On] is enabled.

0-44 [Off/Reset] Key on LCP		
Option:		**Function:**
[0]	Disabled	
[1] *	Enabled	
[7]	Enable Reset Only	

4.1.5 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:**
[0] *	No copy	No funciton
[1]	All to LCP	Copies all parameters in all set-ups from the frequency converter memory to the LCP memory. For service purpose, copy all parameters to the LCP after commissioning.
[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	Copies only the parameters that are independent of the motor size. This selection can be used to programme several frequency converters with the same function wihtout disturbing motor data already set.

0-51 Set-up Copy		
Option:		**Function:**
[0] *	No copy	No funciton
[1]	Copy from setup 1	Copy from set-up 1 to set-up 2.
[2]	Copy from setup 2	Copy from set-up 2 to set-up 1.
[9]	Copy from Factory setup	Copy factory setting to programming set-up (selected in *parameter 0-11 Programming Set-up*).

4.1.6 0-6* Password

0-60 Main Menu Password		
Range:		**Function:**
0*	[0 - 999]	Define the password for access to the Main Menu via the [Main Menu] key. Setting values to 0 disables the password function.

4.2 Parameters: 1-** Load and Motor

4.2.1 1-0* General Settings

1-00 Configuration Mode		
Option:		**Function:**
		Select the application control principle to be used when a remote reference (i.e. via analog input or fieldbus) is active.
[0] *	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* Load and Motor*. The speed control parameters are set in parameter group *7-0* Speed PID Control*.
[1]	Speed closed loop	Enables speed closed loop control with feedback. For increased speed accuracy, provide a feedback signal and set the speed PID control. The speed control parameters are set in parameter group *7-0* Speed PID Control*.
[2]	Torque closed loop	Enables torque closed loop control with speed feedback. Only possible when option *[1] VVC+* is selected for parameter *1-01 Motor Control Principle*.
[3]	Process Closed Loop	Enables the use of process control in the frequency converter. The process control parameters are set in parameter groups *7-2* Process Ctrl. Feedback* and *7-3* Process PID Ctrl*.
[4]	Torque open loop	
[6]	Surface Winder	
[7]	Extended PID Speed OL	

1-01 Motor Control Principle		
Option:		**Function:**
[0]	U/f	***NOTICE*** **When running U/f, control slip and load compensations are not included.** Used for parallel-connected motors and/or special motor applications. Set the U/f settings in *1-55 U/f Characteristic - U* and *1-56 U/f Characteristic - F*.
[1] *	VVC+	***NOTICE*** **When *1-10 Motor Construction* is set to PM-enabled options, only VVC+ option is available.**

1-01 Motor Control Principle		
Option:		**Function:**
		Normal running mode, including slip and load compensations.

1-03 Torque Characteristics		
Option:		**Function:**
		Select the torque characteristic required. VT and AEO are both energy saving operations.
[0] *	Constant torque	
[1]	Variable Torque	
[2]	Auto Energy Optim. CT	

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 frequency converter is connected U⇒U; V⇒V; and W⇒W to motor.
[1]	Inverse	The motor shaft turns in counterclockwise direction when frequency converter is connected U⇒U; V⇒V; and W⇒W to motor.

4.2.2 1-1* Motor Selection

Parameter group for setting general motor data. The parameters cannot be adjusted while the motor is running.

The active parameters are shown in *Table 4.2*. x indicates a particular parameter is active when the option is selected.

1-10 Motor Construction	[0] Asynchron	[1] PM Motor non salient	[2] PM, salient IPM, non-Sat	[3] PM, salient IPM, Sat
1-00 Configuration Mode	x	x	x	x
1-03 Torque Characteristics	x			
1-06 Clockwise Direction	x	x	x	x
1-08 Motor Control Bandwidth	x	x	x	x
1-14 Damping Gain		x	x	x
1-15 Low Speed Filter Time Const.		x	x	x

1-16 High Speed Filter Time Const.		x	x	x
1-17 Voltage filter time const.		x	x	x
1-20 Motor Power [kW]	x			
1-22 Motor Voltage	x			
1-23 Motor Frequency	x			
1-24 Motor Current	x	x	x	x
1-25 Motor Nominal Speed	x	x	x	x
1-26 Motor Cont. Rated Torque		x	x	x
Parameter 1-29 Automatic Motor Adaption (AMA)	x	x	x	x
1-30 Stator Resistance (Rs)	x	x	x	x
1-33 Stator Leakage Reactance (X1)	x			
1-35 Main Reactance (Xh)	x			
1-37 d-axis Inductance (Ld)		x	x	x
1-38 q-axis Inductance (Lq)			x	x
1-39 Motor Poles	x	x	x	x
Parameter 1-40 Back EMF at 1000 RPM		x	x	x
1-42 Motor Cable Length	x	x	x	x
1-43 Motor Cable Length Feet	x	x	x	x
1-44 d-axis Inductance Sat. (LdSat)				
1-45 q-axis Inductance Sat. (LqSat)				x
1-46 Position Detection Gain		x	x	x
1-48 Current at Min Inductance for d-axis				x
1-49 Current at Min Inductance for q-axis				x
Parameter 1-50 Motor Magnetisation at Zero Speed				
1-52 Min Speed Normal Magnetising [Hz]				
1-55 U/f Characteristic - U				
1-56 U/f Characteristic - F				
1-62 Slip Compensation				
Parameter 1-63 Slip Compensation Time Constant				
1-64 Resonance Dampening				
1-65 Resonance Dampening Time Constant				
1-66 Min. Current at Low Speed		x	x	x
1-70 PM Start Mode		x	x	x
1-71 Start Delay	x	x	x	x
1-72 Start Function	x	x	x	x
1-73 Flying Start	x	x	x	x
1-80 Function at Stop	x	x	x	x
1-90 Motor Thermal Protection	x	x	x	x
2-00 DC Hold Current	x	x	x	x
2-01 DC Brake Current	x	x	x	x
2-02 DC Braking Time	x	x	x	x
2-04 DC Brake Cut In Speed [Hz]	x	x	x	x
2-06 Parking Current		x	x	x
2-07 Parking Time		x	x	x
2-10 Brake Function	x	x	x	x
2-16 AC brake Max. Current	x			
2-17 Over-voltage Control	x	x	x	x
4-10 Motor Speed Direction	x	x	x	x
4-14 Motor Speed High Limit [Hz]	x	x	x	x
4-18 Current Limit	x	x	x	x
4-19 Max Output Frequency	x	x	x	x
4-58 Missing Motor Phase Function	x	x	x	x
14-01 Switching Frequency	x	x	x	x
14-03 Overmodulation	x	x	x	x
14-07 Dead Time Compensation Level	x	x	x	x
14-08 Damping Gain Factor	x	x	x	x
14-09 Dead Time Bias Current Level	x	x	x	x
14-10 Mains Failure	x	x	x	x
14-11 Mains Voltage at Mains Fault	x	x	x	x
14-12 Function at Mains Imbalance	x			
14-27 Action At Inverter Fault	x	x	x	x
14-40 VT Level	x	x	x	x
14-41 AEO Minimum Magnetisation	xx	x	x	x
14-50 RFI Filter	x			
14-51 DC-Link Voltage Compensation	x	x	x	x
14-55 Output Filter	x	x	x	x
14-64 Dead Time Compensation Zero Current Level	x	x	x	x
14-65 Speed Derate Dead Time Compensation	x	x	x	x
30-22 Locked Rotor Detection		x	x	x
30-23 Locked Rotor Detection Time [s]		x	x	x

Table 4.2 Active Parameters

1-10 Motor Construction

Option:		Function:
[0] *	Asynchron	For asynchronous motors.
[1]	PM, non-salient SPM	For permanent magnet (PM) motors with surface mounted (non-salient) magnets. Refer to *1-14 Damping Gain* to *1-17 Voltage filter time const.* for details about optimising the motor operation.

4

1-10 Motor Construction		
Option:		**Function:**
[2]	PM, salient IPM, non Sat.	For permanent magnet (PM) motors with interior (salient) magnets, without inductance saturation control.
[3]	PM, salient IPM, Sat.	For permanent magnet (PM) motors with interior (salient) magnets, with inductance saturation control.

1-14 Damping Gain		
Range:		**Function:**
120 %*	[0 - 250 %]	The damping gain stabilises the PM machine. The value of damping gain controls the dynamic performance of the PM machine. High damping gain gives high dynamic performance and low damping gain gives low dynamic performance. The dynamic performance is related to the machine data and load type. If the damping gain is too high or low the control becomes unstable.

1-15 Low Speed Filter Time Const.		
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 gets 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 gets unstable.

1-17 Voltage filter time const.		
Range:		**Function:**
Size related*	[0.01 - 1 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.

4.2.3 1-2* Motor Data

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

NOTICE

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

1-20 Motor Power		
Option:		**Function:**
[2]	0.12 kW - 0.16 hp	
[3]	0.18 kW - 0.25 hp	
[4]	0.25 kW - 0.33 hp	
[5]	0.37 kW - 0.5 hp	
[6]	0.55 kW - 0.75 hp	
[7]	0.75 kW - 1 hp	
[8]	1.1 kW - 1 hp	
[9]	1.5 kW - 2 hp	
[10]	2.2 kW - 3 hp	
[11]	3 kW - 4 hp	
[12]	3.7 kW - 5 hp	
[13]	4 kW - 5.4 hp	
[14]	5.5 kW - 7.5 hp	
[15]	7.5 kW - 10 hp	
[16]	11 kW - 15 hp	
[17]	15 kW - 20 hp	
[18]	18.5 kW - 25 hp	
[19]	22 kW - 30 hp	
[20]	30 kW - 40 hp	
[21]	37 kW - 50 hp	
[22]	45 kW - 60 hp	
[23]	55 kW - 75 hp	
[24]	75 kW - 100 hp	
[25]	90 kW - 120 hp	
[26]	110 kW - 150 hp	

1-22 Motor Voltage		
Range:		**Function:**
Size related*	[50 - 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:**
		NOTICE **This parameter cannot be changed while the motor Is running.**
Size related*	[20 - 500 Hz]	Select the motor frequency value from the motor nameplate. For 87 Hz operation with

1-23 Motor Frequency		
Range:		**Function:**
		230/440 V motors, set the nameplate data for 230 V/50 Hz. Adapt *parameter 4-14 Motor Speed High Limit [Hz]* and *parameter 3-03 Maximum Reference* to the 87 Hz application.

1-24 Motor Current		
Range:		**Function:**
Size related*	[0.01 - 10000.00 A]	Enter the nominal motor current value from the motor nameplate data. This data is used for calculating motor torque, motor thermal protection, etc.

1-25 Motor Nominal Speed		
Range:		**Function:**
Size related*	[50 - 60000 RPM]	Enter the nominal motor speed value from the motor nameplate data. This data is used for calculating automatic motor compensations.

1-26 Motor Cont. Rated Torque		
Range:		**Function:**
Size related*	[0.1 - 10000 Nm]	Enter the value from the motor nameplate data. The default value corresponds to the nominal rated output. This parameter is available when *1-10 Motor Construction* is set to *[1] PM*, non-salient SPM, i.e. the parameter is valid for PM and non-salient SPM motors only.

1-29 Automatic Motor Adaption (AMA)		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** The AMA function optimises dynamic motor performance by automatically optimising the advanced motor *parameter 1-30 Stator Resistance (Rs)* to *parameter 1-35 Main Reactance (Xh)* while the motor is stationary.
[0] *	Off	No function
[1]	Enable Complete AMA	Performs AMA of the stator resistance R_S, the stator leakage reactance X_1, and the main reactance X_h.

1-29 Automatic Motor Adaption (AMA)		
Option:		**Function:**
		NOTICE **Terminal 27 Digital Input (*5-12 Terminal 27 Digital Input*) has coast inverse as the default setting. This means that AMA cannot be performed if there is no 24 V to terminal 27.**
[2]	Enable Reduced AMA	Performs a reduced AMA of the stator resistance R_s in the system only. Select this option if an LC filter is used between the frequency converter and the motor.

NOTICE

When *1-10 Motor Construction* is set to options that enable permanent motor mode, the only option available is *[1] Enable Complete AMA*.

Activate the AMA function by pressing [Hand On] after selecting *[1] Enable Complete AMA* or *[2] Enable Reduced AMA*. After a normal sequence, the display reads: *Press [OK] to finish AMA*. After pressing [OK], the frequency converter is ready for operation.

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 be performed on a motor with a bigger power rating than the frequency converter, e.g. when a 5.5 kW motor is connected to a 4 kW frequency converter.**

NOTICE

Avoid generating external torque during AMA.

NOTICE

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

NOTICE

Full AMA should be run without filter only, while reduced AMA should be run with a filter.

4

4.2.4 1-3* Adv. Motor Data I

Set parameters for advanced motor data. The motor data in parameters 1-30 to 1-39 must match the motor for optimal performance. If the motor data is not known, running an AMA is recommended.

1-30 Stator Resistance (Rs)

Range:		Function:
Size related*	[0.0 - 99.99 Ohm]	***NOTICE*** **This parameter cannot be adjusted while the motor is running.** Set the stator resistance value. Enter the value from a motor data sheet or perform an AMA on a cold motor.

1-31 Rotor Resistance (Rr)

Range:		Function:
Size related*	[0.010 - 100.000 Ohm]	Enter the rotor resistance value. Obtain the value from a motor data sheet or by performing an AMA on a cold motor. The default setting is calculated by the frequency converter from the motor nameplate data.

1-33 Stator Leakage Reactance (X1)

Range:		Function:
Size related*	[0.0 - 999.9 Ohm]	Set the stator leakage reactance value. Obtain the value from a motor data sheet or perform an AMA on a cold motor. The default setting is calculated by the frequency converter from the motor nameplate data.

1-35 Main Reactance (Xh)

Range:		Function:
Size related*	[0.0 - 999.9 Ohm]	Set the main reactance of the motor using one of these methods: • Run an AMA on a cold motor. The frequency converter measures the value from the motor. • Enter the X_h value manually. Obtain the value from the motor supplier. • Use the X_h default setting. The frequency converter establishes the setting on the basis of the motor name plate data.

1-37 d-axis Inductance (Ld)

Range:		Function:
Size related*	[0 - 1000 mH]	Enter the value of the d-axis inductance. Obtain the value from the permanent magnet motor data sheet.

1-38 q-axis Inductance (Lq)

Range:		Function:
Size related*	[0.000 - 1000 mH]	Set the value of the q-axis inductance. Find the value in the motor data sheet. This parameter cannot be changed while the motor is running.

1-39 Motor Poles

Range:		Function:
Size related*	[2 - 100]	***NOTICE*** **This parameter cannot be adjusted while the motor is running.** Enter the number of motor poles. The motor pole value is always an even number, because it refers to the total number of poles, not pairs of poles.

4.2.5 1-4* Adv. Motor Data II

Set parameters for advanced motor data.

1-40 Back EMF at 1000 RPM

Range:		Function:
Size related*	[0 - 9000 V]	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 e.g. 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. This parameter is only active when *1-10 Motor Construction* is set to options that enable PM (permanent magnet) motors. FC 360 only.

1-40 Back EMF at 1000 RPM		
Range:		**Function:**
		NOTICE **When using PM motors, it is recommended to use brake resistors.**

1-42 Motor Cable Length		
Range:		**Function:**
50 m*	[0 - 100 m]	Set the motor cable length in meters.

1-43 Motor Cable Length Feet		
Range:		**Function:**
164 ft*	[0 - 328 ft]	Set the motor cable length. The length unit is foot.

1-44 d-axis Inductance Sat. (LdSat)		
Range:		**Function:**
Size related	[0 - 1000 mH]	This parameter corresponds to the inductance saturation of Ld. Ideally, this parameter has the same value as *parameter 1-37 d-axis Inductance (Ld)*. If the motor supplier provides an induction curve, enter here the induction value, which is 200% of the nominal current.

1-45 q-axis Inductance Sat. (LqSat)		
Range:		**Function:**
Size related*	[0 - 1000 mH]	This parameter corresponds to the inductance saturation of Lq. Ideally, this parameter has the same value as *parameter 1-38 q-axis Inductance (Lq)*. If the motor supplier provides an induction curve, enter the induction value, which is 200% of the nominal current.

1-46 Position Detection Gain		
Range:		**Function:**
100 %*	[20 - 200 %]	

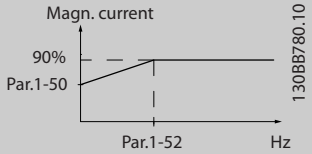
1-48 Current at Min Inductance for d-axis		
Range:		**Function:**
100 %	[20 - 200 %]	Use this parameter to set the inductance saturation point.

1-49 Current at Min Inductance for q-axis		
Range:		**Function:**
100 %	[20 - 200 %]	This parameter specifies the saturation curve of the q-inductance values. From 20–100% of this parameter, the inductance is linearly approximated due to *parameter 1-38 q-axis Inductance (Lq)* and *parameter 1-45 q-axis Inductance Sat. (LqSat)*. These parameters are related to the motor nameplate load compensations, the application load type, and the electronic brake function for quick stop/hold of the motor.

1-49 Current at Min Inductance for q-axis		
Range:		**Function:**
		electronic brake function for quick stop/hold of the motor.

4.2.6 1-5* Load Indep. Setting

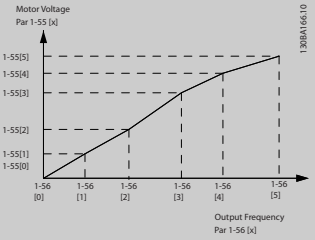
Parameters for load-independent motor settings.

1-50 Motor Magnetisation at Zero Speed		
Range:		**Function:**
100 %*	[0 - 300 %]	Use this parameter along with *1-52 Min Speed Normal Magnetising [Hz]* to obtain a different thermal load on the motor when running at low speed. Enter a value that is a percentage of the rated magnetising current. If the setting is too low, the torque on the motor shaft may be reduced.  **Illustration 4.2 Motor Magnetisation**

1-52 Min Speed Normal Magnetising [Hz]		
Range:		**Function:**
1 Hz*	[0.1 - 10.0 Hz]	Set the required frequency for normal magnetising current. Use this parameter along with *parameter 1-50 Motor Magnetisation at Zero Speed*, also see *Illustration 4.2*.

1-55 U/f Characteristic - U		
Range:		**Function:**
Size related*	[0 - 500 V]	Enter voltage at each frequency point to manually form a U/f characteristic matching motor. Frequency points are defined in *parameter 1-56 U/f Characteristic - F*.

1-56 U/f Characteristic - F		
Range:		**Function:**
Size related*	[0 - 400.0 Hz]	Enter frequency points to manually form a U/f characteristic matching motor. Voltage at each point is defined in *parameter 1-55 U/f Characteristic - U*. Make a U/f characteristic based on 6 definable voltages and frequencies, see *Illustration 4.3*.

1-56 U/f Characteristic - F		
Range:		**Function:**
		 **Illustration 4.3 Example of U/f Characteristic**

4.2.7 1-6* Load Depen. Setting

Parameters for adjusting the load-dependent motor settings.

1-60 Low Speed Load Compensation		
Range:		**Function:**
100 %*	[0 - 300 %]	Enter the low speed voltage compensation value in percent. This parameter is used for optimising the low speed load performance. This parameter is only active if *1-10 Motor Construction=[0] Asynchron*.

1-61 High Speed Load Compensation		
Range:		**Function:**
100 %*	[0 - 300 %]	Enter the high speed load voltage compensation value in percent. This parameter is used for optimising the high speed load performance. This parameter is only active if *1-10 Motor Construction=[0] Asynchron*

1-62 Slip Compensation		
Range:		**Function:**
Size related*	[-400 - 399.0 %]	Enter the % value for slip compensation to compensate for tolerance in the value of $n_{M,N}$. Slip compensation is calculated automatically, i.e. on the basis of the rated motor speed $n_{M,N}$.

1-63 Slip Compensation Time Constant		
Range:		**Function:**
0.1 s*	[0.05 - 5 s]	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 Dampening		
Range:		**Function:**
100 %*	[0 - 500 %]	Enter the resonance dampening 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 Dampening Time Constant		
Range:		**Function:**
0.005 s*	[0.001 - 0.05 s]	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:**
50 %*	[0 - 120 %]	

4.2.8 1-7* Start Adjustments

Parameters for adjusting the motor start settings.

1-70 PM Start Mode		
Option:		**Function:**
[0] *	Rotor Detection	
[1]	Parking	

1-71 Start Delay		
Range:		**Function:**
0 s*	[0 - 10 s]	This parameter enables a delay of the starting time. The frequency converter begins with the start function selected in *1-72 Start Function*. Set the start delay time until acceleration is to begin.

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	
[2] *	Coast/delay time	
[3]	Start speed cw	
[4]	Horizontal operation	
[5]	VVC+ clockwise	The start speed is calculated automatically. This function uses the start speed in the start delay time only.

1-73 Flying Start		
Option:		**Function:**
		NOTICE **This parameter cannot be changed while the motor is running.** ***NOTICE*** **To obtain the best flying start performance, the advanced motor data, *1-30 Stator Resistance (Rs)* to *1-35 Main Reactance (Xh)*, must be correct.** Catches a motor which is spinning freely due to a mains drop-out.
[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.
[2]	Enabled Always	
[3]	Enabled Ref. Dir.	
[4]	Enab. Always Ref. Dir.	

1-75 Start Speed [Hz]		
Range:		**Function:**
Size related*	[0 - 10 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:**
Size related*	[0 - 10000 A]	Some motors, e.g. cone rotor motors, need extra current/starting speed to disengage the rotor. To obtain this boost, set the required current in this parameter. 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*.

1-78 Compressor Start Max Speed [Hz]		
Range:		**Function:**
0 Hz*	[0 - 650 Hz]	This parameter enables high starting torque. This function ignores current limit and torque limit during start of the motor. The time from the start signal is given until the speed exceeds the speed set in this parameter becomes a start zone where the current limit and motoric torque limit are set to what is maximum possible for the frequency converter/motor combination. The time without protection from the current limit and torque limit must not exceed the value set in *parameter 1-79 Compressor Start Max Time to Trip*. Otherwise, the frequency converter trips with *Alarm 18, Start Failed*.

1-79 Compressor Start Max Time to Trip		
Range:		**Function:**
5 s*	[0 - 10 s]	The time, from the start signal is given until the speed exceeds the speed set in *parameter 1-78 Compressor Start Max Speed [Hz]* must not exceed the time set in this parameter. Otherwise, the frequency converter trips with *Alarm 18, Start Failed*. Any time set in *parameter 1-71 Start Delay* for use of a start function must be executed within the time limit.

4.2.9 1-8* Stop Adjustments

Parameters for adjusting motor stop settings.

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 1-82 Min Speed for Function at Stop [Hz]*. Available selections depend on *1-10 Motor Construction*. [0] Asynchron [0] Coast [1] DC-hold [2] Motor check, warning [6] Motor check, alarm PM non salient [0] Coast
[0] *	Coast	Leaves the motor in free mode.
[1]	DC hold / Motor Preheat	Energises the motor with a DC holding current (see *parameter 2-00 DC Hold/Motor Preheat Current*.

4

1-80 Function at Stop		
Option:		**Function:**
[3]	Pre-magnetizing	Builds up a magnetic field while the motor is stopped. This allows the motor to produce torque quickly at commands (asynchronous motors only). This pre-magnetising function does not help the very first start command. 2 different solutions are available to pre-magnetise the machinie for the first start command. 1. Start the freqeuncy converter with a 0 RPM reference and wait 2 to 4 rotor time constants (see below) before increasing the speed reference. 2. 2a Set *parameter 1-71 Start Delay* to the desired pre-mag time (2 to 4 rotor time constants). 2b Set *parameter 1-72 Start Function* to either *[0] DC-hold* or *[1] DC-brake*. Set the DC-hold or DC-brake current magnitude (*parameter 2-00 DC Hold/ Motor Preheat Current* or *2-01 DC Brake Current*) to be equal to $I_{pre\text{-}mag}=U_{nom}/(1.73 \times Xh)$ Sample rotor time constants= (Xh+X2)/(6.3*Freq_nom*Rr) 1 kW=0.2 s 10 kW=0.5 s 100 kW=1.7 s

1-82 Min Speed for Function at Stop [Hz]		
Range:		**Function:**
0 Hz*	[0 - 20 Hz]	Set the output frequency at which to activate *1-80 Function at Stop*.

4.2.10 1-9* Motor Temperature

Parameters for adjusting temperature protection settings for the motor.

1-90 Motor Thermal Protection		
Option:		**Function:**
[0] *	No protection	Continously 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 the connected thermistor or KTY-sensor in the motor reacts in the event of motor over-temperature. Ther thermistor cut-out value must be > 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 in the display when the motor is overloaded. Programme a warning signal via one 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. Programme a warning signal via one of the digital outputs. The signal appears in the event of a warning and if the frequency converter trips (thermal warning).

1-93 Thermistor Source		
Option:		**Function:**
		NOTICE **This parameter cannot be changed while the motor is running.** ***NOTICE*** **Digital input should be set to *[0] PNP - Active at 24 V* in *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*.
[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	
[7]	Digital input 31	

4.3 Parameters: 2-** Brakes

4.3.1 2-0* DC Brake

Use this parameter group to configure DC brake and DC hold functions.

2-00 DC Hold/Motor Preheat Current		
Range:		**Function:**
50 %*	[0 - 160 %]	Set holding current as a percentage of the rated motor current $I_{M,N}$ *1-24 Motor Current*. This parameter holds the motor function (holding torque) or pre-heats the motor. This parameter is active if *[0] DC hold* is selected in *parameter 1-72 Start Function*, or if *[1] DC hold/ pre-heat* is selected in *parameter 1-80 Function at Stop*. ***NOTICE*** **The maximumm value depends on the rated motor current. Avoid 100% current for too long. It may damage the motor.**

2-01 DC Brake Current		
Range:		**Function:**
50 %*	[0 - 150 %]	Set current as % of rated motor current, *parameter 1-24 Motor Current*. DC brake current is applied on stop command, when speed is below the limit set in *parameter 2-04 DC Brake Cut In Speed*; when the DC brake inverse function is active; or via the serial port. See *parameter 2-02 DC Braking Time* for duration. ***NOTICE*** **The maximum value depends on the rated motor current. Avoid 100% current for too long. It may damage the motor.**

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.

2-04 DC Brake Cut In Speed		
Range:		**Function:**
0 Hz*	[0 - 400 Hz]	This parameter is for setting the DC brake cut-in speed at which the DC brake current *parameter 2-01 DC Brake Current* is to be active, in connection with a stop command.

2-06 Parking Current		
Range:		**Function:**
50 %*	[0 - 1000 %]	Set current as percentage of rated motor current, *1-24 Motor Current*.

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 braking parameters. Only valid for frequency converters with brake chopper.

2-10 Brake Function		
Option:		**Function:**
[0] *	Off	No brake resistor is installed.
[1]	Resistor brake	A brake resistor is incorporated in the system for dissipation of surplus brake energy as heat. Connecting a brake resistor allows a higher DC-link voltage during braking (generating operation). The brake resistor function is only active in frequency converters with an integral dynamic brake.
[2]	AC brake	Improves braking without using a brake resistor. This parameter controls an overmagnetisation 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 braking torque without exceeding the voltage 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.**

2-11 Brake Resistor (ohm)		
Range:		**Function:**
Size related*	[0 - 65535 Ohm]	Set the brake resistor value in Ω. This value is used for monitoring the power to the brake resistor. *Parameter 2-11 Brake Resistor (ohm)* is only active in frequency converters with an integral dynamic brake. Use this parameter for values without decimals.

4

4

2-12 Brake Power Limit (kW)		
Range:		**Function:**
Size related*	[0.001 - 2000 kW]	*2-12 Brake Power Limit (kW)* is the expected average power dissipated in the brake resistor over a period of 120 s. It is used as the monitoring limit for *16-33 Brake Energy Average* and thereby specifies when a warning/alarm is to be given. To calculate *2-12 Brake Power Limit (kW)*, the following formula can be used. $P_{br,avg}[W] = \frac{U_{br}^2[V] \times t_{br}[s]}{R_{br}[\Omega] \times T_{br}[s]}$ $P_{br,avg}$ is the average power dissipated in the brake resistor, R_{br} is the resistance of the brake resistor. t_{br} is the active breaking time within the 120 s period, T_{br}. U_{br} is the DC voltage where the brake resistor is active. For T4 units, the DC voltage is 778 V. ***NOTICE*** **If R_{br} is not known or if T_{br} is different from 120 s, the practical approach is to run the brake application, readout *16-33 Brake Energy Average* and then enter this + 20% in *2-12 Brake Power Limit (kW)*.**

2-14 Brake voltage reduce		
Range:		**Function:**
0 V*	[0 - 0 V]	Set this parameter may change the brake resistor (*parameter 2-11 Brake Resistor (ohm)*).

2-16 AC Brake, Max current		
Range:		**Function:**
100 %*	[0 - 160 %]	Enter the maximum permissible current when using AC brake to avoid overheating of motor windings. ***NOTICE*** ***Parameter 2-16 AC Brake, Max current* has no effect when *1-10 Motor Construction* is set to *[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 **⚠WARNING** **PERSONAL INJURY AND EQUIPMENT DAMAGE** **Enabling OVC in hoisting applications may lead to personal injuries and equipment damage. Do not enable OVC in such applications.**

2-19 Over-voltage Gain		
Range:		**Function:**
100 %*	[0 - 200 %]	Select overvoltage gain.

4.3.3 2-2* Mechanical Brake

2-20 Release Brake Current		
Range:		**Function:**
0 A*	[0 - 100 A]	Set the motor current for release of the mechanical brake, when a start condition is present. The default value is the maximum current the inverter can provide for the particular power size. The upper limit is specified in *16-37 Inv. Max. Current*. ***NOTICE*** **When mechanical brake control output is selected but no mechanical brake is connected, the function does not work by default setting due to too low motor current.**

2-22 Activate Brake Speed [Hz]		
Range:		**Function:**
0 Hz*	[0 - 400 Hz]	Set the motor frequency for activation of the mechanical brake when a stop condition is present.

2-23 Activate Brake Delay		
Enter the brake delay time of the coast after ramp-down time. The shaft is held at 0 speed with full holding torque. Ensure that the mechanical brake has locked the load before the motor enters coast mode.		
Range:		**Function:**
0 s*	[0 - 5 s]	

4.4 Parameters: 3-** Reference/Ramps

4.4.1 3-0* Reference Limits

Parameters for setting the reference unit, limits and ranges.

3-00 Reference Range		
Option:		**Function:**
[0] *	Min - Max	Select the range of the reference signal and the feedback signal. Signal values can be positive only, or positive and negative.
[1]	-Max - +Max	For both positive and negative values (both directions), relative to *4-10 Motor Speed Direction*.

3-01 Reference/Feedback Unit		
Option:		**Function:**
[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	

3-01 Reference/Feedback Unit		
Option:		**Function:**
[131]	lb/min	
[132]	lb/h	
[140]	ft/s	
[141]	ft/min	
[145]	ft	
[150]	lb ft	
[160]	°F	
[170]	psi	
[171]	lb/in2	
[172]	in WG	
[173]	ft WG	
[180]	HP	

3-02 Minimum Reference		
Range:		**Function:**
0 ReferenceFeedbackUnit*	[0 - 4999 ReferenceFeedbackUnit]	Enter the minimum reference. The minimum reference is the lowest value obtainable by summing all references. The minimum reference is active only when *parameter 3-00 Reference Range* is set to *[0] Min.–Max.* The minimum reference unit matches: • The choice of configuration in *parameter 1-00 Configuration Mode.* • The unit selected in *parameter 3-01 Reference/Feedback Unit.*

3-03 Maximum Reference		
Range:		**Function:**
Size related*	[-4999.0 - 4999 ReferenceFeedbackUnit]	Enter the maximum reference. The maximum reference is the highest value obtainable by summing all references. **The maximum reference unit matches:** • The choice of configuration in *parameter 1-00 Configuration Mode.* • 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

4.4.2 3-1* References

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

3-10 Preset Reference		
Range:		**Function:**
0 %*	[-100 - 100 %]	Enter up to 8 different preset references (0-7) in this parameter, using array programming. Select *preset reference bit 0/1/2 [16], [17], or [18]* for the corresponding digital inputs in parameter group *5-1* Digital Inputs*, for selecting dedicated references.

