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Programming Guide
VLT® HVAC Basic Drive FC 101

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VLT® THE REAL DRIVE

Contents

1 Introduction

1.1 Purpose of the Manual

This programming guide provides information for advanced programming of the frequency converter. It provides a complete overview of all parameters as well as descriptions for all parameters.

The programming guide is intended for use by qualified personnel.

To operate the frequency converter safely and professionally, read and follow the programming guide, and pay particular attention to the safety instructions and general warnings.

1.2 Document and Software Version

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

Edition	Remarks	Software version
MG18B4xx	Replaces MG18B3xx	2.7x

Table 1.1 Document and Software Version

1.3 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.

1.4 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. Start the motor with an external switch, a fieldbus command, an input reference signal from the local control panel (LCP), via remote operation using MCT 10 software, or after a cleared fault condition. To prevent unintended motor start:

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

⚠WARNING

DISCHARGE TIME!

Frequency converters contain DC-link capacitors that can remain charged even when the frequency converter is not powered. To avoid electrical hazards, disconnect AC mains, any permanent magnet type motors, and any remote DC-link supplies, including battery back-ups, UPS, and DC-link connections to other frequency converters. Wait for the capacitors to fully discharge before performing any service or repair work. The amount of waiting time is listed in *Table 1.2*. Failure to wait the specified time after power has been removed before doing service or repair could result in death or serious injury.

1

Voltage [V]	Power range [kW(hp)]	Minimum waiting time (minutes)
3x200	0.25–3.7 (0.33–5)	4
3x200	5.5–11 (7–15)	15
3x400	0.37–7.5 (0.5–10)	4
3x400	11–90 (15–125)	15
3x600	2.2–7.5 (3–10)	4
3x600	11–90 (15–125)	15

Table 1.2 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 manual.**

⚠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.**

1.5 Additional Resources

- *VLT HVAC Basic Drive FC 101 Quick Guide* provides basic information on mechanical dimensions, installation, and programming
- *VLT HVAC Basic Drive FC 101 Design Guide* provides information on how to design motor control systems.
- Danfoss VLT® Energy Box software. Select *PC Software Download* at *www.danfoss.com/BusinessAreas/DrivesSolutions*.

  VLT® Energy Box software allows energy consumption comparisons of HVAC fans and pumps driven by Danfoss frequency converters and alternative methods of flow control. Use this tool to project the costs, savings, and payback of using Danfoss frequency converters on HVAC fans, pumps, and cooling towers.

Danfoss technical literature is available in electronic form on the documentation CD that is shipped with the product, or in print from your local Danfoss sales office.

MCT 10 Setup Software Support

Download the software from *http://www.danfoss.com/BusinessAreas/DrivesSolutions/Software+MCT10/MCT10+Downloads.htm*.

During the installation process of the software, enter access code 81463800 to activate FC 101 functionality. A licence key is not required for using FC 101 functionality.

The latest software does not always contain the latest updates for frequency converters. Contact the local sales office for the latest frequency converter updates (*.upd files), or download the frequency converter updates from *www.danfoss.com/BusinessAreas/DrivesSolutions/fc101driveupdates*.

1.6 Definitions

Frequency Converter

$I_{VLT, MAX}$

The maximum output current.

$I_{VLT,N}$

The rated output current supplied by the frequency converter.

$U_{VLT, MAX}$

The maximum output voltage.

Input

The connected motor can start and stop via LCP and digital inputs. Functions are divided into 2 groups, as described in *Table 1.3*. Functions in group 1 have higher priority than functions in group 2.

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

Table 1.3 Control Commands

Motor

f_{JOG}

The motor frequency when the jog function is activated (via digital terminals).

f_M

The motor frequency.

f_{MAX}

The maximum motor frequency.

f_{MIN}
The minimum motor frequency.

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

I_M
The motor current.

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

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

$P_{M,N}$
The rated motor power (nameplate data).

U_M
The instantaneous motor voltage.

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

Breakaway torque

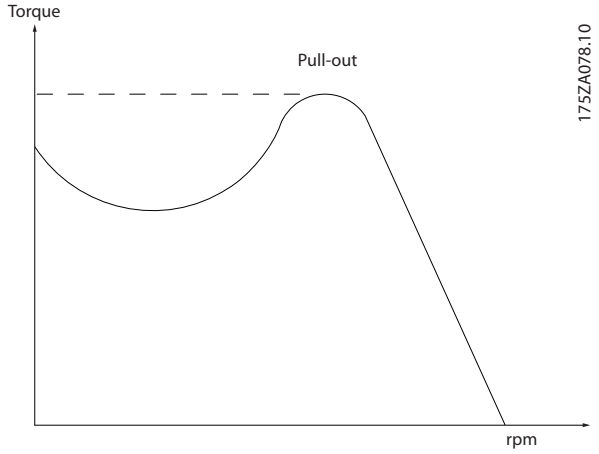

Illustration 1.1 Breakaway Torque

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 *Table 1.3*.

Stop command
See *Table 1.3*.

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

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

Bus reference
A signal transmitted to the serial communication port (FC 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.

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 set in *parameter 3-03 Maximum Reference*.

Ref_{MIN}
Determines the relationship between the reference input at 0% value (typically 0 V, 0 mA, 4 mA) and the resulting reference. The minimum reference value is set in *3-02 Minimum Reference*

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

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

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

Automatic Motor Adaptation, AMA
AMA algorithm determines the electrical parameters for the connected motor at standstill, and compensates for the resistance based on the length of the motor cable.

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

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

Relay outputs
The frequency converter provides 2 programmable relay outputs.

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

Initialising
If initialising is carried out (*parameter 14-22 Operation Mode*), the programmable parameters of the frequency converter return to their default settings.
parameter 14-22 Operation Mode does not initialise communication parameters, fault log, or fire mode log.

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 none-periodic duty.

1

LCP
The local control panel (LCP) makes up a complete interface for control and programming of the frequency converter. The control panel is detachable on IP20 units and fixed on IP54 units. It can be installed up to 3 m from the frequency converter, that is, in a front panel with the installation kit option.

Lsb
Least significant bit.

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

Msb
Most significant bit.

On-line/Off-line parameters
Changes to on-line parameters are activated immediately after the data value is changed. Press [OK] to activate off-line parameters.

PI controller
The PI controller maintains the desired speed, pressure, temperature, and so on, by adjusting the output frequency to match the varying load.

RCD
Residual current device.

Set-up
Parameter settings in 2 set-ups can be saved. Change between the 2 parameter set-ups and edit 1 set-up, while another set-up is active.

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 SLC.

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

Trip
A state entered in fault situations, for example, if the frequency converter is subject to an overtemperature or when the frequency converter is protecting the motor, process, or mechanism. Restart is prevented until the cause of the fault does not exist 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 lock
A state entered in fault situations when the frequency converter is protecting itself and requiring physical intervention, for example, 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 lock for personal safety.

VT characteristics
Variable torque characteristics used for pumps and fans.

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

1

1.7 Electrical Overview

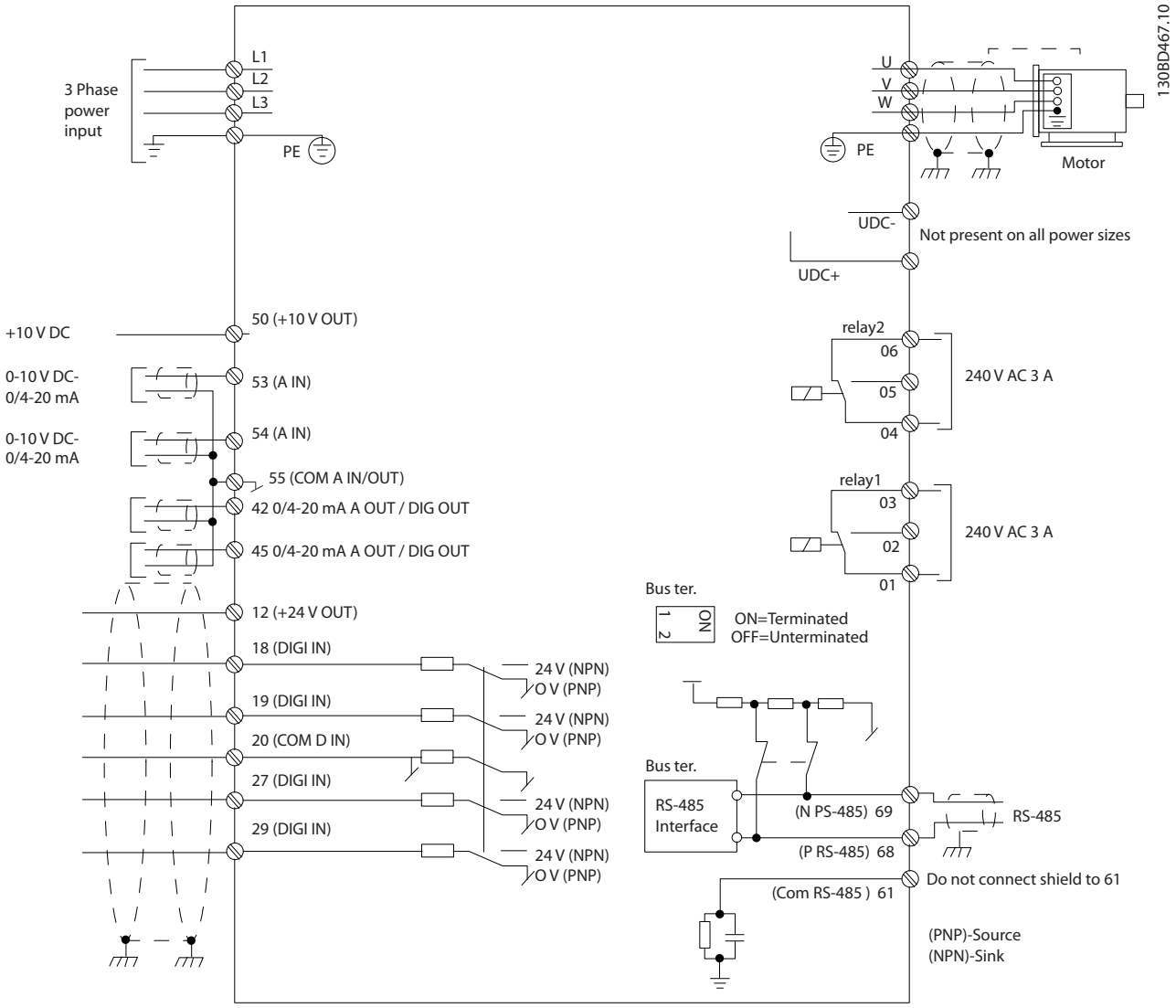

Illustration 1.2 Basic Wiring Schematic Drawing

NOTICE

There is no access to UDC- and UDC+ on the following units:

- **IP20, 380–480 V, 30–90 kW (40–125 hp)**
- **IP20, 200–240 V, 15–45 kW (20–60 hp)**
- **IP20, 525–600 V, 2.2–90 kW (3–125 hp)**
- **IP54, 380–480 V, 22–90 kW (30–125 hp)**

2 Programming

2

2.1 Introduction

The frequency converter can be programmed from the LCP, or from a PC via the RS485 COM port by installing the MCT 10 Setup Software. Refer to *chapter 1.5.1 MCT 10 Setup Software Support* for more details about the software.

2.2 Local Control Panel (LCP)

The LCP is divided into 4 functional sections.

A. Display

B. Menu key

C. Navigation keys and indicator lights

D. Operation keys and indicator lights

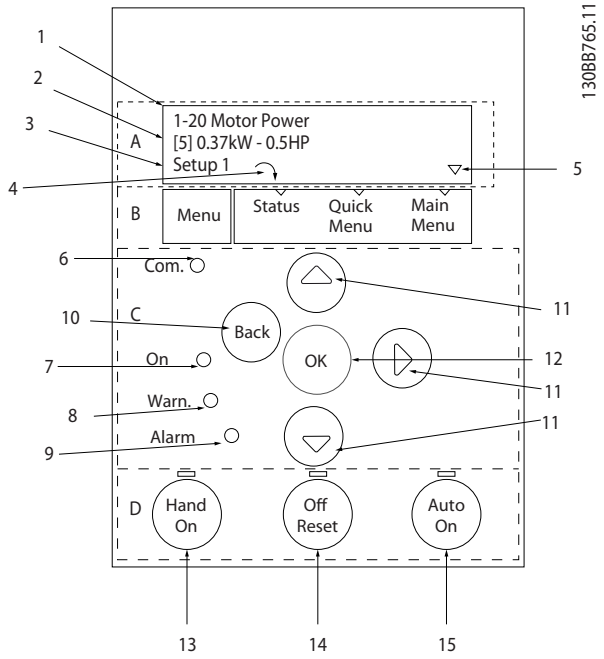

Illustration 2.1 Local Control Panel (LCP)

A. Display
The LCD-display is illuminated with 2 alphanumeric lines. All data is displayed on the LCP.

Illustration 2.1 describes the information that can be read from the display.

1	Parameter number and name.
2	Parameter value.
3	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.
4	Motor direction is shown to the bottom left of the display – indicated by a small arrow pointing either clockwise or counterclockwise.
5	The triangle indicates if the LCP is in Status, Quick Menu, or Main Menu.

Table 2.1 Legend to *Illustration 2.1*, Part I

B. Menu key
Press [Menu] to select from among Status, Quick Menu, or Main Menu.

C. Navigation keys and indicator lights

6	Com. LED: Flashes when bus communication is communicating.
7	Green LED/On: Control section is working correctly.
8	Yellow LED/Warn.: Indicates a warning.
9	Flashing Red LED/Alarm: Indicates an alarm.
10	[Back]: For moving to the previous step or layer in the navigation structure.
11	[▲] [▼] [►]: For navigating among parameter groups, parameters and within parameters. They can also be used for setting local reference.
12	[OK]: For selecting a parameter and for accepting changes to parameter settings.