3-11 Jog Speed [Hz]		
Range:		**Function:**
5 Hz*	[0 - 400.0 Hz]	The jog speed is a fixed output speed which the frequency converter is running when the jog function is activated. See also *parameter 3-80 Jog Ramp Time*.

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 respectively. If *[28] Catch up* is selected via one of the digital inputs (*5-10 Terminal 18 Digital Input* to *5-15 Terminal 33 Digital Input*), the percentage (relative) value is added to the total reference. If *[29] Slow down* is selected via one of the digital inputs (*5-10 Terminal 18 Digital Input* to *5-15 Terminal 33 Digital Input*), the percentage (relative) value is deducted from the total reference.

3-14 Preset Relative Reference		
Range:		**Function:**
0 %*	[-100 - 100 %]	The actual reference, X, is increased or decreased with the percentage Y, set in *3-14 Preset Relative Reference*. This results in the actual reference Z. Actual reference (X) is the sum of the inputs selected in *3-15 Reference 1 Source*, *3-16 Reference 2 Source*, *3-17 Reference 3 Source* and *8-02 Control Source*.

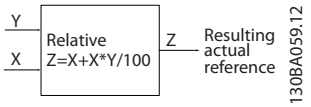


Illustration 4.4 Preset Relative Reference

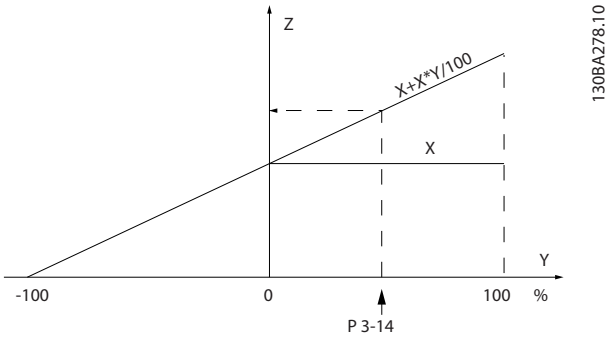


Illustration 4.5 Actual Reference

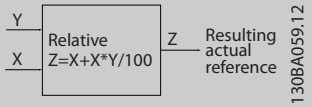
3-15 Reference 1 Source		
Option:		**Function:**
		Select the reference input to be used for the first reference signal. *Parameter 3-15 Reference 1 Source*, *parameter 3-16 Reference 2 Source* and *parameter 3-17 Reference 3 Source* define up to 3 different reference signals. The sum of these reference 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	
[20]	Digital pot.meter	
[32]	Bus PCD	

3-16 Reference 2 Source		
Option:		**Function:**
		Select the reference input to be used for the first reference signal. *Parameter 3-15 Reference 1 Source*, *parameter 3-16 Reference 2 Source* and *parameter 3-17 Reference 3 Source* 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	

3-16 Reference 2 Source		
Option:		**Function:**
[7]	Frequency input 29	
[8]	Frequency input 33	
[11]	Local bus reference	
[20]	Digital pot.meter	
[32]	Bus PCD	

3-17 Reference 3 Source		
Option:		**Function:**
		Select the reference input to be used for the first reference signal. *Parameter 3-15 Reference 1 Source*, *parameter 3-16 Reference 2 Source* and *parameter 3-17 Reference 3 Source* 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	
[20]	Digital pot.meter	
[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 (labelled Y in *Illustration 4.6*) is multiplied with the actual reference (labelled X in *Illustration 4.6*). This product is then added to the actual reference (X+X*Y/100) to give the resulting actual reference.

3-18 Relative Scaling Reference Resource		
Option:		**Function:**
		 **Illustration 4.6 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	

4.4.3 3-4* Ramp 1

Configure the ramp parameter, ramping times, for each of the 2 ramps (parameter group *3-4* Ramp 1* and parameter group *3-5* Ramp 2*).

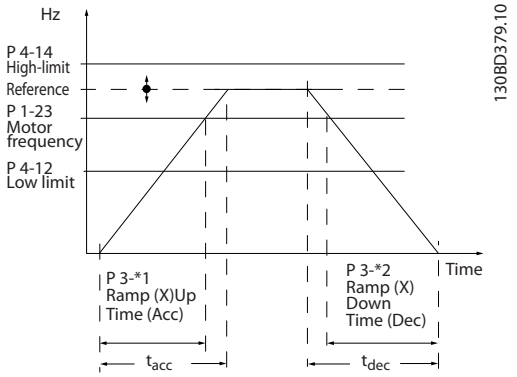


Illustration 4.7 Example of Ramp 1

3-40 Ramp 1 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.
[0] *	Linear	
[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*.

4

3-41 Ramp 1 Ramp Up Time		
Range:		**Function:**
Size related*	[0.05 - 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 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 3-42 Ramp 1 Ramp Down Time*. $Par.\ 3-41 = \frac{tacc\ [s]\ x\ ns\ [RPM]}{ref\ [RPM]}$

3-42 Ramp 1 Ramp Down Time		
Range:		**Function:**
Size related*	[0.05 - 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 arises 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*. $Par.\ 3-42 = \frac{tdec\ [s]\ x\ ns\ [RPM]}{ref\ [RPM]}$

4.4.4 3-5* Ramp 2

This parameter group configures ramp 2 parameters.

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.
[0] *	Linear	
[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*.

3-51 Ramp 2 Ramp Up Time		
Range:		**Function:**
Size related*	[0.05 - 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 *3-52 Ramp 2 Ramp Down Time*.

3-51 Ramp 2 Ramp Up Time		
Range:		**Function:**
		$Par.\ 3-51 = \frac{tacc\ [s]\ x\ ns\ [RPM]}{ref\ [RPM]}$

3-52 Ramp 2 Ramp Down Time		
Range:		**Function:**
Size related*	[0.01 - 3600 s]	Enter the ramp-down time, i.e. the deceleration time from the rated motor speed n_s to 0 RPM. Select a ramp-down time such that no overvoltage arises 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 *4-18 Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See ramp-up time in *3-51 Ramp 2 Ramp Up Time*. $Par.\ 3-52 = \frac{tdec\ [s]\ x\ ns\ [RPM]}{ref\ [RPM]}$

4.4.5 3-6* Ramp 3

This parameter group configures ramp 3 parameters.

3-60 Ramp 3 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.
[0] *	Linear	
[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*.

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 rated motor speed n_s. Select a ramp-up time such that the output current does not exceed the current limit in *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*.

3-62 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 rated motor speed n_s to 0 RPM. Select a ramp-down time such that no overvoltage arises in the inverter due to regenerative operation of

3-62 Ramp 3 Ramp down Time		
Range:		**Function:**
		the motor, and such that the generated current does not exceed the current limit set in *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*. $Par.\ 3-62 = \frac{tdec\ [s]\ x\ ns\ [RPM]}{ref\ [RPM]}$

4.4.6 3-7* Ramp 4

This parameter group configures ramp 4 parameters.

3-70 Ramp 4 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.
[0] *	Linear	
[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*.

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 *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*. $Par.\ 3-71 = \frac{tacc\ [s]\ x\ ns\ [RPM]}{ref\ [RPM]}$

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 rated motor speed n_s to 0 RPM. Select a ramp-down time such that no overvoltage arises in the inverter due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in *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*. $Par.\ 3-72 = \frac{tdec\ [s]\ x\ ns\ [RPM]}{ref\ [RPM]}$

4.4.7 3-8* Other Ramps

3-80 Jog Ramp Time		
Range:		**Function:**
Size related*	[0.05 - 3600 s]	Enter the jog ramp time, which 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 when activating a jog signal via the LCP, a selected digital output, or the serial communication port. When jog state is disabled, the normal ramping times are valid.

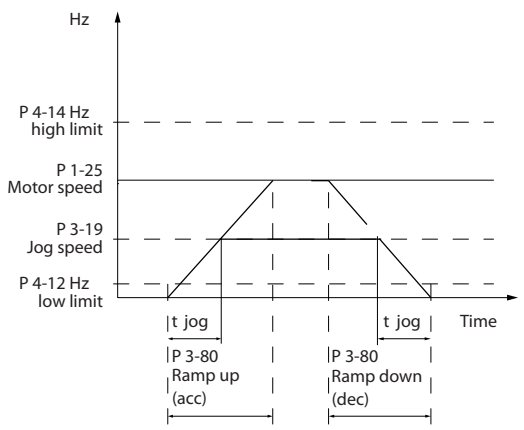


Illustration 4.8 Jog Ramp Time

$Par.\ 3-80 = \frac{tjog\ [s]\ x\ ns\ [RPM]}{\Delta\ jog\ speed\ (par.\ 3\ -\ 19)\ [RPM]}$

3-81 Quick Stop Ramp Time		
Range:		**Function:**
Size related*	[0.05 - 3600 s]	Enter the quick–stop ramp-down time, which is the deceleration time from the synchronous motor speed to 0 RPM. Ensure that no resulting overvoltage arises 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 *4-18 Current Limit*). Quick-stop is activated with a signal on a selected digital input, or via the serial communication port.

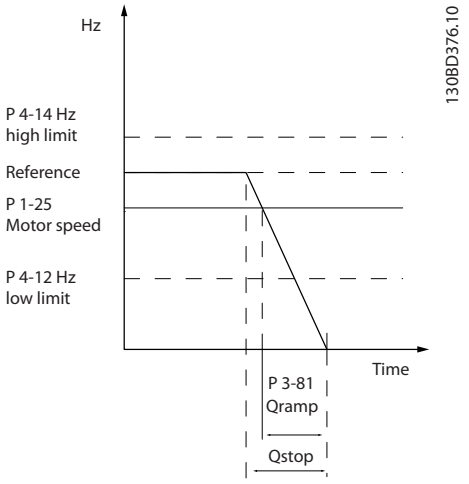


Illustration 4.9 Quick Stop Ramp Time

4.4.8 3-9* Digital Potentiometer

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, at least one digital input must be set to *Increase* or *Decrease*.

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/ decreased by the amount set in this parameter.

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 permissible value for the resultant reference. This is advisable 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 permissible value for the resultant reference. This is advisable if the digital potentiometer is used for fine tuning of the resulting reference.

3-95 Ramp Delay		
Range:		**Function:**
1000 ms*	[0 - 3600000 ms]	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 as soon as INCREASE/-DECREASE is activated.

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, upon which the frequency converter stops and generates an alarm message.

4-10 Motor Speed Direction		
Option:		**Function:**
[0]	Clockwise	Only operation in clockwise direction is allowed.
[2] *	Both directions	Operation in both clockwise and counter-clockwise directions are allowed.

NOTICE

The setting in *parameter 4-10 Motor Speed Direction* has impact on *1-73 Flying Start*.

4-12 Motor Speed Low Limit [Hz]		
Range:		**Function:**
0 Hz*	[0 - 400.0 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]*.

4-14 Motor Speed High Limit [Hz]		
Range:		**Function:**
65 Hz*	[0.1 - 500 Hz]	***NOTICE*** **Max. output frequency cannot exceed 10% of the inverter switching frequency (*parameter 14-01 Switching Frequency*).** Enter the maximum limit for motor speed. The motor speed high limit can be set to correspond to the manufacturer's recommended maximum of the motor shaft. The motor speed high limit must exceed the value in *parameter 4-12 Motor Speed Low Limit [Hz]*.

4-16 Torque Limit Motor Mode		
Range:		**Function:**
Size related*	[0 - 1000 %]	This function limits the torque on the shaft to protect the mechanical installation.

4-17 Torque Limit Generator Mode		
Range:		**Function:**
100 %*	[0 - 1000 %]	This function limits the torque on the shaft to protect the mechanical installation.

4-18 Current Limit		
Range:		**Function:**
Size related*	[0 - 1000 %]	***NOTICE*** **If *[20] ATEX ETR* is selected in *parameter 1-90 Motor Thermal Protection*, *parameter 4-18 Current Limit* current limit must be set 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 drops accordingly when the voltage increase stops above the synchronised motor speed.

4-19 Max Output Frequency		
Range:		**Function:**
Size related*	[0 - 500 Hz]	***NOTICE*** **This parameter cannot be adjusted while the motor is running.** ***NOTICE*** **Max. 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 that have the risk of overspeeding. This limit is final in 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:**
[0] *	No function	
[2]	Analog in 53	
[4]	Analog in 53 inv	
[6]	Analog in 54	
[8]	Analog in 54 inv	

4-21 Speed Limit Factor Source		
Option:		**Function:**
[0] *	No function	
[2]	Analog in 53	
[4]	Analog in 53 inv	

4-21 Speed Limit Factor Source		
Option:		**Function:**
[6]	Analog in 54	
[8]	Analog in 54 inv	

4-22 Break Away Boost		
Option:		**Function:**
[0] *	Off	
[1]	On	

4

4.5.3 4-3* Motor Feedback Monitoring

NOTICE

Warning 90 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 realted to the motor feedback loss-function.

4-30 Motor Feedback Loss Function		
Option:		**Function:**
		This function is used to monitor for consistency in feedback signal, i.e. if the feedback signal is available. Select which reaction the frequency converter should take if a feedback fault is detected. The selected action takes 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	

4-31 Motor Feedback Speed Error		
Range:		**Function:**
20 Hz*	[0 - 50 Hz]	Select the maximum allowed error in speed (output speed vs. feedback).

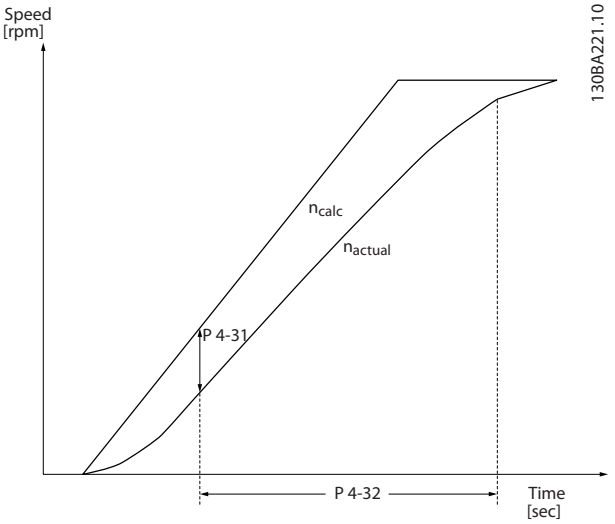


Illustration 4.10 Motor Feedback Speed Error

4-32 Motor Feedback Loss Timeout		
Range:		**Function:**
0.05 s*	[0 - 60 s]	Set the time-out 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* Adjustable Warnings 2

4-40 Warning Freq. Low		
Range:		**Function:**
Size related*	[0 - 400 Hz]	Use this parameter for setting a lower limit for the frequency range. When the motor speed drops below this limit, the display reads *Speed low*. Warning bit 10 is set in *parameter 16-94 Ext. Status Word*. Output relay can be configured to indicate this warning. LCP warning light is not lit when the limit set is reached.

4-41 Warning Freq. High		
Range:		**Function:**
Size related*	[0 - 400 Hz]	Use this parameter for setting a higher limit for the frequency range. When the motor speed exceeds this limit, the display reads *Speed high*. Warning bit 9 is set in *parameter 16-94 Ext. Status Word*. Output relay can be configured to indicate this warning. LCP warning light is not lit when the limit set is reached.

4-42 Adjustable Temperature Warning		
Range:		**Function:**
0*	[0 - 255]	Use this parameter to set the motor temperature limit.

4.5.5 4-5* Adjustable Warnings

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

4-50 Warning Current Low		
Range:		**Function:**
0 A*	[0 - 194.0 A]	Enter the I_{LOW} value. When the motor current drops below this limit, a bit in the status word is set. This value can also be programmed to produce a signal on the digital output or the relay output.

4-51 Warning Current High		
Range:		**Function:**
Size related*	[0.0 - 194.0 A]	Enter the I_{HIGH} value. When the motor current exceeds this limit, a bit in the status word is set. This value can also be programmed to produce a signal on the digital output or the relay output.

4-54 Warning Reference Low		
Range:		**Function:**
-4999*	[-4999 - 4999]	Enter the low reference limit. When the actual reference drops below this limit, the display reads *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:**
4999*	[-4999 - 4999]	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:**
-4999 ProcessCtrlUnit*	[-4999 - 4999 ProcessCtrlUnit]	Enter the low 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:**
4999 ProcessCtrlUnit*	[-4999 - 4999 ProcessCtrlUnit]	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:**
[0]	Off	No alarm is displayed if a missing motor phase occurs.
[1] *	On	An alarm is displayed if a missing motor phase occurs.

4.5.6 4-6* Speed Bypass

4-61 Bypass Speed From [Hz]		
Range:		**Function:**
0 Hz*	[0 - 500 Hz]	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.

4-63 Bypass Speed To [Hz]		
Range:		**Function:**
0 Hz*	[0 - 500 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.

NOTICE

These parameters cannot be adjusted while the motor is running.

5-00 Digital Input Mode		
Option:		**Function:**
		Set NPN or PNP mode for digital inputs 18,19 and 27. Digital input mode
[0] *	PNP	Action on positive directional pulses (0). PNP systems are pulled down to ground (GND).
[1]	NPN	Action on negative directional pulses (1). 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:**
		NOTICE **This parameter cannot be adjusted while the motor is running.**
[0] *	Input	Defines terminal 29 as a digital input.
[1]	Output	Defines terminal 29 as a digital output.

4.6.2 5-1* Digital Inputs

The digital inputs are used for selecting various functions in the frequency converter.

5-10 to 5-16 Digital Inputs

[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): Coasting stop, inverted input (NC). The frequency converter leaves the motor in free mode. Logic 0⇒coasting stop.
[3]	Coast and reset inverse	Reset and coasting stop inverted input (NC). Leaves motor in free mode and resets frequency converter. Logic 0 ⇒coasting stop and reset.
[4]	Quick stop inverse	Inverted input (NC). Generates a stop in accordance with the quick-stop ramp time set in *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 braking (NC). Stops the motor by energising it with a DC current for a certain time period. See *2-01 DC Brake Current* to *2-04 DC Brake Cut In Speed [Hz]*. The function is only active when the value in *2-02 DC Braking Time* is different from 0. Logic 0=>DC braking.
[6]	Stop inverse	***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* and connect this digital output to a digital input that is configured as coast.** Stop Inverted function. Generates a stop function when the selected terminal goes from logic 1 to logic 0. The stop is performed according to the selected ramp time (*3-42 Ramp 1 Ramp Down Time*, *parameter 3-52 Ramp 2 Ramp Down Time*).
[8]	Start	(Default digital input 18): Select start for a start/stop command. Logic 1=start, logic 0=stop.
[9]	Latched start	The motor starts, if a pulse is applied for minimum 2 ms. The motor stops when *[6] 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 *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 for the clockwise direction.
[13]	Enable start reverse	Disengages the clockwise movement and allows for the counterclockwise direction.
[14]	Jog	(Default digital input 29): Use to activate jog speed. See *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 *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 ref. bits 0,1, and 2 enable a choice between 1 of the 8 preset references according to *Table 4.3*.
[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 4.3 Preset Ref. Bit

[19]	Freeze ref	Freezes the actual reference, which is now the point of enable/condition for *[21] Speed up* and *[22] Speed down* to be used. If *[21] Speed up* or *[22] Speed down* is used, the speed change always follows ramp 2 (*3-51 Ramp 2 Ramp Up Time* and *parameter 3-52 Ramp 2 Ramp Down Time*) in the range 0–*3-03 Maximum Reference*.
[20]	Freeze output	***NOTICE*** **When *[20] Freeze output* is active, the frequency converter cannot be stopped by setting the signal on *[8] Start* to low. Stop the frequency converter via a terminal programmed for *[2] Coasting inverse* or *[3] Coast and reset, inverse*.** Freezes the actual motor frequency (Hz), which is now the point of enable/condition for *[21] Speed up* and *[22] Speed down* to be used. If *[21] Speed up* or *[22] Speed down* is used, the speed change always follows ramp 2 (*3-51 Ramp 2 Ramp Up Time* and *parameter 3-52 Ramp 2 Ramp Down Time*) in the range 0–*1-23 Motor Frequency*.
[21]	Speed up	Select *[21] Speed up* and *[22] Speed down* if digital control of the up/down speed is desired (motor potentiometer). Activate this function by selecting either *[19] Freeze reference* or *[20] Freeze output*. When speed up/down is activated for less than 400 ms, the resulting reference is increased/ decreased by 0.1 %. If speed up/down is activated for more than 400 ms, the resulting reference follows the setting in ramping up/down parameter 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 4.4 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 *[1] Set-up select bit 1* to select 1 of the 2 set-ups. Set *0-10 Active Set-up* to *[9] Multi Set-up*.
[24]	Set-up select bit 1	(Default digital input 32): Same as *[23] Set-up select bit 0*.
[26]	Precise stop inv.	Precise stop inverse function is available for terminals 18 or 19.
[28]	Catch up	Increases reference value by percentage (relative) set in *3-12 Catch up/slow Down Value*.
[29]	Slow down	Reduces reference value by percentage (relative) set in *3-12 Catch up/slow Down Value*.
[34]	Ramp bit 0	Enables a choice between 1 of the 4 ramps available, according to *Table 4.5*.

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

Table 4.5 Preset Ramp Bits

[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.
[60]	Counter A	(Terminal 29 or 33 only) Input for increment counting in the SLC counter.
[61]	Counter A	(Terminal 29 or 33 only) Input for decrement counting in the SLC counter.
[62]	Reset Counter A	Input for reset of counter A.
[63]	Counter B	(Terminal 29 or 33 only) Input for increment counting in the SLC counter.
[64]	Counter B	(Terminal 29 or 33 only) Input for decrement counting in the SLC counter.
[65]	Reset Counter B	Input for reset of counter B.
[72]	PID error inverse	When enabled, it inverts the resulting error from the process PID controller. Available only if *1-00 Configuration Mode* is set to *[6] Surface Winder* or *[7] Extended PID Speed OL*.
[73]	PID reset I-part	When enabled, resets the I-part of the Process PID controller. Equivalent to *parameter 7-40 Process PID I-part Reset*.

		Available only if *1-00 Configuration Mode* is set to *[6] Surface Winder* or *[7] Extended PID Speed OL*.
[74]	PID enable	When enabled, this option enables the extended process PID controller. Equivalent to *parameter 7-50 Process PID Extended PID*. Available only if *1-00 Configuration Mode* is set to *[7] Extended PID Speed OL*.

Besides the selections above, default value and some extra selections for specific terminals as below.

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:	
[14] *	Jog	Functions are described in parameter group *5-1* Digital Inputs*.
[32]	Pulse time based	

5-14 Terminal 32 Digital Input

Option:	Function:	
[0] *	No operation	Functions are described in parameter group *5-1* Digital Inputs*.
[82]	Encoder input B	

5-15 Terminal 33 Digital Input

Option:	Function:	
[0] *	No operation	Functions are described in parameter group *5-1* Digital Inputs*.
[32]	Pulse time based	
[81]	Enocder input A	

5-16 Terminal 31 Digital Input

Option:	Function:	
[0]	No operation	Functions are described in parameter group *5-1* Digital Inputs*.

4.6.3 5-3* Digital Outputs

The 2 solid-state digital outputs are common for terminals 27 and 29. Set the I/O function for terminal 27 in *5-01 Terminal 27 Mode*, and set the I/O function for terminal 29 in *5-02 Terminal 29 Mode*.

Terminals 42 and 45 can also be configured as digital outputs.

NOTICE

These parameters cannot be adjusted while the motor is running.

5-30 to 5-31 Digital Outputs

[0]	No operation	Default for all digital outputs and relay outputs.
[1]	Control ready	The control card is ready.
[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 is given (start/disable). No warnings are active.
[5]	Running	The motor is running and shaft torque present.
[6]	Running / no warning	The output speed is higher than the speed set in *1-81 Min Speed for Function at Stop [RPM]*. The motor is running and there are no warnings.
[7]	Run in range / no warning	The motor is running within the programmed current and speed ranges set in *4-50 Warning Current Low* to *4-51 Warning Current High*. There are no warnings.
[8]	Run on reference / no warning	The 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 *4-16 Torque Limit Motor Mode* or *4-17 Torque Limit Generator Mode* has been exceeded.
[12]	Out of current range	The motor current is outside the range set in *4-18 Current Limit*.
[13]	Below current, low	The motor current is lower than set in *4-50 Warning Current Low*.
[14]	Above current, high	The motor current is higher than set in *4-51 Warning Current High*.
[15]	Out of frequency range	Output frequency is outside the frequency range.
[16]	Below frequency, low	The output speed is lower than the setting in *parameter 4-40 Warning Freq. Low*.
[17]	Above frequency, high	The output speed is higher than the setting in *parameter 4-41 Warning Freq. High*.

[18]	Out of feedback range	The feedback is outside the range set in *4-56 Warning Feedback Low* and *4-57 Warning Feedback High*.
[19]	Below feedback low	The feedback is below the limit set in *4-56 Warning Feedback Low*.
[20]	Above feedback high	The feedback is above the limit set in *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	The frequency converter is ready for operation, and there is no overtem-perature warning.
[23]	Remote, ready, no thermal warning	The frequency converter is ready for operation and is in *Auto On* mode. There is no overtemperature warning.
[24]	Ready, no over-/ under voltage	The frequency converter is ready for operation and the mains voltage is within the specified voltage range (see *General Specifications* section in the 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 as soon as the reversing signal is applied.
[26]	Bus OK	Active communication (no time-out) via the serial communication port.
[27]	Torque limit and stop	Use in performing a coasting 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.
[28]	Brake, no brake warning	The brake is active and there are no warnings.
[29]	Brake ready, no fault	The brake is ready for operation and there are no faults.
[30]	Brake fault (IGBT)	The output is logic 1 when the brake IGBT is short-circuited. Use this function to protect the frequency converter if there is a fault on the brake modules. Use the output/relay to cut out the mains voltage from the frequency converter.
[31]	Relay 123	The relay is activated when *[0] Control Word* is selected in parameter group *8-** Communications and Options*.
[32]	Mechanical brake control	Enables control of an external mechanical brake. See parameter group *2-2* Mechanical Brake* for more details.
[31]	Relay 123	
[32]	Mech brake ctrl	
[36]	Control word bit 11	
[37]	Control word bit 12	

[40]	Out of ref range	Active when the actual speed is outside settings in *4-52 Warning Speed Low* to *4-55 Warning Reference High*.
[41]	Below reference low	Active when the actual speed is below the speed reference setting.
[42]	Above reference high	Active when the actual speed is above the speed reference setting
[45]	Bus Ctrl	Controls output via bus. The state of the output is set in *5-90 Digital & Relay Bus Control*. The output state is retained in the event of bus time-out.
[46]	Bus Ctrl On at timeout	Controls output via bus. The state of the output is set in *5-90 Digital & Relay Bus Control*. In the event of bus time-out, the output state is set high (On).
[55]	Pulse output	
[56]	Heat sink cleaning warning, high	
[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 *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 *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 *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 *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.
[160]	No alarm	The output is high when no alarm is present.
[161]	Running reverse	The output is high when the frequency converter is running counterclockwise (the logical product of the status bits *Running* AND *Reverse*).
[165]	Local reference active	
[166]	Remote ref active	
[167]	Start command activ	The output is high when there is an active start command, and no stop command is active.
[168]	Drive in hand mode	The output is high when the frequency converter is in *Hand On* mode.
[169]	Drive in auto mode	The output is high when the frequency converter is in *Auto On* mode.
[193]	Sleep mode	The frequency converter/system has entered sleep mode. See parameter group *22-4* Sleep Mode*.
[194]	Broken belt	A broken belt condition has been detected See parameter group *22-4* Sleep Mode*.

5-30 Terminal 27 Digital Output

Option:		Function:
[0] *	No operation	
[1]	Control Ready	
[2]	Drive ready	
[3]	Drive rdy/rem ctrl	
[4]	Stand-by / no warning	

5-30 Terminal 27 Digital Output

Option:		Function:
[5]	Running	
[6]	Running / no warning	
[7]	Run in range/no warn	
[8]	Run on ref/no warn	
[9]	Alarm	
[10]	Alarm or warning	
[11]	At torque limit	
[12]	Out of current range	
[13]	Below current, low	
[14]	Above current, high	
[15]	Out of frequency range	
[16]	Below frequency, low	
[17]	Above frequency, high	
[18]	Out of feedb. range	
[19]	Below feedback, low	
[20]	Above feedback, high	
[21]	Thermal warning	
[22]	Ready, no thermal warning	
[23]	Remote,ready,no TW	
[24]	Ready, no over-/ under voltage	
[25]	Reverse	
[26]	Bus OK	
[27]	Torque limit & stop	
[28]	Brake, no brake warning	
[29]	Brake ready, no fault	
[30]	Brake fault (IGBT)	
[31]	Relay 123	
[32]	Mech brake ctrl	
[36]	Control word bit 11	
[37]	Control word bit 12	
[40]	Out of ref range	
[41]	Below reference, low	
[42]	Above ref, high	
[43]	Extended PID Limit	
[45]	Bus ctrl.	
[46]	Bus control, timeout: On	
[47]	Bus control, timeout: Off	
[55]	Pulse output	
[56]	Heat sink cleaning warning, high	
[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 output A	

5-30 Terminal 27 Digital Output		
Option:		**Function:**
[81]	SL digital output B	
[82]	SL digital output C	
[83]	SL digital output D	
[91]	Encoder emulate output A	
[160]	No alarm	
[161]	Running reverse	
[165]	Local ref active	
[166]	Remote ref active	
[167]	Start command activ	
[168]	Drive in hand mode	
[169]	Drive in auto mode	
[170]	Homing Completed	
[171]	Target Position Reached	
[172]	Position Control Fault	
[173]	Position Mech Brake	
[174]	TLD indicator	
[175]	Running on tension	
[176]	Ready to run	
[177]	End of roll	
[193]	Sleep Mode	
[194]	Broken Belt Function	

5-31 Terminal 29 Digital Output		
Option:		**Function:**
[0]	No operation	Functions are described in parameter group *5-3* Digital Outputs*.

5-34 On Delay, Digital Output		
Range:		**Function:**
0.01 s*	[0 - 600 s]	

5-35 Off Delay, Digital Output		
Range:		**Function:**
0.01 s*	[0 - 600 s]	

4.6.4 5-4* Relays

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

The parameter is an array parameter representing 2 relays.

5-40 Function Relay		
Option:		**Function:**
[0]	No operation	Default setting for all digital and relay outputs.
[1]	Control Ready	The control card is ready.
[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.

5-40 Function Relay		
Option:		**Function:**
[4]	Stand-by / no warning	Ready for operation. No start or stop commands have been applied. No warnings are active.
[5]	Running	The motor is running and a shaft torque is present.
[6]	Running / no warning	The output speed is higher than the speed set in *1-82 Min Speed for Function at Stop [Hz]*. The motor is running and no warnings are present.
[7]	Run in range/no warn	The motor is running within the programmed current ranges set in *4-50 Warning Current Low*.
[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 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 *4-50 Warning Current Low*.
[14]	Above current, high	The motor current is higher than set in *4-51 Warning Current High*.
[15]	Out of frequency range	The output speed/frequency exceed the set in *parameter 4-40 Warning Freq. Low* and *parameter 4-41 Warning Freq. High*.
[16]	Below frequency, low	The output frequency is lower than the setting in *parameter 4-40 Warning Freq. Low*.
[17]	Above frequency, high	The frequency is higher than the setting in *parameter 4-41 Warning Freq. High*.
[18]	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*.
[19]	Below feedback, low	The feedback is below the limit set in *parameter 4-56 Warning Feedback Low*.
[20]	Above feedback, high	The feedback is above the limit set in *parameter 4-57 Warning Feedback High*.

4

5-40 Function Relay		
Option:		**Function:**
[21]	Thermal warning	Thermal warning turns on when the temperature exceeds the limit within the motor, frequency converter, brake resistor or connected resistor.
[22]	Ready, no thermal warning	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, no over-/ under voltage	The frequency converter is ready for operation, and the mains voltage is within the specified voltage range.
[25]	Reverse	The motor runs (or is ready to run) clockwise when logic=0 and counter-clockwise when logic=1. The output changes as soon as the reversing signal is applied.
[26]	Bus OK	Active communication (no time-out) via the serial communication port.
[27]	Torque limit & stop	Use for performing a coasted stop for frequency converter in torque limit condition. If the frequency converter has received a stop signal and is in torque limit, the signal is logic=0.
[28]	Brake, no brake warning	The brake is active and there are no warnings.
[29]	Brake ready, no fault	The brake is ready for operation and there are no faults.
[30]	Brake fault (IGBT)	The output is logic=1 when the brake IGBT is short-circuited. Use this function to protect the frequency converter if there is a fault on the brake module. Use the digital output/ relay to cut out the mains voltage from the frequency converter.
[31]	Relay 123	Digital output/relay is activated when *[0] Control word* is selected in parameter group *8-** Comm. and Options*.
[32]	Mech brake ctrl	Selection of mechanical brake control. When selected parameters in parameter group *2-2* Mechanical Brake* are active, the output must be reinforced to carry the current for the coil in the brake. This issue is usually solved by connecting an external relay to the selected digital output.
[36]	Control word bit 11	Activate relay 1 by a control word from the fieldbus. No other functional impact on the frequency converter. Typical application: Controlling an auxillary device from a fieldbus. The function is valid when *[0] FC Profile* is selected in *8-10 Control Word Profile*.
[37]	Control word bit 12	Activate relay 2 by a control word from the fieldbus. No other functional impact on the frequency converter. Typical application: Controlling an auxillary device from a fieldbus. The function is valid when *[0] FC Profile* is selected in *8-10 Control Word Profile*.
[40]	Out of ref range	Active when the actual speed is outside the settings in *parameter 4-55 Warning Reference High* and *parameter 4-56 Warning Feedback Low*.
[41]	Below reference, low	Active when the actual speed is below the speed reference setting.
[42]	Above ref, high	Active when the actual speed is above the speed reference setting.
[45]	Bus ctrl.	Controls the digital output/relay via bus. The state of the output is set in *5-90 Digital & Relay Bus Control*. The output state is retained in the event of a bus time-out.
[46]	Bus control, timeout: On	Controls output via bus. The state of the output is set in *5-90 Digital & Relay Bus Control*. In the event of a bus time-out, the output state is set high (on).
[47]	Bus control, timeout: Off	Controls output via bus. The state of the output is set in *5-90 Digital & Relay Bus Control*. In the event of a bus time-out, the output state is set low (off).
[56]	Heat sink cleaning warning, high	
[60]	Comparator 0	See parameter group *13-1* Smart Logic Control*. If comparator 0 in SLC is TRUE, the output goes high. Otherwise, it goes low.
[61]	Comparator 1	See parameter group *13-1* Smart Logic Control*. If comparator 1 in SLC is TRUE, the output goes high. Otherwise, it goes low.
[62]	Comparator 2	See parameter group *13-1* Smart Logic Control*. If comparator 2 in SLC is TRUE, the output goes high. Otherwise, it goes low.

5-40 Function Relay		
Option:		**Function:**
[63]	Comparator 3	See parameter group *13-1* Smart Logic Control*. If comparator 3 in SLC is TRUE, the output goes high. Otherwise, it goes low.
[64]	Comparator 4	See parameter group *13-1* Smart Logic Control*. If comparator 4 in SLC is TRUE, the output goes high. Otherwise, it goes low.
[65]	Comparator 5	See parameter group *13-1* Smart Logic Control*. If comparator 5 in SLC is TRUE, the output goes high. Otherwise, it goes low.
[70]	Logic rule 0	See parameter group *13-4* Logic Rules*. If logic rule 0 in SLC is TRUE, the output goes high. Otherwise, it goes low.
[71]	Logic rule 1	See parameter group *13-4* Logic Rules*. If logic rule 1 in SLC is TRUE, the output goes high. Otherwise, it goes low.
[72]	Logic rule 2	See parameter group *13-4* Logic Rules*. If logic rule 2 in SLC is TRUE, the output goes high. Otherwise, it goes low.
[73]	Logic rule 3	See parameter group *13-4* Logic Rules*. If logic rule 3 in SLC is TRUE, the output goes high. Otherwise, it goes low.
[74]	Logic rule 4	See parameter group *13-4* Logic Rules*. If logic rule 4 in SLC is TRUE, the output goes high. Otherwise, it goes low.
[75]	Logic rule 5	See parameter group *13-4* Logic Rules*. If logic rule 5 in SLC is TRUE, the output goes high. Otherwise, it goes low.
[80]	SL digital output A	See *parameter 13-52 SL Controller Action*. Output A is low on *[32] Smart Logic Action*. Output A is high on *[38] Smart Logic Action*.
[81]	SL digital output B	See *parameter 13-52 SL Controller Action*. Output B is low on *[32] Smart Logic Action*. Output B is high on *[38] Smart Logic Action*.
[82]	SL digital output C	See *parameter 13-52 SL Controller Action*. Output C is low on *[32] Smart Logic Action*. Output C is high on *[38] Smart Logic Action*.
[83]	SL digital output D	See *parameter 13-52 SL Controller Action*. Output D is low on *[32] Smart Logic Action*. Output D is high on *[38] Smart Logic Action*.
[160]	No alarm	
[161]	Running reverse	
[165]	Local ref active	
[166]	Remote ref active	
[167]	Start command activ	
[168]	Drive in hand mode	
[169]	Drive in auto mode	
[170]	Homing Completed	
[171]	Target Position Reached	
[172]	Position Control Fault	
[173]	Position Mech Brake	
[175]	Running on tension	
[176]	Ready to run	
[193]	Sleep Mode	
[194]	Broken Belt Function	

5-41 On Delay, Relay		
Array [9], (Relay 1 [0], Relay 2 [1], Relay 3 [2], Relay 4 [3], Relay 5 [4], Relay 6 [5], Relay 7 [6], Relay 8 [7], Relay 9 [8])		
Range:		**Function:**
0.01 s*	[0.01 - 600 s]	Enter the delay of the relay cut-in time. The relay only cuts in if the condition in *5-40 Function Relay* is uninterrupted during the specified time.

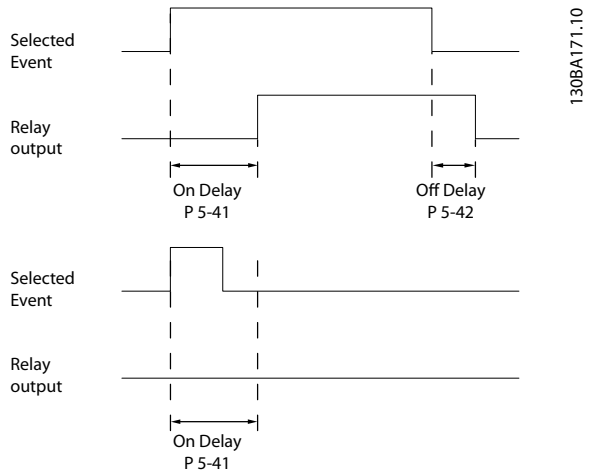


Illustration 4.11 On Delay, Relay

5-42 Off Delay, Relay		
Array[2]: Relay1[0], Relay2[1]		
Range:		**Function:**
0.01 s*	[0.01 - 600 s]	Enter the delay of the relay cut-out time.

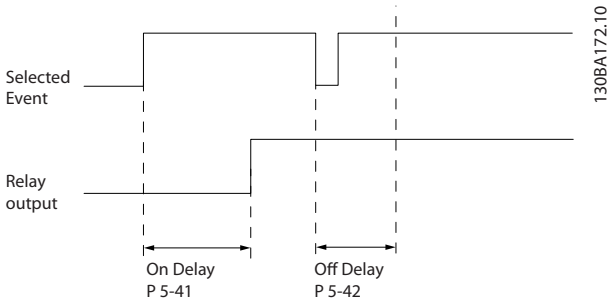


Illustration 4.12 Off Delay, Relay

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

4.6.5 5-5* Pulse Input

The pulse input parameters are used to define an appropriate window for the impulse reference area by configuring the scaling and filter settings for the pulse inputs. Input terminals 29 or 33 act as frequency reference inputs. Set terminal 29 (*5-13 Terminal 29 Digital Input*) or terminal 33 (*5-15 Terminal 33 Digital Input*) to *[32] Pulse input* . If terminal 29 is used as an input, then set *5-01 Terminal 27 Mode* to *[0] Input*.

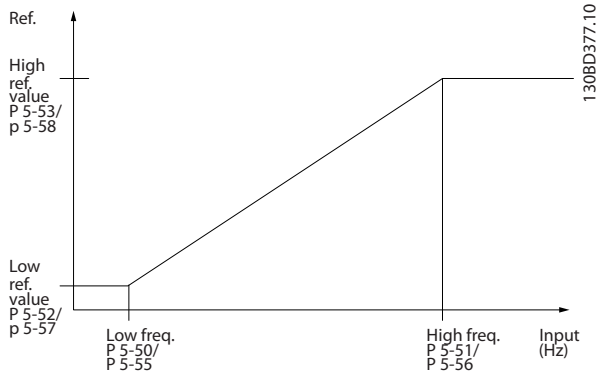


Illustration 4.13 Pulse Input

5-50 Term. 29 Low Frequency		
Range:		**Function:**
4 Hz*	[4 - 31999 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 the *Illustration 4.13* in this section.

5-51 Term. 29 High Frequency		
Range:		**Function:**
32000 Hz*	[5 - 32000 Hz]	Enter the high frequency limit corresponding to the high motor shaft speed (which 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*	[-4999 - 4999]	Enter the low reference value limit for the motor shaft speed [Hz]. 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* and *5-13 Terminal 29 Digital Input*=applicable value.

5-53 Term. 29 High Ref./Feedb. Value		
Range:		**Function:**
Size related*	[-4999 - 4999]	Enter the high reference value [Hz] 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 (*5-02 Terminal 29 Mode=[0] Input* (default) and *5-13 Terminal 29 Digital Input*=applicable value).

5-55 Term. 33 Low Frequency		
Range:		**Function:**
4 Hz*	[4 - 31999 Hz]	Enter the low frequency corresponding to the low motor shaft speed (which is low reference value) in *parameter 5-57 Term. 33 Low Ref./Feedb. Value*.

5-56 Term. 33 High Frequency		
Range:		**Function:**
32000 Hz*	[5 - 32000 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*	[-4999 - 4999]	Enter the low reference value [Hz] 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*	[-4999 - 4999]	Enter the high reference value [Hz] for the motor shaft speed. See also *parameter 5-53 Term. 29 High Ref./ Feedb. Value*.

4.6.6 5-6* Pulse Outputs

NOTICE

These parameters cannot be adjusted while the motor is running.

Use these parameters to configure pulse outputs with their functions and scaling. Terminal 27 and 29 are allocated to pulse output via *5-01 Terminal 27 Mode* and *5-02 Terminal 29 Mode*.

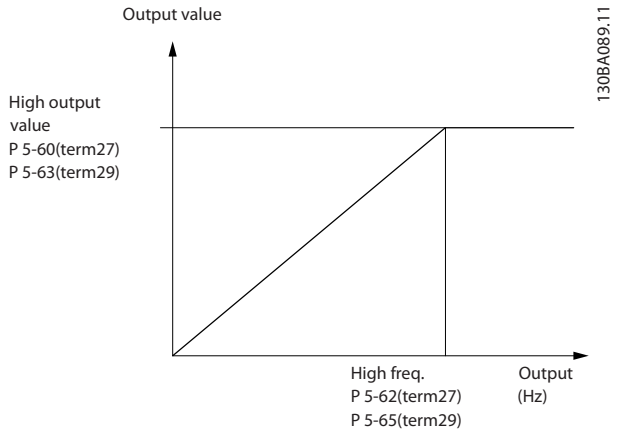


Illustration 4.14 Configuration of Pulse Outputs

5-60 Terminal 27 Pulse Output Variable		
Option:		**Function:**
[0] *	No operation	
[45]	Bus ctrl.	
[48]	Bus ctrl., timeout	
[100]	Output frequency	
[101]	Reference	
[102]	Process Feedback	
[103]	Motor Current	
[104]	Torque rel to limit	
[105]	Torq relate to rated	
[106]	Power	
[107]	Speed	
[109]	Max Out Freq	

5-62 Pulse Output Max Freq 27		
Range:		**Function:**
5000 Hz*	[4 - 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	
[45]	Bus ctrl.	
[48]	Bus ctrl., timeout	
[100]	Output frequency	
[101]	Reference	
[102]	Process Feedback	
[103]	Motor Current	
[104]	Torque rel to limit	
[105]	Torq relate to rated	
[106]	Power	
[107]	Speed	
[109]	Max Out Freq	

5-65 Pulse Output Max Freq 29		
Range:		**Function:**
5000 Hz*	[4 - 32000 Hz]	Set the maximum frequency for terminal 29 corresponding to the output variable set in *parameter 5-63 Terminal 29 Pulse Output Variable*.

4.6.7 5-7* 24 V Encoder Input

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

Encoder connection to the frequency converter
24 V incremental encoder. Maximum cable length 5 m.

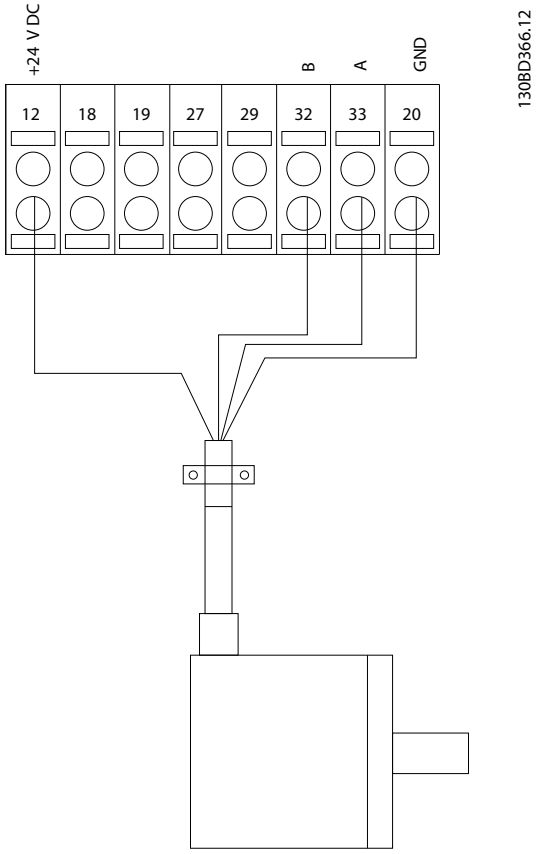


Illustration 4.15 24 V or 10–30 V Encoder Connection

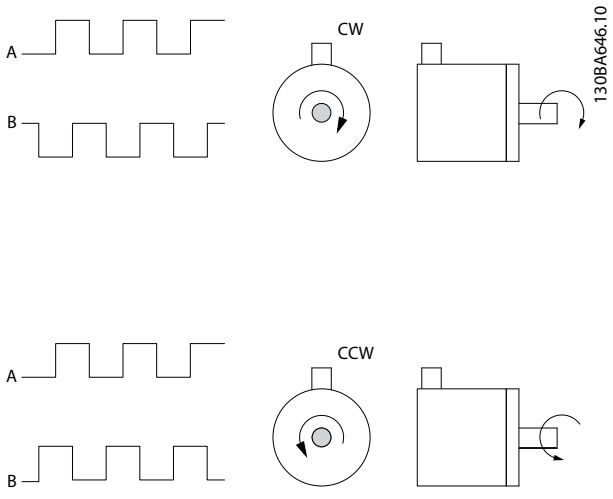


Illustration 4.16 Encoder Rotation Direction

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 changed 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.

4.6.8 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 - 0xFFFFFFFF]	This parameter holds the state of the digital outputs and relays that are 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 0–3	Reserved
Bit 4	Relay 1 output terminal
Bit 5	Relay 2 output terminal
Bit 6–23	Reserved
Bit 24	Terminal 42 digital output
Bit 25	Terminal 45 digital output
Bit 26–31	Reserved

Table 4.6 Bit Functions

5-93 Pulse Out 27 Bus Control		
Range:		**Function:**
0 %*	[0 - 100 %]	Set the output frequency transferred to the 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 the output terminal 27 when the terminal is configured as *[48] Bus Ctrl Timeout* in *parameter 5-60 Terminal 27 Pulse Output Variable* and a time-out is detected.

5-95 Pulse Out 29 Bus Control		
Range:		**Function:**
0 %*	[0 - 100 %]	Set the output frequency transferred to the 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 the output terminal 29 when the terminal is configured as *[48] Bus Ctrl Timeout* in *parameter 5-63 Terminal 29 Pulse Output Variable*, and a time-out is detected.

4.7 Parameters: 6-** Analog In/Out

Parameter group for setting up the analog I/O configuration and the digital output. The frequency converter is equipped with 2 analog inputs:

- Terminal 53
- Terminal 54

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

4.7.1 6-0* Analog I/O Mode

6-00 Live Zero Timeout Time		
Range:		**Function:**
10 s*	[1 - 99 s]	Enter the time-out time.

6-01 Live Zero Timeout Function		
Option:		**Function:**
		Select the time-out function. The function set in *parameter 6-01 Live Zero Timeout Function* is activated 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* or *parameter 6-22 Terminal 54 Low Current* for a time period defined in *parameter 6-00 Live Zero Timeout Time*.
[0] *	Off	
[1]	Freeze output	
[2]	Stop	
[3]	Jogging	
[4]	Max. speed	
[5]	Stop and trip	

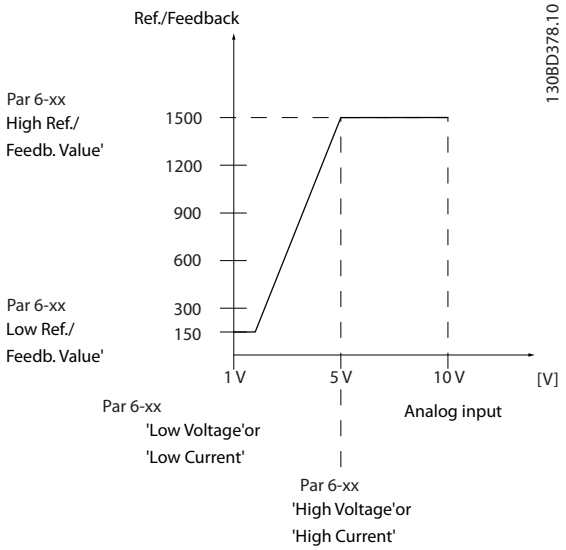


Illustration 4.17 Time-out Function

4.7.2 6-1* Analog Input 53

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

6-10 Terminal 53 Low Voltage		
Range:		**Function:**
0.07 V*	[0 - 10 V]	Enter the voltage (V) that corresponds to *parameter 6-14 Terminal 53 Low Ref./Feedb. Value*. To activate *parameter 6-01 Live Zero Timeout Function*, set the value at >1 V.

6-11 Terminal 53 High Voltage		
Range:		**Function:**
10 V*	[0 - 10 V]	Enter the voltage (V) that corresponds to the high reference value (set in *6-15 Terminal 53 High Ref./Feedb. Value*).

6-12 Terminal 53 Low Current		
Range:		**Function:**
4 mA*	[0 - 20 mA]	Enter the low current value. This reference signal should correspond to the low reference/feedback value, set in *parameter 6-14 Terminal 53 Low Ref./Feedb. Value*. To activate *parameter 6-01 Live Zero Timeout Function*, set the value to >2 mA.

6-13 Terminal 53 High Current		
Range:		**Function:**
20 mA*	[0 - 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*	[-4999 - 4999]	Enter the reference or feedback value that corresponds to the voltage or current set in *parameter 6-10 Terminal 53 Low Voltage* to *parameter 6-12 Terminal 53 Low Current*.

6-15 Terminal 53 High Ref./Feedb. Value		
Range:		**Function:**
Size related*	[-4999 - 4999]	Enter the reference or feedback value that corresponds to the voltage or current set in *parameter 6-11 Terminal 53 High Voltage* to *parameter 6-13 Terminal 53 High Current*.

6-16 Terminal 53 Filter Time Constant		
Range:		**Function:**
0.01 s*	[0.01 - 10 s]	Enter the time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal 53. A high time constant value improves dampening, but also increases the time delay through the filter.

6-19 Terminal 53 mode		
Option:		**Function:**
		Select whether terminal 53 is used for current or voltage input.
[0]	Current mode	
[1] *	Voltage mode	

4.7.3 6-2* Analog Input 54

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

6-20 Terminal 54 Low Voltage		
Range:		**Function:**
0.07 V*	[0 - 10 V]	Enter the voltage (V) that corresponds to the low reference value (set in *parameter 6-24 Terminal 54 Low Ref./Feedb. Value*). To activate *parameter 6-01 Live Zero Timeout Function*, set the value at >1 V .

6-21 Terminal 54 High Voltage		
Range:		**Function:**
10 V*	[0 - 10 V]	Enter the voltage (V) that corresponds to the high reference value (set in *parameter 6-25 Terminal 54 High Ref./Feedb. Value*).

6-22 Terminal 54 Low Current		
Range:		**Function:**
4 mA*	[0 - 20 mA]	Enter the low current value. This reference signal should correspond to the low reference/ feedback value, set in *parameter 6-24 Terminal 54 Low Ref./Feedb. Value*. To activate the live zero timeout function in *parameter 6-01 Live Zero Timeout Function*, set the value to >2 mA .

6-23 Terminal 54 High Current		
Range:		**Function:**
20 mA* 20.00 mA*	[0 - 20 mA] [par. 6-22-20.00 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*	[-4999 - 4999]	Enter the reference or feedback value that corresponds to the voltage or current set in *parameter 6-21 Terminal 54 High Voltage/ parameter 6-22 Terminal 54 Low Current*.

6-25 Terminal 54 High Ref./Feedb. Value		
Range:		**Function:**
Size related*	[-4999 - 4999]	Enter the reference or feedback value that corresponds to the voltage or current set in *parameter 6-21 Terminal 54 High Voltage/ parameter 6-23 Terminal 54 High Current*.

6-26 Terminal 54 Filter Time Constant		
Range:		**Function:**
0.01 s*	[0.01 - 10 s]	Enter the time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal 54. A high time constant value improves dampening but also increases the time delay through the filter.

6-29 Terminal 54 mode		
Option:		**Function:**
		Select if terminal 54 is used for current- or voltage input.
[0]	Current mode	
[1] *	Voltage mode	

4.7.4 6-7* Analog/Digital Output 45

Parameters for configuring the scaling and limits for analog/digital output terminal 45. Analog outputs are current outputs: 0/4-20 mA. Resolution on analog output is 12 bit. Analog output terminals can also be set up as digital output.

6-70 Terminal 45 Mode

Option:		Function:
		Set terminal 45 to act as analog output or as digital output.
[0] *	0-20 mA	
[1]	4-20 mA	
[2]	Digital Output	

6-71 Terminal 45 Analog Output

Option:		Function:
[0] *	No operation	
[100]	Output frequency	0–100 Hz
[101]	Reference	Min_{Ref}–Max_{Ref}
[102]	Process Feedback	Min_{FB}–Max_{FB}
[103]	Motor Current	0–I_{max}
[104]	Torque rel to limit	
[105]	Torq relate to rated	
[106]	Power	0–P_{nom}
[107]	Speed	
[111]	Speed Feedback	
[113]	Ext. Closed Loop 1	
[139]	Bus Control	0–100%
[143]	Ext. CL 1	
[162]	Tapered tension set point	
[254]	DC Link Voltage	

6-72 Terminal 45 Digital Output

Option:		Function:
		Select the function of terminal 45 as a digital current output. See also *6-70 Terminal 45 Mode*. See *parameter 5-40 Function Relay* for descriptions of the option.
[0] *	No operation	
[1]	Control Ready	
[2]	Drive ready	
[3]	Drive rdy/rem ctrl	
[4]	Stand-by / no warning	
[5]	Running	
[6]	Running / no warning	
[7]	Run in range/no warn	
[8]	Run on ref/no warn	

6-72 Terminal 45 Digital Output

Option:		Function:
[9]	Alarm	
[10]	Alarm or warning	
[11]	At torque limit	
[12]	Out of current range	
[13]	Below current, low	
[14]	Above current, high	
[15]	Out of frequency range	
[16]	Below frequency, low	
[17]	Above frequency, high	
[18]	Out of feedb. range	
[19]	Below feedback, low	
[20]	Above feedback, high	
[21]	Thermal warning	
[22]	Ready, no thermal warning	
[23]	Remote,ready,no TW	
[24]	Ready, no over-/ under voltage	
[25]	Reverse	
[26]	Bus OK	
[27]	Torque limit & stop	
[28]	Brake, no brake warning	
[29]	Brake ready, no fault	
[30]	Brake fault (IGBT)	
[31]	Relay 123	
[32]	Mech brake ctrl	
[36]	Control word bit 11	
[37]	Control word bit 12	
[40]	Out of ref range	
[41]	Below reference, low	
[42]	Above ref, high	
[45]	Bus ctrl.	
[46]	Bus control, timeout: On	
[47]	Bus control, timeout: Off	
[56]	Heat sink cleaning warning, high	
[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 output A	
[81]	SL digital output B	
[82]	SL digital output C	
[83]	SL digital output D	
[160]	No alarm	
[161]	Running reverse	

6-72 Terminal 45 Digital Output		
Option:		**Function:**
[165]	Local ref active	
[166]	Remote ref active	
[167]	Start command activ	
[168]	Drive in hand mode	
[169]	Drive in auto mode	
[170]	Homing Completed	
[171]	Target Position Reached	
[172]	Position Control Fault	
[173]	Position Mech Brake	
[174]	TLD indicator	
[175]	Running on tension	
[176]	Ready to run	
[177]	End of roll	
[193]	Sleep Mode	
[194]	Broken Belt Function	
[198]	Drive Bypass	

6-73 Terminal 45 Output Min Scale		
Range:		**Function:**
0 %*	[0 - 200 %]	Scale for the minimum output (0 or 4 mA) of the analog signal at terminal 45. Set the value to be the percentage of the full range of the variable selected in *parameter 6-71 Terminal 45 Analog Output*.

6-74 Terminal 45 Output Max Scale		
Range:		**Function:**
100 %*	[0 - 200 %]	Scale for the maximum output (20 mA) of the analog signal at terminal 45. Set the value to be the percentage of the full range of the variable selected in *parameter 6-71 Terminal 45 Analog Output*.

6-76 Terminal 45 Output Bus Control		
Range:		**Function:**
0*	[0 - 16384]	Holds the level of analog output if controlled by bus.

4.7.5 6-9* Analog/Digital Output 42

Parameters for configuring the limits for analog/digital output terminal 42. Analog outputs are current outputs: 0/4-20 mA. Resolution on analog outputs is 12 bit. Analog output terminals can also be set up as digital output.

6-90 Terminal 42 Mode		
Option:		**Function:**
		Set terminal 42 to act as analog output or as digital output.
[0] *	0-20 mA	
[1]	4-20 mA	
[2]	Digital Output	

6-91 Terminal 42 Analog Output		
Option:		**Function:**
[0] *	No operation	
[100]	Output frequency	
[101]	Reference	
[102]	Process Feedback	
[103]	Motor Current	
[104]	Torque rel to limit	
[105]	Torq relate to rated	
[106]	Power	
[107]	Speed	
[111]	Speed Feedback	
[113]	Ext. Closed Loop 1	
[139]	Bus Control	
[143]	Ext. CL 1	
[162]	Tapered tension set point	
[254]	DC Link Voltage	

6-92 Terminal 42 Digital Output		
Option:		**Function:**
[0] *	No operation	
[1]	Control Ready	
[2]	Drive ready	
[3]	Drive rdy/rem ctrl	
[4]	Stand-by / no warning	
[5]	Running	
[6]	Running / no warning	
[7]	Run in range/no warn	
[8]	Run on ref/no warn	
[9]	Alarm	
[10]	Alarm or warning	
[11]	At torque limit	
[12]	Out of current range	
[13]	Below current, low	
[14]	Above current, high	
[15]	Out of frequency range	
[16]	Below frequency, low	
[17]	Above frequency, high	
[18]	Out of feedb. range	
[19]	Below feedback, low	
[20]	Above feedback, high	
[21]	Thermal warning	
[22]	Ready, no thermal warning	
[23]	Remote,ready,no TW	
[24]	Ready, no over-/ under voltage	
[25]	Reverse	
[26]	Bus OK	
[27]	Torque limit & stop	
[28]	Brake, no brake warning	
[29]	Brake ready, no fault	
[30]	Brake fault (IGBT)	
[31]	Relay 123	
[32]	Mech brake ctrl	
[36]	Control word bit 11	

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6-92 Terminal 42 Digital Output

Option:		Function:
[37]	Control word bit 12	
[40]	Out of ref range	
[41]	Below reference, low	
[42]	Above ref, high	
[45]	Bus ctrl.	
[46]	Bus control, timeout: On	
[47]	Bus control, timeout: Off	
[56]	Heat sink cleaning warning, high	
[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 output A	
[81]	SL digital output B	
[82]	SL digital output C	
[83]	SL digital output D	
[160]	No alarm	
[161]	Running reverse	
[165]	Local ref active	
[166]	Remote ref active	
[167]	Start command activ	
[168]	Drive in hand mode	
[169]	Drive in auto mode	
[170]	Homing Completed	
[171]	Target Position Reached	
[172]	Position Control Fault	
[173]	Position Mech Brake	
[174]	TLD indicator	
[175]	Running on tension	
[176]	Ready to run	
[177]	End of roll	
[193]	Sleep Mode	
[194]	Broken Belt Function	
[198]	Drive Bypass	

6-93 Terminal 42 Output Min Scale

Range:		Function:
0 %*	[0 - 200 %]	Scale for the minimum output (0 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 6-91 Terminal 42 Analog Output*.

6-94 Terminal 42 Output Max Scale

Range:		Function:
100 %*	[0 - 200 %]	Scale for maximum output (20 mA) of the scaling at terminal 42. Set the value to be the percentage of the full range of the variable selected in *parameter 6-91 Terminal 42 Analog Output*.

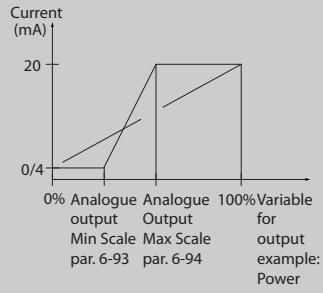

Illustration 4.18 Output Scale vs. Current

6-96 Terminal 42 Output Bus Control

Range:		Function:
0*	[0 - 16384]	Holds the analog output at terminal 42 if controlled by bus.