Table 2.2 Legend to *Illustration 2.1*, Part II

D. Operation keys and indicator lights

13	[Hand On]: Starts the motor and enables control of the frequency converter via the LCP. ***NOTICE*** ***[2] coast inverse* is the default option for *parameter 5-12 Terminal 27 Digital Input*. [Hand On] does not start the motor if there is no 24 V supply to terminal 27. Connect terminal 12 to terminal 27.**
14	[Off/Reset]: Stops the motor (Off). If in alarm mode, the alarm is reset.
15	[Auto On]: The frequency converter is controlled either via control terminals or serial communication.

Table 2.3 Legend to *Illustration 2.1*, Part III

2.3 Menus

2.3.1 Status Menu

In the *Status* menu, the selection options are:

- Motor Frequency [Hz], *parameter 16-13 Frequency*.
- Motor Current [A], *parameter 16-14 Motor current*.
- Motor Speed Reference in Percentage [%], *parameter 16-02 Reference [%]*.
- Feedback, *parameter 16-52 Feedback[Unit]*.
- Motor Power [kW] (if *parameter 0-03 Regional Settings* is set to *[1] North America*, motor power is shown in the unit of hp instead of kW), *parameter 16-10 Power [kW]* for kW, *parameter 16-11 Power [hp]* for hp.
- Custom Readout *parameter 16-09 Custom Readout*.

2.3.2 Quick Menu

Use the Quick Menu to programme the most common functions. The Quick Menu consists of:

- Wizard for open-loop applications. See *Illustration 2.4* for details.
- Wizard for closed-loop applications. See *Illustration 2.5* for details.
- Motor set-up. See *Table 2.6* for details.
- Changes made.

The built-in wizard menu guides the installer through the set-up of the frequency converter in a clear and structured manner for open-loop and closed-loop applications and quick motor settings.

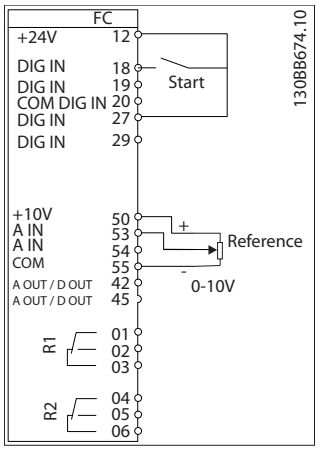

Illustration 2.2 Frequency Converter Wiring

The wizard is displayed after power-up until any parameter has been changed. The wizard can always be accessed again through the quick menu. Press [OK] to start the wizard. Press [Back] to return to the status screen.

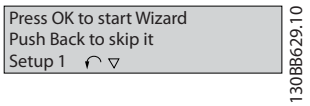

Illustration 2.3 Start-up/Quit Wizard

2

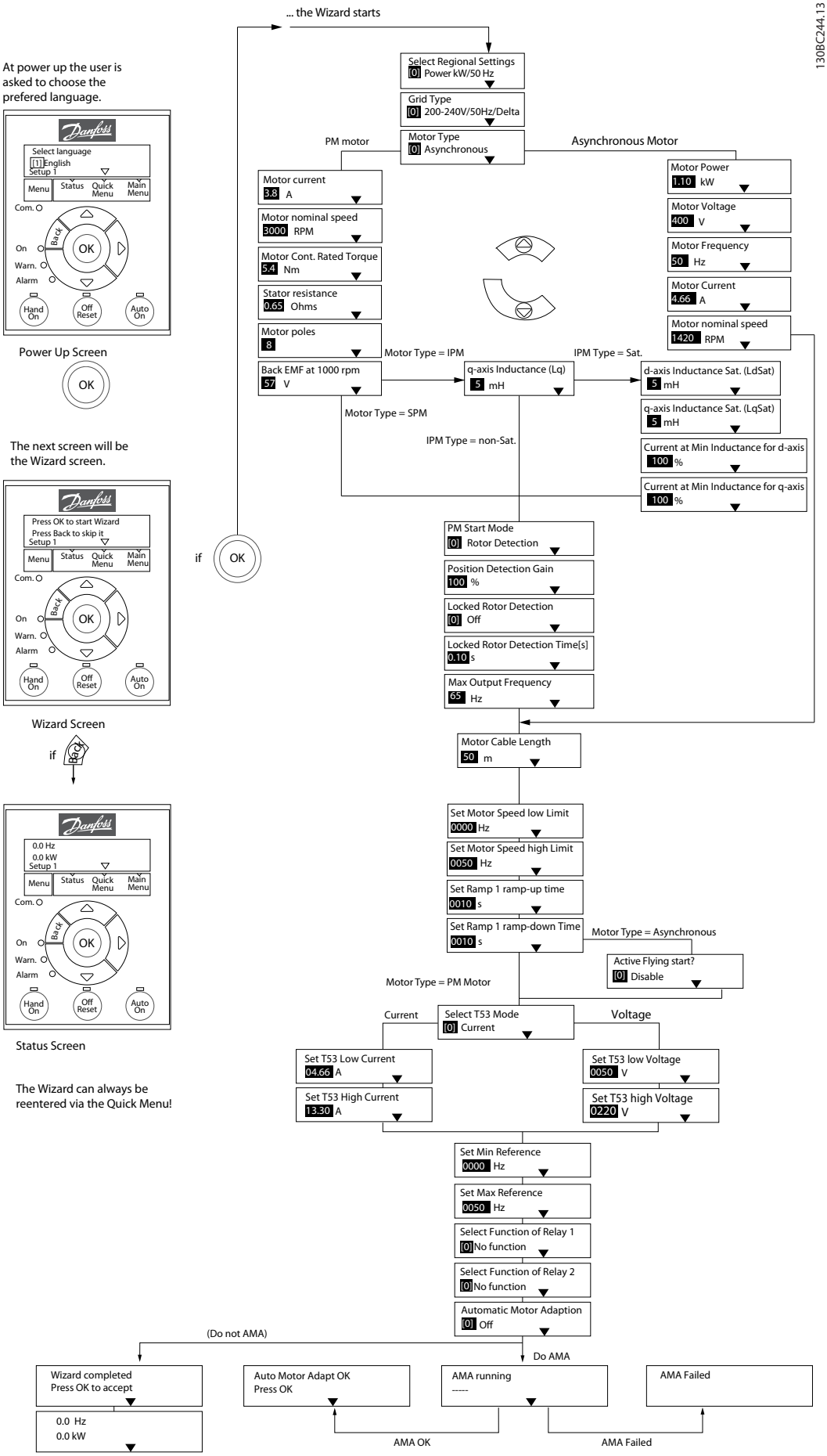

Illustration 2.4 Set-up Wizard for Open-loop Applications

Parameter 1-46 Position Detection Gain and *parameter 1-70 PM Start Mode* are available in software version 2.80 and subsequent versions.

Set-up Wizard for Open-loop Applications

Parameter	Option	Default	Usage
Parameter 0-03 Regional Settings	[0] International [1] US	0	
Parameter 0-06 GridType	[0] 200–240 V/50 Hz/IT-grid [1] 200–240 V/50 Hz/Delta [2] 200–240 V/50 Hz [10] 380–440 V/50 Hz/IT-grid [11] 380–440 V/50 Hz/Delta [12] 380–440 V/50 Hz [20] 440–480 V/50 Hz/IT-grid [21] 440–480 V/50 Hz/Delta [22] 440–480 V/50 Hz [30] 525–600 V/50 Hz/IT-grid [31] 525–600 V/50 Hz/Delta [32] 525–600 V/50 Hz [100] 200–240 V/60 Hz/IT-grid [101] 200–240 V/60 Hz/Delta [102] 200–240 V/60 Hz [110] 380–440 V/60 Hz/IT-grid [111] 380–440 V/60 Hz/Delta [112] 380–440 V/60 Hz [120] 440–480 V/60 Hz/IT-grid [121] 440–480 V/60 Hz/Delta [122] 440–480 V/60 Hz [130] 525–600 V/60 Hz/IT-grid [131] 525–600 V/60 Hz/Delta [132] 525–600 V/60 Hz	Size related	Select the operating mode for restart upon reconnection of the frequency converter to mains voltage after power down.

2

Parameter	Option	Default	Usage
1-10 Motor Construction	*[0] Asynchron [1] PM, non-salient SPM [2] PM, salient IPM, non Sat. [3] PM, salient IPM, Sat.	[0] Asynchron	Setting the parameter value might change these parameters: *parameter 1-01 Motor Control Principle* *parameter 1-03 Torque Characteristics* *parameter 1-08 Motor Control Bandwidth* *parameter 1-14 Damping Gain* *parameter 1-15 Low Speed Filter Time Const.* *parameter 1-16 High Speed Filter Time Const.* *parameter 1-17 Voltage filter time const.* *parameter 1-20 Motor Power* *parameter 1-22 Motor Voltage* *parameter 1-23 Motor Frequency* *parameter 1-24 Motor Current* *parameter 1-25 Motor Nominal Speed* *1-26 Motor Cont. Rated Torque* *parameter 1-30 Stator Resistance (Rs)* *parameter 1-33 Stator Leakage Reactance (X1)* *parameter 1-35 Main Reactance (Xh)* *parameter 1-37 d-axis Inductance (Ld)* *parameter 1-38 q-axis Inductance (Lq)* *parameter 1-39 Motor Poles* *parameter 1-40 Back EMF at 1000 RPM* *parameter 1-44 d-axis Inductance Sat. (LdSat)* *parameter 1-45 q-axis Inductance Sat. (LqSat)* *parameter 1-46 Position Detection Gain* *parameter 1-48 Current at Min Inductance for d-axis* *parameter 1-49 Current at Min Inductance for q-axis* *parameter 1-66 Min. Current at Low Speed* *parameter 1-70 PM Start Mode* *parameter 1-72 Start Function* *1-73 Flying Start* *parameter 1-80 Function at Stop* *parameter 1-82 Min Speed for Function at Stop [Hz]* *parameter 1-90 Motor Thermal Protection* *parameter 2-00 DC Hold/Motor Preheat Current* *parameter 2-01 DC Brake Current* *parameter 2-02 DC Braking Time* *parameter 2-04 DC Brake Cut In Speed* *parameter 2-10 Brake Function* *parameter 4-14 Motor Speed High Limit [Hz]* *parameter 4-19 Max Output Frequency* *parameter 4-58 Missing Motor Phase Function* *parameter 14-65 Speed Derate Dead Time Compensation*

Parameter	Option	Default	Usage
Parameter 1-20 Motor Power	0.12–110 kW/0.16–150 hp	Size related	Enter the motor power from the nameplate data.
Parameter 1-22 Motor Voltage	50–1000 V	Size related	Enter the motor voltage from the nameplate data.
Parameter 1-23 Motor Frequency	20–400 Hz	Size related	Enter the motor frequency from the nameplate data.
Parameter 1-24 Motor Current	0.01–10000.00 A	Size related	Enter the motor current from the nameplate data.
Parameter 1-25 Motor Nominal Speed	50–9999 RPM	Size related	Enter the motor nominal speed from the nameplate data.
1-26 Motor Cont. Rated Torque	0.1–1000.0 Nm	Size related	This parameter is available when *1-10 Motor Construction* is set to options that enable permanent motor mode. ***NOTICE*** **Changing this parameter affects the settings of other parameters.**
Parameter 1-29 Automatic Motor Adaption (AMA)	See *parameter 1-29 Automatic Motor Adaption (AMA)*	Off	Performing an AMA optimises motor performance.
Parameter 1-30 Stator Resistance (Rs)	0.000–99.990 Ohm	Size related	Set the stator resistance value.
Parameter 1-37 d-axis Inductance (Ld)	0.000–1000.000 mH	Size related	Enter the value of the d-axis inductance. Obtain the value from the permanent magnet motor datasheet. The d-axis inductance cannot be found by performing an AMA.
Parameter 1-38 q-axis Inductance (Lq)	0.000–1000.000 mH	Size related	Enter the value of the q-axis inductance.
Parameter 1-39 Motor Poles	2–100	4	Enter the number of motor poles.
Parameter 1-40 Back EMF at 1000 RPM	10–9000 V	Size related	Line-line RMS back EMF voltage at 1000 RPM.
Parameter 1-42 Motor Cable Length	0–100 m	50 m	Enter the motor cable length.
Parameter 1-44 d-axis Inductance Sat. (LdSat)	0.000–1000.000 mH	Size related	This parameter corresponds to the inductance saturation of Ld. Ideally, this parameter has the same value as *1-37 d-axis Inductance (Ld)*. However, if the motor supplier provides an induction curve, enter the induction value, which is 200% of the nominal current.
Parameter 1-45 q-axis Inductance Sat. (LqSat)	0.000–1000.000 mH	Size related	This parameter corresponds to the inductance saturation of Lq. Ideally, this parameter has the same value as *parameter 1-38 q-axis Inductance (Lq)*. However, if the motor supplier provides an induction curve, enter the induction value, which is 200% of the nominal current.
Parameter 1-46 Position Detection Gain	20–200%	100%	Adjusts the height of the test pulse during position detection at start (valid from software version 2.80).
Parameter 1-48 Current at Min Inductance for d-axis	20–200 %	100%	Enter the inductance saturation point.