4.8 Parameters: 7-** Controllers

4.8.1 7-0* Speed PID Ctrl.

7-00 Speed PID Feedback Source

Option:		Function:
		NOTICE **This parameter cannot be changed while the motor is running.** Select feedback source for Speed CL Control.
[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	
[20] *	None	

7-02 Speed PID Proportional Gain

Range:		Function:
0.015*	[0 - 1]	Enter the speed controller proportional gain. The proportional gain amplifies the error (that is the deviation between the feedback signal and the set-point). This parameter is used with *1-00 Configuration Mode [0] Speed open loop* and *[1] Speed closed loop* control. Quick control is obtained at high amplification. However, if the amplification is too large, the process may become unstable.

7-03 Speed PID Integral Time

Range:		Function:
8 ms*	[2 - 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 *1-00 Configuration Mode*.

7-04 Speed PID Differentiation Time

Range:		Function:
30 ms*	[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 zero 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. Since the differential gain increases at higher frequencies, limiting the gain may be useful. 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:
10 ms*	[1 - 100 ms]	***NOTICE*** **Severe filtering can be detrimental to dynamic performance.** **This parameter is used with *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 4.19*. 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	7-06 Speed PID Lowpass Filter Time
512	10 ms
1024	5 ms
2048	2 ms
4096	1 ms

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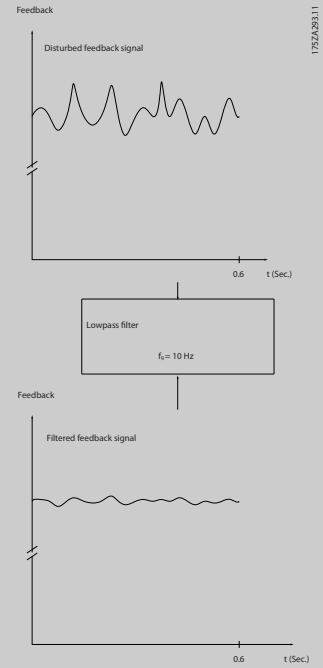
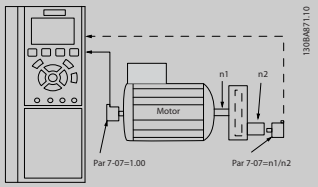
7-06 Speed PID Lowpass Filter Time		
Range:		**Function:**
		 **Illustration 4.19 Feedback Signal**

7-07 Speed PID Feedback Gear Ratio		
Range:		**Function:**
1*	[0.0001 - 32]	 **Illustration 4.20 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.

4.8.2 7-1* Torque PI Control

Parameters for configuring the torque PI control.

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

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

4.8.3 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 input should be treated as the source of the first of these signals. The second 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	

7-22 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 input should be treated as the source of the second of these signals. The first 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	

4.8.4 7-3* Process PID Ctrl.

7-30 Process PID Normal/ Inverse Control

Option:		Function:
		Normal and inverse control are implemented by introducing a difference between the reference signal and the feedback signal.
[0] *	Normal	Sets process control to increase the output frequency.
[1]	Inverse	Sets process control to decrease the output frequency.

7-31 Process PID Anti Windup

Option:		Function:
[0]	Off	Continues regulation of an error even when the output frequency cannot be increased or decreased.
[1] *	On	Ceases 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 commences ramping 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 set-point and the feedback signal.

7-34 Process PID Integral Time

Range:		Function:
9999 s*	[0.10 - 9999 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 - 20 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 (DG). If there is no limit, the DG increases when there are fast changes. Limit the DG to obtain a pure differentiator gain at slow changes and a constant differentiator gain where fast changes occur.

7-38 Process PID Feed Forward Factor

Range:		Function:
0 %*	[0 - 200 %]	Enter the PID feed forward (FF) factor. The FF 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 FF factor is activated, it provides less overshoot, and high dynamics when changing the set point. *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 set value of this parameter, the On reference status bit is high, i.e. =1.

4.8.5 7-4* Advanced Process PID Ctrl.

This parameter group is only used if *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, e.g. changing a textile roll.

7-41 Process PID Output Neg. Clamp

Range:		Function:
-100 %*	[-100 - 100 %]	Enter a negative limit for the process PID controller output.

7-42 Process PID Output Pos. Clamp

Range:		Function:
100 %*	[-100 - 100 %]	Enter a positive limit for the process PID controller output.

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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 min. ref. (*parameter 7-43 Process PID Gain Scale at Min. Ref.*) and the scale at max. ref. (*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 min. ref. (*parameter 7-43 Process PID Gain Scale at Min. Ref.*) and the scale at max. ref. (*parameter 7-44 Process PID Gain Scale at Max. Ref.*).

7-45 Process PID Feed Fwd Resource		
Option:		**Function:**
		Select which frequency converter input should be used as the feed forward factor. The FF factor is added directly to the output of the PID controller. This increases dynamic performance.
[0] *	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[7]	Frequency input 29	
[8]	Frequency input 33	
[11]	Local bus reference	
[32]	Bus PCD	

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]	

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.

4.8.6 7-5* Ext. Process PID Ctrl.

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

7-50 Process PID Extended PID		
Option:		**Function:**
[0]	Disabled	Disables the extended parts of the process PID controller.
[1] *	Enabled	Enables 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 desired level, based on a well-known signal available. The PID controller then only takes care of the smaler part of the control, necessary because of unknown characters. The standard feed fwd 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 choices. In winder applications, the feed fwd factor is typically the line speed of the system.

7-52 Process PID Feed Fwd Ramp up		
Range:		**Function:**
0.01 s*	[0.01 - 100 s]	Controls dynamics of the feed forward signal when ramping up.

7-53 Process PID Feed Fwd Ramp down		
Range:		**Function:**
0.01 s*	[0.01 - 100 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.

4.8.7 7-6* Feedback Conversion

Use the parameter group to configure conversions for feedback signals.

7-60 Feedback 1 Conversion		
Option:		**Function:**
[0] *	Linear	
[1]	Square root	

7-62 Feedback 2 Conversion		
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

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

8-02 Control Source

Option:		Function:
		NOTICE **This parameter cannot be adjusted while the motor is running.**
[0]	None	
[1]	FC Port	
[3]	Option A	

8-03 Control Timeout Time

Range:		Function:
1 s*	[0.1 - 6000 s]	Enter the maximum time expected to pass between the reception of 2 consecutive telegerams. If this time is exceeded, it indicates that the serial communication has stopped. The function is selected in *parameter 8-04 Control Timeout Function* is then carried out.

8-04 Control Timeout Function

Option:		Function:
[0] *	Off	Select the time-out function. The time-out function is activated when the control word fails to be updated within the time period specified in *parameter 8-03 Control Timeout Time*.

8-07 Diagnosis Trigger

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

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 *Serial communication via RS485 Interface* section in the design guide.
For additional guidelines in the selection of *[1] PROFIdrive profile*, refer to the *operating instructions* for the installed fieldbus.

Option:		Function:
[0] *	FC profile	
[1]	PROFIdrive profile	
[5]	ODVA	
[7]	CANopen DSP 402	
[8]	MCO	

8-14 Configurable Control Word CTW

Option:		Function:
[0]	None	
[1] *	Profile default	
[2]	CTW Valid, active low	
[4]	PID error inverse	
[5]	PID reset I part	
[6]	PID enable	

8-19 Product Code

Range:		Function:
Size related*	[0 - 2147483647]	Select [0] to readout 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 for the integrated RS485 port.
[0] *	FC	Communication according to the FC Protocol.
[2]	Modbus RTU	Communication according to the Modbus RTU protocol.

8-31 Address

Range:		Function:
1*	[0.0 - 247]	Enter the address for the RS485 port. Valid range: 1-126 for FC-bus, or 1-247 for Modbus.

8-32 Baud Rate		
Option:		**Function:**
		Select the baud rate for the RS485 port.
[0]	2400 Baud	
[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	

8-35 Minimum Response Delay		
Range:		**Function:**
0.01 s*	[0.0010 - 0.5 s]	Specify the minimum delay time between receiving a request and transmitting a response. This is used for overcoming modem turn-around delays.

8-36 Maximum Response Delay		
Range:		**Function:**
Size related*	[0.1 - 10.0 s]	Specify the maximum permissible delay time between receiving a request and transmitting the response. If this time is exceeded, no response is returned.

8-37 Maximum Inter-char delay		
Range:		**Function:**
0.025 s*	[0.025 - 0.025 s]	Specify the maximum delay time between 2 characters in a message. Exceeding this delay time causes the message to be discarded.

4.9.4 8-4* FC MC Protocol Set

8-42 PCD Write Configuration		
Different parameters can be assigned to PCD 3 to 10 of the PPOs (the number of PCDs depends on the PPO type). The values in PCD 3 to 10 are written to the selected parameters as data values.		
Option:		**Function:**
[0]	None	
[1]	[302] Minimum Reference	
[2]	[303] Maximum Reference	
[3]	[341] Ramp 1 Ramp up time	
[4]	[342] Ramp 1 Ramp down time	
[5]	[351] Ramp 2 Ramp up time	
[6]	[352] Ramp 2 Ramp down time	
[7]	[380] Jog Ramp Time	
[8]	[381] Quick Stop Time	
[9]	[412] Motor Speed Low Limit [Hz]	
[10]	[414] Motor Speed High Limit [Hz]	
[11]	[590] Digital & Relay Bus Control	
[12]	[676] Terminal45 Output Bus Control	
[13]	[696] Terminal 42 Output Bus Control	
[14]	[894] Bus Feedback 1	
[15]	FC Port CTW	
[16]	FC Port REF	

8-43 PCD Read Configuration		
Option:		**Function:**
[0]	None	
[1]	[1500] Operation Hours	
[2]	[1501] Running Hours	
[3]	[1502] kWh Counter	
[4]	[1600] Control Word	
[5]	[1601] Reference [Unit]	
[6]	[1602] Reference %	
[7]	[1603] Status Word	
[8]	[1605] Main Actual Value [%]	
[9]	[1609] Custom Readout	
[10]	[1610] Power [kW]	
[11]	[1611] Power [hp]	
[12]	[1612] Motor Voltage	
[13]	[1613] Frequency	
[14]	[1614] Motor Current	
[15]	[1615] Frequency [%]	
[16]	[1616] Torque [Nm]	
[17]	[1618] Motor Thermal	
[18]	[1630] DC Link Voltage	
[19]	[1634] Heatsink Temp.	
[20]	[1635] Inverter Thermal	
[21]	[1638] SL Controller State	
[22]	[1650] External Reference	
[23]	[1652] Feedback [Unit]	
[24]	[1660] Digital Input 18,19,27,33	
[25]	[1661] Terminal 53 Switch Setting	
[26]	[1662] Analog Input 53(V)	

8-43 PCD Read Configuration		
Option:		**Function:**
[27]	[1663] Terminal 54 Switch Setting	
[28]	[1664] Analog Input 54	
[29]	[1665] Analog Output 42 [mA]	
[30]	[1671] Relay Output [bin]	
[31]	[1672] Counter A	
[32]	[1673] Counter B	
[33]	[1690] Alarm Word	
[34]	[1692] Warning Word	
[35]	[1694] Ext. Status Word	
[38]	[1622] Torque [%]	

4.9.5 8-5* Digital/Bus

Parameters for configuring the control word digital/bus 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		
Option:		**Function:**
		Select control of the coasting function via the terminals (digital input) and/or via the bus.
[0]	Digital input	Activates start command via a digital input.
[1]	Bus	Activates start command via the serial communication port or fieldbus option.
[2]	Logic AND	Activates start command via the fieldbus/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activates start command via the fieldbus/serial communication port OR via one of the digital inputs.

8-51 Quick Stop Select		
Select control of the Quick Stop function via the terminals (digital input) and/or via the bus.		
Option:		**Function:**
[0]	Digital input	
[1]	Bus	
[2]	Logic AND	
[3] *	Logic OR	

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

8-53 Start Select		
Option:		**Function:**
		Select control of the frequency converter start function via the terminals (digital input) and/or via the fieldbus.
[0]	Digital input	Activates a start command via a digital input.
[1]	Bus	Activates a start command via the serial communication port or fieldbus option.
[2]	Logic AND	Activates a start command via the fieldbus/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activates a start command via the fieldbus/serial communication port, OR via 1 of the digital inputs.

8-54 Reversing Select		
Option:		**Function:**
[0]	Digital input	Select control of the frequency converter reverse function via the terminals (digital input) and/or via the fieldbus.
[1]	Bus	Activates the reverse command via the serial communication port, or fieldbus option.
[2]	Logic AND	Activates the reverse command via the fieldbus/serial communication port, AND additionally via 1 of the digital inputs.
[3] *	Logic OR	Activates the reverse command via the fieldbus/serial communication port, OR via 1 of the digital inputs.

8-55 Set-up Select		
Option:		**Function:**
		Select control of the frequency converter set-up selection via the terminals (digital input) and/or via the fieldbus.
[0]	Digital input	Activates the set-up selection via a digital input.
[1]	Bus	Activates the set-up selection via the serial communication port, or fieldbus option.
[2]	Logic AND	Activates the set-up selection via the fieldbus/ serial communication port, AND additionally via 1 of the digital inputs.
[3] *	Logic OR	Activate the set-up selection via the fieldbus/ serial communication port OR via 1 of the digital inputs.

8-56 Preset Reference Select		
Option:		**Function:**
		Select control of the preset reference selection via the terminals (digital input) and/or via the fieldbus.
[0]	Digital input	Activates preset reference selection via a digital input.
[1]	Bus	Activates preset reference selection via the serial communication port, or fieldbus option.
[2]	Logic AND	Activates preset reference selection via the fieldbus/serial communication port, AND additionally via 1 of the digital inputs.
[3] *	Logic OR	Activates the preset reference selection via the fieldbus/serial communication port, OR via 1 of the digital inputs.

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	

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:**
[2]	Logic AND	
[3] *	Logic OR	

4.9.6 8-7* BACnet

8-79 Protocol Firmware version		
Range:		**Function:**
Size related*	[0 - 65535]	The version of the protocol firmware.

4.9.7 8-8* FC Port Diagnostics

These parameters are used for monitoring the bus communication via the FC Port.

8-80 Bus Message Count		
Range:		**Function:**
0*	[0 - 65536]	This parameter shows the number of valid telegrams detected on the bus.

8-81 Bus Error Count		
Range:		**Function:**
0*	[0 - 65536]	This parameter shows the number of telegrams with faults (e.g. CRC faults), detected on the bus.

8-82 Slave Messages Rcvd		
Range:		**Function:**
0*	[0 - 65536]	This parameter shows the number of valid telegrams sent by the frequency converter to the slave.

8-83 Slave Error Count		
Range:		**Function:**
0*	[0 - 65536]	This parameter shows the number of error telegrams, which could not be executed by the frequency converter.

8-84 Slave Messages Sent		
Range:		**Function:**
0*	[0 - 65536]	This parameter shows the number of messages sent from the slave.

8-85 Slave Timeout Errors		
Range:		**Function:**
0*	[0 - 65536]	This parameter shows the number of slave time-out errors.

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

4.9.8 8-9* Bus Feedback

Use the parameter group to configure the bus feedback.

8-90 Bus Jog 1 Speed		
Range:		**Function:**
100 RPM*	[0 - 1500 RPM]	Enter the jog speed. This is a fixed jog speed activated via the serial port or fieldbus option.

8-91 Bus Jog 2 Speed		
Range:		**Function:**
200 RPM*	[0 - 1500 RPM]	Enter the jog speed. This is a fixed jog speed activated via the serial port or fieldbus option.

4.10 Parameters: 9-** PROFIdrive

9-00 Setpoint		
Range:		**Function:**
0*	[0 - 65535]	This parameter receives cyclical 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 cyclical reference is ignored.

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

9-15 PCD Write Configuration		
Option:		**Function:**
[0]		
[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	
[412]	Motor Speed Low Limit [Hz]	
[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	
[615]	Terminal 53 High Ref./Feedb. Value	
[625]	Terminal 54 High Ref./Feedb. Value	
[696]	Terminal 42 Output Bus Control	
[748]	PCD Feed Forward	
[890]	Bus Jog 1 Speed	
[891]	Bus Jog 2 Speed	
[1680]	Fieldbus CTW 1	
[1682]	Fieldbus REF 1	

9-16 PCD Read Configuration		
Option:		**Function:**
[0]		
[1500]	Operating hours	
[1501]	Running Hours	
[1502]	kWh Counter	
[1600]	Control Word	
[1601]	Reference [Unit]	

9-16 PCD Read Configuration		
Option:		**Function:**
[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]	
[1618]	Motor Thermal	
[1622]	Torque [%]	
[1630]	DC Link Voltage	
[1633]	Brake Energy /2 min	
[1634]	Heatsink Temp.	
[1635]	Inverter Thermal	
[1638]	SL Controller State	
[1639]	Control Card Temp.	
[1650]	External Reference	
[1652]	Feedback[Unit]	
[1653]	Digi Pot Reference	
[1657]	Feedback [RPM]	
[1660]	Digital Input	
[1661]	Terminal 53 Setting	
[1662]	Analog Input 53	
[1663]	Terminal 54 Setting	
[1664]	Analog Input AI54	
[1665]	Analog Output 42 [mA]	
[1667]	Pulse Input 29[Hz]	
[1668]	Pulse Input 33 [Hz]	
[1669]	Pulse Output 27 [Hz]	
[1670]	Pulse Output 29 [Hz]	
[1671]	Relay Output	
[1672]	Counter A	
[1673]	Counter B	
[1679]	Analog Output AO45	
[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	
[1697]	Alarm Word 3	

9-18 Node Address		
Range:		**Function:**
126*	[0 - 126]	Enter the station address in this parameter or, alternatively, in the hardware switch. To adjust the station address in *parameter 9-18 Node Address*,

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9-18 Node Address		
Range:	**Function:**	
		set the hardware switch to 126 or 127 (that is all switches set to *on*). Otherwise, this parameter displays the actual setting of the switch.

9-19 Drive Unit System Number		
Range:		**Function:**
1037*	[0 - 65535]	Manufacturer specific system ID

9-22 Telegram Selection		
Option:		**Function:**
[1]	Standard telegram 1	Select a standard PROFIBUS telegram configuration for the frequency converter as an alternative to using the freely configurable telegrams in *parameter 9-15 PCD Write Configuration* and *parameter 9-16 PCD Read Configuration*.
[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		
Option:		**Function:**
[0] *		
[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	
[412]	Motor Speed Low Limit [Hz]	
[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	
[615]	Terminal 53 High Ref./Feedb. Value	
[625]	Terminal 54 High Ref./Feedb. Value	
[696]	Terminal 42 Output Bus Control	

9-23 Parameters for Signals		
Option:		**Function:**
[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]	
[1618]	Motor Thermal	
[1622]	Torque [%]	
[1630]	DC Link Voltage	
[1633]	Brake Energy /2 min	
[1634]	Heatsink Temp.	
[1635]	Inverter Thermal	
[1638]	SL Controller State	
[1639]	Control Card Temp.	
[1650]	External Reference	
[1652]	Feedback[Unit]	
[1653]	Digi Pot Reference	
[1657]	Feedback [RPM]	
[1660]	Digital Input	
[1661]	Terminal 53 Setting	
[1662]	Analog Input 53	
[1663]	Terminal 54 Setting	
[1664]	Analog Input AI54	
[1665]	Analog Output 42 [mA]	
[1667]	Pulse Input 29[Hz]	
[1668]	Pulse Input 33 [Hz]	
[1669]	Pulse Output 27 [Hz]	
[1670]	Pulse Output 29 [Hz]	
[1671]	Relay Output	
[1672]	Counter A	
[1673]	Counter B	
[1679]	Analog Output AO45	
[1680]	Fieldbus CTW 1	
[1682]	Fieldbus REF 1	
[1684]	Comm. Option STW	
[1685]	FC Port CTW 1	
[1690]	Alarm Word	
[1691]	Alarm Word 2	
[1692]	Warning Word	

9-23 Parameters for Signals

Option:		Function:
[1693]	Warning Word 2	
[1694]	Ext. Status Word	
[1695]	Ext. Status Word 2	
[1697]	Alarm Word 3	
[3401]	PCD 1 Write For Application	
[3402]	PCD 2 Write For Application	
[3403]	PCD 3 Write For Application	
[3404]	PCD 4 Write For Application	
[3405]	PCD 5 Write For Application	
[3406]	PCD 6 Write For Application	
[3407]	PCD 7 Write For Application	
[3408]	PCD 8 Write For Application	
[3409]	PCD 9 Write For Application	
[3410]	PCD 10 Write For Application	
[3421]	PCD 1 Read For Application	
[3422]	PCD 2 Read For Application	
[3423]	PCD 3 Read For Application	
[3424]	PCD 4 Read For Application	
[3425]	PCD 5 Read For Application	
[3426]	PCD 6 Read For Application	
[3427]	PCD 7 Read For Application	
[3428]	PCD 8 Read For Application	
[3429]	PCD 9 Read For Application	
[3430]	PCD 10 Read For Application	
[3450]	Actual Position	
[3456]	Track Error	

9-27 Parameter Edit

Option:		Function:
		Parameters can be edited via PROFIBUS, the standard RS485 interface, or the LCP.
[0]	Disabled	Disables editing via PROFIBUS.
[1] *	Enabled	Enables editing via PROFIBUS.

9-28 Process Control

Option:		Function:
		Process control (setting of control word, speed reference, and process data) is possible via either PROFIBUS or standard fieldbus, but not both simultaneously. Local control is always possible via the LCP. Control via process control is possible via either terminals or fieldbus depending on the settings in *parameter 8-50 Coasting Select* to *parameter 8-56 Preset Reference Select*.
[0]	Disable	Disables process control via PROFIBUS, and enables process control via standard fieldbus or PROFIBUS master class 2.
[1] *	Enable cyclic master	Enables process control via PROFIBUS master class 1, and disables process control via standard fieldbus or PROFIBUS master class 2.

9-44 Fault Message Counter

Range:		Function:
0*	[0 - 65535]	Indicates the number of fault events presently stored in *parameter 9-45 Fault Code*. The buffer capacity is maximum 8 error events. The buffer and counter is set to 0 by 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 buffer capacity is maximum 8 error events.

9-47 Fault Number

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 buffer capacity is maximum eight error events.

9-52 Fault Situation Counter

Range:		Function:
0*	[0 - 1000]	Indicates the number of fault events occurred since last reset or power-up.

9-53 Profibus Warning Word

Range:		Function:
0*	[0 - 65535]	This parameter displays PROFIBUS communication warnings.

Bit	Meaning
0	Connection with DP-master is lost.
1	Not used.
2	FDL (fieldbus data link layer) is not OK.
3	Clear data command received.
4	Actual value is not updated.
5	Baudrate search.
6	PROFIBUS ASIC is not transmitting.
7	Initialising of PROFIBUS is not ok.
8	Frequency converter is tripped.
9	Internal CAN error.
10	Wrong configuration data from PLC.
11	Wrong ID sent by PLC.
12	Internal error occurred.
13	Not configured.
14	Time-out active.
15	Warning 34 active.

Table 4.7 Bit Definition

4

9-63 Actual Baud Rate

Option:		Function:
		This parameter displays the actual PROFIBUS baud rate. The PROFIBUS master automatically sets the baud rate.
[0]	9,6 kbit/s	
[1]	19,2 kbit/s	
[2]	93,75 kbit/s	
[3]	187,5 kbit/s	
[4]	500 kbit/s	
[6]	1500 kbit/s	
[7]	3000 kbit/s	
[8]	6000 kbit/s	
[9]	12000 kbit/s	
[10]	31,25 kbit/s	
[11]	45,45 kbit/s	
[255] *	No baudrate found	

9-64 Device Identification

Range:		Function:
0*	[0 - 0]	The device identification parameter. The data type is Array[n] of Unsigned16. The assignment of the first subindexes is defined and shown in *Table 4.8*.

NOTICE

This parameter is not visible via LCP.

Index	Content	Value
0	Manufacturer	128
1	Device type	1
2	Version	xxyy
3	Firmware date year	yyyy
4	Firmware date month	ddmm
5	No. of axes	variable
6	Vendor specific: PB Version	xxyy
7	Vendor specific: Database Version	xxyy
8	Vendor specific: AOC Version	xxyy
9	Vendor specific: MOC Version	xxyy

9-65 Profile Number

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.

NOTICE

This parameter is not visible via LCP.

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 Edit Set-up

Option:		Function:
		Select the set-up in which programming (change of data) is performed during operation. It is possible to programme the 4 set-ups independently of the set-up selected as active. Parameter access from each master is directed to the set-up, which is selected by the individual master (cyclic, acylic MCL1, first acyclic MCL2, second acyclic MCL2, third acyclic MCL2).
[1]	Set-up 1	
[2]	Set-up 2	
[9] *	Active Set-up	

9-71 Profibus Save Data Values

Option:		Function:
		Parameter values changed via 485 are not automatically stored in a non-volatile memory. Use this parameter to activate a function that stores parameter values in the EEPROM non-volatile memory, so changed parameter values are retained at power-down.
[0] *	Off	Deactivates the non-volatile storage function.
[1]	Store all setups	Stores all parameter values in the set-up selected in *parameter 9-70 Edit Set-up* in the non-volatile memory. The selection returns to *[0] Off* when all values have been stored.
[2]	Store all setups	Stores all parameter values for all set-ups in the non-volatile memory. The selection returns to *[0] Off* when all parameter values have been stored.

9-72 ProfibusDriveReset

Option:		Function:
[0] *	No action	
[1]	Power-on reset	Resets frequency converter upon power-up, as for power-cycle.
[2]	Power-on reset prep	
[3]	Comm option reset	When reset, the frequency converter disappears from the fieldbus, which may

9-72 ProfibusDriveReset		
Option:		**Function:**
		cause a communication error from the master. ***NOTICE*** **Resets the PROFIBUS option only.**

9-75 DO Identification		
Range:		**Function:**
0*	[0 - 65535]	Provides information about the DO (Drive Object).

9-80 Defined Parameters (1)		
Range:		**Function:**
0*	[0 - 9999]	This parameter displays a list of all the defined frequency converter parameters available for PROFIBUS.

9-81 Defined Parameters (2)		
Range:		**Function:**
0*	[0 - 9999]	This parameter displays a list of all the defined frequency converter parameters available for PROFIBUS.

9-82 Defined Parameters (3)		
Range:		**Function:**
0*	[0 - 9999]	This parameter displays a list of all the defined frequency converter parameters available for PROFIBUS.

9-83 Defined Parameters (4)		
Range:		**Function:**
0*	[0 - 9999]	This parameter displays a list of all the defined frequency converter parameters available for PROFIBUS.

9-84 Defined Parameters (5)		
Range:		**Function:**
0*	[0 - 9999]	

9-85 Defined Parameters (6)		
Range:		**Function:**
0*	[0 - 9999]	

9-90 Changed Parameters (1)		
Range:		**Function:**
0*	[0 - 9999]	This parameter displays a list of all the frequency converter parameters deviating from default setting.

9-91 Changed Parameters (2)		
Range:		**Function:**
0*	[0 - 9999]	This parameter displays a list of all the frequency converter parameters deviating from default setting.

9-92 Changed Parameters (3)		
Range:		**Function:**
0*	[0 - 9999]	This parameter displays a list of all the frequency converter parameters deviating from default setting.

9-93 Changed Parameters (4)		
Range:		**Function:**
0*	[0 - 9999]	This parameter displays a list of all the frequency converter parameters deviating from default setting.

9-94 Changed Parameters (5)		
Range:		**Function:**
0*	[0 - 9999]	This parameter displays 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

4.11 Parameters: 12-** Ethernet

4.11.1 12-0* IP Settings

12-00 IP Address Assignment

Option:		Function:
		Selects the IP Address assignment method.
[0] *	Manual	Set the IP-address 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.

12-01 IP Address

Range:		Function:
0*	[0 - 4294967295]	

12-02 Subnet Mask

Range:		Function:
0*	[0 - 4244635647]	

12-03 Default Gateway

Range:		Function:
0*	[0 - 2147483647]	

12-04 DHCP Server

Range:		Function:
0*	[0 - 2147483647]	

12-05 Lease Expires

Range:		Function:
Size related*	[0 - 0]	Read only. Displays the lease-time left for the current DHCP-assigned IP address.
Size related*	[0 - 0]	

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:
Blank	[0-19 characters]	Logical (given) name of option.

12-09 Physical Address

Range:		Function:
0*	[0 - 17]	Read only. Displays the physical (MAC) address of the option.

4.11.2 12-1* Ethernet Link Parameters

12-10 Link Status

Option:		Function:
[0] *	No Link	
[1]	Link	Displays the link status of the Ethernet ports.

12-11 Link Duration

Range:		Function:
Size related*	[0 - 0]	Displays the duration of the present link on each port in dd:hh:mm:ss.

12-12 Auto Negotiation

Option:		Function:
		Configures 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*.

12-13 Link Speed

Option:		Function:
		Forces the link speed for each port in 10 or 100 Mbps. If *parameter 12-12 Auto Negotiation* is set to *[1] On*, this parameter is read-only and displays the actual link speed. If no link is present, *"None"* is displayed.
[0] *	None	
[1]	10 Mbps	
[2]	100 Mbps	

12-14 Link Duplex

Option:		Function:
		Forces the duplex for each port to full or half duplex. If *parameter 12-12 Auto Negotiation* is set to *[1] On*, this parameter is read-only.
[0]	Half Duplex	
[1] *	Full Duplex	

4.11.3 12-8* Other Ethernet Services

12-80 FTP Server

Option:		Function:
[0] *	Disabled	
[1]	Enabled	

12-81 HTTP Server

Option:		Function:
[0] *	Disabled	
[1]	Enabled	

12-82 SMTP Service		
Option:		**Function:**
[0] *	Disabled	
[1]	Enabled	

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

4.11.4 12-9* Advanced Ethernet Services

12-90 Cable Diagnostic		
Option:		**Function:**
		Enables/disables advanced cable diagnosis function. If enabled, the distance to cable errors can be read out in *parameter 12-93 Cable Error Length*. The parameter resumes to the default setting *Disable* after the diagnostics have finished. ***NOTICE*** **The cable diagnostics function is only issued on ports where there is no link (see *parameter 12-10 Link Status*)**
[0] *	Disabled	
[1]	Enabled	

12-91 Auto Cross Over		
Option:		**Function:**
		NOTICE **Disabling of the auto cross-over function requires crossed Ethernet cables for daisy-chaining the options.**
[0]	Disabled	Disables the auto cross-over function.
[1] *	Enabled	Enables the auto cross-over function.

12-92 IGMP Snooping		
Option:		**Function:**
[0]	Disabled	
[1] *	Enabled	

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 is a measurement technique which detects common cabling problems such as open circuits, short circuits and impedance mismatches

12-93 Cable Error Length		
Range:		**Function:**
		or breaks in transmission cables. The distance from the option to the error is displayed in metres with an accuracy of ±2 m. The value 0 means no errors 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 a percentage of the total bandwidth that is allowed for broadcast messages. Example: OFF means that the filter is disabled - all broadcast messages are passed through. The value 0% means that no broadcast messages are passed through. A value of 10% means that 10% of the total bandwidth is allowed for broadcast messages. If the amount of broadcast messages increases above the 10% threshold, they are blocked.