2

Parameter	Option	Default	Usage
Parameter 1-49 Current at Min Inductance for q-axis	20–200 %	100%	This parameter specifies the saturation curve of the d- and q-inductance values. From 20% to 100% of this parameter, the inductances are linearly approximated due to parameters *parameter 1-37 d-axis Inductance (Ld)*, *parameter 1-38 q-axis Inductance (Lq)*, *parameter 1-44 d-axis Inductance Sat. (LdSat)*, and *parameter 1-45 q-axis Inductance Sat. (LqSat)*.
Parameter 1-70 PM Start Mode	[0] Rotor Detection [1] Parking	[0] Rotor Detection	Valid from software version 2.80.
1-73 Flying Start	[0] Disabled [1] Enabled	0	Select *[1] Enabled* to enable the frequency converter to catch a motor spinning due to mains drop-out. Select *[0] Disabled* if this function is not required. When this parameter is set to *[1] Enabled*, *parameter 1-71 Start Delay* and *parameter 1-72 Start Function* are not functional. *1-73 Flying Start* is active in VVC+ mode only.
3-02 Minimum Reference	-4999.000–4999.000	0	The minimum reference is the lowest value obtainable by summing all references.
Parameter 3-03 Maximum Reference	-4999.000–4999.000	50	The maximum reference is the lowest obtainable by summing all references.
Parameter 3-41 Ramp 1 Ramp Up Time	0.05–3600.00 s	Size related	Ramp-up time from 0 to rated *parameter 1-23 Motor Frequency* if asynchronous motor is selected; ramp-up time from 0 to *parameter 1-25 Motor Nominal Speed* if PM motor is selected.
Parameter 3-42 Ramp 1 Ramp Down Time	0.05–3600.00 s	Size related	For asynchronous motors, the ramp-down time is from rated *parameter 1-23 Motor Frequency* to 0 ; For PM motors, the ramp-down time is from *parameter 1-25 Motor Nominal Speed* to 0.
Parameter 4-12 Motor Speed Low Limit [Hz]	0.0–400.0 Hz	0 Hz	Enter the minimum limit for low speed.
Parameter 4-14 Motor Speed High Limit [Hz]	0.0–400.0 Hz	100 Hz	Enter the maximum limit for high speed.
Parameter 4-19 Max Output Frequency	0.0–400.0 Hz	100 Hz	Enter the maximum output frequency value.
Parameter 5-40 Function Relay [0] Function relay	See *parameter 5-40 Function Relay*	Alarm	Select the function to control output relay 1.
Parameter 5-40 Function Relay [1] Function relay	See *parameter 5-40 Function Relay*	Drive running	Select the function to control output relay 2.
Parameter 6-10 Terminal 53 Low Voltage	0.00–10.00 V	0.07 V	Enter the voltage that corresponds to the low reference value.
Parameter 6-11 Terminal 53 High Voltage	0.00–10.00 V	10 V	Enter the voltage that corresponds to the high reference value.
Parameter 6-12 Terminal 53 Low Current	0.00–20.00 mA	4 mA	Enter the current that corresponds to the low reference value.
Parameter 6-13 Terminal 53 High Current	0.00–20.00 mA	20 mA	Enter the current that corresponds to the high reference value.
6-19 Terminal 53 mode	[0] Current [1] Voltage	1	Select if terminal 53 is used for current or voltage input.

Parameter	Option	Default	Usage
Parameter 30-22 Locked Rotor Detection	[0] Off [1] On	[0] Off	–
Parameter 30-23 Locked Rotor Detection Time [s]	0.05–1 s	0.10 s	–

Table 2.4 Set-up Wizard for Open-loop Applications

2

Set-up Wizard for Closed-loop Applications

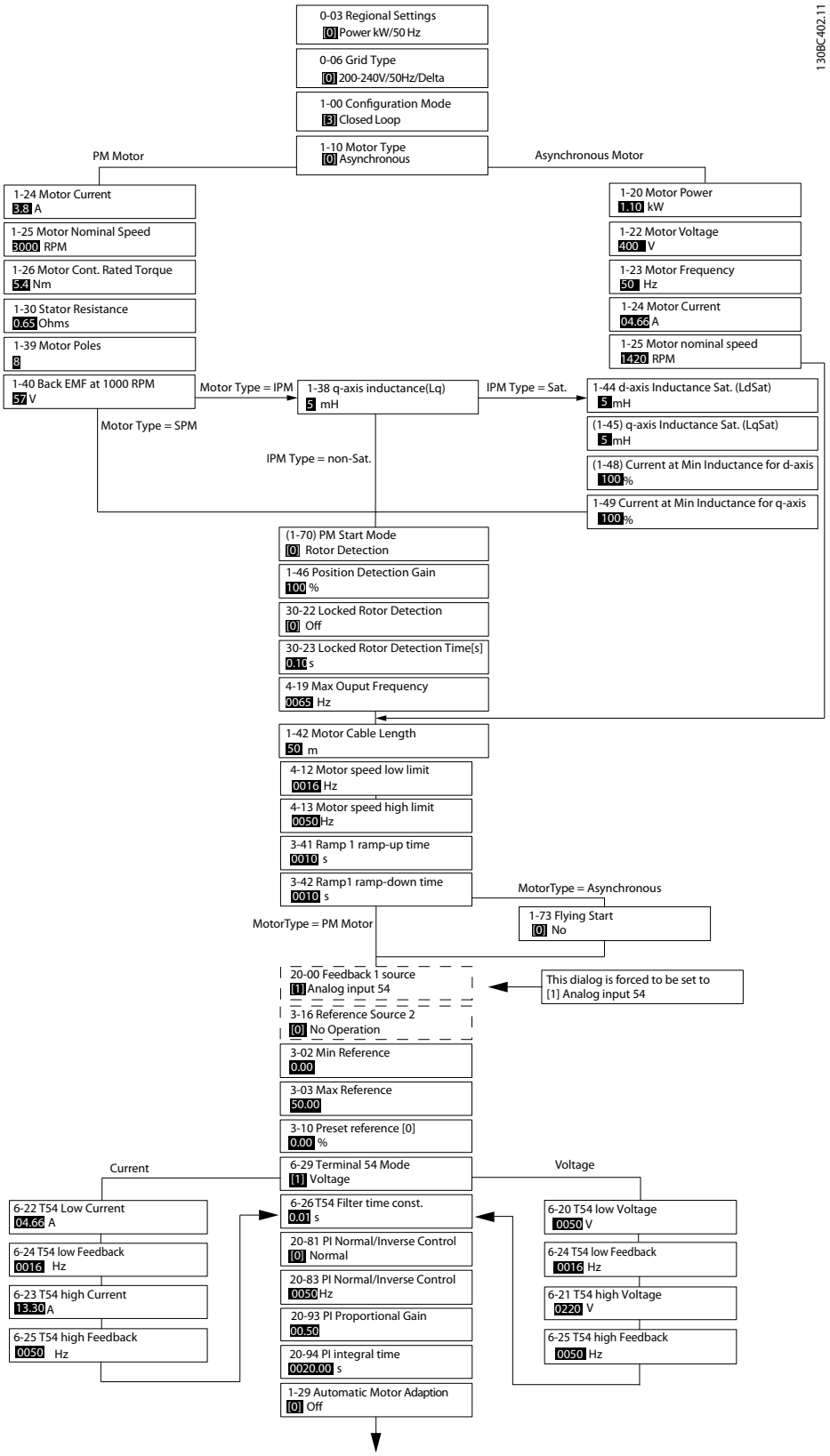

Illustration 2.5 Set-up Wizard for Closed-loop Applications

Parameter 1-46 Position Detection Gain and *parameter 1-70 PM Start Mode* are available in software version 2.80 and subsequent versions.

Parameter	Range	Default	Usage
Parameter 0-03 Regional Settings	[0] International [1] US	0	–
Parameter 0-06 GridType	[0]–[132] see *Table 2.4*.	Size selected	Select the operating mode for restart upon reconnection of the frequency converter to mains voltage after power down.
Parameter 1-00 Configuration Mode	[0] Open loop [3] Closed loop	0	Select *[3] Closed loop*.
1-10 Motor Construction	*[0] Asynchron [1] PM, non-salient SPM [2] PM, salient IPM, non Sat. [3] PM, salient IPM, Sat.	[0] Asynchron	Setting the parameter value might change these parameters: *parameter 1-01 Motor Control Principle* *parameter 1-03 Torque Characteristics* *parameter 1-08 Motor Control Bandwidth* *parameter 1-14 Damping Gain* *parameter 1-15 Low Speed Filter Time Const.* *parameter 1-16 High Speed Filter Time Const.* *parameter 1-17 Voltage filter time const.* *parameter 1-20 Motor Power* *parameter 1-22 Motor Voltage* *parameter 1-23 Motor Frequency* *parameter 1-24 Motor Current* *parameter 1-25 Motor Nominal Speed* *1-26 Motor Cont. Rated Torque* *parameter 1-30 Stator Resistance (Rs)* *parameter 1-33 Stator Leakage Reactance (X1)* *parameter 1-35 Main Reactance (Xh)* *parameter 1-37 d-axis Inductance (Ld)* *parameter 1-38 q-axis Inductance (Lq)* *parameter 1-39 Motor Poles* *parameter 1-40 Back EMF at 1000 RPM* *parameter 1-44 d-axis Inductance Sat. (LdSat)* *parameter 1-45 q-axis Inductance Sat. (LqSat)* *parameter 1-46 Position Detection Gain* *parameter 1-48 Current at Min Inductance for d-axis* *parameter 1-49 Current at Min Inductance for q-axis* *parameter 1-66 Min. Current at Low Speed* *parameter 1-70 PM Start Mode* *parameter 1-72 Start Function* *1-73 Flying Start* *parameter 1-80 Function at Stop* *parameter 1-82 Min Speed for Function at Stop [Hz]* *parameter 1-90 Motor Thermal Protection* *parameter 2-00 DC Hold/Motor Preheat Current* *parameter 2-01 DC Brake Current* *parameter 2-02 DC Braking Time* *parameter 2-04 DC Brake Cut In Speed* *parameter 2-10 Brake Function* *parameter 4-14 Motor Speed High Limit [Hz]* *parameter 4-19 Max Output Frequency* *parameter 4-58 Missing Motor Phase Function* *parameter 14-65 Speed Derate Dead Time Compensation*

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Parameter	Range	Default	Usage
Parameter 1-20 Motor Power	0.09–110 kW	Size related	Enter the motor power from the nameplate data.
Parameter 1-22 Motor Voltage	50–1000 V	Size related	Enter the motor voltage from the nameplate data.
Parameter 1-23 Motor Frequency	20–400 Hz	Size related	Enter the motor frequency from the nameplate data.
Parameter 1-24 Motor Current	0–10000 A	Size related	Enter the motor current from the nameplate data.
Parameter 1-25 Motor Nominal Speed	50–9999 RPM	Size related	Enter the motor nominal speed from the nameplate data.
1-26 Motor Cont. Rated Torque	0.1–1000.0 Nm	Size related	This parameter is available when*1-10 Motor Construction* is set to options that enable permanent motor mode. ***NOTICE*** **Changing this parameter affects the settings of other parameters.**
Parameter 1-29 Automatic Motor Adaption (AMA)		Off	Performing an AMA optimises motor performance.
Parameter 1-30 Stator Resistance (Rs)	0–99.990 Ohm	Size related	Set the stator resistance value.
Parameter 1-37 d-axis Inductance (Ld)	0.000–1000.000 mH	Size related	Enter the value of the d-axis inductance. Obtain the value from the permanent magnet motor datasheet. The d-axis inductance cannot be found by performing an AMA.
Parameter 1-38 q-axis Inductance (Lq)	0.000–1000.000 mH	Size related	Enter the value of the q-axis inductance.
Parameter 1-39 Motor Poles	2–100	4	Enter the number of motor poles.
Parameter 1-40 Back EMF at 1000 RPM	10–9000 V	Size related	Line-line RMS back EMF voltage at 1000 RPM.
Parameter 1-42 Motor Cable Length	0–100 m	50 m	Enter the motor cable length.
Parameter 1-44 d-axis Inductance Sat. (LdSat)	0.000–1000.000 mH	Size related	This parameter corresponds to the inductance saturation of Ld. Ideally, this parameter has the same value as *1-37 d-axis Inductance (Ld)*. However, if the motor supplier provides an induction curve, enter the induction value, which is 200% of the nominal current.
Parameter 1-45 q-axis Inductance Sat. (LqSat)	0.000–1000.000 mH	Size related	This parameter corresponds to the inductance saturation of Lq. Ideally, this parameter has the same value as *parameter 1-38 q-axis Inductance (Lq)*. However, if the motor supplier provides an induction curve, enter the induction value, which is 200% of the nominal current.
Parameter 1-46 Position Detection Gain	20–200%	100%	Adjusts the height of the test pulse during position detection at start (valid from software version 2.80).
Parameter 1-48 Current at Min Inductance for d-axis	20–200 %	100%	Enter the inductance saturation point.

Parameter	Range	Default	Usage
Parameter 1-49 Current at Min Inductance for q-axis	20–200 %	100%	This parameter specifies the saturation curve of the d- and q-inductance values. From 20% to 100% of this parameter, the inductances are linearly approximated due to parameters *parameter 1-37 d-axis Inductance (Ld)*, *parameter 1-38 q-axis Inductance (Lq)*, *parameter 1-44 d-axis Inductance Sat. (LdSat)*, and *parameter 1-45 q-axis Inductance Sat. (LqSat)*.
Parameter 1-70 PM Start Mode	[0] Rotor Detection [1] Parking	[0] Rotor Detection	Valid from software version 2.80.
1-73 Flying Start	[0] Disabled [1] Enabled	0	Select *[1] Enabled* to enable the frequency converter to catch a spinning motor, that is, fan applications. When PM is selected, this parameter is enabled.
3-02 Minimum Reference	-4999.000–4999.000	0	The minimum reference is the lowest value obtainable by summing all references.
Parameter 3-03 Maximum Reference	-4999.000–4999.000	50	The maximum reference is the highest value obtainable by summing all references.
Parameter 3-10 Preset Reference	-100–100%	0	Enter the setpoint.
Parameter 3-41 Ramp 1 Ramp Up Time	0.05–3600.0 s	Size related	Ramp-up time from 0 to rated *parameter 1-23 Motor Frequency* for asynchronous motors; ramp-up time from 0 to *parameter 1-25 Motor Nominal Speed* for PM motors.
Parameter 3-42 Ramp 1 Ramp Down Time	0.05–3600.0 s	Size related	Ramp-down time from rated *parameter 1-23 Motor Frequency* to 0 for asynchronous motors; ramp-down time from *parameter 1-25 Motor Nominal Speed* to 0 for PM motors.
Parameter 4-12 Motor Speed Low Limit [Hz]	0.0–400.0 Hz	0.0 Hz	Enter the minimum limit for low speed.
Parameter 4-14 Motor Speed High Limit [Hz]	0.0–400.0 Hz	100 Hz	Enter the minimum limit for high speed.
Parameter 4-19 Max Output Frequency	0.0–400.0 Hz	100 Hz	Enter the maximum output frequency value.
Parameter 6-20 Terminal 54 Low Voltage	0.00–10.00 V	0.07 V	Enter the voltage that corresponds to the low reference value.
Parameter 6-21 Terminal 54 High Voltage	0.00–10.00 V	10.00 V	Enter the voltage that corresponds to the high reference value.
Parameter 6-22 Terminal 54 Low Current	0.00–20.00 mA	4.00 mA	Enter the current that corresponds to the low reference value.
Parameter 6-23 Terminal 54 High Current	0.00–20.00 mA	20.00 mA	Enter the current that corresponds to the high reference value.
Parameter 6-24 Terminal 54 Low Ref./Feedb. Value	-4999–4999	0	Enter the feedback value that corresponds to the voltage or current set in *parameter 6-20 Terminal 54 Low Voltage*/ *parameter 6-22 Terminal 54 Low Current*.
Parameter 6-25 Terminal 54 High Ref./Feedb. Value	-4999–4999	50	Enter the 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*.
Parameter 6-26 Terminal 54 Filter Time Constant	0.00–10.00 s	0.01	Enter the filter time constant.