12-95 Broadcast Storm Filter		
Applies to *parameter 12-94 Broadcast Storm Protection*, if the broadcast storm protection also includes multicast telegrams.		
Option:		**Function:**
[0] *	Broadcast only	
[1]	Broadcast & Multicast	

12-96 Port Config		
Option:		**Function:**
[0]	Normal	
[1]	Mirror Port 1 to 2	
[2]	Mirror Port 2 to 1	
[10]	Port 1 disabled	
[11]	Port 2 disabled	
[254]	Mirror Int. Port to 1	
[255]	Mirror Int. Port to 2	

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

4

4.12 Parameters: 13-** Smart Logic Control

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

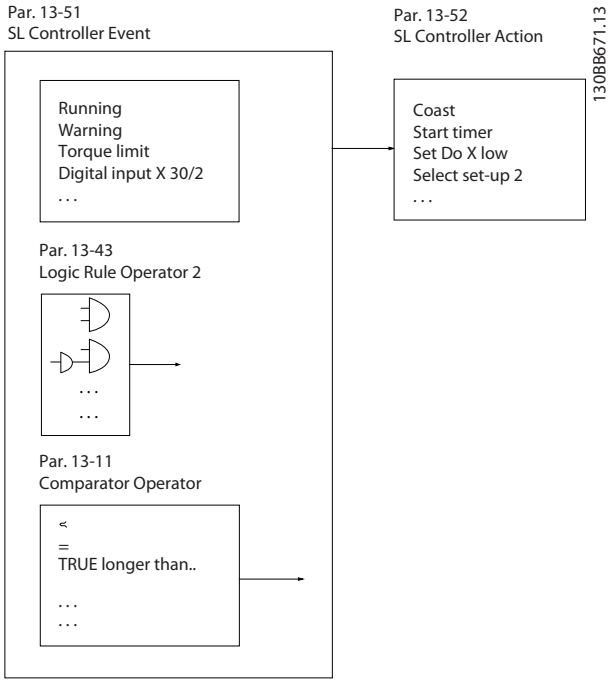

Illustration 4.21 Smart logic control (SLC)

Events and *actions* are each numbered and linked in pairs (states). This means that when *event* [0] is fulfilled (attains the value TRUE), *action* [0] is executed. After this, the conditions of *event* [1] are evaluated and if evaluated TRUE, *action* [1] 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 *event* [0] (and only *event* [0]) in each scan interval. Only when *event* [0] is evaluated TRUE, the SLC executes *action* [0] and starts evaluating *event* [1]. It is possible to program from 1 to 20 *events* and *actions*.
When the last *event*/*action* has been executed, the sequence starts over again from *event* [0]/*action* [0]. *Illustration 4.22* shows an example with 3 *events/actions*:

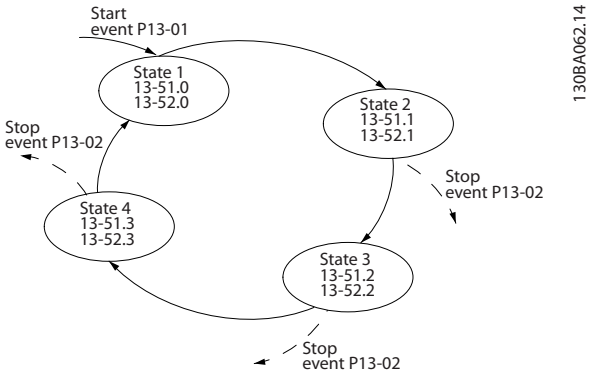

Illustration 4.22 Events and Actions

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 *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* (*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		
Option:		**Function:**
[0]	False	
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	

13-01 Start Event		
Option:		**Function:**
[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	
[39] *	Start command	
[40]	Drive stopped	
[42]	Auto Reset Trip	
[50]	Comparator 4	
[51]	Comparator 5	
[60]	Logic rule 4	
[61]	Logic rule 5	
[83]	Broken Belt	

13-02 Stop Event		
Option:		**Function:**
[0]	False	
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I 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	

13-02 Stop Event		
Option:		**Function:**
[34]	Digital input DI19	
[35]	Digital input DI27	
[36]	Digital input DI29	
[39]	Start command	
[40] *	Drive stopped	
[42]	Auto Reset Trip	
[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	
[83]	Broken Belt	

13-03 Reset SLC		
Option:		**Function:**
[0] *	Do not reset SLC	Retains programmed settings in all parameter group *13-** Smart Logic Control*.
[1]	Reset SLC	Resets all parameters in parameter group *13-** Smart Logic Control* to default settings.

4.12.2 13-1* Comparators

Comparators are used for comparing continuous variables (i.e. output frequency, output current, analog input etc.) to fixed preset values.

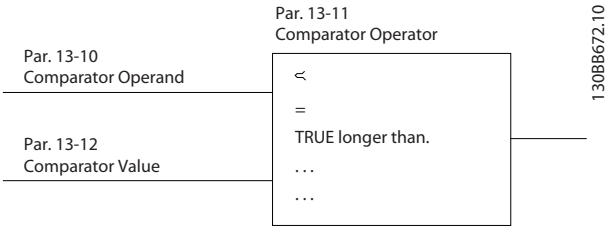

Illustration 4.23 Comparators

There are digital values that are compared to fixed time values. See explanation in *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 to 5. Select index 0 to program comparator 0, select index 1 to program comparator 1, and so on.

13-10 Comparator Operand		
Option:		**Function:**
[0] *	Disabled	
[1]	Reference %	

13-10 Comparator Operand		
Option:		**Function:**
[2]	Feedback %	
[3]	Motor speed	
[4]	Motor Current	
[6]	Motor power	
[7]	Motor voltage	
[12]	Analog input AI53	
[13]	Analog input AI54	
[18]	Pulse input FI29	
[19]	Pulse input FI33	
[20]	Alarm number	
[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 to 5.
[0]	Less Than (<)	The result of the evaluation is TRUE, when the variable selected in *parameter 13-10 Comparator Operand* is smaller than the fixed value in *parameter 13-12 Comparator Value*. The result is FALSE, if the variable selected in *parameter 13-10 Comparator Operand* is greater than the fixed value in *parameter 13-12 Comparator Value*.
[1] *	Approx.Equal (~)	The result of the evaluation is TRUE, when the variable speed selected in *parameter 13-10 Comparator Operand* is approximately equal to the fixed value in *parameter 13-12 Comparator Value*.
[2]	Greater Than (>)	Inverse logic of *[0] Less Than (<)*.

13-12 Comparator Value		
Range:		**Function:**
0*	[-9999 - 9999]	Enter the trigger level for the variable that is monitored by this comparator. This is an array parameter containing comparator values 0 to 5.

4.12.3 13-2* Timers

Use the result (TRUE or FALSE) from *timers* directly to define an *event* (see *13-51 SL Controller Event*), or as boolean input in a *logic rule* (see *13-40 Logic Rule Boolean 1*, *13-42 Logic Rule Boolean 2* or *13-44 Logic Rule Boolean 3*). A timer is only FALSE when started by an action (i.e. *[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 to 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:**
0 s*	[0 - 3600 s]	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 (i.e. *[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 *13-40 Logic Rule Boolean 1*, *13-42 Logic Rule Boolean 2* and *13-44 Logic Rule Boolean 3*. Define the operators used to logically combine the selected inputs in *13-41 Logic Rule Operator 1* and *13-43 Logic Rule Operator 2*.

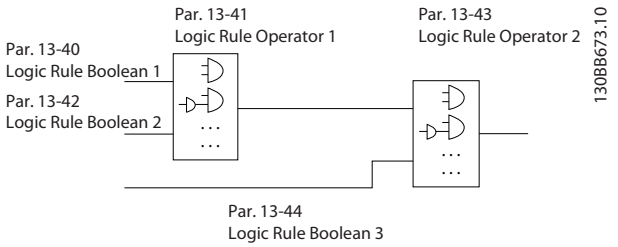

Illustration 4.24 Logic Rules

Priority of calculation

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

13-40 Logic Rule Boolean 1		
Option:		**Function:**
		Select the first boolean (TRUE or FALSE) input for the selected logic rule. See *parameter 13-01 Start Event* (*[0]-[61]*) and *parameter 13-02 Stop Event* (*[70]-[74]*) for further description.
[0] *	False	
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[7]	Out of current range	

4

13-40 Logic Rule Boolean 1		
Option:		**Function:**
[8]	Below I low	
[9]	Above I 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	
[39]	Start command	
[40]	Drive stopped	
[42]	Auto Reset Trip	
[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	
[83]	Broken Belt	

13-41 Logic Rule Operator 1		
Option:		**Function:**
		Select the first logical operator to use on the boolean inputs from *parameter 13-40 Logic Rule Boolean 1* and *parameter 13-42 Logic Rule Boolean 2*.
[0] *	Disabled	Ignores *parameter 13-42 Logic Rule Boolean 2*, *parameter 13-43 Logic Rule Operator 2* and *parameter 13-44 Logic Rule Boolean 3*.
[1]	AND	Evaluates the expression [13-40] AND [13-42].
[2]	OR	Evaluates the expression [13-40] OR [13-42].
[3]	AND NOT	Evaluates the expression [13-40] AND NOT [13-42].

13-41 Logic Rule Operator 1		
Option:		**Function:**
[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:**
		Select the second boolean (TRUE or FALSE) input for the selected logic rule. See *parameter 13-01 Start Event* (*[0]-[61]*) and *parameter 13-02 Stop Event* (*[70]-[74]*) for further description.
[0] *	False	
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I 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	
[39]	Start command	
[40]	Drive stopped	
[42]	Auto Reset Trip	

13-42 Logic Rule Boolean 2		
Option:		**Function:**
[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	
[83]	Broken Belt	

13-43 Logic Rule Operator 2		
Option:		**Function:**
		Select the second 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* and *parameter 13-42 Logic Rule Boolean 2*, and the boolean input coming from *parameter 13-42 Logic Rule Boolean 2*. *Parameter 13-42 Logic Rule Boolean 2* signifies the boolean input of *parameter 13-44 Logic Rule Boolean 3*. *Parameter 13-40 Logic Rule Boolean 1* and *parameter 13-42 Logic Rule Boolean 2* signify the boolean input calculated in *parameter 13-40 Logic Rule Boolean 1*, *parameter 13-41 Logic Rule Operator 1* and *parameter 13-42 Logic Rule Boolean 2*.
[0] *	Disabled	Ignores *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	

13-44 Logic Rule Boolean 3		
Option:		**Function:**
		Select the third boolean (TRUE or FALSE) input for the selected logic rule. See *parameter 13-40 Logic Rule Boolean 1*, *parameter 13-41 Logic Rule Operator 1* and *parameter 13-42 Logic Rule Boolean 2*, and the boolean input. See *parameter 13-01 Start Event* (*[0]-[61]*) and *parameter 13-02 Stop Event* (*[70]-[74]*) for further description.

13-44 Logic Rule Boolean 3		
Option:		**Function:**
[0] *	False	
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I 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	
[39]	Start command	
[40]	Drive stopped	
[42]	Auto Reset Trip	
[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	
[83]	Broken Belt	

4.12.5 13-5* States

13-51 SL Controller Event		
Option:		**Function:**
		Select the third boolean (TRUE or FALSE) input for the selected logic rule. See *parameter 13-40 Logic Rule Boolean 1*, *parameter 13-41 Logic Rule*

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13-51 SL Controller Event		
Option:		**Function:**
		Operator 1 and *parameter 13-42 Logic Rule Boolean 2*, and the boolean input. See *parameter 13-01 Start Event* (*[0]-[61]*) and *parameter 13-02 Stop Event* (*[70]-[74]*) for further description.
[0] *	False	
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I 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	
[39]	Start command	
[40]	Drive stopped	
[42]	Auto Reset Trip	
[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	
[83]	Broken Belt	

13-52 SL Controller Action		
Option:		**Function:**
[0] *	Disabled	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.
[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 wither the digital inputs, or via a fieldbus.
[10]	Select preset ref 0	Select 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.

13-52 SL Controller Action		
Option:		**Function:**
[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.
[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]	DC Brake	Issues a DC-brake 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 of the frequency converter.
[29]	Start timer 0	See *parameter 13-20 SL Controller Timer* for further description.
[30]	Start timer 1	See *parameter 13-20 SL Controller Timer* for further description.
[31]	Start timer 2	See *parameter 13-20 SL Controller Timer* for further description.
[32]	Set digital out A low	Any output with SL output A is low.
[33]	Set digital out B low	Any output with SL output B is low.
[34]	Set digital out C low	Any output with SL output C is low.
[35]	Set digital out D low	Any output with SL output D is low.
[38]	Set digital out A high	Any output with SL output A is high.
[39]	Set digital out B high	Any output with SL output B is high.
[40]	Set digital out C high	Any output with SL output C is high.
[41]	Set digital out D high	Any output with SL output D is high.
[60]	Reset Counter A	Resets Counter A to zero.
[61]	Reset Counter B	Resets Counter B to zero.

13-52 SL Controller Action		
Option:		**Function:**
[70]	Start Timer 3	See *parameter 13-20 SL Controller Timer* for further description.
[71]	Start Timer 4	See *parameter 13-20 SL Controller Timer* for further description.
[72]	Start Timer 5	See *parameter 13-20 SL Controller Timer* for further description.
[73]	Start Timer 6	See *parameter 13-20 SL Controller Timer* for further description.
[74]	Start Timer 7	See *parameter 13-20 SL Controller Timer* for further description.

4.13 Parameters: 14-** Special Functions

4.13.1 14-0* Inverter Switching

14-01 Switching Frequency		
Option:		**Function:**
		Select the inverter switching frequency. Changing the switching frequency helps to reduce acoustic noise from the motor.
[0]	Ran3	3 kHz true random PWM (white noise modulation).
[1]	Ran5	5 kHz true ramdom PWM (white noise modulation).
[2]	2.0 kHz	
[3]	3.0 kHz	
[4]	4.0 kHz	
[5]	5.0 kHz	
[6]	6.0 kHz	
[7]	8.0 kHz	
[8]	10.0 kHz	
[9]	12.0 kHz	
[10]	16.0 kHz	

14-03 Overmodulation		
Option:		**Function:**
[0]	Off	To avoid torque ripple on the motor shaft, select *[0] Off* for no overmodulation of the output voltage. This feature may be useful for applications such as grinding machines.
[1] *	On	Select *[1] On* to enable the overmodulation function for the output voltage. This is the right selection when it is required that the output voltage is > 95% of the input voltage (typical when running over-synchronously). The output voltage is increased according to the degree of overmodulation. ***NOTICE*** **Overmodulation leads to increased torque ripple as harmonics are increased.**

14-07 Dead Time Compensation Level		
Range:		**Function:**
Size related*	[0 - 100]	Level of applied deadtime compensation in percentage. A high level (>90%) optimizes the dynamic motor response; a level from 50% to 90% is good for both motor-torque-ripple minimization and the motor dynamics; a zero level turns the deadtime compensation off.

14-08 Damping Gain Factor		
Range:		**Function:**
Size related*	[0 - 100 %]	Damping factor for DC-link voltage compensation.

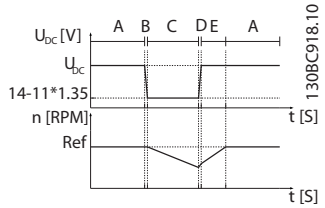
14-09 Dead Time Bias Current Level		
Range:		**Function:**
Size related*	[0 - 100 %]	Set a bias signal (in [%]) to add to the current-sense signal for deadtime compensation for some motors.

4.13.2 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 has been exhausted.

14-10 Mains Failure		
Option:		**Function:**
		NOTICE ***Parameter 14-10 Mains Failure* cannot be changed while 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 is down to about 373 V DC and the IGBTs cut off and loses 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 to which the frequency converter must act when the threshold in *14-11 Mains Voltage at Mains Fault* has been reached.
[0] *	No function	The frequency converter does not compensate for a mains interruption. The voltage on the DC-link drops quickly and the motor is lost within milliseconds to seconds. Trip lock is the result.
[1]	Ctrl. ramp-down	The frequency converter remains control of the motor and does a controlled ramp-down from *parameter 14-11 Mains Voltage at Mains Fault* 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

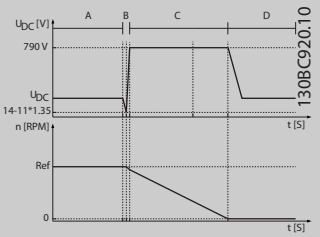
14-10 Mains Failure		
Option:		**Function:**
		parameter 3-81 Quick Stop Ramp Time. This selection is particularly useful in pump applications, where the inertia is low and the friction is high. When mains is restored, the output frequency ramps the motor up to the reference speed (if the mains interruption is prolonged, the controlled ramp-down might take the output frequency all the way down to 0 RPM, and when the mains is restored, the application is ramped up from 0 RPM to the previous reference speed via the normal ramp up). If the energy in the DC-link disappears before the motor is ramped to zero, the motor is coasted.
[2]	Ctrl. ramp-down, trip	This selection is similar to selection [1], except that in [2] a reset is necessary for starting up after power-up.
[3]	Coasting	Centrifuges can run for an hour without power 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 thereby 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 seconds 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 4.25 Kinetick Back-up

14-10 Mains Failure		
Option:		**Function:**
		The DC-level during *[4] Kinetic back-up* is *parameter 14-11 Mains Voltage at Mains Fault* * 1.35. If the mains do not return, U_{DC} is maintained as long as possible by ramping the speed down towards 0 RPM. Finally, the frequency converter coasts. If mains return while in kinetic back-up, U_{DC} increases above *parameter 14-11 Mains Voltage at Mains Fault**1.35. This is detected in one of the following ways. • If U_{DC} > *parameter 14-11 Mains Voltage at Mains Fault**1.35*1.05 • If the speed is above the reference. This is relevant if mains comes back at a lower level than before, e.g. *parameter 14-11 Mains Voltage at Mains Fault**1.35*1.02. This does not fulfil the criterion above and the frequency converter tries to reduce U_{DC} to *parameter 14-11 Mains Voltage at Mains Fault**1.35 by increasing the speed. This does not succeed as mains cannot be lowered. • If running motoric. The same mechanism as in the previous point, but where the inertia prevents that the speed goes above the reference speed. This leads to the motor running motoric until the speed is above the reference speed and the above situation occurs. Instead of waiting for that, the present criterion 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 return or not. The function is made so that it does not even detect if mains return, this is the reason for the relatively high level on the DC-link during ramp down.



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14-10 Mains Failure		
Option:		**Function:**
		A Normal operation B Mains failure C Kinetic back-up D Trip **Illustration 4.26 Kinetic Back-up Trip**
[6]	Alarm	
[7]	Kin. back-up, trip w recovery	

14-11 Mains Voltage at Mains Fault		
Range:		**Function:**
342 V*	[100 - 800 V]	This parameter defines the threshold voltage at which the selected function in *parameter 14-10 Mains Failure* should be activated. The detection level is at a factor sqrt^2 of the value in this parameter.

14-12 Function at Mains Imbalance		
Option:		**Function:**
		Operation under severe mains imbalance conditions reduces the lifetime of the motor. Conditions are considered severe if the motor is operated continously near nominal load (e.g. a pump or fan running near full speed).
[0] *	Trip	Trips the frequency converter.
[1]	Warning	Issues a warning.
[2]	Disabled	No action is taken.
[3]	Derate	Derates the frequency converter.

14-15 Kin. Backup Trip Recovery Level		
Range:		**Function:**
Size related*	[0 - 500.000 ReferenceFeedbackUnit]	

4.13.3 14-2* Trip Reset

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

14-20 Reset Mode		
Option:		**Function:**
		⚠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.** • **Fully wire and assembly the frequency converter, motor, and any driven equipment before connecting the frequency converter to AC mains, DC supply, or load sharing.** ***NOTICE*** **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* reverts to the original selection. If the number of automatic resets is not reached within 10 minutes, or when a manual reset is performed, the internal automatic reset counter returns to zero.** Select the reset function after tripping. Once reset, the frequency converter can be restarted.
[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 between 1 and 20 automatic resets after tripping.

14-20 Reset Mode		
Option:		**Function:**
[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 *[13] Infinite Automatic Reset* for continuous resetting after tripping.
[14]	Reset at power-up	

14-21 Automatic Restart Time		
Range:		**Function:**
10 s*	[0 - 600 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:**
		Specify normal operation, perform tests or initialise all parameters except for *parameter 15-03 Power Up's*, *parameter 15-04 Over Temp's*, and *parameter 15-05 Over Volt's*. This function is only active when the power is cycled to the frequency converter.
[0] *	Normal operation	Normal operation with motor selected.
[2]	Initialisation	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.

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

14-27 Action At Inverter Fault		
Option:		**Function:**
		Select how the frequency converter should react at inverter fault.
[0]	Trip	The frequency converter trips.
[1] *	Warning	The frequency converter issues a warning.

14-28 Production Settings		
Option:		**Function:**
[0] *	No action	
[1]	Service reset	
[3]	Software Reset	

14-29 Service Code		
Range:		**Function:**
0*	[0 - 0x7FFFFFFF]	For internal use only.

4.13.4 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 *4-16 Torque Limit Motor Mode* and *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 to 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.

4

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:**
0.020 s*	[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 control instability.

14-32 Current Lim Ctrl, Filter Time		
Range:		**Function:**
5 ms*	[1 - 100 ms]	Sets a time constant for the current limit controller low-pass filter.

4.13.5 14-4* Energy Optimising

Parameters for adjusting the energy optimisation level in both Variable Torque (VT) and Automatic Energy Optimisation (AEO) mode in *1-03 Torque Characteristics*.

14-40 VT Level		
Range:		**Function:**
66 %*	[40 - 90 %]	***NOTICE*** **This parameter cannot be adjusted while the motor is running.** Enter the level of motor magnetisation at low speed. Selection of a low value reduces energy loss in the motor, but also reduces load capability.

NOTICE

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

14-41 AEO Minimum Magnetisation		
Range:		**Function:**
66 %*	[40 - 75 %]	Enter the minimum allowable magnetisation for AEO. Selection of a low value reduces energy loss in the motor, but can also reduce resistance to sudden load changes.

4.13.6 14-5* Environment

These parameters help the frequency converter to operate under special environmental conditions.

14-50 RFI Filter		
Option:		**Function:**
[0]	Off	
[1]	On	
[2] *	Grid Type	

14-51 DC-Link Voltage Compensation		
Option:		**Function:**
[0]	Off	Disables DC-link compensation.
[1] *	On	Enables DC-link compensation.

14-52 Fan Control		
This feature is only available in frequency converters from 11 to 75 kW.		
Option:		**Function:**
[5] *	Constant-on mode	
[6]	Constant-off mode	
[7]	On-when-Inverter-is-on-else-off Mode	
[8]	Variable-speed mode	

14-55 Output Filter		
Option:		**Function:**
		NOTICE **This parameter cannot be changed while the motor is running.** Select the type of output filter connected.
[0] *	No Filter	
[1]	Sine-Wave Filter	

4.13.7 14-6* Auto Derate

Use this parameter group to configure automatic derating for the output current of the frequency converter.

14-63 Min Switch Frequency		
Option:		**Function:**
		Set the minimumn switch frequency allowed by the output filter.
[2] *	2.0 kHz	
[3]	3.0 kHz	
[4]	4.0 kHz	
[5]	5.0 kHz	
[6]	6.0 kHz	
[7]	8.0 kHz	
[8]	10.0 kHz	
[9]	12.0 kHz	
[10]	16.0 kHz	

14-64 Dead Time Compensation Zero Current Level		
Option:		**Function:**
[0] *	Disabled	
[1]	Enabled	

14-65 Speed Derate Dead Time Compensation		
Range:		**Function:**
Size related*	[20 - 1000 Hz]	Deadtime compensation level is reduced linearly versus output frequency from the maximum level set in *parameter 14-07 Dead Time Compensation Level* to a minimum level set in this parameter.

4.13.8 14-8* Options

14-89 Option Detection		
Option:		**Function:**
[0] *	Protect Option Config.	
[1]	Enable Option Change	

4.13.9 14-9* Fault Settings

Use the parameters to configure the fault settings.

14-90 Fault Level		
Use this parameter to customise fault levels.		
Option:		**Function:**
[3] *	Trip Lock	
[4]	Trip w. delayed reset	
[5]	Flystart	

Index	Alarm	Trip lock	Trip w. delayed	Flystart
0	Reserved			
1	Reserved			
2	Reserved			
3	Reserved			
4	Reserved			
5	Reserved			
6	Reserved			
7	Over Current	D	x	x

Table 4.8 Table for Selection of Action when Selected Alarm Appears (*parameter 14-90 Fault Level*)

D=Default setting
x=possible selection

4

4.14 Parameters: 15-** Drive Information

4.14.1 15-0* Operating Data

15-00 Operating hours		
Range:		**Function:**
0 h*	[0 - 0x7fffffff. 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 - 0x7fffffff. h]	View how many hours the frequency converter 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]	Registering the power consumption of the motor as a mean 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, which have occurred.

15-05 Over Volt's		
Range:		**Function:**
0*	[0 - 65535]	View the number of frequency converter overvoltages, which have occurred.

15-06 Reset kWh Counter		
Option:		**Function:**
[0] *	Do not reset	No reset of the kWh counter is desired.
[1]	Reset counter	Press [OK] to reset the kWh counter to zero (see *parameter 15-02 kWh Counter*).

NOTICE

The reset is carried out by pressing [OK].

15-07 Reset Running Hours Counter		
Option:		**Function:**
[0] *	Do not reset	
[1]	Reset counter	Press [OK] to reset the running hours counter to zero (see *parameter 15-01 Running Hours*.

4.14.2 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. Error codes, values, and time stamp can be viewed for all logged data.

15-30 Alarm Log: Error Code		
Range:		**Function:**
0*	[0 - 255]	View the error code and look up its meaning in *chapter 6 Troubleshooting*.

15-31 InternalFaultReason		
Range:		**Function:**
0*	[-32767 - 32767]	View an extra description of the error. This parameter is mostly used in combination with *Alarm 38 Internal Fault*.

4.14.3 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 - 0]	View the frequency converter type. The readout is identical to the power field of the typecode definition, characters 1–6.

15-41 Power Section		
Range:		**Function:**
0*	[0 - 20]	View the FC type. The readout is identical to the power field of the typecode definition, characters 7–10.

15-42 Voltage		
Range:		**Function:**
0*	[0 - 20]	View the FC type. The readout is identical to the power field type of the typecode 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 re-ordering the frequency converter in its original configuration.

15-45 Actual Typecode String		
Range:	**Function:**	
0*	[0 - 40]	View the actual typecode.

15-46 Drive Ordering No		
Range:	**Function:**	
0*	[0 - 0]	View the 8-digit ordering number used for re-ordering the frequency converter in its original configuration.

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.

4.14.4 15-6* Option Indent.

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		
Range:	**Function:**	
Size related*	[0 - 30]	View the installed option type.

15-61 Option SW Version		
Range:	**Function:**	
Size related*	[0 - 20]	View the installed option software version.

15-62 Option Ordering No		
Range:	**Function:**	
Size related*	[0 - 8]	Shows the ordering number for the installed options.

15-63 Option Serial No		
Range:	**Function:**	
Size related*	[0 - 18]	View the installed option serial number.

15-70 Option in Slot A		
Range:	**Function:**	
0*	[0 - 30]	View the type code string for the option installed in slot A, and a translation of the type code string.

15-71 Slot A Option SW Version		
Range:	**Function:**	
0*	[0 - 20]	View the software version for the option installed in slot A.

4.14.5 15-9* Parameter Info

Use this parameter group to view information about available parameters for the frequency converter.

15-92 Defined Parameters		
Range:	**Function:**	
0*	[0 - 2000]	View a list of all defined parameters in the frequency converter. The list ends with 0.

15-97 Application Type		
Range:	**Function:**	
0*	[0 - 0xFFFFFFFF]	This parameter contains data used by the MCT10 software tool.

15-98 Drive Identification		
Range:	**Function:**	
0*	[0 - 56]	This parameter contains data used by the MCT10 software tool.

15-99 Parameter Metadata		
Range:	**Function:**	
0*	[0 - 9999]	This parameter contains data used by the MCT10 software tool.

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.

16-01 Reference [Unit]		
Range:		**Function:**
0 ReferenceFeedbackUnit*	[-4999 - 4999 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*.

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 %*	[-200 - 200 %]	View the 2-byte word sent with the status word to the bus master reporting the main actual value.

16-09 Custom Readout		
Range:		**Function:**
0 CustomReadoutUnit*	[0 - 9999 CustomReadoutUnit]	View the custom readout from *parameter 0-30 Custom Readout Unit* to *parameter 0-32 Custom Readout Max Value*.

4.15.2 16-1* Motor Status

16-10 Power [kW]		
Range:		**Function:**
0 kW*	[0 - 1000 kW]	Displays motor power in kW. The calculated value shown is based on the actual motor voltage and motor current. The value is filtered, and therefore approximately 30 ms 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 - 1000 hp]	View the motor power in HP. The value shown is calculated on the basis of the actual motor voltage and motor current. The value is filtered, and therefore approximately 30 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 - 65535 V]	View the motor voltage, a calculated value is used for controlling the motor.

16-13 Frequency		
Range:		**Function:**
0 Hz*	[0 - 6553.5 Hz]	View the motor frequency, without resonance dampening.

16-14 Motor current		
Range:		**Function:**
0 A*	[0 - 655.35 A]	View the motor current measured as a mean value, I_{RMS}. The value is filtered, and thus approximately 30 ms may pass from when an input value changes to when the data readout values change.

16-15 Frequency [%]		
Range:		**Function:**
0 %*	[0 - 6553.5 %]	View a 2-byte word reporting the actual motor frequency (without resonance dampening) as a percentage (scale 0000-4000 hex) of *4-19 Max Output Frequency*.

16-16 Torque [Nm]		
Range:		**Function:**
0 Nm	[-30000 - 30000 Nm]	View the torque value with sign, applied to the motor shaft. Some motors supply more than 160% torque. Consequently, the minimum value and the maximum value

16-16 Torque [Nm]		
Range:		**Function:**
		depend on the maximum motor current as well as the motor used.

16-18 Motor Thermal		
Range:		**Function:**
0 %*	[0 - 100 %]	View the calculated thermal load on the motor. The cut-out limit is 100%. The basis for calculation is the ETR function selected in *parameter 1-90 Motor Thermal Protection*.

16-22 Torque [%]		
Range:		**Function:**
0 %*	[-200– 200 %]	View the torque in percent of nominal torque, with sign, applied to the motor shaft.

4.15.3 16-3* Drive Status

16-30 DC Link Voltage		
Range:		**Function:**
0 V*	[0 - 65535 V]	View a measured value. The value is filtered with a 30 ms time constant.

16-33 Brake Energy /2 min		
Range:		**Function:**
0 kW*	[0 - 10000 kW]	View the brake power transmitted to an external brake resistor. The mean power is calculated on an average level based on the selected time period within *2-13 Brake Power Monitoring*.

16-34 Heatsink Temp.		
Range:		**Function:**
0 °C*	[-128 - 127 °C]	View the frequency converter heat sink temperature. The cut-out limit is 90 ±5 °C, and the motor cuts back in at 60 ±5 °C.

16-35 Inverter Thermal		
Range:		**Function:**
0 %*	[0 - 255 %]	View the percentage load on the inverter.

16-36 Inv. Nom. Current		
Range:		**Function:**
0 A*	[0 - 655.35 A]	View the inverter nominal current, which should match the nameplate data on the connected motor. The data are used for calculation of torque, motor protection, etc.

16-37 Inv. Max. Current		
Range:		**Function:**
0 A*	[0 - 655.35 A]	View the inverter maximum current, which should match the nameplate data on the connected motor. The data are used for calculation of torque, motor protection, etc.

16-38 SL Controller State		
Range:		**Function:**
0*	[0 - 20]	View the state of the event under execution by the SL controller.

16-39 Control Card Temp.		
Range:		**Function:**
0 °C*	[0 - 65535 °C]	View the temperature on the control card, stated in °C.

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, bus and freeze references, plus catch-up and slow-down.

16-52 Feedback[Unit]		
Range:		**Function:**
0 ProcessCtrlUnit*	[-4999 - 4999 ProcessCtrlUnit]	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 torque value with sign, applied to the motor shaft. Some motors supply more than 160% torque. Consequently, the minimum value and the maximum value depend on the maximum motor current as well as the motor used.

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

16-57 Feedback [RPM]		
Range:		**Function:**
		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 - 65535]	View the actual state of the digital inputs 18, 19, 27 and 29.

Bit 0	Unused
Bit 1	Unused
Bit 2	Digital input term. 29
Bit 3	Digital input term. 27
Bit 4	Digital input term. 19
Bit 5	Digital input term. 18
Bit 6-15	Unused

Table 4.9 Bits Definition

16-61 Terminal 53 Setting		
Option:		**Function:**
		View the setting of input terminal 53.
[0]	Current mode	
[1]	Voltage mode	

16-62 Analog Input 53		
Range:		**Function:**
1*	[0 - 20]	View the actual value at input 53.

16-63 Terminal 54 Setting		
Option:		**Function:**
		View the setting of input terminal 54.
[0]	Current mode	
[1]	Voltage mode	

16-64 Analog Input AI54		
Range:		**Function:**
1*	[0 - 20]	View the actual value at input 54.

16-65 Analog Output 42 [mA]		
Range:		**Function:**
0 mA*	[0 - 20 mA]	View the actual value at output 42. The value shown reflects the selections in *6-90 Terminal 42 Mode* and *parameter 6-91 Terminal 42 Analog Output*.

16-66 Digital Output		
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 Pulse 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 impulses 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 to terminal 29 in digital output mode.

16-71 Relay Output		
Range:		**Function:**
0*	[0 - 65535]	View the settings of all relays.

16-72 Counter A		
Range:		**Function:**
0*	[-32768 - 32767]	View the present value of counter A. Counters are useful as comparator operands, see *parameter 13-10 Comparator Operand*. The value can be reset or changed 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*	[-32768 - 32767]	View the present value of counter B. Counters are useful as comparator operands (*parameter 13-10 Comparator Operand*). The value can be reset or changed either via digital inputs (parameter group *5-1* Digital Inputs*) or by using an SLC action (*parameter 13-52 SL Controller Action*).

16-79 Analog Output AO45		
Range:		**Function:**
0 mA*	[0 - 20 mA]	View the actual value at output 45 in mA. The value shown reflects the selection in *6-70 Terminal 45 Mode* and *parameter 6-71 Terminal 45 Analog Output*.

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 two-byte Control word (CTW) received from the Bus-Master. Interpretation of the CTW depends on the fieldbus option installed and the CTW profile selected in *8-10 Control Word Profile*. For more information see relevant fieldbus manuals.

16-82 Fieldbus REF 1		
Range:		**Function:**
0*	[-32768 - 32767]	View the two-byte word sent with the control word form the Bus-Master to set the reference value. For more information please refer to the relevant fieldbus manual.

16-84 Comm. Option STW		
Range:		**Function:**
0*	[0 - 65535]	View the extended fieldbus comm. option status word. For more information please refer to the relevant fieldbus manual.

16-85 FC Port CTW 1		
Range:		**Function:**
1084*	[0 - 65535]	View the two-byte Control word (CTW) received from the Bus-Master. Interpretation of the Control word depends on the fieldbus option installed and the Control word profile selected in *8-10 Control Word Profile*.

16-86 FC Port REF 1		
Range:		**Function:**
0*	[-32768 - 32767]	View the last received reference from the FC port.

4.15.7 16-9* Diagnosis Readouts

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

16-90 Alarm Word		
Range:		**Function:**
0*	[0 - 0xFFFFFFFFUL]	View the alarm word sent via the serial communication port in hex code.

16-91 Alarm Word 2		
Range:		**Function:**
0*	[0 - 0xFFFFFFFFUL]	View the alarm word 2 sent via the serial communication port in hex code.

16-92 Warning Word		
Range:		**Function:**
0*	[0 - 0xFFFFFFFFUL]	View the warning word sent via the serial communication port in hex code.

16-93 Warning Word 2		
Range:		**Function:**
0*	[0 - 0xFFFFFFFFUL]	View the warning word 2 sent via the serial communication port in hex code.

16-94 Ext. Status Word		
Range:		**Function:**
0*	[0 - 0xFFFFFFFFUL]	Returns the extended status word sent via the serial communication port in hex code.

16-95 Ext. Status Word 2		
Range:		**Function:**
0*	[0 - 0xFFFFFFFFUL]	Returns the extended status word 2 sent via the serial communication port in hex code.

4.16 Parameters: 17-** Feedback Options

4.16.1 17-1* Inc.Enc.Interface

17-10 Signal Type		
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, which is the number of pulses or periods per revolution.

4.16.2 17-5* Resolver Interface

17-50 Poles		
Range:		**Function:**
2*	[2 - 2]	

17-51 Input Voltage		
Range:		**Function:**
7 V*	[2 - 8 V]	

17-52 Input Frequency		
Range:		**Function:**
10 kHz*	[2 - 15 kHz]	

17-53 Transformation Ratio		
Range:		**Function:**
0.5*	[0.1 - 1.1]	

17-56 Encoder Sim. Resolution		
Option:		**Function:**
[0] *	Disabled	
[1]	512	
[2]	1024	
[3]	2048	
[4]	4096	

17-59 Resolver Interface		
Option:		**Function:**
[0] *	Disabled	
[1]	Enabled	

4.16.3 17-6* Monitoring and App.

17-60 Feedback Direction		
Option:		**Function:**
[0] *	Clockwise	
[1]	Counter clockwise	

17-61 Feedback Signal Monitoring		
Option:		**Function:**
[0]	Disabled	
[1] *	Warning	
[2]	Trip	
[3]	Jog	
[4]	Freeze Output	
[5]	Max Speed	
[6]	Switch to Open Loop	

4.17 Parameters: 18-** Data Readouts 2

4.17.1 18-8* Center Winder Readout

18-81 Tension PID Output		
Range:		**Function:**
0 Hz	[-5000 - 5000 Hz]	Read only parameter used to display the output of the tension loop PID.

18-82 Center Winder Output		
Range:		**Function:**
0 Hz	[-5000 - 5000 Hz]	Read only parameter used to display the output of the tension loop PID.

18-83 Line Speed		
Range:		**Function:**
0 Hz	[-5000 - 5000 Hz]	Read only parameter used to display the output of the tension loop PID.

18-84 Diameter		
Range:		**Function:**
0 %*	[0 - 100 %]	

18-85 Tapered Tension Set Point		
Range:		**Function:**
0 %*	[0 - 100 %]	

18-86 Tension Feedback		
Range:		**Function:**
0 %*	[0 - 100 %]	

4.17.2 18-9* PID Readouts

18-90 Process PID Error		
Range:		**Function:**
0 %*	[-200 - 200 %]	Gives the present error value used by the process PID controller.

18-91 Process PID Output		
Range:		**Function:**
0 %*	[-200 - 200 %]	Gives the present raw output value from the process PID controller.

18-92 Process PID Clamped Output		
Range:		**Function:**
0 %*	[-200 - 200 %]	Gives 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 %]	Gives the present output value from the process PID controller after the clamp limits have been observed and the resulting value has been gain scaled.

4

4.18 Parameters: 21-** Ext. Closed Loop

4.18.1 21-0* Ext. CL Autotuning

21-09 Extended PID Enable

Select the Extended CL PID controller that is to be autotuned.

Option:		Function:
[0] *	Disabled	
[1]	Enabled Ext CL1 PID	

4.18.2 21-1* Ext. Closed-loop Reference/ feedback

21-11 Ext. 1 Minimum Reference

Range:		Function:
0 ExtPID1Unit	[-999999.999 - 999999.999 ExtPID1Unit]	This parameter sets the minimum value that can be obtained by the sum setpoint and reference.

21-12 Ext. 1 Maximum Reference

Range:		Function:
100 ExtPID1Unit	[-999999.999 - 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	

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	

21-15 Ext. 1 Setpoint

This parameter is used as the reference to compare the feedback values with. The setpoint can be offset with digital, analogue or bus references.

Range:		Function:
0 ExtPID1Unit*	[-999999.999 - 999999.999 ExtPID1Unit]	

21-17 Ext. 1 Reference [Unit]

Returns the resulting reference value.

Range:		Function:
0 ExtPID1Unit*	[-999999.999 - 999999.999 ExtPID1Unit]	

21-18 Ext. 1 Feedback [Unit]

Returns the feedback value.

Range:		Function:
0 ExtPID1Unit*	[-999999.999 - 999999.999 ExtPID1Unit]	

21-19 Ext. 1 Output [%]

Returns the Ext. Closed Loop 1 PID controller output value.

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

21-20 Ext. 1 Normal/Inverse Control

Select Normal if the controller output should be reduced when the feedback is higher than the reference. Select 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

The proportional gain indicates the number of times the error between the set point and the feedback signal is to be applied.

Range:		Function:
0.01*	[0 - 10]	

21-22 Ext. 1 Integral Time

The integrator provides an increasing gain at a constant error between the set point and the feedback signal. The integral time is the time needed by the integrator to reach the same gain as the proportional gain.

Range:		Function:
10000 s*	[0.01 - 10000 s]	

21-23 Ext. 1 Differentation Time

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.

Range:		Function:
0 s*	[0 - 10 s]	

21-24 Ext. 1 Dif. Gain Limit		
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		
Range:		**Function:**
5*	[1 - 50]	

4.19 Parameters: 22-** Application Functions

4.19.1 22-4* Sleep Mode

The sequence when running sleep mode in open loop:

1. The motor speed is less than *parameter 22-47 Sleep Speed [Hz]* and the motor has been running longer than *parameter 22-40 Minimum Run Time*.
2. The frequency converter ramps the motor speed down to *parameter 1-82 Min Speed for Function at Stop [Hz]*.
3. The frequency converter activates *1-80 Function at Stop*. The frequency converter is now in sleep mode.
4. The frequency converter compares the speed setpoint with *parameter 22-43 Wake-Up Speed [Hz]* to detect wake-up situation.
5. The speed setpoint is greater than *parameter 22-43 Wake-Up Speed [Hz]* and the sleep condition has last for more than *parameter 22-41 Minimum Sleep Time*. The frequency converter is now out of sleep mode.
6. Go back to speed open loop control (ramp motor speed up to the speed setpoint).

The sequence when running sleep mode in closed loop:

1. If *20-81 PI Normal/ Inverse Control=[0] Normal*. When error between reference and feedback is greater than *22-44 Wake-Up Ref./FB Diff*, the frequency converter enters boost status. If *22-45 Setpoint Boost* is not set, the frequency converter enters sleep mode.
2. After *22-46 Maximum Boost Time*, the frequency converter ramps the motor speed down to *parameter 1-82 Min Speed for Function at Stop [Hz]*.
3. The frequency converter activates *1-80 Function at Stop*. The frequency converter is now in sleep mode.
4. When the error between reference and feedback is greater than *22-44 Wake-Up Ref./FB Diff*, and the condition lasts more than *parameter 22-41 Minimum Sleep Time*, the frequency converter is out of sleep mode.
5. The frequency converter reverts to closed-loop control.

NOTICE

Sleep mode is not active when local reference is active (set speed manually with navigation keys on the LCP). Does not work in *Hand On* mode. Auto set-up in open loop must be carried out before setting input/output in closed loop.

22-40 Minimum Run Time		
Range:		**Function:**
10 s*	[0 - 600 s]	Set the desired 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 desired minimum time for staying in sleep mode. This overrides any wake-up conditions.

22-43 Wake-Up Speed [Hz]		
Range:		**Function:**
10*	[0 - 400.0]	Only to be used if *1-00 Configuration Mode*, is set for open loop and speed reference is applied by an external controller. Set the reference speed at which the sleep mode should be deactivated

22-44 Wake-Up Ref./FB Diff		
Range:		**Function:**
10 %*	[0 - 100 %]	Only to be used if *parameter 1-00 Configuration Mode* is set for 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 cancelling the sleep mode.

22-45 Setpoint Boost		
Range:		**Function:**
0 %*	[-100 - 100 %]	Only to be used if *parameter 1-00 Configuration Mode* is set for 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 setting for 5%, the boost pressure is be P_{set}*1.05. The negative values can used for example 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 if *parameter 1-00 Configuration Mode* is set for 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.

22-47 Sleep Speed [Hz]		
Range:		**Function:**
0*	[0 - 400.0]	Set the speed below which the frequency converter goes into sleep mode.

4.19.2 22-6* Broken Belt Detection

Use broken belt detection in both closed 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*), and the frequency converter output frequency is above or equal to 15 Hz, *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 a broken belt warning [W95]. 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 a broken belt alarm [A95]. A frequency converter digital outputs or a serial communication bus communicates an alarm to other equipment.

22-61 Broken Belt Torque		
Range:		**Function:**
10 %*	[5 - 100 %]	Sets 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]	High starting torque time for PM motors in VVC+ mode without feedback.

30-21 High Starting Torque Current [%]		
Range:		**Function:**
Size related*	[0 - 200.0 %]	High starting torque time for PM motors in VVC+ mode without feedback.

30-22 Locked Rotor Protection		
Option:		**Function:**
[0] *	Off	
[1]	On	The locked rotor protection for PM motors.

30-23 Locked Rotor Detection Time [s]		
Range:		**Function:**
0.10 s*	[0.05 - 1 s]	The locked rotor detection time for PM motors.

4.21 Parameters: 32-** Motion Control Basic Settings

32-11 User Unit Denominator		
Range:		**Function:**
1*	[1 - 65535]	

32-12 User Unit Numerator		
Range:		**Function:**
1*	[1 - 65535]	

32-67 Max. Tolerated Position Error		
Range:		**Function:**
2000000*	[1 - 2147483648]	

32-80 Maximum Allowed Velocity		
Range:		**Function:**
1500 RPM*	[1 - 30000 RPM]	

32-81 Motion Ctrl Quick Stop Ramp		
Range:		**Function:**
1000 ms*	[50 - 3600000 ms]	

4.22 Parameters: 33-** Motion Control Adv. Settings

33-00 Homing Mode		
Select the homing mode.		
Option:		**Function:**
[0] *	Not forced	
[1]	Forced manual homing	
[2]	Forced automated homing	

33-01 Home Offset		
Range:		**Function:**
0*	[-1073741824 - 1073741824]	

33-02 Home Ramp Time		
Range:		**Function:**
10 ms*	[1 - 1000 ms]	

33-03 Homing Velocity		
Range:		**Function:**
100 RPM*	[-1500 - 1500 RPM]	

33-04 Homing Behaviour		
Option:		**Function:**
		Define the behaviour when the home switch is found: Reversing without index (0 pulse) search, or forwarding without index search.
[1] *	Reverse no index	
[3]	Forward no index	

33-41 Negative Software Limit		
Range:		**Function:**
-500000*	[-1073741824 - 1073741824]	

33-42 Positive Software Limit		
Range:		**Function:**
500000*	[-1073741824 - 1073741824]	

33-43 Negative Software Limit Active		
When this parameter is set to active, the frequency converter continuously checks whether the target position is below the negative software limit. If it occurs, an error is issued and the frequency converter control is switched off.		
Option:		**Function:**
[0] *	Inactive	
[1]	Active	

33-44 Positive Software Limit Active		
When this parameter is set to active, the frequency converter continuously checks whether the target position is above the positive software limit. If it occurs, an error is issued and the frequency converter control is switched off.		
Option:		**Function:**
[0] *	Inactive	

33-44 Positive Software Limit Active

When this parameter is set to active, the frequency converter continuously checks whether the target position is above the positive software limit. If it occurs, an error is issued and the frequency converter control is switched off.

Option:		Function:
[1]	Active	

33-47 Target Position Window

Defines the size of the target window with user unit. A position is only viewed as reached when the actual position is within this window.

Range:		Function:
0*	[0 - 10000]	

4.23 Parameters: 34-** Motion Control Data Readouts

4.23.1 34-0* PCD Writer Par.

Parameters for readout of fieldbus data received from fieldbus master.

4

34-01 PCD 1 Write For Application

Value received in PCD1 of fieldbus telegram.

Range:		Function:
0*	[0 - 65535]	

34-02 PCD 2 Write For Application

Value received in PCD2 of fieldbus telegram.

Range:		Function:
0*	[0 - 65535]	

34-03 PCD 3 Write For Application

Value received in PCD3 of fieldbus telegram.

Range:		Function:
0*	[0 - 65535]	

34-04 PCD 4 Write For Application

Value received in PCD4 of fieldbus telegram.

Range:		Function:
0*	[0 - 65535]	

34-05 PCD 5 Write For Application

Value received in PCD5 of fieldbus telegram.

Range:		Function:
0*	[0 - 65535]	

34-06 PCD 6 Write For Application

Value received in PCD6 of fieldbus telegram.

Range:		Function:
0*	[0 - 65535]	

34-07 PCD 7 Write For Application

Value received in PCD7 of fieldbus telegram.

Range:		Function:
0*	[0 - 65535]	

34-08 PCD 8 Write For Application

Value received in PCD8 of fieldbus telegram.

Range:		Function:
0*	[0 - 65535]	

34-09 PCD 9 Write For Application

Value received in PCD9 of fieldbus telegram.

Range:		Function:
0*	[0 - 65535]	

34-10 PCD 10 Write For Application

Value received in PCD10 of fieldbus telegram.

Range:		Function:
0*	[0 - 65535]	

4.23.2 34-2* PCD Read Par.

Parameters for readout of fieldbus data sent to the fieldbus master.

34-21 PCD 1 Read For Application

Value sent in PCD1 of fieldbus telegram.

Range:		Function:
0*	[0 - 65535]	

34-22 PCD 2 Read For Application

Value sent in PCD2 of fieldbus telegram.

Range:		Function:
0*	[0 - 65535]	

34-23 PCD 3 Read For Application

Value sent in PCD3 of fieldbus telegram.

Range:		Function:
0*	[0 - 65535]	

34-24 PCD 4 Read For Application

Value sent in PCD4 of fieldbus telegram.

Range:		Function:
0*	[0 - 65535]	

34-25 PCD 5 Read For Application

Value sent in PCD5 of fieldbus telegram.

Range:		Function:
0*	[0 - 65535]	

34-26 PCD 6 Read For Application

Value sent in PCD6 of fieldbus telegram.

Range:		Function:
0*	[0 - 65535]	

34-27 PCD 7 Read For Application

Value sent in PCD7 of fieldbus telegram.

Range:		Function:
0*	[0 - 65535]	

34-28 PCD 8 Read For Application

Value sent in PCD8 of fieldbus telegram.

Range:		Function:
0*	[0 - 65535]	

34-29 PCD 9 Read For Application

Value sent in PCD9 of fieldbus telegram.

Range:		Function:
0*	[0 - 65535]	

34-30 PCD 10 Read For Application		
Value sent in PCD10 of fieldbus telegram.		
Range:		**Function:**
0*	[0 - 65535]	

4.23.3 34-5* Process Data

Readout of process data for motion control.

34-50 Actual Position		
The actual position in user unit.		
Range:		**Function:**
0*	[-1073741824 - 1073741824]	

34-56 Track Error		
Readout of the error between calculated command position and actual position in UU.		
Range:		**Function:**
0*	[-2147483647 - 2147483647]	

4.24 Parameters: 37-** Application Settings

4.24.1 37-0* Application Mode

37-00 Application Mode

Option:		Function:
[0] *	Drive mode	
[1]	Center winder	
[2]	Position control	

4.24.2 37-1* Position Control

37-01 Pos. Feedback Source

Select position feedback source.

Option:		Function:
[1] *	MCB102	
[2]	MCB103	

37-02 Pos. Target

If *parameter 37-03 Pos. Type* is set to *[0] Absolute*, the target position is an absolute position (relative to home position). If the *parameter 37-03 Pos. Type* is set to *[1] Relative* and the last position was obtained through jogging, the target position is relative to that position. If the last position was reached as a result of a positioning command, then the target position is relative to the last target position no matter whether it was reached or not.

Range:		Function:
0*	[-1073741824 - 1073741824]	

37-03 Pos. Type

This parameter defines the target position type.

Option:		Function:
[0] *	Absolute	
[1]	Relative	

37-04 Pos. Velocity

Defines the velocity during positioning. The maximum value must not exceed the value specified in *parameter 32-80 Maximum Allowed Velocity*.

Range:		Function:
100 RPM*	[1 - 30000 RPM]	

37-05 Pos. Ramp Up Time

Defines the time in milliseconds that it takes to ramp from standstill to *parameter 32-80 Maximum Allowed Velocity*.

Range:		Function:
5000 ms*	[50 - 100000 ms]	

37-06 Pos. Ramp Down Time

It is defined as the time in milliseconds that it takes to ramp from *parameter 32-80 Maximum Allowed Velocity* to standstill.

Range:		Function:
5000 ms*	[50 - 100000 ms]	

37-07 Pos. Auto Brake Ctrl

When the automatic brake control function is disabled, the frequency converter controls the application also at standstill. When the automatic brake control function is enabled, the mechanical brake is automatically activated every time the application is at standstill for a time period specified in *parameter 37-08 Pos. Hold Delay*.

Option:		Function:
[0]	Disable	
[1] *	Enable	

37-08 Pos. Hold Delay

To be used with the automatic brake control function. The hold delay is a waiting period in which the brake is not activated even though the application is at standstill.

Range:		Function:
0 ms*	[0 - 10000 ms]	

37-09 Pos. Coast Delay

To be used with the automatic brake control function. The coast delay is the delay from activating the mechanical brake to disabling the controller and coasting the frequency converter.

Range:		Function:
200 ms*	[0 - 1000 ms]	

37-10 Pos. Brake Delay

To be used with the automatic brake control function. The brake delay is the delay after activating the control and magnetising the motor before opening the brake.

Range:		Function:
200 ms*	[0 - 1000 ms]	

37-11 Pos. Brake Wear Limit

Set this parameter to a positive value. While the brake is activated, if the frequency converter moves more than the limit in UU set in this parameter, the frequency converter reports an alarm *POSITION CTRL FAULT* with fault reason *Brake Wear Limit Exceeded*.

Range:		Function:
0*	[0 - 1073741824]	

37-12 Pos. PID Anti Windup

Configure whether to enable the anti-windup of positioning PID.

Option:		Function:
[0]	Disable	
[1] *	Enable	

37-13 Pos. PID Output Clamp

This parameter clamps the total output of the PID. A setting of 1000 corresponds to 100% of *parameter 32-80 Maximum Allowed Velocity*.

Range:		Function:
1000*	[1 - 10000]	

37-14 Pos. Ctrl. Source

Selects the control source for positioning control.

Option:		Function:
[0] *	DI	
[1]	FieldBus	

37-15 Pos. Direction Block

Use this parameter to configure whether to block a direction, and the direction to be blocked.

Option:		Function:
[0] *	No Blocking	
[1]	Block Reverse	
[2]	Block Forward	

37-16 Pos. Power Recovery

Configures whether to enable the power recovery function.

Option:		Function:
[0]	Disable	
[1] *	Enable	

37-17 Pos. Ctrl Fault Behaviour

This parameter determines the behaviour of the frequency converter after a fault is detected.

Option:		Function:
[0] *	Ramp Down&Brake	
[1]	Brake Directly	

37-18 Pos. Ctrl Fault Reason

READ-ONLY PARAMETER: The current fault reason of the alarm *POSITION CTRL FAULT* is displayed in this parameter.

Option:		Function:
[0] *	No Fault	
[1]	Homing Needed	
[2]	Pos. HW Limit	
[3]	Neg. HW Limit	
[4]	Pos. SW Limit	
[5]	Neg. SW Limit	
[7]	Brake Wear Limit	
[8]	Quick Stop	
[9]	PID Error Too Big	
[12]	Rev. Operation	
[13]	Fwd. Operation	
[20]	Can not find home position	

37-19 Pos. New Index

The currently latched index number.

Range:		Function:
0*	[0 - 255]	

4.24.3 37-2* Center Winder

37-20 Winder Mode Selection

Use the machine for either winding or unwinding.

Option:		Function:
[0] *	Wind	
[1]	Unwind	

37-21 Tension Set Point

Set the desired running tension.

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

37-22 Taper Set Point

Use this parameter to change the tension setpoint while the diameter increases.

Range:		Function:
0 %*	[-110 - 110 %]	

37-23 Partial Roll Diameter Value

Use this parameter to preset the diameter when a partial roll is loaded on the winder. For unwinding applications, use this parameter to set the full roll diameter.

Range:		Function:
5 %*	[5 - 100 %]	

37-24 Core1 Diameter

Set the main core value to be used on the winder. This parameter must be set for the smallest core diameter for both winding and unwinding applications.

Range:		Function:
5 %*	[5 - 100 %]	

37-25 Core2 Diameter

Set a secondary core diameter for winding applications, or a secondary full roll diameter for unwinding applications.

Range:		Function:
5 %*	[5 - 100 %]	

37-26 Winder Jog Speed

Set the winder jog speed percentage. This percentage value is used for both forward and reverse jogging speed.

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

37-27 TLD Low Limit

Set the low limit for the tension limit detection.

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

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37-28 TLD High Limit

Set the high limit for the tension limit detection.

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

37-29 TLD Timer

Sets the time within which the tension must exceed the high or low tension limit.

Range:		Function:
0.001 s*	[0.001 - 5 s]	

37-30 TLDOnDelay

Enable this parameter to allow time for the winder to stabilize the web tension. As soon as the tension moves within the low and high tension limits, the TLD function begins operating normally. This function can be useful during a quick machine start with a slack web. This function is only active while running.

Option:		Function:
[0]	Disabled	
[1] *	Enabled	

37-31 Diameter Limit Detector

When the calculated roll diameter reaches the set diameter, the corresponding digital output is turned on to indicate the end of the roll. This indicates a full roll when winding and an empty roll when unwinding.

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

37-32 Initial Diameter Measurement

It is possible to connect a roll diameter sensor to one of the frequency converter analog inputs. This signal can be used to make the controller use a measured initial diameter, rather than a diameter size set by parameters.

Option:		Function:
[0] *	Set diameter when diameter reset	
[1]	Set diameter based on analog signal	

37-33 Diameter Measurement Input

Use this parameter to set the analog input used for diameter measurement.

Option:		Function:
[0] *	No Function	
[1]	Input53(0~10 VDC or 0~20 mA)	
[2]	Input54(0~10 VDC or 0~20 mA)	

37-34 Reading at Core

Use this parameter to set the analog input signal reading at the smallest core used.

Range:		Function:
0*	[0 - 10]	

37-35 Reading at Full Roll

Use this parameter to set the analog input signal reading at the full roll size used.

Range:		Function:
0 V*	[0 - 20 V]	

37-36 Tension Set Point Input

Use this parameter to set the source of the tension set point.

Option:		Function:
[0] *	Par.3721	
[1]	Input53(0~10 VDC or 0~20 mA)	
[2]	Input54(0~10 VDC or 0~20 mA)	

37-37 Taper Set Point Input

Use this parameter to set the source of the taper set point.

Option:		Function:
[0] *	Par.3722	
[1]	Input53(0~10 VDC or 0~20 mA)	
[2]	Input54(0~10 VDC or 0~20 mA)	

37-38 Tension Feedback Input

Use this parameter to set analog input used for tension feedback.

Option:		Function:
[0] *	No Function	
[1]	Input53(0~10 VDC or 0~20 mA)	
[2]	Input54(0~10 VDC or 0~20 mA)	

37-39 Tension Feedback Type

Selects the device type used for tension feedback.

Option:		Function:
[0] *	Load cell	
[1]	Dancer	

37-40 Center Winder Cmd Src

Use this parameter to configure the command source for controlling.

Option:		Function:
[0]	Digital and parameter	
[1] *	Parameter 3754~3759 control the functions	
[2]	Digital input control	

37-41 Diameter Change Rate

Sets the amount of changes allowed for the diameter in each program scan.

Range:		Function:
0.001 %*	[0.001 - 0.05 %]	

37-42 Tapered Tension Change Rate

Sets the amount of tapered tension that can change during each scan period. This function ramps the tapered tension setpoint to the preset value when the user changes either the tension or taper setpoints. This ensures stability during step changes in setpoints.

Range:		Function:
0.1 %*	[0.1 - 1 %]	

37-43 Diameter Calculator Min Speed

Sets the minimum line speed to be achieved before the diameter calculator is activated. At low line speeds, the resolution of the line and winder speed are too low for the diameter to be accurately calculated.

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

37-44 Line Acceleration Feed Forward

Sets the feed forward speed that helps compensate for tension changes caused by line speed acceleration and deceleration.

Range:		Function:
0*	[-20 - 20]	

37-45 Line Speed Source

Use this parameter to set the input for line speed.

Option:		Function:
[0] *	No function	
[1]	24V encoder	
[2]	MCB102	
[3]	MCB103	
[4]	Analog input 53	
[5]	Analog input 54	
[6]	Frequency input 29	
[7]	Frequency input 33	

37-46 Winder Speed Match Scale

This parameter is used to match the surface speeds of line and winder at smallest core while running line at 100 % speed.

Range:		Function:
1*	[0.001 - 1000]	

37-47 Tension PID Profile

Allows scaling the tension loop PID output to compensate for roll diameter. Ideally, the output from the tension loop PID amplifier is halved each time the diameter doubles, which is considered fully profiled. In some cases, it might be desirable to be less than fully profiled, which would give over compensation when the diameter increases.

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

37-48 Tension PID Proportional Gain

Sets the proportional gain for tension loop PID amplifier.

Range:		Function:
0*	[0 - 10]	

37-49 Tension PID Derivate Time

Sets the derivative time for tension loop PID amplifier.

Range:		Function:
0 s*	[0 - 20 s]	

37-50 Tension PID Integral Time

Sets the integral time for tension loop PID amplifier.

Range:		Function:
501 s*	[0.01 - 501 s]	

37-51 Tension PID Out Limit

Sets the maximum tension PID loop output that can be added to the open loop speed reference. The value is normally set to limit the contribution of the tension PID loop to 10 % of the maximum reference speed.

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

37-52 Tension PID Der Gain Limit

Sets the limit for derivation gain in tension loop PID amplifier.

Range:		Function:
5*	[1 - 50]	

37-53 Tension PID Anti Windup

Activates the anti-wind-up function in tension loop PID amplifier.

Option:		Function:
[0]	Disabled	
[1] *	Enabled	

37-54 Winder Jog Reverse

Jogs the winder in the reverse winding direction at the speed set in *parameter 37-26 Winder Jog Speed*.

Option:		Function:
[0] *	No Function	
[1]	Jog reverse	

37-55 Winder Jog Forward

Jogs the winder in forward winding direction at the speed set in *parameter 37-26 Winder Jog Speed*.

Option:		Function:
[0] *	No function	
[1]	Jog forward	

37-56 New Diameter Select

Selects partial roll diameter as the preset starting diameter when the diameter reset is energized, rather than using one of the 2 preset core diameters.

Option:		Function:
[0] *	Core diameter	
[1]	Partial roll diameter	

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37-57 Tension On/Off

Turns the tension controller on or off.

Option:		Function:
[0] *	Off	
[1]	On	

37-58 Core Select

Selects 1 of the 2 preset core sizes.