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Parameter	Range	Default	Usage
Parameter 6-29 Terminal 54 mode	[0] Current [1] Voltage	1	Select if terminal 54 is used for current or voltage input.
Parameter 20-81 PI Normal/ Inverse Control	[0] Normal [1] Inverse	0	Select *[0] Normal* to set the process control to increase the output speed when the process error is positive. Select *[1] Inverse* to reduce the output speed.
Parameter 20-83 PI Start Speed [Hz]	0–200 Hz	0 Hz	Enter the motor speed to be attained as a start signal for commencement of PI control.
Parameter 20-93 PI Proportional Gain	0.00–10.00	0.01	Enter the process controller proportional gain. Quick control is obtained at high amplification. However, if amplification is too high, the process may become unstable.
Parameter 20-94 PI Integral Time	0.1–999.0 s	999.0 s	Enter the process controller integral time. Obtain quick control through a short integral time, though if the integral time is too short, the process becomes unstable. An excessively long integral time disables the integral action.
Parameter 30-22 Locked Rotor Detection	[0] Off [1] On	[0] Off	–
Parameter 30-23 Locked Rotor Detection Time [s]	0.05–1.00 s	0.10 s	–

Table 2.5 Set-up Wizard for Closed-loop Applications

Motor set-up

The motor set-up wizard guides users through the needed motor parameters.

Parameter	Range	Default	Usage
Parameter 0-03 Regional Settings	[0] International [1] US	0	–
Parameter 0-06 GridType	[0]–[132] see *Table 2.4*	Size related	Select the operating mode for restart upon reconnection of the frequency converter to mains voltage after power down.

Parameter	Range	Default	Usage
1-10 Motor Construction	*[0] Asynchron [1] PM, non-salient SPM [2] PM, salient IPM, non Sat. [3] PM, salient IPM, Sat.	[0] Asynchron	Setting the parameter value might change these parameters: *parameter 1-01 Motor Control Principle* *parameter 1-03 Torque Characteristics* *parameter 1-08 Motor Control Bandwidth* *parameter 1-14 Damping Gain* *parameter 1-15 Low Speed Filter Time Const.* *parameter 1-16 High Speed Filter Time Const.* *parameter 1-17 Voltage filter time const.* *parameter 1-20 Motor Power* *parameter 1-22 Motor Voltage* *parameter 1-23 Motor Frequency* *parameter 1-24 Motor Current* *parameter 1-25 Motor Nominal Speed* *1-26 Motor Cont. Rated Torque* *parameter 1-30 Stator Resistance (Rs)* *parameter 1-33 Stator Leakage Reactance (X1)* *parameter 1-35 Main Reactance (Xh)* *parameter 1-37 d-axis Inductance (Ld)* *parameter 1-38 q-axis Inductance (Lq)* *parameter 1-39 Motor Poles* *parameter 1-40 Back EMF at 1000 RPM* *parameter 1-44 d-axis Inductance Sat. (LdSat)* *parameter 1-45 q-axis Inductance Sat. (LqSat)* *parameter 1-46 Position Detection Gain* *parameter 1-48 Current at Min Inductance for d-axis* *parameter 1-49 Current at Min Inductance for q-axis* *parameter 1-66 Min. Current at Low Speed* *parameter 1-70 PM Start Mode* *parameter 1-72 Start Function* *1-73 Flying Start* *parameter 1-80 Function at Stop* *parameter 1-82 Min Speed for Function at Stop [Hz]* *parameter 1-90 Motor Thermal Protection* *parameter 2-00 DC Hold/Motor Preheat Current* *parameter 2-01 DC Brake Current* *parameter 2-02 DC Braking Time* *parameter 2-04 DC Brake Cut In Speed* *parameter 2-10 Brake Function* *parameter 4-14 Motor Speed High Limit [Hz]* *parameter 4-19 Max Output Frequency* *parameter 4-58 Missing Motor Phase Function* *parameter 14-65 Speed Derate Dead Time Compensation*

2

Parameter	Range	Default	Usage
Parameter 1-20 Motor Power	0.12–110 kW/0.16–150 hp	Size related	Enter the motor power from the nameplate data.
Parameter 1-22 Motor Voltage	50–1000 V	Size related	Enter the motor voltage from the nameplate data.
Parameter 1-23 Motor Frequency	20–400 Hz	Size related	Enter the motor frequency from the nameplate data.
Parameter 1-24 Motor Current	0.01–10000.00 A	Size related	Enter the motor current from the nameplate data.
Parameter 1-25 Motor Nominal Speed	50–9999 RPM	Size related	Enter the motor nominal speed from the nameplate data.
1-26 Motor Cont. Rated Torque	0.1–1000.0 Nm	Size related	This parameter is available when *1-10 Motor Construction* is set to options that enable permanent motor mode. ***NOTICE*** **Changing this parameter affects the settings of other parameters.**
Parameter 1-30 Stator Resistance (Rs)	0–99.990 Ohm	Size related	Set the stator resistance value.
Parameter 1-37 d-axis Inductance (Ld)	0.000–1000.000 mH	Size related	Enter the value of the d-axis inductance. Obtain the value from the permanent magnet motor datasheet. The d-axis inductance cannot be found by performing an AMA.
Parameter 1-38 q-axis Inductance (Lq)	0.000–1000.000 mH	Size related	Enter the value of the q-axis inductance.
Parameter 1-39 Motor Poles	2–100	4	Enter the number of motor poles.
Parameter 1-40 Back EMF at 1000 RPM	10–9000 V	Size related	Line-line RMS back EMF voltage at 1000 RPM.
Parameter 1-42 Motor Cable Length	0–100 m	50 m	Enter the motor cable length.
Parameter 1-44 d-axis Inductance Sat. (LdSat)	0.000–1000.000 mH	Size related	This parameter corresponds to the inductance saturation of Ld. Ideally, this parameter has the same value as *parameter 1-37 d-axis Inductance (Ld)*. However, if the motor supplier provides an induction curve, enter the induction value, which is 200% of the nominal current.
Parameter 1-45 q-axis Inductance Sat. (LqSat)	0.000–1000.000 mH	Size related	This parameter corresponds to the inductance saturation of Lq. Ideally, this parameter has the same value as *parameter 1-38 q-axis Inductance (Lq)*. However, if the motor supplier provides an induction curve, enter the induction value, which is 200% of the nominal current.
Parameter 1-46 Position Detection Gain	20–200%	100%	Adjusts the height of the test pulse during position detection at start (valid from software version 2.80).
Parameter 1-48 Current at Min Inductance for d-axis	20–200 %	100%	Enter the inductance saturation point.

Parameter	Range	Default	Usage
Parameter 1-49 Current at Min Inductance for q-axis	20–200 %	100%	This parameter specifies the saturation curve of the d- and q-inductance values. From 20% to 100% of this parameter, the inductances are linearly approximated due to parameters 1-37, 1-38, 1-44, and 1-45.
Parameter 1-70 PM Start Mode	[0] Rotor Detection [1] Parking	[0] Rotor Detection	Valid from software version 2.80.
1-73 Flying Start	[0] Disabled [1] Enabled	0	Select *[1] Enabled* to enable the frequency converter to catch a spinning motor.
Parameter 3-41 Ramp 1 Ramp Up Time	0.05–3600.0 s	Size related	Ramp-up time from 0 to rated *parameter 1-23 Motor Frequency*.
Parameter 3-42 Ramp 1 Ramp Down Time	0.05–3600.0 s	Size related	Ramp-down time from rated *parameter 1-23 Motor Frequency* to 0.
Parameter 4-12 Motor Speed Low Limit [Hz]	0.0–400.0 Hz	0.0 Hz	Enter the minimum limit for low speed.
Parameter 4-14 Motor Speed High Limit [Hz]	0.0–400.0 Hz	100.0 Hz	Enter the maximum limit for high speed.
Parameter 4-19 Max Output Frequency	0.0–400.0 Hz	100.0 Hz	Enter the maximum output frequency value.
Parameter 30-22 Locked Rotor Detection	[0] Off [1] On	[0] Off	–
Parameter 30-23 Locked Rotor Detection Time [s]	0.05–1.00 s	0.10 s	–

Table 2.6 Motor Set-up Wizard Settings

Changes made

The *Changes Made* function lists all parameters changed from default settings.

- The list shows only parameters that have been changed in the current edit set-up.
- Parameters that have been reset to default values are not listed.
- The message *Empty* indicates that no parameters have been changed.

Changing parameter settings

1. Press the [Menu] key to enter the Quick Menu until the indicator in the display is placed above *Quick Menu*.
2. Press [▲] [▼] to select the wizard, closed-loop set-up, motor set-up, or changes made, 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. Press either [Back] twice to enter *Status*, or press [Menu] once to enter the main menu.

The main menu accesses all parameters

1. Press the [Menu] key until the indicator in the display is placed above *Main Menu*.
2. Press [▲] [▼] to browse through the parameter groups.
3. Press [OK] to select a parameter group.
4. Press [▲] [▼] to browse through the parameters in the specific group.
5. Press [OK] to select the parameter.
6. Press [▲] [▼] to set/change the parameter value.

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2.3.3 Main Menu

Press [Main Menu] to access and programme all parameters. The main menu parameters can be accessed readily unless a password has been created via *parameter 0-60 Main Menu Password*.
For most VLT HVAC Basic Drive applications, it is not necessary to access the main menu parameters. The quick menu provides the simplest and quickest access to the typical required parameters.

2.4 Quick Transfer of Parameter Settings between Multiple Frequency Converters

When the set-up of a frequency converter is completed, it is recommended to store the data in the LCP or on a PC via MCT 10 Setup Software.

Data transfer from the frequency converter to the LCP:

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

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

Data transfer from the LCP to the frequency converter:

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

2.5 Readout and Programming of Indexed Parameters

Select the parameter, press [OK], and press [▲]/[▼] to scroll through the indexed values. To change the parameter value, select the indexed value and press [OK]. Change the value by pressing [▲]/[▼]. Press [OK] to accept the new setting. Press [Cancel] to abort. Press [Back] to leave the parameter.

2.6 Initialisation to Default Settings

There are 2 ways to initialise the frequency converter to the default settings.

Recommended initialisation

1. Select *parameter 14-22 Operation Mode*.
2. Press [OK].
3. Select *[2] Initialisation* and Press [OK].
4. Power off the frequency converter and wait until the display turns off.
5. Reconnect the mains supply. The frequency converter is now reset, except the following parameters:
   - *1-06 Clockwise Direction*
   - *Parameter 8-30 Protocol*
   - *Parameter 8-31 Address*
   - *Parameter 8-32 Baud Rate*
   - *Parameter 8-33 Parity / Stop Bits*
   - *Parameter 8-35 Minimum Response Delay*
   - *Parameter 8-36 Maximum Response Delay*
   - *Parameter 8-37 Maximum Inter-char delay*
   - *Parameter 8-70 BACnet Device Instance*
   - *Parameter 8-72 MS/TP Max Masters*
   - *Parameter 8-73 MS/TP Max Info Frames*
   - *Parameter 8-74 "I am" Service*
   - *Parameter 8-75 Intialisation Password*
   - *Parameter 15-00 Operating hours* to *parameter 15-05 Over Volt's*
   - *Parameter 15-03 Power Up's*
   - *Parameter 15-04 Over Temp's*
   - *Parameter 15-05 Over Volt's*
   - *Parameter 15-30 Alarm Log: Error Code*
   - 15-4* Drive identification parameters

2-finger initialisation
The other way to initialise the frequency converter to default settings is through 2-finger initialisation, which is described in the following steps.

1. Power off the frequency converter.
2. Press [OK] and [Menu].
3. Power up the frequency converter while still pressing the keys for 10 s.
4. The frequency converter is now reset, except the following parameters:
   - *Parameter 15-00 Operating hours*
   - *Parameter 15-03 Power Up's*
   - *Parameter 15-04 Over Temp's*
   - *Parameter 15-05 Over Volt's*
   - 15-4* Drive identification parameters

Initialisation of parameters is confirmed by AL80 in the display after the power cycle.

3 Parameters

The * in parameter numbers indicates a group or subgroup of parameters for which the first 1 or 2 numbers are the same. For example, 0-** indicate the group of parameters that all start with 0. 0-0* indicates the subgroup of parameters that share the first 2 numbers, which is 0-0.

An asterisk (*) after an option number indicates it is the default option. For example, *[0]* English* is the default option for *parameter 0-01 Language*.

3.1 Main Menu - Operation and Display - Group 0

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

3.1.1 0-0* Basic Settings

0-01 Language		
Option:		**Function:**
		Defines the language to be used in the display.
[0] *	English	
[1]	Deutsch	
[2]	Francais	
[3]	Dansk	
[4]	Spanish	
[5]	Italiano	
[28]	Bras.port	
[255]	No Text	

0-03 Regional Settings		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** To meet the needs for different default settings in different parts of the world, *parameter 0-03 Regional Settings* is implemented in the frequency converter. The selected setting influences the default setting of the motor nominal frequency.
[0]	International	Sets the default value of *parameter 1-23 Motor Frequency* to 50 Hz.
[1]	North America	Sets the default value of *parameter 1-23 Motor Frequency* to 60 Hz.

0-04 Operating State at Power-up		
Option:		**Function:**
		Select the operating mode upon reconnection of the frequency converter to mains voltage after power-down when operating in *Hand (local) mode*.
[0] *	Resume	Resumes operation of the frequency converter, maintaining the same local reference and the same start/stop condition (applied by [Hand On]/[Off] on the LCP or local start via a digital input as before the frequency converter was powered down.
[1]	Forced stop, ref=old	Uses saved reference [1] to stop the frequency converter, but at the same time retains the local speed reference in memory before powering down. After mains voltage is reconnected, and after receiving a start command (pressing [Hand On] key or using the local start command via a digital input) the frequency converter restarts and operates at the retained speed reference.

0-06 GridType		
Option:		**Function:**
		Select the grid type of the supply voltage/frequency. ***NOTICE*** **Not all options are supported in all power sizes.** IT Grid is a supply mains, where there are no connections to ground. Delta is a supply mains where the secondary part of the transformer is delta connected and one phase is connected to ground.
[0]	200-240V/50Hz/IT-grid	
[1]	200-240V/50Hz/Delta	
[2]	200-240V/50Hz	
[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	
[30]	525-600V/50Hz/IT-grid	
[31]	525-600V/50Hz/Delta	
[32]	525-600V/50Hz	
[100]	200-240V/60Hz/IT-grid	
[101]	200-240V/60Hz/Delta	

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0-06 GridType		
Option:		**Function:**
[102]	200-240V/60Hz	
[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	
[130]	525-600V/60Hz/IT-grid	
[131]	525-600V/60Hz/Delta	
[132]	525-600V/60Hz	

0-07 Auto DC Braking		
Option:		**Function:**
		Protective function against overvoltage at coast. ***NOTICE*** **Can cause PWM when coasted.**
[0]	Off	This function is not active.
[1] *	On	This function is active.

3.1.2 0-1* Define and Set Up Operations

A complete set of all parameters controlling the frequency converter is called a set-up. The frequency converter contains 2 set-ups: set-up 1 and set-up 2. Furthermore, a fixed set of factory settings can be copied into 1 or both set-ups.

Some of the advantages of having more than 1 set-up in the frequency converter are:

- Run the motor in 1 set-up (active set-up) while updating parameters in another set-up (edit set-up)
- Connect the 2 motors (1 at a time) to the frequency converter. Motor data for the 2 motors can be placed in the 2 set-ups.
- Rapidly change settings of the frequency converter and/or the motor while the motor is running. For example, ramp time or preset references via bus or digital inputs.

The active set-up can be set as multi set-up, where the active set-up is selected via input on a digital input terminal and/or via the bus control word.

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

0-10 Active Set-up		
Option:		**Function:**
		Select the set-up in which the frequency converter operates.
[1] *	Set-up 1	Set-up 1 is active.
[2]	Set-up 2	Set-up 2 is active.
[9]	Multi Set-up	Used for remote set-up selections via 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:**
		The number of the set-up being edited is displayed in the LCP, flashing.
[1]	Set-up 1	Edit Set-up 1
[2]	Set-up 2	Edit Set-up 2
[9] *	Active Set-up	Edit parameters in the set-up selected via digital I/Os

0-12 Link Setups		
Option:		**Function:**
		If the set-ups are not linked, a change between them is not possible while the motor is running.
[0]	Not linked	When selecting a different set-up for operation, the set-up change does not occur until the motor is coasted
[20] *	Linked	Copies *not changeable during operation* parameters from one set-up to the other. It is possible to switch set-ups while the motor is running.

3.1.3 0-3* LCP Custom Readout and Display Text

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

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

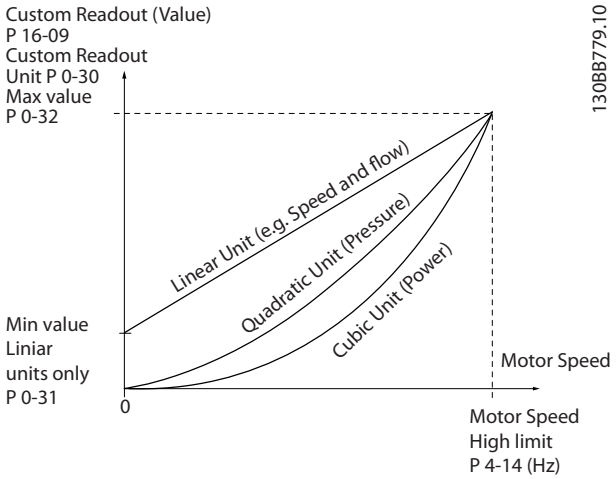


Illustration 3.1 Custom Readout

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

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

Table 3.1 Speed Relation

0-30 Custom Readout Unit

Option:		Function:
		Program a value to be shown in the display of the LCP. The value has a linear, squared, or cubed relation to speed. This relation depends on the unit selected (see *Table 3.1*). The actual calculated value can be read in *parameter 16-09 Custom Readout*.
[0]	None	
[1] *	%	
[5]	PPM	
[10]	l/Min	
[11]	RPM	
[12]	Pulse/s	
[20]	l/s	
[21]	l/min	
[22]	l/h	
[23]	m3/s	
[24]	m3/min	
[25]	m3/h	

0-30 Custom Readout Unit

Option:		Function:
[30]	kg/s	
[31]	kg/min	
[32]	kg/h	
[33]	t/min	
[34]	t/h	
[40]	m/s	
[41]	m/min	
[45]	m	
[60]	Degree Celsius	
[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]	ft3/h	
[140]	ft/s	
[141]	ft/min	
[160]	Degree Fahr	
[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-defined readout (occurs at 0 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 speed of the motor has reached the set value for *parameter 4-14 Motor Speed High Limit [Hz]*.

3

0-37 Display Text 1		
Range:	**Function:**	
	[0 - 0]	Use this parameter to write an individual text string to be read via serial communication. Device ID can be included. Only used when running BACnet.

0-38 Display Text 2		
Range:	**Function:**	
	[0 - 0]	Use this parameter to write an individual text string to be read via serial communication. Only used when running BACnet.

0-39 Display Text 3		
Range:	**Function:**	
	[0 - 0]	Use this parameter to write an individual text string to be read via serial communication. Only used when running BACnet.

3.1.4 0-4* LCP

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

0-40 [Hand on] Key on LCP		
Option:		**Function:**
[0]	Disabled	Select *[0] Disabled* to avoid accidental start of the frequency converter in *local mode*.
[1] *	Enabled	[Hand On] is enabled.

0-42 [Auto on] Key on LCP		
Option:		**Function:**
[0]	Disabled	Select *[0] Disabled* to avoid accidental start of the frequency converter from the LCP.
[1] *	Enabled	[Auto On] is enabled.

0-44 [Off/Reset] Key on LCP		
Option:		**Function:**
[0]	Disabled	Disable the Off/Reset key.
[1] *	Enabled	Enable both Off and Reset functions.
[7]	Enable Reset Only	Enable the Reset function, and disable the Off function to avoid accidental stop of the frequency converter.

3.1.5 0-5* Copy/Save

Copy parameter settings between set-ups and to/from the LCP.

0-50 LCP Copy		
Option:		**Function:**
[0] *	No copy	
[1]	All to LCP	Copies all parameters in all set-ups from the frequency converter memory to the LCP memory. For service purposes, 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. The latter selection can be used to programme several frequency converters with the same function without disturbing motor data that is already set.

0-51 Set-up Copy		
Option:		**Function:**
[0] *	No copy	No function
[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*).

3.1.6 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 the value to 0 disables the password function.

3.2 Main Menu - Load and Motor - Group 1

Parameters related to the motor nameplate load compensations and application load type.

3.2.1 1-0* General Settings

1-00 Configuration Mode

Option:		Function:
[0] *	Open Loop	***NOTICE*** **This parameter cannot be adjusted when the motor is running.** Motor speed is determined by applying a speed reference or by setting the desired speed when in local mode. Open loop is also used if the frequency converter is part of a closed loop control system based on an external PI controller providing a speed reference signal as output.
[3]	Closed Loop	***NOTICE*** **When set for *Closed Loop*, the commands *Reversing* and *Start Reversing* do not reverse the direction of the motor.** Motor speed is determined by a reference from the built-in PI controller varying the motor speed as of a closed-loop control process (for example, constant pressure or flow). Configure the PI controller in parameter group *20-** Drive Closed Loop*.

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 *parameter 1-55 U/f Characteristic - U* and *parameter 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.** Normal running mode, including slip and load compensations.

1-03 Torque Characteristics

Option:		Function:
[1] *	Variable Torque	For speed control of centrifugal pumps and fans. Also to be used when controlling more than one motor from the same frequency converter (for example, multiple condenser fans or cooling tower fans). Provides a voltage that is optimised for a squared torque load characteristic of the motor.
[3]	Auto Energy Optim.	For optimum energy efficient speed control of centrifugal pumps and fans, it provides a voltage that is optimised for a squared torque load characteristic of the motor. In addition, the AEO feature adapts the voltage exactly to the current load situation, thereby reducing energy consumption and audible noise from the motor.

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.

1-08 Motor Control Bandwidth

Option:		Function:
[0]	High	Suitable for highly dynamic response.
[1] *	Medium	Suitable for smooth steady-state operation.
[2]	Low	Suitable for smooth steady-state operation with lowest dynamic response.
[3]	Adaptive 1	Suitable for smooth steady-state operation with extra active damping.
[4]	Adaptive 2	This is an alternative to Adaptive 1, which focuses on low-inductance PM motors.

3.2.2 1-10 to 1-13 Motor Selection

NOTICE

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

The following parameters are active ('x') depending on the setting of *1-10 Motor Construction*.

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
Parameter 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
Parameter 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
Parameter 1-38 q-axis Inductance (Lq)			x	x
1-39 Motor Poles	x	x	x	x
1-40 Back EMF at 1000 RPM		x	x	x
Parameter 1-42 Motor Cable Length	x	x	x	x
Parameter 1-43 Motor Cable Length Feet	x	x	x	x
Parameter 1-44 d-axis Inductance Sat. (LdSat)				
Parameter 1-45 q-axis Inductance Sat. (LqSat)				x
parameter 1-46 Position Detection Gain		x	x	x
Parameter 1-48 Current at Min Inductance for d-axis				x
Parameter 1-49 Current at Min Inductance for q-axis				x
Parameter 1-50 Motor Magnetisation at Zero Speed				
Parameter 1-52 Min Speed Normal Magnetising [Hz]				
Parameter 1-55 U/f Characteristic - U				
Parameter 1-56 U/f Characteristic - F				
Parameter 1-62 Slip Compensation				
Parameter 1-63 Slip Compensation Time Constant				
Parameter 1-64 Resonance Dampening				
parameter 1-65 Resonance Dampening Time Constant				
Parameter 1-66 Min. Current at Low Speed		x	x	x
Parameter 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
Parameter 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
Parameter 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
Parameter 14-01 Switching Frequency	x	x	x	x
Parameter 14-03 Overmodulation	x	x	x	x
Parameter 14-07 Dead Time Compensation Level	x	x	x	x
Parameter 14-08 Damping Gain Factor	x	x	x	x

Parameter 14-09 Dead Time Bias Current Level	x	x	x	x
Parameter 14-10 Mains Failure	x	x	x	x
Parameter 14-11 Mains Voltage at Mains Fault	x	x	x	x
Parameter 14-12 Function at Mains Imbalance	x			
Parameter 14-27 Action At Inverter Fault	x	x	x	x
Parameter 14-40 VT Level	x	x	x	x
14-41 AEO Minimum Magnetisation	xx	x	x	x
Parameter 14-50 RFI Filter	x			
Parameter 14-51 DC-Link Voltage Compensation	x	x	x	x
Parameter 14-55 Output Filter	x	x	x	x
Parameter 14-64 Dead Time Compensation Zero Current Level	x	x	x	x
Parameter 14-65 Speed Derate Dead Time Compensation	x	x	x	x
Parameter 30-22 Locked Rotor Detection		x	x	x
Parameter 30-23 Locked Rotor Detection Time [s]		x	x	x

Table 3.2 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 *parameter 1-14 Damping Gain* to *parameter 1-17 Voltage filter time const.* for details about optimising the motor operation.
[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.

3.2.3 1-14 to 1-17 VVC+ PM

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

1-14 Damping Gain

Range:		Function:
120 %*	[0 - 250 %]	The parameter stabilises the PM motor to ensure smooth and stable operation. The value of damping gain controls the dynamic performance of the PM motor. Low damping gain results in high dynamic performance and a high value results in a low dynamic performance. The dynamic performance is related to the motor 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]	High pass-filter damping time constant determines the response time to load steps. Obtain quick control through a short damping time constant. However, if this value is too short, the control becomes unstable. This time constant is used below 10% rated speed.

1-16 High Speed Filter Time Const.

Range:		Function:
Size related*	[0.01 - 20 s]	High pass-filter damping time constant determines the response time to load steps. Obtain quick control through a short damping time constant. However, if this value is too short, the control becomes unstable. This time constant is used above 10% rated speed.

1-17 Voltage filter time const.

Range:		Function:
Size related*	[0.01 - 1 s]	Machine supply voltage filter time constant is used for reducing the influence of high frequency ripples and system resonances in the calculation of machine supply voltage. Without this filter, the ripples in the currents can distort the calculated voltage and affects the stability of the system.