Option:		Function:
[0] *	Core1 diameter	
[1]	Core2 diameter	

37-59 Diameter Reset

Resets the diameter to a new value. If the new diameter select is energized, the partial core diameter value is used, otherwise the diameter is reset to core1 or core2 values based on the selected core.

Option:		Function:
[0] *	Off	
[1]	On	

5 Parameter Lists

5.1 Introduction

5.1.1 Default Settings

Changes during operation
TRUE means that the parameter can be changed while the frequency converter is in operation, and FALSE means that the frequency converter must be stopped before a change can be made.

2-Set-up
All set-ups: The parameter can be set individually in each of the 2 set-ups, that is 1 single parameter can have 2 different data values.
1 set-up: 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	Normalised value 2 bytes	N2
35	Bit sequence of 16 boolean variables	V2
54	Time difference w/o date	TimD

Table 5.1 Data Type

5.1.2 Conversion

The various attributes of each parameter are displayed in *Factory Setting*. Parameter values are transferred as whole numbers only. Conversion factors are therefore used to transfer decimals.

4-12 Motor Speed Low Limit [Hz] has a conversion factor of 0.1. To preset the minimum frequency to 10 Hz, transfer the value 100. 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.

Examples:
0 s⇒conversion index 0
0.00 s⇒conversion index -2
0 ms⇒conversion index -3
0.00 ms⇒conversion index -5

Conversion index	Conversion factor
100	
75	
74	
67	
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
-7	0.0000001

Table 5.2 Conversion Table

5.1.3 Active/Inactive Parameters in Different Drive Control Modes

+ indicates that the parameter is active in the mode.
- indicates that the parameter is inactive in the mode.

1-10 Motor Construction	AC motor	
1-01 Motor Control Principle	**U/f mode**	**VVC+**
1-00 Configuration Mode		
[0] Speed Open Loop	+	+
[1] Speed Closed Loop	-	+
[3] Process	+	+
[4] Torque Open Loop	-	+
[6] Surface Winder	+	+
[7] Ext. PID Open Loop	+	+
1-03 Torque Characteristics	-	+ see 1, 2, 3)
1-06 Clockwise Direction	+	+
1-20 Motor Power [kW] (*0-03 Regional Settings =[0] International*)	+	+
1-22 Motor Voltage	+	+
1-23 Motor Frequency	+	+
1-24 Motor Current	+	+
1-25 Motor Nominal Speed	+	+
1-29 Automatic Motor Adaptation (AMA)	+	+
1-30 Stator Resistance (Rs)	+	+
1-33 Stator Leakage Reactance (X1)	+	+
1-34 Rotor Leakage Reactance (X2)	-	+ see 5)
1-35 Main Reactance (Xh)	+	+
1-39 Motor Poles	+	+

Table 5.3 Active/Inactive Parameters

1) Constant torque
2) Variable torque
3) AEO
5) Used in flystart

1-10 Motor Construction	AC motor	
1-01 Motor Control Principle	**U/f mode**	**VVC+**
1-50 Motor Magnetisation at Zero Speed	-	+
1-52 Min Speed Normal Magnetising [Hz]	-	+
1-55 U/f Characteristic - U	+	-
1-56 U/f Characteristic - F	+	-
1-60 Low Speed Load Compensation	-	+
1-61 High Speed Load Compensation	-	+
1-62 Slip Compensation	-	+ see [7]
1-63 Slip Compensation Time Constant	+ see [8]	+
1-64 Resonance Damping	+	+
1-65 Resonance Damping Time Constant	+	+
1-71 Start Delay	+	+
1-72 Start Function	+	+
1-73 Flying Start	-	+
1-75 Start Speed [Hz]	-	+
1-76 Start Current	-	+

Table 5.4 Active/inactive Parameters

6) Used when 1-03 Torque Characteristics is constant power.

7) Not used when 1-03 Torque Characteristics=VT.

8) Part of resonance damping.

1-10 Motor Construction	AC motor	
1-01 Motor Control Principle	**U/f mode**	**VVC+**
1-80 Function at Stop	+	+
1-82 Min Speed for Function at Stop [Hz] (*Par. 002*=Hz)	+	+
1-90 Motor Thermal Protection	+	+
1-93 Thermistor Resource	+	+
2-00 DC Hold Current	+	+
2-01 DC Brake Current	+	+
2-02 DC Braking Time	+	+
2-04 DC Brake Cut In Speed [Hz]	+	+
2-10 Brake Function	+ see [9]	+
2-11 Brake Resistor (ohm)	+	+
2-12 Brake Power Limit (kW)	+	+
2-16 AC brake Max. Current	-	+
2-17 Over-voltage Control	+	+
2-19 Over-voltage Gain	+	+
2-20 Release Brake Current	+	+
2-22 Activate Brake Speed [Hz]	+	+

Table 5.5 Active/inactive Parameters

9) Not AC brake

5.2 Parameter Lists

5.2.1 0-** Operation and Display

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
0-0* Basic Settings						
0-01	Language	[0] English	1 set-up	TRUE	–	Uint8
0-03	Regional Settings	[0] International	1 set-up	FALSE	–	Uint8
0-04	Operating State at Power-up	[0] Resume	All set-ups	TRUE	–	Uint8
0-06	GridType	ExpressionLimit	1 set-up	FALSE	–	Uint8
0-07	Auto DC Braking	[1] On	1 set-up	FALSE	–	Uint8
0-1* Set-up Operations						
0-10	Active Set-up	[1] Set-up 1	1 set-up	TRUE	–	Uint8
0-11	Programming Set-up	[9] Active Set-up	1 set-up	TRUE	–	Uint8
0-12	Link Setups	[20] Linked	All set-ups	FALSE	–	Uint8
0-14	Readout: Edit Set-ups/Channel	0 N/A	All set-ups	TRUE	0	Int32
0-16	Application Selection	[0] None	1 set-up	FALSE	–	Uint8
0-2* LCP Display						
0-20	Display Line 1.1 Small	1602	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
0-3* LCP Custom Readout						
0-30	Custom Readout Unit	[1] %	1 set-up	TRUE	–	Uint8
0-31	Custom Readout Min Value	0 CustomReadoutUnit	1 set-up	TRUE	-2	Int32
0-32	Custom Readout Max Value	100 CustomReadoutUnit	1 set-up	TRUE	-2	Int32
0-37	Display Text 1	[]	1 set-up	TRUE	0	VisStr[21]
0-38	Display Text 2	[]	1 set-up	TRUE	0	VisStr[26]
0-39	Display Text 3	[]	1 set-up	TRUE	0	VisStr[26]
0-4* LCP Keypad						
0-40	[Hand on] Key on LCP	[1] Enabled	All set-ups	TRUE	–	Uint8
0-42	[Auto on] Key on LCP	[1] Enabled	All set-ups	TRUE	–	Uint8
0-44	[Off/Reset] Key on LCP	[1] Enabled	All set-ups	TRUE	–	Uint8
0-5* Copy/Save						
0-50	LCP Copy	[0] No copy	1 set-up	FALSE	–	Uint8
0-51	Set-up Copy	[0] No copy	1 set-up	FALSE	–	Uint8
0-6* Password						
0-60	Main Menu Password	0 N/A	1 set-up	TRUE	0	Uint16

5.2.2 1-** Load and Motor

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
1-0* General Settings						
1-00	Configuration Mode	[0] Open Loop	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	FALSE	–	Uint8
1-06	Clockwise Direction	[0] Normal	1 set-up	FALSE	–	Uint8
1-08	Motor Control Bandwidth	ExpressionLimit	1 set-up	FALSE	–	Uint8
1-1* Motor Selection						
1-10	Motor Construction	[0] Asynchron	1 set-up	FALSE	–	Uint8
1-14	Damping Gain	120 %	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
1-2* Motor Data						
1-20	Motor Power	ExpressionLimit	All set-ups	FALSE	–	Uint8
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 Adaption (AMA)	[0] Off	All set-ups	FALSE	–	Uint8
1-3* Adv. Motor Data I						
1-30	Stator Resistance (Rs)	ExpressionLimit	All set-ups	FALSE	-3	Uint32
1-31	Rotor Resistance (Rr)	ExpressionLimit	All set-ups	FALSE	-3	Uint32
1-33	Stator Leakage Reactance (X1)	ExpressionLimit	All set-ups	FALSE	-3	Uint32
1-35	Main Reactance (Xh)	ExpressionLimit	All set-ups	FALSE	-2	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	-6	Int32
1-39	Motor Poles	ExpressionLimit	All set-ups	FALSE	0	Uint8
1-4* Adv. Motor Data II						
1-40	Back EMF at 1000 RPM	ExpressionLimit	All set-ups	FALSE	0	Uint16
1-42	Motor Cable Length	50 m	All set-ups	FALSE	0	Uint8
1-43	Motor Cable Length Feet	164 ft	All set-ups	FALSE	0	Uint16
1-44	d-axis Inductance Sat. (LdSat)	ExpressionLimit	All set-ups	FALSE	-3	Int32
1-45	q-axis Inductance Sat. (LqSat)	ExpressionLimit	All set-ups	FALSE	-3	Int32
1-46	Position Detection Gain	100 %	All set-ups	TRUE	0	Uint16
1-48	Current at Min Inductance for d-axis	100 %	All set-ups	TRUE	0	Uint16
1-49	Current at Min Inductance for q-axis	100 %	All set-ups	TRUE	0	Uint16
1-5* Load Indep. Setting						
1-50	Motor Magnetisation at Zero Speed	100 %	All set-ups	TRUE	0	Uint16
1-52	Min Speed Normal Magnetising [Hz]	1 Hz	All set-ups	TRUE	-1	Uint16
1-55	U/f Characteristic - U	ExpressionLimit	All set-ups	FALSE	-1	Uint16
1-56	U/f Characteristic - F	ExpressionLimit	All set-ups	FALSE	-1	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	0.1 s	All set-ups	TRUE	-2	Uint16
1-64	Resonance Dampening	100 %	All set-ups	TRUE	0	Uint16
1-65	Resonance Dampening Time Constant	0.005 s	All set-ups	TRUE	-3	Uint16

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
1-66	Min. Current at Low Speed	50 %	All set-ups	TRUE	0	Uint32
1-7* Start Adjustments						
1-70	PM 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	TRUE	–	Uint8
1-75	Start Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
1-76	Start Current	ExpressionLimit	All set-ups	TRUE	-2	Uint32
1-78	Compressor Start Max Speed [Hz]	0 Hz	All set-ups	TRUE	-1	Uint16
1-79	Compressor Start Max Time to Trip	5 s	All set-ups	TRUE	-1	Uint8
1-8* Stop Adjustments						
1-80	Function at Stop	[0] Coast	All set-ups	TRUE	–	Uint8
1-82	Min Speed for Function at Stop [Hz]	0 Hz	All set-ups	TRUE	-1	Uint16
1-9* Motor Temperature						
1-90	Motor Thermal Protection	[0] No protection	All set-ups	TRUE	–	Uint8
1-93	Thermistor Source	[0] None	All set-ups	FALSE	–	Uint8

5.2.3 2-** Brakes

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
2-0* DC-Brake						
2-00	DC Hold/Motor Preheat Current	50 %	All set-ups	TRUE	0	Uint16
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
2-04	DC Brake Cut In Speed	0 Hz	All set-ups	TRUE	-1	Uint16
2-06	Parking Current	100 %	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	[0] Off	All set-ups	FALSE	–	Uint8
2-11	Brake Resistor (ohm)	ExpressionLimit	All set-ups	FALSE	-1	Uint16
2-12	Brake Power Limit (kW)	ExpressionLimit	All set-ups	TRUE	0	Uint32
2-14	Brake voltage reduce	0 V	All set-ups	FALSE	0	Uint16
2-16	AC Brake, Max current	100 %	All set-ups	TRUE	-1	Uint16
2-17	Over-voltage Control	[0] Disabled	All set-ups	TRUE	–	Uint8
2-19	Over-voltage Gain	100 %	All set-ups	TRUE	0	Uint16
2-2* Mechanical Brake						
2-20	Release Brake Current	0 A	All set-ups	TRUE	-2	Uint32
2-22	Activate Brake Speed [Hz]	0 Hz	All set-ups	TRUE	-1	Uint16
2-23	Activate Brake Delay	0.0 s	All set-ups	TRUE	-1	Uint8

5.2.4 3-** Reference/Ramps

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conver-sion index	Type
3-0* Reference Limits						
3-00	Reference Range	[0] Min - Max	All set-ups	TRUE	–	Uint8
3-01	Reference/Feedback Unit	ExpressionLimit	All set-ups	TRUE	–	Uint8
3-02	Minimum Reference	0 ReferenceFeedbackUnit	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]	5 Hz	All set-ups	TRUE	-1	Uint16
3-12	Catch up/slow Down Value	0 %	All set-ups	TRUE	-2	Int16
3-14	Preset Relative Reference	0 %	All set-ups	TRUE	-2	Int16
3-15	Reference 1 Source	[1] Analog Input 53	All set-ups	TRUE	–	Uint8
3-16	Reference 2 Source	[2] Analog Input 54	All set-ups	TRUE	–	Uint8
3-17	Reference 3 Source	[11] Local bus reference	All set-ups	TRUE	–	Uint8
3-18	Relative Scaling Reference Resource	[0] No function	All set-ups	TRUE	–-	Uint8
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
3-5* 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
3-6* 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
3-7* 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
3-8* Other Ramps						
3-80	Jog Ramp Time	ExpressionLimit	All set-ups	TRUE	-2	Uint32
3-81	Quick Stop Ramp Time	ExpressionLimit	1 set-up	TRUE	-2	Uint32
3-9* Digital Pot.Meter						
3-90	Step Size	0.10 %	All set-ups	TRUE	-2	Uint16
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	1000 ms	All set-ups	TRUE	-3	Uint16

5.2.5 4-** Limits/Warnings

Par. No. #	Parameter description	Default value	2-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
4-12	Motor Speed Low Limit [Hz]	0 Hz	All set-ups	FALSE	-1	Uint16
4-14	Motor Speed High Limit [Hz]	65 Hz	All set-ups	FALSE	-1	Uint16
4-16	Torque Limit Motor Mode	ExpressionLimit	All set-ups	TRUE	0	Uint16
4-17	Torque Limit Generator Mode	100 %	All set-ups	TRUE	0	Uint16
4-18	Current Limit	ExpressionLimit	All set-ups	TRUE	0	Uint16
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
4-22	Break Away Boost	[0] Off	All set-ups	FALSE	–	Uint8
4-3* Motor Fb Monitor						
4-30	Motor Feedback Loss Function	[0] Disabled	All set-ups	TRUE	–	Uint8
4-31	Motor Feedback Speed Error	20 Hz	All set-ups	TRUE	0	Uint16
4-32	Motor Feedback Loss Timeout	0.05 s	All set-ups	TRUE	-2	Uint16
4-4* Adj. Warnings 2						
4-40	Warning Freq. Low	ExpressionLimit	All set-ups	TRUE	-1	Uint16
4-41	Warning Freq. High	ExpressionLimit	All set-ups	TRUE	-1	Uint16
4-42	Adjustable Temperature Warning	0 N/A	All set-ups	TRUE	0	Uint8
4-5* Adj. Warnings						
4-50	Warning Current Low	0 A	All set-ups	TRUE	-2	Uint32
4-51	Warning Current High	ExpressionLimit	All set-ups	TRUE	-2	Uint32
4-54	Warning Reference Low	-4999 N/A	All set-ups	TRUE	-3	Int32
4-55	Warning Reference High	4999 N/A	All set-ups	TRUE	-3	Int32
4-56	Warning Feedback Low	-4999 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
4-57	Warning Feedback High	4999 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
4-58	Missing Motor Phase Function	[1] On	All set-ups	FALSE	–	Uint8
4-6* Speed Bypass						
4-61	Bypass Speed From [Hz]	0 Hz	All set-ups	TRUE	-1	Uint16
4-63	Bypass Speed To [Hz]	0 Hz	All set-ups	TRUE	-1	Uint16

5.2.6 5-** Digital In/Out

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
5-0* Digital I/O mode						
5-00	Digital I/O Mode	[0] PNP	1 set-up	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	[8] Start	All set-ups	TRUE	–	Uint8
5-11	Terminal 19 Digital Input	[10] Reversing	All set-ups	TRUE	–	Uint8
5-12	Terminal 27 Digital Input	ExpressionLimit	All set-ups	TRUE	–	Uint8
5-13	Terminal 29 Digital Input	[14] Jog	All set-ups	TRUE	–	Uint8
5-14	Terminal 32 Digital Input	[0] No operation	All set-ups	TRUE	–	Uint8
5-15	Terminal 33 Digital Input	[16] Preset ref bit 0	All set-ups	TRUE	–	Uint8
5-16	Terminal 31 Digital Input	[0] No operation	All set-ups	TRUE	–	Uint8

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
5-3* Digital Outputs						
5-30	Terminal 27 Digital Output	[0] No operation	All set-ups	TRUE	–	Uint8
5-31	Terminal 29 Digital Output	[0] No operation	All set-ups	TRUE	–	Uint8
5-34	On Delay, Digital Output	0.01 s	All set-ups	TRUE	-2	Uint16
5-35	Off Delay, Digital Output	0.01 s	All set-ups	TRUE	-2	Uint16
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	4 Hz	All set-ups	TRUE	0	Uint32
5-51	Term. 29 High Frequency	32000 Hz	All set-ups	TRUE	0	Uint32
5-52	Term. 29 Low Ref./Feedb. Value	0 N/A	All set-ups	TRUE	-3	Int32
5-53	Term. 29 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
5-55	Term. 33 Low Frequency	4 Hz	All set-ups	TRUE	0	Uint32
5-56	Term. 33 High Frequency	32000 Hz	All set-ups	TRUE	0	Uint32
5-57	Term. 33 Low Ref./Feedb. Value	0 N/A	All set-ups	TRUE	-3	Int32
5-58	Term. 33 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
5-6* Pulse Output						
5-60	Terminal 27 Pulse Output Variable	[0] No operation	All set-ups	TRUE	–	Uint8
5-62	Pulse Output Max Freq 27	5000 Hz	All set-ups	TRUE	0	Uint32
5-63	Terminal 29 Pulse Output Variable	[0] No operation	All set-ups	TRUE	–	Uint8
5-65	Pulse Output Max Freq 29	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	Uint16
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	Uint16
5-96	Pulse Out 29 Timeout Preset	0 %	1 set-up	TRUE	-2	Uint16

5.2.7 6-** Analog In/Out

Par. No. #	Parameter description	Default value	2-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 53						
6-10	Terminal 53 Low Voltage	0.07 V	All set-ups	TRUE	-2	Uint16
6-11	Terminal 53 High Voltage	10 V	All set-ups	TRUE	-2	Uint16
6-12	Terminal 53 Low Current	4 mA	All set-ups	TRUE	-5	Uint16
6-13	Terminal 53 High Current	20 mA	All set-ups	TRUE	-5	Uint16
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
6-19	Terminal 53 mode	[1] Voltage mode	1 set-up	TRUE	–	Uint8
6-2* Analog Input 54						

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
6-20	Terminal 54 Low Voltage	0.07 V	All set-ups	TRUE	-2	Uint16
6-21	Terminal 54 High Voltage	10 V	All set-ups	TRUE	-2	Uint16
6-22	Terminal 54 Low Current	4 mA	All set-ups	TRUE	-5	Uint16
6-23	Terminal 54 High Current	20 mA	All set-ups	TRUE	-5	Uint16
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
6-29	Terminal 54 mode	[1] Voltage mode	1 set-up	TRUE	–	Uint8
6-7* Analog/Digital Output 45						
6-70	Terminal 45 Mode	[0] 0-20 mA	All set-ups	TRUE	–	Uint8
6-71	Terminal 45 Analog Output	[0] No operation	All set-ups	TRUE	–	Uint8
6-72	Terminal 45 Digital Output	[0] No operation	All set-ups	TRUE	–	Uint8
6-73	Terminal 45 Output Min Scale	0 %	All set-ups	TRUE	-2	Uint16
6-74	Terminal 45 Output Max Scale	100 %	All set-ups	TRUE	-2	Uint16
6-76	Terminal 45 Output Bus Control	0 N/A	All set-ups	TRUE	0	Uint16
6-9* Analog/Digital Output 42						
6-90	Terminal 42 Mode	[0] 0-20 mA	All set-ups	TRUE	–	Uint8
6-91	Terminal 42 Analog Output	[0] No operation	All set-ups	TRUE	–	Uint8
6-92	Terminal 42 Digital Output	[0] No operation	All set-ups	TRUE	–	Uint8
6-93	Terminal 42 Output Min Scale	0 %	All set-ups	TRUE	-2	Uint16
6-94	Terminal 42 Output Max Scale	100 %	All set-ups	TRUE	-2	Uint16
6-96	Terminal 42 Output Bus Control	0 N/A	All set-ups	TRUE	0	Uint16

5.2.8 7-** Controllers

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
7-0* Speed PID Ctrl.						
7-00	Speed PID Feedback Source	[20] None	All set-ups	FALSE	–	Uint8
7-02	Speed PID Proportional Gain	0.015 N/A	All set-ups	TRUE	-3	Uint16
7-03	Speed PID Integral Time	8 ms	All set-ups	TRUE	-4	Uint32
7-04	Speed PID Differentiation Time	30 ms	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	10 ms	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 PID Ctrl.						
7-12	Torque PID Proportional Gain	100 %	All set-ups	TRUE	0	Uint16
7-13	Torque PID 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	9999 s	All set-ups	TRUE	-2	Uint32
7-35	Process PID Differentiation Time	0 s	All set-ups	TRUE	-2	Uint16

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
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-** Communications and Options

Par. No. #	Parameter description	Default value	2-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 Source	ExpressionLimit	All set-ups	TRUE	–	Uint8
8-03	Control Timeout Time	1 s	1 set-up	TRUE	-1	Uint16
8-04	Control Timeout Function	[0] Off	1 set-up	TRUE	–	Uint8
8-07	Diagnosis Trigger	[0] Disable	1 set-up	TRUE	–	Uint8
8-1* Ctrl. Word Settings						
8-10	Control Word Profile	[0] FC profile	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	Baud Rate	ExpressionLimit	1 set-up	TRUE	–	Uint8
8-33	Parity / Stop Bits	ExpressionLimit	1 set-up	TRUE	–	Uint8
8-35	Minimum Response Delay	0.01 s	1 set-up	TRUE	-3	Uint16
8-36	Maximum Response Delay	ExpressionLimit	1 set-up	TRUE	-3	Uint16
8-37	Maximum Inter-char delay	0.025 s	1 set-up	TRUE	-3	Uint16
8-4* FC MC protocol set						
8-42	PCD Write Configuration	ExpressionLimit	1 set-up	TRUE	–	Uint8
8-43	PCD Read Configuration	ExpressionLimit	1 set-up	TRUE	–	Uint8
8-5* Digital/Bus						

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
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	[3] Logic OR	All set-ups	TRUE	–	Uint8
8-53	Start Select	[3] Logic OR	All set-ups	TRUE	–	Uint8
8-54	Reversing Select	[3] Logic OR	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
8-7* BACnet						
8-79	Protocol Firmware version	ExpressionLimit	1 set-up	FALSE	-2	Uint16
8-8* FC Port Diagnostics						
8-80	Bus Message Count	0 N/A	1 set-up	TRUE	0	Uint32
8-81	Bus Error Count	0 N/A	1 set-up	TRUE	0	Uint32
8-82	Slave Messages Rcvd	0 N/A	1 set-up	TRUE	0	Uint32
8-83	Slave Error Count	0 N/A	1 set-up	TRUE	0	Uint32
8-84	Slave Messages Sent	0 N/A	1 set-up	TRUE	0	Uint32
8-85	Slave Timeout Errors	0 N/A	1 set-up	TRUE	0	Uint32
8-88	Reset FC port Diagnostics	[0] Do not reset	1 set-up	TRUE	–	Uint8
8-9* Bus Feedback						
8-90	Bus Jog 1 Speed	100 RPM	All set-ups	TRUE	67	Uint16
8-91	Bus Jog 2 Speed	200 RPM	All set-ups	TRUE	67	Uint16

5.2.10 9-** PROFIdrive

Par. No. #	Parameter description	Default value	2-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	1 set-up	TRUE	–	Uint16
9-18	Node Address	126 N/A	1 set-up	TRUE	0	Uint8
9-19	Drive Unit System Number	1037 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	1 set-up	FALSE	–	Uint16
9-28	Process Control	[1] Enable cyclic master	1 set-up	FALSE	–	Uint8
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[0]
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	Programming Set-up	[9] Active Set-up	1 set-up	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

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
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
9-90	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

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
12-0* IP Settings						
12-00	IP Address Assignment	[10] DCP	1 set-up	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	1 set-up	TRUE	0	OctStr[4]
12-05	Lease Expires	0 N/A	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	[1] On	1 set-up	TRUE	–	Uint8
12-13	Link Speed	[0] None	1 set-up	TRUE	–	Uint8
12-14	Link Duplex	[1] Full Duplex	1 set-up	TRUE	–	Uint8
12-8* Other Ethernet Services						
12-80	FTP Server	[0] Disabled	1 set-up	TRUE	–	Uint8
12-81	HTTP Server	[0] Disabled	1 set-up	TRUE	–	Uint8
12-82	SMTP Service	[0] Disabled	1 set-up	TRUE	–	Uint8
12-89	Transparent Socket Channel Port	4000 N/A	1 set-up	TRUE	0	Uint16
12-9* Advanced Ethernet Services						
12-90	Cable Diagnostic	[0] Disabled	1 set-up	TRUE	–	Uint8
12-91	Auto Cross Over	[1] Enabled	1 set-up	TRUE	–	Uint8
12-92	IGMP Snooping	[1] Enabled	1 set-up	TRUE	–	Uint8
12-93	Cable Error Length	0 N/A	1 set-up	TRUE	0	Uint16
12-94	Broadcast Storm Protection	-1 %	1 set-up	TRUE	0	Int8
12-95	Broadcast Storm Filter	[0] Broadcast only	1 set-up	TRUE	–	Uint8
12-96	Port Config	ExpressionLimit	1 set-up	TRUE	–	Uint8
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 Control

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
13-0* SLC Settings						
13-00	SL Controller Mode	[0] Off	1 set-up	TRUE	–	Uint8
13-01	Start Event	[39] Start command	1 set-up	TRUE	–	Uint8
13-02	Stop Event	[40] Drive stopped	1 set-up	TRUE	–	Uint8
13-03	Reset SLC	[0] Do not reset SLC	1 set-up	TRUE	–	Uint8
13-1* Comparators						
13-10	Comparator Operand	[0] Disabled	1 set-up	TRUE	–	Uint8
13-11	Comparator Operator	[1] Approx.Equal (~)	1 set-up	TRUE	–	Uint8
13-12	Comparator Value	0 N/A	1 set-up	TRUE	-3	Int32
13-2* Timers						
13-20	SL Controller Timer	0 s	1 set-up	TRUE	-2	Uint32
13-4* Logic Rules						
13-40	Logic Rule Boolean 1	[0] False	1 set-up	TRUE	–	Uint8
13-41	Logic Rule Operator 1	[0] Disabled	1 set-up	TRUE	–	Uint8
13-42	Logic Rule Boolean 2	[0] False	1 set-up	TRUE	–	Uint8
13-43	Logic Rule Operator 2	[0] Disabled	1 set-up	TRUE	–	Uint8
13-44	Logic Rule Boolean 3	[0] False	1 set-up	TRUE	–	Uint8
13-5* States						
13-51	SL Controller Event	[0] False	1 set-up	TRUE	–	Uint8
13-52	SL Controller Action	[0] Disabled	1 set-up	TRUE	–	Uint8

5.2.13 14-** Special Functions

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
14-0* Inverter Switching						
14-01	Switching Frequency	ExpressionLimit	All set-ups	TRUE	–	Uint8
14-03	Overmodulation	[1] On	All set-ups	FALSE	–	Uint8
14-07	Dead Time Compensation Level	ExpressionLimit	All set-ups	FALSE	0	Uint8
14-08	Damping Gain Factor	96 %	All set-ups	TRUE	0	Uint8
14-09	Dead Time Bias Current Level	ExpressionLimit	All set-ups	FALSE	0	Uint8
14-1* Mains On/Off						
14-10	Mains Failure	[0] No function	All set-ups	FALSE	–	Uint8
14-11	Mains Voltage at Mains Fault	342 V	All set-ups	TRUE	0	Uint16
14-12	Function at Mains Imbalance	[0] Trip	1 set-up	TRUE	–	Uint8
14-15	Kin. Backup Trip Recovery Level	200.000 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Uint32
14-2* Reset Functions						
14-20	Reset Mode	[0] Manual reset	All set-ups	TRUE	–	Uint8
14-21	Automatic Restart Time	10 s	All set-ups	TRUE	0	Uint16
14-22	Operation Mode	[0] Normal operation	1 set-up	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
14-27	Action At Inverter Fault	[1] Warning	All set-ups	TRUE	–	Uint8
14-28	Production Settings	[0] No action	1 set-up	FALSE	–	Uint8
14-29	Service Code	0 N/A	1 set-up	TRUE	0	Uint32
14-3* Current Limit Ctrl.						
14-30	Current Lim Ctrl, Proportional Gain	100 %	All set-ups	TRUE	0	Uint16

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
14-31	Current Lim Ctrl, Integration Time	0.002 s	All set-ups	TRUE	-3	Uint16
14-32	Current Lim Ctrl, Filter Time	5 ms	All set-ups	TRUE	-4	Uint16
14-4* Energy Optimising						
14-40	VT Level	66 %	All set-ups	FALSE	0	Uint8
14-41	AEO Minimum Magnetisation	66 %	All set-ups	FALSE	0	Uint8
14-5* Environment						
14-50	RFI Filter	[2] Grid type	1 set-up	FALSE	–	Uint8
14-51	DC-Link Voltage Compensation	[1] On	All set-ups	FALSE	–	Uint8
14-52	Fan Control	[5] Constant-on mode	1 set-up	TRUE	–	Uint8
14-55	Output Filter	[0] No Filter	1 set-up	FALSE	–	Uint8
14-6* Auto Derate						
14-63	Min Switch Frequency	[2] 2.0 kHz	1 set-up	FALSE	–	Uint8
14-64	Dead Time Compensation Zero Current Level	[0] Disabled	All set-ups	FALSE	–	Uint8
14-65	Speed Derate Dead Time Compensation	ExpressionLimit	All set-ups	FALSE	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	[3] Trip Lock	All set-ups	TRUE	–	Uint8

5.2.14 15-** Drive Information

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
15-0* Operating Data						
15-00	Operating hours	0 h	1 set-up	TRUE	74	Uint32
15-01	Running Hours	0 h	1 set-up	TRUE	74	Uint32
15-02	kWh Counter	0 kWh	1 set-up	TRUE	75	Uint32
15-03	Power Up's	0 N/A	1 set-up	TRUE	0	Uint32
15-04	Over Temp's	0 N/A	1 set-up	TRUE	0	Uint16
15-05	Over Volt's	0 N/A	1 set-up	TRUE	0	Uint16
15-06	Reset kWh Counter	[0] Do not reset	1 set-up	TRUE	–	Uint8
15-07	Reset Running Hours Counter	[0] Do not reset	1 set-up	TRUE	–	Uint8
15-3* Alarm Log						
15-30	Alarm Log: Error Code	0 N/A	1 set-up	TRUE	0	Uint8
15-31	InternalFaultReason	0 N/A	1 set-up	TRUE	0	Int16
15-4* Drive Identification						
15-40	FC Type	0 N/A	1 set-up	FALSE	0	VisStr[7]
15-41	Power Section	0 N/A	1 set-up	FALSE	0	VisStr[20]
15-42	Voltage	0 N/A	1 set-up	FALSE	0	VisStr[20]
15-43	Software Version	0 N/A	1 set-up	FALSE	0	VisStr[20]
15-44	Ordered TypeCode	0 N/A	1 set-up	FALSE	0	VisStr[41]
15-45	Actual Typecode String	0 N/A	All set-ups	FALSE	0	VisStr[40]
15-46	Drive Ordering No	0 N/A	1 set-up	FALSE	0	VisStr[9]
15-48	LCP Id No	0 N/A	1 set-up	FALSE	0	VisStr[21]
15-49	SW ID Control Card	0 N/A	1 set-up	FALSE	0	VisStr[21]
15-50	SW ID Power Card	0 N/A	1 set-up	FALSE	0	VisStr[21]
15-51	Drive Serial Number	0 N/A	1 set-up	FALSE	0	VisStr[13]
15-53	Power Card Serial Number	0 N/A	1 set-up	FALSE	0	VisStr[21]
15-6* Option Ident						