3.2.4 1-2* Motor Data

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

3

NOTICE

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

1-20 Motor Power

Enter the nominal motor power in kW/hp according to the motor nameplate data. The default value corresponds to the nominal rated output of the unit.
This parameter cannot be adjusted while the motor is running.

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:
Size related*	[20 - 400 Hz]	***NOTICE*** **This parameter cannot be adjusted while the motor is running.** Select the motor frequency value from the motor nameplate data. For 87 Hz operation with 230/400 V motors, set the nameplate data for 230 V/50 Hz. Adapt *parameter 4-14 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, and so on.

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]	***NOTICE*** **Changing this parameter affects settings of other parameters.** This parameter is available only when *1-10 Motor Construction* is set to options that enable permanent motor mode.

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 parameters while the motor is stationary.

1-29 Automatic Motor Adaption (AMA)		
Option:		**Function:**
[0] *	Off	No function
[1]	Enable Complete AMA	When *1-10 Motor Construction* is set to *[0] Asynchron*, performs AMA of *parameter 1-30 Stator Resistance (Rs)*, *parameter 1-33 Stator Leakage Reactance (X1)*, and *parameter 1-35 Main Reactance (Xh)*. When *1-10 Motor Construction* is set to options that enable permanent motors, performs AMA of *parameter 1-30 Stator Resistance (Rs)*, and *parameter 1-37 d-axis Inductance (Ld)*. **NOTICE** **Terminal 27 Digital Input (*parameter 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, for example, 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

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

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 datasheet or perform an AMA on a cold motor.

1-33 Stator Leakage Reactance (X1)		
Range:		**Function:**
Size related*	[0.0 - 999.9 Ohm]	Set stator leakage reactance of motor.

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 based on the motor nameplate data.

1-37 d-axis Inductance (Ld)		
Range:		**Function:**
Size related*	[0 - 1000 mH]	Obtain the value from the permanent magnet motor datasheet.

3

1-38 q-axis Inductance (Lq)		
Range:		**Function:**
Size related*	[0.000 - 1000 mH]	Set the value of the q-axis inductance. Obtain the value from the permanent magnet motor datasheet. The value cannot be changed when the motor is running.

1-39 Motor Poles		
Enter the number of motor poles. The motor pole value is always an even number, because it refers to the total pole number, not pairs of poles.		
Range:		**Function:**
Size related*	[2 - 100]	

1-40 Back EMF at 1000 RPM		
Range:		**Function:**
Size related*	[10 - 9000 V]	Line-line RMS back EMF voltage at 1000 RPM

1-42 Motor Cable Length		
Range:		**Function:**
50 m*	[0 - 100 m]	This parameter only affects smaller frequency converters. Set the motor cable length during commissioning.

1-43 Motor Cable Length Feet		
Range:		**Function:**
164 ft*	[0 - 328 ft]	This parameter only affects smaller frequency converters. Set the motor cable length during commissioning

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)*. However, if the motor supplier provides an induction curve, enter the induction value here, 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)*. However, if the motor supplier provides an induction curve, enter the induction value here, which is 200% of the nominal current.

1-46 Position Detection Gain		
Range:		**Function:**
100 %*	[20 - 200 %]	Use this parameter to adjust the height of the test pulse during position detection at start. This parameter is valid from software version 2.80.

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 d- and q-inductance values. From 20% to 100% of this parameter, the inductances are linearly approximated due to *parameter 1-37 d-axis Inductance (Ld)*, *parameter 1-38 q-axis Inductance (Lq)*, *parameter 1-44 d-axis Inductance Sat. (LdSat)*, and *parameter 1-45 q-axis Inductance Sat. (LqSat)*. Below and above they are specified by the corresponding parameters. 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.

3.2.5 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 *parameter 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.

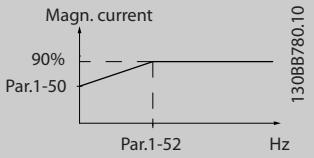


Illustration 3.2 Motor Magnetisation

1-52 Min Speed Normal Magnetising [Hz]		
Range:		**Function:**
0 Hz*	[0 - 10.0 Hz]	Set the required frequency for normal magnetising current. Use this parameter along with *parameter 1-50 Motor Magnetisation at Zero Speed*. See *Illustration 3.2*.

1-55 U/f Characteristic - U		
Range:		**Function:**
Size related*	[0 - 999 V]	Enter voltage at each frequency point to form a U/f characteristic matching the 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 form a U/f characteristic matching the 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 3.3*. Simplify U/f characteristics by merging 2 or more points (voltages and frequencies), respectively, are set equal.

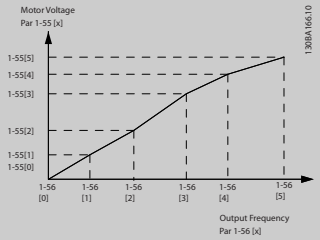


Illustration 3.3 U/f Characteristic

3.2.6 1-6* Load Depen. Setting

Parameters for adjusting the load-dependent motor settings.

1-62 Slip Compensation		
Range:		**Function:**
0 %*	[-400 - 399 %]	Enter the % value for slip compensation to compensate for tolerances in the value of $n_{M,N}$. Slip compensation is calculated automatically, which is based on the nominal 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 damping value. Set *parameter 1-64 Resonance Dampening* and *parameter 1-65 Resonance Dampening Time Constant* to help eliminate high-frequency resonance problems. To reduce resonance oscillation, increase the value of *parameter 1-64 Resonance Dampening*.

1-65 Resonance Dampening Time Constant		
Range:		**Function:**
0.005 s*	[0.001 - 0.050 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 %]	Applies to PM motors only. Increasing the minimum current improves motor torque at low speed, but also reduces efficiency.

3.2.7 1-7* Start Adjustments

Parameters for configuring special motor start features.

1-70 PM Start Mode		
This parameter is valid for software version 2.80 and later versions. Use this parameter to select the PM motor start mode, which is to initialise the VVC+ control core for previously free-running PM motors. This parameter is active for PM motors in VVC+ mode only if the motor is stopped (or running at low speed).		
Option:		**Function:**
[0] *	Rotor Detection	The rotor detection function estimates the electrical angle of the rotor and uses the angle as a starting point. This is the standard selection for automation frequency converter applications. If the flying start function detects that motor is running at low speed or is stopped, the frequency converter can detect the rotor position (the angle), and start the motor from that angle.

3

1-70 PM Start Mode

This parameter is valid for software version 2.80 and later versions. Use this parameter to select the PM motor start mode, which is to initialise the VVC+ control core for previously free-running PM motors. This parameter is active for PM motors in VVC+ mode only if the motor is stopped (or running at low speed).

Option:		Function:
[1]	Parking	The parking function applies DC current across the stator winding, and rotates the rotor to electrical zero position. This function is typically selected for HVAC applications. If the flying start function detects that motor is running at low speed or is stopped, the frequency converter sends out a DC current to park the motor at an angle and then start the motor from that angle.

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 *parameter 1-72 Start Function*. Set the start delay time until acceleration is to begin.

1-72 Start Function

Option:		Function:
[0]	DC Hold/ delay time	The motor is energised with *parameter 2-00 DC Hold/Motor Preheat Current* during start delay time.
[2] *	Coast/delay time	The frequency converter is coasted during start delay time (frequency converter off).

1-73 Flying Start

This function makes it possible to catch a motor that is spinning freely due to a mains drop-out. Flying start searches in clockwise direction only. If not successful, a DC brake is activated. If PM-enabled options are selected, parking is carried out if the speed is below 2.5–5% of nominal speed, in the time set in *parameter 2-07 Parking Time*

If the speed estimate comes out below 2.5–5% of nominal speed, the parking function is engaged (see *2-06 Parking Current* and *parameter 2-07 Parking Time*). Otherwise, the frequency converter catches the motor at that speed and resumes normal operation. The flying start function used for PM motors is based on an initial speed estimation. The speed is always estimated as the first thing after an active start signal is given.

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

- The speed range is up to 100% Nominal Speed or the field weakening speed (which ever is lowest).
- For high inertia applications (that is, where the load inertia is more than 30 times larger than the motor inertia).

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

3.2.8 1-8* Stop Adjustments

Parameters for configuring special motor stop features.

1-80 Function at Stop

Option:		Function:
		Select this 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]*.
[0] *	Coast	Leaves the motor in free mode.
[1]	DC hold / Motor Preheat	Energises the motor with a DC hold current (see *parameter 2-00 DC Hold/Motor Preheat Current*).

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

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

3.2.9 1-9* Motor Temperature

Parameters for configuring the temperature protection features for the motor.

1-90 Motor Thermal Protection		
Option:		**Function:**
		Using ETR (electronic thermal relay), the motor temperature is calculated based on frequency, current, and time. Danfoss recommends using the ETR function, if a thermistor is not present. The functionality is the same for asynchronous motors and PM motors. ***NOTICE*** **ETR calculation is based on motor data from group *1-2* Motor Data*.**
[0]	No protection	Disables temperature monitoring.
[1]	Thermistor warning	A thermistor gives a warning if the upper limit of motor temperature range is exceeded.
[2]	Thermistor trip	If the upper limit of motor temperature range is exceeded, a thermistor gives an alarm and makes the frequency converter trip.
[3]	ETR warning 1	If the calculated upper limit of the motor temperature range is exceeded, a warning occurs.
[4]	ETR trip 1	If 90% of calculated upper limit of motor temperature range is exceeded, an alarm occurs and frequency converter trips.

1-93 Thermistor Source		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** ***NOTICE*** **Set the digital input to *[0] PNP - Active at 24 V* in *parameter 5-03 Digital Input 29 Mode*.** Select the input at which the thermistor (PTC sensor) should be connected. When using an analog input, the same analog cannot be used as a reference in *3-15 Reference Resource 1* to *3-17 Reference Resource 3*, *parameter 20-00 Feedback 1 Source*, *parameter 20-03 Feedback 2 Source*, *parameter 24-06 Fire Mode Reference Source*, and *parameter 24-07 Fire Mode Feedback Source*.
[0] *	None	Do not set thermistor source.
[1]	Analog input AI53	Use analog input 53 as thermistor source.
[6]	Digital input 29	Use digital input 29 as thermistor source.

1-93 Thermistor Source

Option: Function:

[1] Analog input AI53 Use analog input 53 as thermistor source.
[6] Digital input 29 Use digital input 29 as thermistor source.

3

3.3 Main Menu - Brakes - Group 2

3.3.1 2-0* DC Brakes

Parameters for configuring the 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 $I_{M,N}$ in *parameter 1-24 Motor Current*. *Parameter 2-00 DC Hold/Motor Preheat Current* holds the motor function (holding torque) or pre-heats the motor. This parameter is active if DC hold is selected in *parameter 1-72 Start Function* [0] or *parameter 1-80 Function at Stop* [1].

NOTICE

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

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, with a stop command.

2-06 Parking Current		
Range:		**Function:**
100 %*	[0 - 150 %]	Set current as percentage of rated motor current, *parameter 1-24 Motor Current*. active with *parameter 1-73 Flying Start*. The parking current is active during the time period set in *parameter 2-07 Parking Time*. **NOTICE** ***2-06 Parking Current* is only active when PM motor construction is selected in *1-10 Motor Construction***

2-07 Parking Time		
Range:		**Function:**
3 s*	[0.1 - 60 s]	Set the duration of the parking current time set in *2-06 Parking Current*. Active with *parameter 1-73 Flying Start*. **NOTICE** ***Parameter 2-07 Parking Time* is only active when *1-10 Motor Construction* is set to options that enable PM motors.**

3.3.2 2-1* Brake Energy Function

Parameter group for selecting dynamic braking parameters.

2-10 Brake Function		
Option:		**Function:**
[0] *	Off	The brake resistor is not active.
[2]	AC brake	AC brake is active.

2-16 AC Brake, Max current		
Range:		**Function:**
100 %*	[0 - 150 %]	Enter the maximum permissible current when using the AC brake to avoid overheating motor windings.

2-17 Over-voltage Control		
Option:		**Function:**
		Select whether to enable OVC during ramping down, which reduces the risk of frequency converter trip due to overvoltage on the DC link caused by generative power from load.
[0]	Disabled	No OVC required.
[2] *	Enabled	Activates OVC. **NOTICE** **The ramp time is automatically adjusted to avoid tripping of the frequency converter.**

3.4 Main Menu–Reference/Ramps–Group 3

3.4.1 3-0* Reference Limits

Parameters for setting the reference unit, limits, and ranges.

Also see parameter group *20-0* Feedback* for information on settings in closed loop.

3-02 Minimum Reference

Range:		Function:
0*	[-4999–4999]	The minimum reference is the lowest value obtainable by summing all references.

3-03 Maximum Reference

Range:		Function:
Size related*	[-4999.0 - 4999]	The maximum reference is the highest value obtainable by summing all references. The maximum reference unit matches the selection of configuration in *parameter 1-00 Configuration Mode*.

3.4.2 3-1* References

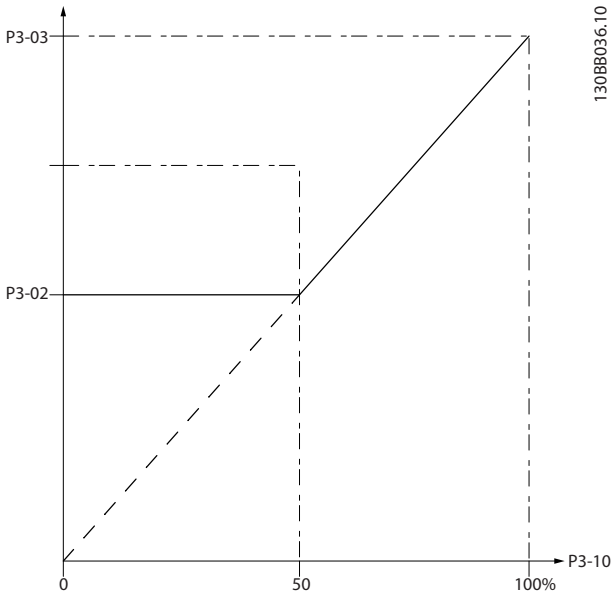


Illustration 3.4 References

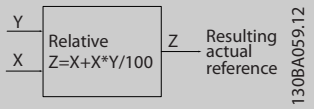
3-10 Preset Reference

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 at which the frequency converter is running when the jog function is activated. See also *parameter 3-80 Jog Ramp Time*.