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
15-60	Option Mounted	ExpressionLimit	All set-ups	FALSE	0	VisStr[30]
15-61	Option SW Version	ExpressionLimit	All set-ups	FALSE	0	VisStr[20]
15-62	Option Ordering No	ExpressionLimit	All set-ups	FALSE	0	VisStr[8]
15-63	Option Serial No	ExpressionLimit	All set-ups	FALSE	0	VisStr[18]
15-70	Option in Slot A	0 N/A	All set-ups	FALSE	0	VisStr[30]
15-71	Slot A Option SW Version	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-9* Parameter Info						
15-92	Defined Parameters	0 N/A	1 set-up	TRUE	0	Uint16
15-97	Application Type	0 N/A	1 set-up	TRUE	0	Uint32
15-98	Drive Identification	0 N/A	1 set-up	FALSE	0	VisStr[56]
15-99	Parameter Metadata	0 N/A	1 set-up	FALSE	0	Uint16

5.2.15 16-** Data Read-outs

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
16-0* General Status						
16-00	Control Word	0 N/A	1 set-up	TRUE	0	Uint16
16-01	Reference [Unit]	0 ReferenceFeedbackUnit	1 set-up	TRUE	-3	Int32
16-02	Reference [%]	0 %	1 set-up	TRUE	-1	Int16
16-03	Status Word	0 N/A	1 set-up	TRUE	0	Uint16
16-05	Main Actual Value [%]	0 %	1 set-up	TRUE	-2	Int16
16-09	Custom Readout	0 CustomReadoutUnit	1 set-up	TRUE	-2	Int32
16-1* Motor Status						
16-10	Power [kW]	0 kW	1 set-up	TRUE	-3	Uint32
16-11	Power [hp]	0 hp	1 set-up	TRUE	-3	Uint32
16-12	Motor Voltage	0 V	1 set-up	TRUE	-1	Uint32
16-13	Frequency	0 Hz	1 set-up	TRUE	-1	Uint32
16-14	Motor current	0 A	1 set-up	TRUE	-2	Uint16
16-15	Frequency [%]	0 %	1 set-up	TRUE	-1	Uint16
16-16	Torque [Nm]	0 Nm	All set-ups	FALSE	-1	Int32
16-18	Motor Thermal	0 %	1 set-up	TRUE	0	Uint8
16-22	Torque [%]	0 %	All set-ups	FALSE	0	Int16
16-3* Drive Status						
16-30	DC Link Voltage	0 V	1 set-up	TRUE	0	Uint32
16-33	Brake Energy /2 min	0 kW	All set-ups	FALSE	0	Uint32
16-34	Heatsink Temp.	0 °C	1 set-up	TRUE	100	Int8
16-35	Inverter Thermal	0 %	1 set-up	TRUE	0	Uint8
16-36	Inv. Nom. Current	0 A	1 set-up	TRUE	-2	Uint16
16-37	Inv. Max. Current	0 A	1 set-up	TRUE	-2	Uint16
16-38	SL Controller State	0 N/A	1 set-up	TRUE	0	Uint8
16-39	Control Card Temp.	0 °C	All set-ups	FALSE	100	Uint16
16-5* Ref. & Feedb.						
16-50	External Reference	0 %	1 set-up	TRUE	-1	Int16
16-52	Feedback[Unit]	0 ProcessCtrlUnit	1 set-up	TRUE	-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	1 set-up	TRUE	0	Uint16

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conver-sion index	Type
16-61	Terminal 53 Setting	ExpressionLimit	1 set-up	TRUE	–	Uint8
16-62	Analog Input 53	1 N/A	1 set-up	TRUE	-2	Uint16
16-63	Terminal 54 Setting	ExpressionLimit	1 set-up	TRUE	–	Uint8
16-64	Analog Input AI54	1 N/A	1 set-up	TRUE	-2	Uint16
16-65	Analog Output 42 [mA]	0 mA	1 set-up	TRUE	-2	Uint16
16-66	Digital Output	0 N/A	1 set-up	TRUE	0	VisStr[5]
16-67	Pulse Input 29[Hz]	0 N/A	All set-ups	FALSE	0	Int32
16-68	Pulse 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	0 N/A	1 set-up	TRUE	0	Uint16
16-72	Counter A	0 N/A	1 set-up	TRUE	0	Int16
16-73	Counter B	0 N/A	1 set-up	TRUE	0	Int16
16-79	Analog Output AO45	0 mA	1 set-up	TRUE	-2	Uint16
16-8* Fieldbus & FC Port						
16-80	Fieldbus CTW 1	0 N/A	1 set-up	TRUE	0	Uint16
16-82	Fieldbus REF 1	0 N/A	1 set-up	TRUE	0	Int16
16-84	Comm. Option STW	0 N/A	1 set-up	TRUE	0	Uint16
16-85	FC Port CTW 1	1084 N/A	1 set-up	FALSE	0	uint16
16-86	FC Port REF 1	0 N/A	1 set-up	TRUE	0	Int16
16-9* Diagnosis Readouts						
16-90	Alarm Word	0 N/A	1 set-up	TRUE	0	Uint32
16-91	Alarm Word 2	0 N/A	1 set-up	TRUE	0	Uint32
16-92	Warning Word	0 N/A	1 set-up	TRUE	0	Uint32
16-93	Warning Word 2	0 N/A	1 set-up	TRUE	0	Uint32
16-94	Ext. Status Word	0 N/A	1 set-up	TRUE	0	Uint32
16-95	Ext. Status Word 2	0 N/A	1 set-up	TRUE	0	Uint32
16-97	Alarm Word 3	0 N/A	1 set-up	TRUE	0	Uint32

5.2.16 17-** Feedback Options

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conver-sion 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	All 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

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
18-8* Center Winder Readout						
18-81	Tension PID Output	0 Hz	1 set-up	TRUE	-3	Int32
18-82	Center Winder Output	0 Hz	1 set-up	TRUE	-3	Int32
18-83	Line Speed	0 Hz	1 set-up	TRUE	-3	Int32
18-84	Diameter	0 %	1 set-up	TRUE	-3	Int32
18-85	Tapered Tension Set Point	0 %	1 set-up	TRUE	-1	Int32
18-86	Tension Feedback	0 %	1 set-up	TRUE	-1	Int32
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

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
21-0* Ext. CL Autotuning						
21-09	Extended PID Enable	[0] Disabled	All set-ups	TRUE	-	Uint8
21-1* Ext. CL 1 Ref./Fb.						
21-11	Ext. 1 Minimum Reference	0 ExtPID1Unit	All set-ups	TRUE	-3	Int32
21-12	Ext. 1 Maximum Reference	100 ExtPID1Unit	All set-ups	TRUE	-3	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	-3	Int32
21-17	Ext. 1 Reference [Unit]	0 ExtPID1Unit	All set-ups	TRUE	-3	Int32
21-18	Ext. 1 Feedback [Unit]	0 ExtPID1Unit	All set-ups	TRUE	-3	Int32
21-19	Ext. 1 Output [%]	0 %	All set-ups	TRUE	0	Int32
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	-2	Uint32
21-23	Ext. 1 Differentation Time	0 s	All set-ups	TRUE	-2	Uint16
21-24	Ext. 1 Dif. Gain Limit	5 N/A	All set-ups	TRUE	-1	Uint16

5.2.19 22-** Application Functions

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
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
22-43	Wake-Up Speed [Hz]	10 N/A	All set-ups	TRUE	-1	Uint16
22-44	Wake-Up Ref./FB Diff	10 %	All set-ups	TRUE	0	Uint8
22-45	Setpoint Boost	0 %	All set-ups	TRUE	0	Int8
22-46	Maximum Boost Time	60 s	All set-ups	TRUE	0	Uint16
22-47	Sleep Speed [Hz]	0 N/A	All set-ups	TRUE	-1	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

Par. No. #	Parameter description	Default value	2-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	[0] Off	All set-ups	TRUE	-	Uint8
30-23	Locked Rotor Detection Time [s]	0.10 s	All set-ups	TRUE	-2	Uint8

5.2.21 32-** Motion Control Basic Settings

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
32-11	User Unit Denominator	1 N/A	1 set-up	TRUE	0	Uint32
32-12	User Unit Numerator	1 N/A	1 set-up	TRUE	0	Uint32
32-67	Max. Tolerated Position Error	2000000 N/A	1 set-up	TRUE	0	Uint32
32-69	PID Sample Time	16 ms	1 set-up	TRUE	-3	Uint16
32-80	Maximum Allowed Velocity	1500 RPM	1 set-up	FALSE	67	Uint16
32-81	Motion Ctrl Quick Stop Ramp	1000 ms	1 set-up	TRUE	-3	Uint32

5.2.22 33-** Motion Control Adv. Settings

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
33-00	Force Home	[0] Home not forced	1 set-up	TRUE	–	Uint8
33-01	Home Offset	0 N/A	1 set-up	TRUE	0	Int32
33-02	Home Ramp Time	10 ms	1 set-up	TRUE	-3	Uint16
33-03	Homing Velocity	100 RPM	1 set-up	TRUE	67	Int16
33-04	Homing Type	[1] Reverse no index	1 set-up	TRUE	–	Uint8
33-41	Negative Software Limit	-500000 N/A	1 set-up	TRUE	0	Int32
33-42	Positive Software Limit	500000 N/A	1 set-up	TRUE	0	Int32
33-43	Negative Software Limit Active	[0] Inactive	1 set-up	TRUE	–	Uint8
33-44	Positive Software Limit Active	[0] Inactive	1 set-up	TRUE	–	Uint8
33-47	Target Position Window	0 N/A	1 set-up	TRUE	0	Uint16

5.2.23 34-** Motion Control Data Readouts

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
34-0* PCD Write Par.						
34-01	PCD 1 Write For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-02	PCD 2 Write For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-03	PCD 3 Write For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-04	PCD 4 Write For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-05	PCD 5 Write For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-06	PCD 6 Write For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-07	PCD 7 Write For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-08	PCD 8 Write For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-09	PCD 9 Write For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-10	PCD 10 Write For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-2* PCD Read Par.						
34-21	PCD 1 Read For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-22	PCD 2 Read For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-23	PCD 3 Read For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-24	PCD 4 Read For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-25	PCD 5 Read For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-26	PCD 6 Read For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-27	PCD 7 Read For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-28	PCD 8 Read For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-29	PCD 9 Read For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-30	PCD 10 Read For Application	0 N/A	All set-ups	TRUE	0	Uint16
34-5* Process Data						
34-50	Actual Position	0 N/A	All set-ups	TRUE	0	Int32
34-56	Track Error	0 N/A	All set-ups	TRUE	0	Int32

5.2.24 37-** Application Settings

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conver-sion index	Type
37-0* Application Mode						
37-00	Application Mode	[0] Drive mode	1 set-up	FALSE	–	Uint8
37-1* Position Control						
37-01	Pos. Feedback Source	[0] 24V Encoder	1 set-up	FALSE	–	Uint8
37-02	Pos. Target	0 N/A	1 set-up	FALSE	0	Int32
37-03	Pos. Type	[0] Absolute	1 set-up	FALSE	–	Uint8
37-04	Pos. Velocity	100 RPM	1 set-up	FALSE	67	Uint16
37-05	Pos. Ramp Up Time	5000 ms	1 set-up	FALSE	-3	Uint32
37-06	Pos. Ramp Down Time	5000 ms	1 set-up	FALSE	-3	Uint32
37-07	Pos. Auto Brake Ctrl	[1] Enable	1 set-up	TRUE	–	Uint8
37-08	Pos. Hold Delay	0 ms	1 set-up	TRUE	-3	Uint32
37-09	Pos. Coast Delay	200 ms	1 set-up	TRUE	-3	Uint16
37-10	Pos. Brake Delay	200 ms	1 set-up	TRUE	-3	Uint16
37-11	Pos. Brake Wear Limit	0 N/A	1 set-up	TRUE	0	Uint32
37-12	Pos. PID Anti Windup	[1] Enable	1 set-up	TRUE	–	Uint8
37-13	Pos. PID Output Clamp	1000 N/A	1 set-up	TRUE	0	Uint16
37-14	Pos. Ctrl. Source	[0] DI	1 set-up	TRUE	–	Uint8
37-15	Pos. Direction Block	[0] No Blocking	1 set-up	TRUE	–	Uint8
37-16	Pos. Power Recovery	[1] Enable	1 set-up	TRUE	–	Uint8
37-17	Pos. Ctrl Fault Behaviour	[0] Ramp Down&Brake	1 set-up	FALSE	–	Uint8
37-18	Pos. Ctrl Fault Reason	[0] No Fault	1 set-up	TRUE	–	Uint8
37-19	Pos. New Index	0 N/A	1 set-up	TRUE	–	Uint8
37-2* Center Winder1 set-up						
37-20	Winder Mode Selection	[0] Wind	1 set-up	FALSE	–	Uint8
37-21	Tension Set Point	0 %	1 set-up	TRUE	-1	Uint16
37-22	Taper Set Point	0 %	1 set-up	TRUE	-1	Int16
37-23	Partial Roll Diameter Value	5 %	1 set-up	FALSE	-3	Uint32
37-24	Core1 Diameter	5 %	1 set-up	FALSE	-3	Uint32
37-25	Core2 Diameter	5 %	1 set-up	FALSE	-3	Uint32
37-26	Winder Jog Speed	0 %	1 set-up	TRUE	0	Uint8
37-27	TLD Low Limit	0 %	1 set-up	TRUE	-1	Uint16
37-28	TLD High Limit	0 %	1 set-up	TRUE	-1	Uint16
37-29	TLD Timer	0.001 s	1 set-up	TRUE	-3	Uint16
37-30	TLDOnDelay	[1] Enabled	1 set-up	TRUE	–	Uint8
37-31	Diameter Limit Detector	100 %	1 set-up	TRUE	-3	Uint32
37-32	Initial Diameter Measurement	[0] Set diameter when diameter reset	1 set-up	FALSE	–	Uint8
37-33	Diameter Measurement Input	[0] No Function	1 set-up	FALSE	–	Uint8
37-34	Reading at Core	0 N/A	1 set-up	TRUE	-2	Int16
37-35	Reading at Full Roll	0 V	1 set-up	TRUE	-2	Int16
37-36	Tension Set Point Input	[0] Par.3721	1 set-up	FALSE	–	Uint8
37-37	Taper Set Point Input	[0] Par.3722	1 set-up	FALSE	–	Uint8
37-38	Tension Feedback Input	[0] No Function	1 set-up	FALSE	–	Uint8
37-39	Tension Feedback Type	[0] Load cell	1 set-up	FALSE	–	Uint8
37-40	Center Winder Cmd Src	[1] Parameter 3754~3759 control the functions	1 set-up	TRUE	–	Uint8
37-41	Diameter Change Rate	0.001 %	1 set-up	TRUE	-3	Uint8
37-42	Tapered Tension Change Rate	0.1 %	1 set-up	TRUE	-1	Uint8

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
37-43	Diameter Calculator Min Speed	0 %	1 set-up	TRUE	0	Uint16
37-44	Line Acceleration Feed Forward	0 N/A	1 set-up	TRUE	-3	Int16
37-45	Line Speed Source	[0] No function	1 set-up	FALSE	–	Uint8
37-46	Winder Speed Match Scale	1 N/A	1 set-up	FALSE	-3	Uint32
37-47	Tension PID Profile	0 %	1 set-up	TRUE	-2	Uint16
37-48	Tension PID Proportional Gain	0 N/A	1 set-up	TRUE	-2	Uint16
37-49	Tension PID Derivate Time	0 s	1 set-up	TRUE	-2	Uint16
37-50	Tension PID Integral Time	501 s	1 set-up	TRUE	-2	Uint32
37-51	Tension PID Out Limit	0 %	1 set-up	TRUE	-3	Uint32
37-52	Tension PID Der Gain Limit	5 N/A	1 set-up	TRUE	-1	Uint16
37-53	Tension PID Anti Windup	[1] Enabled	1 set-up	TRUE	–	Uint8
37-54	Winder Jog Reverse	[0] No Function	1 set-up	TRUE	–	Uint8
37-55	Winder Jog Forward	[0] No function	1 set-up	TRUE	–	Uint8
37-56	New Diameter Select	[0] Core diameter	1 set-up	FALSE	–	Uint8
37-57	Tension On/Off	[0] Off	1 set-up	TRUE	–	Uint8
37-58	Core Select	[0] Core1 diameter	1 set-up	FALSE	–	Uint8
37-59	Diameter Reset	[0] Off	1 set-up	FALSE	–	Uint8

6 Troubleshooting

6.1 Warnings and Alarms

When the frequency converter fault circuitry detects a fault condition or a pending fault, a warning, or alarm is issued. A flashing display on the LCP indicates an alarm or warning condition and the associated number code on line 2. Sometimes a warning precedes an alarm.

6.1.1 Alarms

An alarm causes the frequency converter to trip (suspend operation). The frequency converter has 3 trip conditions which are displayed in line 1:

TRIP (AUTO RESTART): The frequency converter is programmed to restart automatically after the fault is removed. The number of automatic reset attempts can be continuous or limited to a programmed number of attempts. If the selected number of automatic reset attempts is exceeded, the trip condition changes to TRIP (RESET).

TRIP (RESET): Requires resetting of the frequency converter before operation after a fault is cleared. Press [Reset] to reset the frequency converter manually, or use a digital input, or a serial bus command. For NLCP, the stop and reset are the same key. If [Off/Reset] is used to reset the frequency converter, press [Start] to initiate a run command in either Hand On or Auto On mode.

TRIPLOCK (DISC>MAINS): Disconnect the mains AC input power to the frequency converter long enough for the display to go blank. Remove the fault condition and reapply power. Following power-up, the fault indication changes to TRIP (RESET) and allows for manual, digital, or serial bus reset.

6.1.2 Warnings

During a warning, the frequency converter remains operational, although the warning flashes for as long as the condition exists. The frequency converter may, however, reduce the warning condition. For example, if the warning displayed was *Torque Limit* (Warning 12), the frequency converter would be reducing speed to compensate for the overcurrent condition. In some cases, if the condition is not corrected or worsens, an alarm condition is activated and the frequency converter output to the motor terminats. Line 1 identifies the warning in plain language and line 2 identifies the warning number.

6.1.3 Warning/Alarm Messages

The LEDs on the front of the frequency converter and a code in the display signal a warning or an alarm.

LED indication	
Warning	Yellow
Alarm	Flashing red

Table 6.1 Control Terminals and Associated Parameter

A **warning** indicates a condition that may require attention, or a trend that may eventually require attention. A warning remains active until the cause is no longer present. Under some circumstances, motor operation may continue.

A **trip** is the action when an alarm has appeared. The trip removes power to the motor. It can be reset after the condition has been cleared by pressing [Reset], or through a digital input (parameter group *5–1* Digital Inputs*). The event that caused an alarm cannot damage the frequency converter, or cause a dangerous condition. Alarms must be reset to restart operation once their cause has been rectified.

The reset can be done in 3 ways:

- Press [Reset].
- A digital reset input.
- Serial communication/optional fieldbus reset signal.

NOTICE

After a manual reset pressing [Reset], press [Auto On] to restart the motor.

An X marked in *Table 6.2* means that action occurs. A warning precedes an alarm.

A trip lock is an action when an alarm occurs which can damage the frequency converter or connected equipment. Power is removed from the motor. A trip lock can only be reset after a cycling power has cleared the condition. Once the problem has been rectified, only the alarm continues flashing until the frequency converter is reset.

No.	Description	Warning	Alarm	Trip lock	Cause
2	Live zero error	X	X		Signal on terminal 53 or 54 is less than 50% of value set in *6-10 Terminal 53 Low Voltage*, *6-12 Terminal 53 Low Current*, *6-20 Terminal 54 Low Voltage* and *6-22 Terminal 54 Low Current*.
3	No motor	X			No motor has been connected to the output of the frequency converter.
4	Mains phase loss[1)]	X	X	X	Missing phase on supply side, or too high voltage imbalance. Check supply voltage.
7	DC overvoltage[1)]	X	X		Intermediate circuit voltage exceeds the upper limit.
8	DC under voltage[1)]	X	X		Intermediate circuit voltage drops below the lower limit.
9	Frequency converter overloaded	X	X		Normal overload: More than 110% of nominal load for 1 minute; High overload: More than 150% of nominal load for 1 minute.
10	Motor ETR overtemperature	X	X		Motor is too hot due to overload.
11	Motor thermistor overtemperature	X	X		Thermistor is disconnected, or the frequency converter is overloaded.
12	Torque limit	X	X		Torque exceeds value set in either *parameter 4-16 Torque Limit Motor Mode* or *parameter 4-17 Torque Limit Generator Mode*.
13	Overcurrent	X	X	X	The peak current limit is exceeded.
14	Ground fault	X	X	X	Discharge from output phases to ground.
16	Short circuit		X	X	Short-circuit in motor or on motor terminals.
17	Control word time-out	X	X		No communication to frequency converter.
25	Brake resistor short-circuited	X	X	X	Brake resistor is short-circuited, thus the brake function is disconnected.
26	Brake overload	X	X		The power transmitted to the brake resistor over the last 120 s. exceeds the limit. Possible corrections: Decrease brake energy via lower speed or longer ramp time.
27	Brake IGBT/Brake chopper short-circuited	X	X	X	Brake transistor is short-circuited, thus the brake function is disconnected.
28	Brake check	X	X		Brake resistor is not connected/working.
30	U phase loss		X	X	Motor phase U is missing. Check the phase.
31	V phase loss		X	X	Motor phase V is missing. Check the phase.
32	W phase loss		X	X	Motor phase W is missing. Check the phase.
34	Fieldbus fault	X	X		PROFIBUS communication issues have occurred.
35	Option fault		X		Fieldbus or option B detects internal errors.
36	Mains failure	X	X		This warning/alarm is only active if the supply voltage to the frequency converter is lost, and *parameter 14-10 Mains Failure* is NOT set to *[0] No Function*.
38	Internal fault		X	X	Contact the local Danfoss supplier.
40	Overload T27	X			Check the load connected to terminal 27 or remove short-circuit connection.

No.	Description	Warning	Alarm	Trip lock	Cause
41	Overload T29	X			Check the load connected to terminal 29 or remove short-circuit connection.
46	Gate drive voltage fault		X	X	The supply on the power card is out of range. Check the power card.
47	24 V supply low	X	X	X	24 V DC may be overloaded.
51	AMA check U_{nom} and I_{nom}		X		Wrong setting for motor voltage and/or motor current.
52	AMA low I_{nom}		X		Motor current is too low. Check settings.
53	AMA big motor		X		The motor is too big for the AMA to operate.
54	AMA small motor		X		The motor is too small for the AMA to operate.
55	AMA parameter range		X		The parameter values of the motor are outside of the acceptable range. AMA does not run.
56	AMA interrupt		X		The user has interrupted the AMA.
57	AMA timeout		X		Run the AMA again.
58	AMA internal		X		Contact Danfoss.
59	Current limit	X	X		Frequency converter overload.
61	Encoder loss	X	X		
63	Mechanical brake low		X		Actual motor current has not exceeded the release brake current within start delay-time window.
65	Control card temp	X	X	X	The cut-out temperature of the control card is 80 °C.
67	Option change		X		A new option is detected, or a mounted option is removed.
69	Power card temp	X	X	X	The difference between the speed reference and the feedback exceeds the limit.
80	Drive initialised to default value		X		All parameters are initialised to default settings.
87	Auto DC braking	X			Occurs in IT mains when the frequency converter coasts and V DC is higher than 830 V. Energy on the DC link is consumed by the motor. This function can be enabled/ disabled in *parameter 0-07 Auto DC Braking*.
88	Option detection		X	X	The option is removed successfully.
90	Feedback monitor	X	X		A feedback fault is detected by option B.
95	Broken belt	X	X		
101	Flow/pressure information missing		X	X	
120	Position control fault		X		
250	New spare part		X	X	
251	New type code		X	X	
252	Tension limit		X		
nw run	Not while running				The parameter can only be changed when the motor is stopped.
Err.	A wrong password was entered				Occurs when using a wrong password for changing a password-protected parameter.

Table 6.2 Warnings and Alarms Code List

1) These faults may be caused by mains distortions. Installing Danfoss line filter may rectify this problem.

The alarm words, warning words and extended status words can be read out via serial bus or optional fieldbus for diagnosis.

WARNING/ALARM 2, Live zero error
This warning or alarm only appears if programmed in *6-01 Live Zero Timeout Function*. The signal on 1 of the analog inputs is less than 50% of the minimum value programmed for that input. Broken wiring or faulty device sending the signal can cause this condition.

Troubleshooting

- Check connections on all the analog input terminals. Control card terminals 53 and 54 for signals, terminal 55 common.
- Check that the frequency converter programming and switch settings match the analog signal type.
- Perform the input terminal signal test.

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 on the frequency converter. Options are programmed in *14-12 Function at Mains Imbalance*.

Troubleshooting
- Check the supply voltage and supply currents to the frequency converter.

WARNING/ALARM 7, DC overvoltage
If the intermediate circuit voltage exceeds the limit, the frequency converter trips after a time.

Troubleshooting
- Extend the ramp time.
- Change the ramp type.

WARNING/ALARM 8, DC under voltage
If the intermediate circuit voltage (DC-link) drops below the undervoltage limit, the frequency converter trips after a fixed time delay. The time delay varies with unit size.

Troubleshooting
- Check that the supply voltage matches the frequency converter voltage.
- Perform input voltage test.
- Perform soft charge circuit test.

WARNING/ALARM 9, Inverter overload
The frequency converter is about to cut out because of an overload (too high current for too long). The counter for electronic, thermal inverter protection issues a warning at 90% and trips at 100%, while giving an alarm. The frequency converter *cannot* be reset until the counter is below 0%.
The fault is that the frequency converter has run with more than 100% overload for too long.

Troubleshooting
- Compare the output current shown on the LCP with the frequency converter rated current.
- Compare the output current shown on the LCP with measured motor current.
- Display the thermal drive load on the LCP and monitor the value. When running above the frequency converter continuous current rating, the counter increases. When running below the frequency converter 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 whether the frequency converter issues a warning or an alarm when the counter reaches 100% in *1-90 Motor Thermal Protection*. The fault occurs when the motor runs with more than 100% overload for too long.

Troubleshooting
- Check for motor overheating.
- Check if the motor is mechanically overloaded.
- Check that the motor current set in *1-24 Motor Current* is correct.
- Ensure that motor data in parameters 1-20 to 1-25 are set correctly.
- Running AMA in *1-29 Automatic Motor Adaptation (AMA)* tunes the frequency converter to the motor more accurately and reduces thermal loading.

WARNING/ALARM 11, Motor thermistor over temp
Check whether the thermistor is disconnected. Select whether the frequency converter issues a warning or an alarm in *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 Source* 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 Source*.

WARNING/ALARM 13, Over current
The inverter peak current limit (approximately 200% of the rated current) is exceeded. The warning lasts about 5 s, then the frequency converter trips and issues an alarm. Shock loading or fast acceleration with high-inertia loads can cause this fault.

Troubleshooting:
- Remove power and check if the motor shaft can be turned.
- Check that the motor size matches the frequency converter.
- Check parameters 1-20 to 1-25 for correct motor data.

ALARM 14, Earth (ground) fault
There is current from the output phases to ground, either in the cable between the frequency converter and the motor or in the motor itself.

Troubleshooting

- Remove power to the frequency converter and repair the ground fault.
- Check for ground faults in the motor by measuring the resistance to ground of the motor leads and the motor with a megohmmeter.

ALARM 16, Short circuit
There is short-circuiting in the motor or motor wiring.

Remove power to the frequency converter and repair the short circuit.

WARNING/ALARM 17, Control word timeout
There is no communication to the frequency converter.
The warning is only active when *8-04 Control Word Timeout Function* is NOT set to *[0] Off*.
If *8-04 Control Word Timeout Function* is set to *[5] Stop and Trip*, a warning appears and the frequency converter ramps down until it trips, while giving an alarm. *8-03 Control Timeout Time* could possibly be increased.

Troubleshooting:

- Check connections on the serial communication cable.
- Increase *8-03 Control Word Timeout Time*.
- Check the operation of the communication equipment.
- Verify a proper installation based on EMC requirements.

ALARM 30, Motor phase U missing
Motor phase U between the frequency converter and the motor is missing.

Troubleshooting

WARNING

HIGH VOLTAGE!
Disconnect power before proceeding.

- Remove power from the frequency converter and check motor phase U.

ALARM 31, Motor phase V missing
Motor phase V between the frequency converter and the motor is missing.

Troubleshooting

WARNING

HIGH VOLTAGE
Disconnect power before proceeding.

- Remove power from the frequency converter and check motor phase V.

ALARM 32, Motor phase W missing
Motor phase W between the frequency converter and the motor is missing.

Troubleshooting

WARNING

Disconnect power before proceeding.

- Remove power from the frequency converter and check motor phase W.

ALARM 38, Internal fault
When an internal fault occurs, a code number is displayed.

Troubleshooting

- Cycle power.
- Check that the option is properly installed.
- Check for loose or missing wiring.

If the fault persists, contact the Danfoss supplier or service department for assistance.

WARNING 47, 24 V supply low
The 24 V DC is measured on the control card.

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 setting in *1-24 Motor Current*.

ALARM 53, AMA motor too big
The motor is too big 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 parameter values of the motor are outside of the acceptable range. AMA does not run.

56 ALARM, AMA interrupted by user
The user has interrupted AMA.

ALARM 57, AMA internal fault
Try to restart AMA again. Repeated restarts can overheat the motor.

ALARM 58, Internal fault
Contact your Danfoss supplier.

WARNING 59, Current limit
The current is higher than the value in *4-18 Current Limit*.

Troubleshooting

- Ensure that motor data in parameters 1–20 to 1–25 are set correctly.
- Possibly increase the current limit.
- Be sure that the system can operate safely at a higher limit.

6

WARNING 60, External interlock
A digital input signal is indicating a fault condition external to the frequency converter. An external interlock has commanded the frequency converter to trip.

Troubleshooting

- Clear the external fault condition.
- To resume normal operation, apply 24 V DC to the terminal programmed for external interlock.
- Reset the frequency converter.

ALARM 80, Drive initialised to default value
Parameter settings are initialised to default settings after a manual reset.

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Troubleshooting

- To clear the alarm, reset the unit.

ALARM 95, Broken belt
Torque is below the torque level set for no load, indicating a broken belt. *22-60 Broken Belt Function* is set for alarm.

Troubleshooting

- Troubleshoot the system and reset the frequency converter after the fault has been cleared.

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130R0507 MG06C502 11/2014