3-14 Preset Relative Reference

Range:		Function:
0 %*	[-100 - 100 %]	Define the fixed value in % to be added to the variable value defined in *3-18 Relative Scaling Reference Resource*, *Relative Scaling Reference Source*. The sum of fixed and variable values (labelled Y in *Illustration 3.5*) is multiplied with actual reference (labelled X in *Illustration 3.5*). This product is added to actual reference $X + X \times \frac{Y}{100}$  **Illustration 3.5 Preset Relative Reference**

3-15 Reference 1 Source

Option:		Function:
		Select the 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]	Pulse input 29	
[11]	Local bus reference	

3-16 Reference 2 Source

Option:		Function:
		Select the input to be used for the second 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. See also *parameter 1-93 Thermistor Source*.
[0]	No function	

3

3-16 Reference 2 Source		
Option:		**Function:**
[1]	Analog Input 53	
[2] *	Analog Input 54	
[7]	Pulse input 29	
[11]	Local bus reference	

3-17 Reference 3 Source		
Option:		**Function:**
		Select the reference input to be used for the third 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]	Pulse input 29	
[11] *	Local bus reference	

3.4.3 3-4* Ramp 1

Configure the ramp time parameters, for each of the 2 ramps (parameter group *3-4* Ramp 1* and parameter group *3-5* Ramp 2*). The ramp time is preset to the minimum value of 10 ms for all power sizes.

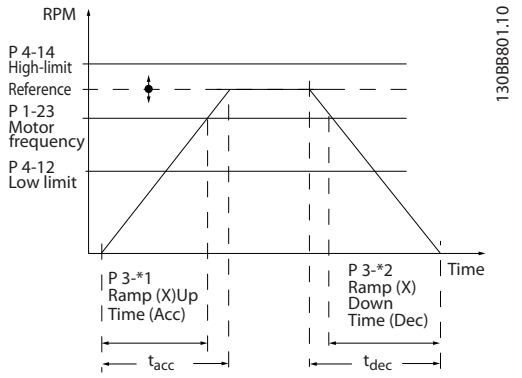


Illustration 3.6 Ramps

3-41 Ramp 1 Ramp Up Time		
Range:		**Function:**
Size related*	[0.05 - 3600 s]	Enter acceleration time from 0 Hz to *parameter 1-23 Motor Frequency* if asynchronous motor is selected. Enter acceleration time from 0 RPM, to *parameter 1-25 Motor Nominal Speed* if PM motor is selected. Select a ramp-up time such that the output current does not exceed the current limit in *parameter 4-18 Current Limit* during ramping. See ramp-down time in *3-42 Ramp 1 Ramp Down Time*.

3-42 Ramp 1 Ramp Down Time		
Range:		**Function:**
Size related*	[0.05 - 3600 s]	Enter deceleration time from *parameter 1-23 Motor Frequency* to 0 Hz if asynchronous motor is selected. Enter deceleration time from *parameter 1-25 Motor Nominal Speed* to 0 RPM if PM motor is selected. Select a ramp-down time to avoid tripping on overvoltage in the DC-link.

3.4.4 3-5* Ramp 2

This parameter group configures ramp 2 parameters.

3-51 Ramp 2 Ramp Up Time		
Range:		**Function:**
Size related*	[0.05 - 3600 s]	Enter acceleration time from 0 Hz to *parameter 1-23 Motor Frequency* if asynchronous motor is selected. Enter acceleration time from 0 RPM to *parameter 1-25 Motor Nominal Speed* if PM motor is selected. Select a ramp-up time such that the output current does not exceed the current limit in *parameter 4-18 Current Limit* during ramping up.

3-52 Ramp 2 Ramp Down Time		
Range:		**Function:**
Size related*	[0.05 - 3600 s]	Enter deceleration time from *parameter 1-25 Motor Nominal Speed* to 0 RPM. Select a ramp-down time such that the output current does not exceed the current limit in *parameter 4-18 Current Limit* during ramping down.

3.4.5 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 Hz to *parameter 1-23 Motor Frequency*. Ensure that the resultant 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 upon activation of a jog signal via the control panel, a selected digital input, or the serial communication port.

3-81 Quick Stop Ramp Time		
Range:		**Function:**
Size related*	[0.05 - 3600 s]	Enter the quick stop ramp time from the *parameter 1-23 Motor Frequency* to 0 Hz. During ramping, no overvoltage may arise in the inverter, nor may the generated current exceed the limit in *parameter 4-18 Current Limit* is activated with a signal on a selected digital input or via the serial communication port.

3.5 Main Menu - Limits/Warnings - Group 4

3.5.1 4-1* Motor Limits

Define current and speed limits for the motor, and the reaction of the frequency converter when the limits are exceeded.

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 speed low limit must not exceed the setting in *parameter 4-14 Motor Speed High Limit [Hz]*.

4-14 Motor Speed High Limit [Hz]

Enter the maximum limit for motor speed. It can be set to match the recommended maximum motor speed. The motor speed high limit must exceed the value in *parameter 4-12 Motor Speed Low Limit [Hz]*.
Motor speed high limit cannot be set higher than *parameter 4-19 Max Output Frequency*.

Range:		Function:
Size related*	[0.1 - 400.0 Hz]	

4-18 Current Limit

Range:		Function:
110 %*	[0 - 300 %]	Enter the current limit for motor and generator operation (in % of rated motor current. If the value is higher than maximum rated output from frequency converter, current is still limited to the maximum output current of the frequency converter). If a setting in *parameter 1-00 Configuration Mode* to *parameter 1-25 Motor Nominal Speed* is changed, *parameter 4-18 Current Limit* is not automatically reset to the default setting.

4-19 Max Output Frequency

Enter the maximum output frequency, which defines the absolute limit on the frequency converter output frequency for improved safety in applications where accidental over-speeding must be avoided. This absolute limit applies to all configurations and is independent of the setting in *parameter 1-00 Configuration Mode*.

Range:		Function:
Size related*	[0.0 - 400 Hz]	

3.5.2 4-4* Adjustable Warnings 2

4-40 Warning Freq. Low

Range:		Function:
Size related*	[0 - 400 Hz]	Use this parameter to set 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*. The output relay or the digital output can be configured to indicate this warning. The LCP warning indicator light is not turned on when this parameter set limit is reached.

4-41 Warning Freq. High

Use this parameter to set 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*. The output relay or the digital output can be configured to indicate this warning. The LCP warning indicator light is not turned on when this parameter set limit is reached.

Range:		Function:
Size related*	[0 - 400 Hz]	

3.5.3 4-5* Adj. Warnings

Define adjustable warning limits for current. Warnings are shown on the display, programmed output, or fieldbus.

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 lower reference limit. When the actual reference drops below this limit, the display indicates Ref_{Low}. Warning bit 20 is set in *parameter 16-94 Ext. Status Word*. The output relay or the digital output can be configured to indicate this warning. The LCP warning indicator light does not light when this parameter set limit is reached.

4-55 Warning Reference High		
Range:		**Function:**
4999*	[-4999 - 4999]	Use this parameter to set a higher limit for the reference range. When the actual reference exceeds this limit, the display reads *Reference High*. Warning bit 19 is set in *parameter 16-94 Ext. Status Word*. The output relay or the digital output can be configured to indicate this warning. The LCP warning indicator light is not turned on when this parameter set limit is reached.

4-56 Warning Feedback Low		
Range:		**Function:**
-4999*	[-4999 - 4999]	Use this parameter to set a lower limit for the feedback range. When the feedback drops below this limit, the display reads *Feedback Low*. Warning bit 6 is set in *parameter 16-94 Ext. Status Word*. The output relay or digital output can be configured to indicate this warning. The LCP warning indicator light does not light when this parameter set limit is reached.

4-57 Warning Feedback High		
Range:		**Function:**
4999*	[-4999 - 4999]	Use this parameter to set a higher limit for the feedback range. When the feedback exceeds this limit, the display reads *Feedback High*. Warning bit 5 is set in *parameter 16-94 Ext. Status Word*. The output relay or digital output can be configured to indicate this warning. The LCP warning indicator light does not light when this parameter set limit is reached.

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.

3.5.4 4-6* Speed Bypass

Define the speed bypass areas for the ramps. 3 frequency ranges can be avoided.

4-61 Bypass Speed From [Hz]		
Range:		**Function:**
0 Hz	[0 - 500 Hz]	Enter the lower limits of the speeds to be avoided. Some systems call for avoiding certain output speeds due to resonance problems in the system.

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.

3.5.5 Semi-Automatic Bypass Speed Set-up

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

Procedure:

1. Stop the motor.

NOTICE

Adjust the ramp times in *parameter 3-41 Ramp 1 Ramp Up Time* and *parameter 3-42 Ramp 1 Ramp Down Time*.

2. Select *[1] Enabled* in *parameter 4-64 Semi-Auto Bypass Set-up*.
3. Press [Hand On] to start the search for frequency bands causing resonances. The motor ramps up according to the ramp set.

NOTICE

Terminal 27 digital input *parameter 5-12 Terminal 27 Digital Input* has coast inverse as default setting. [Hand On] does not start the motor if there is no 24 V to terminal 27. If so, connect terminal 12 to terminal 27.

4. When sweeping through a resonance band, press [OK] on the LCP when leaving the band. The actual frequency is stored as the first element in *parameter 4-63 Bypass Speed To [Hz]* (array). Repeat this for each resonance band identified at the ramp-up (maximum of 3 can be adjusted).
5. When maximum speed has been reached, the motor automatically begins to ramp down. Repeat this procedure when speed is leaving the resonance bands during the deceleration. The

actual frequencies registered when pressing [OK] are stored in *parameter 4-61 Bypass Speed From [Hz]*.

6. When the motor has ramped down to stop, press [OK]. The *parameter 4-64 Semi-Auto Bypass Set-up* automatically resets to *off*. The frequency converter stays in *Hand On* mode until [Off] or [Auto On] is pressed.

If the frequencies for a certain resonance band are not registered in the right order (frequency values stored in *parameter 4-63 Bypass Speed To [Hz]* are higher than those in *parameter 4-61 Bypass Speed From [Hz]*), or if they do not have the same numbers of registrations for the *parameter 4-61 Bypass Speed From [Hz]* and *parameter 4-63 Bypass Speed To [Hz]*, all registrations are cancelled and the following message is displayed: *Collected speed areas overlapping or not determined. Press [Cancel] to abort*.

4-64 Semi-Auto Bypass Set-up		
Option:		**Function:**
[0] *	Off	
[1]	Enable	If this option is selected, speed ranges are automatically swept to identify bands of resonances.

3.6 Main Menu - Digital In/Out - Group 5

3.6.1 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.

5-03 Digital Input 29 Mode		
Option:		**Function:**
[0] *	PNP	Set to PNP mode for digital inputs 18, 19, and 27.
[1]	NPN	Set to NPN mode for digital inputs 18, 19, and 27.

3.6.2 5-1* Digital Inputs

Parameters for configuring the input functions for the input terminals.
The digital inputs are used for selecting various functions in the frequency converter. All digital inputs can be set to the following functions:

Digital input function	Description
[0] No operation	No reaction to signals transmitted to the terminal.
[1] Reset	Resets the frequency converter after a trip/alarm. Trip lock alarms can be reset.
[2] Coast inverse	Leaves the motor in free mode. Logic '0' ⇒ coast stop.
[3] Coast and reset inverse	Reset and coast stop inverted input (NC). Leaves the motor in free mode and resets the frequency converter. Logic '0' ⇒ coast stop and reset.
[4] Quick stop inverse	Inverted input (NC). Generates a stop in accordance with the quick-stop ramp time set in *parameter 3-81 Quick Stop Ramp Time*. After ramping down, the shaft is in free mode.
[5] DC brake inverse	Inverted input for DC braking (NC). Stops the motor by energising it with DC current for a certain time period, see *parameter 2-01 DC Brake Current*. The function is only active when value in *parameter 2-02 DC Braking Time* is different from 0. This selection is not possible when *1-10 Motor Construction* is set to *[1] PM non salient SPM*.
[6] Stop inverse	Stop inverse function generates the stop function when the selected terminal goes from logical level 1 to 0 (not latched). Stop is performed according to selected ramp time.
[7] External Interlock	Same function as coast stop, inverse, but external interlock generates the alarm message *external fault* on the display when the terminal, which is programmed for coast inverse, is logic '0'. The alarm message is also active via digital outputs and relay outputs, if programmed for external interlock. The alarm can be reset using a digital input, fieldbus, or the [Reset] key if the cause for the external interlock has been removed.
[8] Start	Select start for a start/stop command. Logic 1=start, logic 0=stop. (Default digital input 18)
[9] Latched start	Motor starts, if a pulse is applied for a minimum of 2 ms. The motor stops when stop inverse is activated.
[10] Reversing	Change direction of motor shaft rotation. The reversing signal only changes the direction of rotation, it does not activate the start function. Select *[2] Both directions* in *parameter 4-10 Motor Speed Direction*. 0=normal, 1=reversing.
[11] Start reversing	Use for start/stop and for reversing at the same time. Signals on *[8] start* are not allowed at the same time. 0=stop, 1=start reversing.
[14] Jog	Used for activating jog speed. See *parameter 3-11 Jog Speed [Hz]*. (Default digital input 29)
[16] Preset ref bit 0	Enables a selection of 1 of the 8 preset references according to *Table 3.4*.
[17] Preset ref bit 1	Enables a selection of 1 of the 8 preset references according to *Table 3.4*.
[18] Preset ref bit 2	Enables a selection of 1 of the 8 preset references according to *Table 3.4*.

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Digital input function	Description
[19] Freeze reference	Freeze actual reference. The frozen reference is now the point of enable/ condition for speed up and speed down to be used. If speed up/down is used, a speed change always follows ramp 2 (*parameter 3-51 Ramp 2 Ramp Up Time* and *parameter 3-52 Ramp 2 Ramp Down Time*) in the range *3-02 Minimum Reference - parameter 3-03 Maximum Reference*.
[20] Freeze output	Freezes actual reference. The frozen reference is now the point of enable/ condition for speed up and speed down to be used. If speed up/down is used, the speed change always follows ramp 2.
[21] Speed up	For digital control of the up/down speed (motor potentiometer). Activate this function by selecting either freeze reference or freeze output. When speed up is activated for less than 400 ms, the resulting reference is increased by 0.1%. If speed up is activated for more than 400 ms, the resulting reference ramps according to ramp 1 in *parameter 3-41 Ramp 1 Ramp Up Time*.
[22] Speed down	Same as *[21] Speed up*, but reference decreases.
[23] Set-up select bit 0	Selects one of the 2 set-ups. Set *parameter 0-10 Active Set-up* to multi set-up.
[32] Pulse Input	Select pulse input when using a pulse sequence as either reference or feedback. Scaling is done in parameter group *5-5* Pulse Input*. Available only for terminal 29.
[34] Ramp bit 0	Select which ramp to use. Logic 0 selects ramp 1 while logic 1 selects ramp 2.
[37] Fire mode	A signal applied puts the frequency converter into fire mode and disregards all other commands. See *24-0* Fire Mode*.

Digital input function	Description
[52] Run permissive	The input terminal, for which the run permissive has been programmed must be logic 1 before a start command can be accepted. Run permissive has a logic *AND* function related to the terminal, which is programmed for *[8] Start*, *[14] Jog* or *[20] Freeze Output*. To start running the motor, both conditions must be fulfilled. If run permissive is programmed on multiple terminals, run permissive needs only be logic 1 on one of the terminals for the function to be carried out. The digital output signal for run request (*[8] Start*, *[14] Jog* or *[20] Freeze Output*) programmed in parameter group *5-3* Digital Outputs*, or parameter group *5-4* Relays*, is not affected by run permissive. ***NOTICE*** **If no run permissive signal is applied but either Run, Jog or Freeze commands is activated, the status line in the display shows either *Run Requested*, *Jog Requested*, or *Freeze Requested*.**
[53] Hand Start	A signal applied puts the frequency converter into hand mode as if [Hand On] has been pressed and a normal stop command is overridden. If the signal is disconnected, the motor stops. To make any other start commands valid, another digital input must be assigned to *Auto Start* and a signal applied. The [Hand On] and [Auto On] keys have no impact. The [Off] key overrides *Hand Start* and *Auto Start*. Press either [Hand On] or [Auto On] to make *Hand Start* and *Auto Start* active again. If no signal on neither *Hand Start* nor *Auto Start*, the motor stops regardless of any normal *start* command applied. If a signal is applied to both *Hand Start* and *Auto Start*, the function is *Auto Start*.
[54] Auto start	A signal applied puts the frequency converter into *Auto* mode as if [Auto On] has been pressed. See also *[53] Hand Start*.
[60] Counter A (up)	Input for increment counting in the SLC counter.
[61] Counter A (down)	Input for decrement counting in the SLC counter.
[62] Reset Counter A	Input for reset of counter A.
[63] Counter B (up)	Input for increment counting in the SLC counter.

Digital input function	Description
[64] Counter B (down)	Input for decrement counting in the SLC counter.
[65] Reset Counter B	Input for reset of counter B

Table 3.3 Digital Input Functions

Selected preset ref.:	Preset ref. bit 2	Preset ref. bit 1	Preset ref. bit 0
Preset reference 0	0	0	0
Preset reference 1	0	0	1
Preset reference 2	0	1	0
Preset reference 3	0	1	1
Preset reference 4	1	0	0
Preset reference 5	1	0	1
Preset reference 6	1	1	0
Preset reference 7	1	1	1

Table 3.4 Selected Preset Reference

5-10 Terminal 18 Digital Input

Parameter for configuring the input function on input terminal 18. Refer to *Table 3.3* for setting options.

Option:		Function:
[0]	No operation	
[1]	Reset	
[2]	Coast inverse	
[3]	Coast and reset inverse	
[4]	Quick stop inverse	
[5]	DC-brake inverse	
[6]	Stop inverse	
[7]	External Interlock	
[8] *	Start	
[9]	Latched start	
[10]	Reversing	
[11]	Start reversing	
[14]	Jog	
[16]	Preset ref bit 0	
[17]	Preset ref bit 1	
[18]	Preset ref bit 2	
[19]	Freeze reference	
[20]	Freeze output	
[21]	Speed up	
[22]	Speed down	
[23]	Set-up select bit 0	

5-10 Terminal 18 Digital Input

Parameter for configuring the input function on input terminal 18. Refer to *Table 3.3* for setting options.

Option:		Function:
[34]	Ramp bit 0	
[37]	Fire Mode	
[52]	Run permissive	
[53]	Hand start	
[54]	Auto start	
[60]	Counter A (up)	
[61]	Counter A (down)	
[62]	Reset Counter A	
[63]	Counter B (up)	
[64]	Counter B (down)	
[65]	Reset Counter B	

5-11 Terminal 19 Digital Input

Parameter for configuring the input function on input terminal 19.

Option:		Function:
[0] *	No operation	
[1]	Reset	
[2]	Coast inverse	
[3]	Coast and reset inverse	
[4]	Quick stop inverse	
[5]	DC-brake inverse	
[6]	Stop inverse	
[7]	External Interlock	
[8]	Start	
[9]	Latched start	
[10]	Reversing	
[11]	Start reversing	
[14]	Jog	
[16]	Preset ref bit 0	
[17]	Preset ref bit 1	
[18]	Preset ref bit 2	
[19]	Freeze reference	
[20]	Freeze output	
[21]	Speed up	
[22]	Speed down	
[23]	Set-up select bit 0	
[34]	Ramp bit 0	
[37]	Fire Mode	
[52]	Run permissive	
[53]	Hand start	
[54]	Auto start	
[60]	Counter A (up)	
[61]	Counter A (down)	
[62]	Reset Counter A	
[63]	Counter B (up)	
[64]	Counter B (down)	
[65]	Reset Counter B	

3

5-12 Terminal 27 Digital Input

Parameter for configuring the input function on input terminal 27. When *parameter 0-03 Regional Settings* is set to *[0] International*, the default value is *[2] Coast inverse*; When *parameter 0-03 Regional Settings* is set to *[1] North America*, the default value is *[7] External Interlock*.

Option:		Function:
[0]	No operation	
[1]	Reset	
[2]	Coast inverse	
[3]	Coast and reset inverse	
[4]	Quick stop inverse	
[5]	DC-brake inverse	
[6]	Stop inverse	
[7]	External Interlock	
[8]	Start	
[9]	Latched start	
[10]	Reversing	
[11]	Start reversing	
[14]	Jog	
[16]	Preset ref bit 0	
[17]	Preset ref bit 1	
[18]	Preset ref bit 2	
[19]	Freeze reference	
[20]	Freeze output	
[21]	Speed up	
[22]	Speed down	
[23]	Set-up select bit 0	
[34]	Ramp bit 0	
[37]	Fire Mode	
[52]	Run permissive	
[53]	Hand start	
[54]	Auto start	
[60]	Counter A (up)	
[61]	Counter A (down)	
[62]	Reset Counter A	
[63]	Counter B (up)	
[64]	Counter B (down)	
[65]	Reset Counter B	

5-13 Terminal 29 Digital Input

Parameter for configuring the input function on input terminal 29.

Option:		Function:
[0]	No operation	
[1]	Reset	
[2]	Coast inverse	
[3]	Coast and reset inverse	
[4]	Quick stop inverse	
[5]	DC-brake inverse	
[6]	Stop inverse	
[7]	External Interlock	
[8]	Start	
[9]	Latched start	
[10]	Reversing	

5-13 Terminal 29 Digital Input

Parameter for configuring the input function on input terminal 29.

Option:		Function:
[11]	Start reversing	
[14] *	Jog	
[16]	Preset ref bit 0	
[17]	Preset ref bit 1	
[18]	Preset ref bit 2	
[19]	Freeze reference	
[20]	Freeze output	
[21]	Speed up	
[22]	Speed down	
[23]	Set-up select bit 0	
[32]	Pulse input	
[34]	Ramp bit 0	
[37]	Fire Mode	
[52]	Run permissive	
[53]	Hand start	
[54]	Auto start	
[60]	Counter A (up)	
[61]	Counter A (down)	
[62]	Reset Counter A	
[63]	Counter B (up)	
[64]	Counter B (down)	
[65]	Reset Counter B	

3.6.3 5-3* Digital Outputs

Parameters for configuring the output functions for the output terminals.

5-34 On Delay, Digital Output

Enter the delay time before the digital output is switched on. The digital output (terminal 42/45) condition must not be interrupted during the delay time.

Range:		Function:
0.01 s*	[0 - 600 s]	

5-35 Off Delay, Digital Output

Enter the delay time before the digital output is switched off. The digital output (terminal 42/45) condition must not be interrupted during the delay time.

Range:		Function:
0.01 s*	[0 - 600 s]	

3.6.4 5-4* Relays

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

5-40 Function Relay

Array (Relay 1 [0], Relay 2 [1])
Select options to define the function of the relays.
The selection of each mechanical relay is realised in an array parameter. When *parameter 0-03 Regional Settings* is set to *[0] International*, the default value is *[9] Alarm*; When *parameter 0-03 Regional Settings* is set to *[1] North America*, the default value is *[160] No alarm*

Option:		Function:
[0]	No operation	
[1]	Control Ready	Control board receives supply voltage.
[2]	Drive ready	Frequency converter is ready for operation and applies a supply signal on the control board.
[3]	Drive ready/ remote control	Frequency converter is ready for operation in auto-on mode.
[4]	Standby / no warning	Frequency converter is ready for operation. No start or stop command is given. No warnings are present.
[5]	Drive running	Motor is running.
[6]	Running / no warning	Motor runs, and no warnings are present.
[7]	Run in range/no warning	Motor runs within programmed current ranges, see *parameter 4-50 Warning Current Low* and *parameter 4-51 Warning Current High*. No warnings are present.
[8]	Run on ref/no warning	Motor runs at reference speed and with no warnings.
[9]	Alarm	An alarm activates output.
[10]	Alarm or warning	An alarm or warning activates output.
[12]	Out of current range	Motor current is outside the range set in *parameter 4-50 Warning Current Low* and *parameter 4-51 Warning Current High*.
[13]	Below current, low	Motor current is lower than the limit set in *parameter 4-50 Warning Current Low*.
[14]	Above current, high	Motor current is higher than the limit set in *parameter 4-51 Warning Current High*.
[16]	Below speed, low	The frequency converter output speed is lower than the limit set in *parameter 4-40 Warning Freq. Low*.
[17]	Above speed, high	The frequency converter output speed is higher than the limit set in *parameter 4-41 Warning Freq. High*.

5-40 Function Relay

Array (Relay 1 [0], Relay 2 [1])
Select options to define the function of the relays.
The selection of each mechanical relay is realised in an array parameter. When *parameter 0-03 Regional Settings* is set to *[0] International*, the default value is *[9] Alarm*; When *parameter 0-03 Regional Settings* is set to *[1] North America*, the default value is *[160] No alarm*

Option:		Function:
[19]	Below feedback, low	The feedback is lower than the limit set in *parameter 4-56 Warning Feedback Low*.
[20]	Above feedback, high	The feedback is higher than the limit set in *parameter 4-57 Warning Feedback High*.
[21]	Thermal warning	The thermal warning turns on when the temperature exceeds the limit in motor, frequency converter, or thermistor.
[22]	Ready, no thermal warning	The frequency converter is ready for operation and no overtemperature warning is present.
[23]	Remote, ready, no thermal warning	The frequency converter is ready for operation in *Auto* mode, and no overtemperature warning is present.
[24]	Ready, Voltage OK	The frequency converter is ready for operation and mains voltage is within the specified voltage range.
[25]	Reverse	Motor runs/is ready to run clockwise when logic=0 and counterclockwise when logic=1. Output changes as soon as reversing signal is applied.
[26]	Bus OK	Active communication (no time-out) via serial communication port.
[35]	External Interlock	See digital input.
[36]	Control word bit 11	Bit 11 in control word controls relay.
[37]	Control word bit 12	Bit 12 in control word controls relay.
[41]	Below reference, low	The reference is lower than the limit set in *parameter 4-54 Warning Reference Low*.
[42]	Above ref, high	The reference is higher than the limit set in *parameter 4-55 Warning Reference High*.
[45]	Bus Control	The output is configured in *parameter 5-90 Digital & Relay Bus Control*.
[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 2 is evaluated as *true*, the output goes high. Otherwise, it is low.

3

5-40 Function Relay

Array (Relay 1 [0], Relay 2 [1])

Select options to define the function of the relays.

The selection of each mechanical relay is realised in an array parameter. When *parameter 0-03 Regional Settings* is set to *[0] International*, the default value is *[9] Alarm*; When *parameter 0-03 Regional Settings* is set to *[1] North America*, the default value is *[160] No alarm*

Option:		Function:
[62]	Comparator 2	See parameter group *13-1* Comparators*. If Comparator 2 is evaluated as *true*, the output goes high. Otherwise, it is low.
[63]	Comparator 3	See parameter group *13-1* Comparators*. If Comparator 3 is evaluated as *true*, the output goes high. Otherwise, it is low.
[64]	Comparator 4	See parameter group *13-1* Comparators*. If Comparator 4 is evaluated as *true*, the output goes high. Otherwise, it is low.
[65]	Comparator 5	See parameter group *13-1* Comparators*. If Comparator 5 is evaluated as *true*, the output goes high. Otherwise, it is low.
[70]	Logic rule 0	See parameter group *13-4* Logic Rules*. If logic rule 0 is evaluated as *true*, the output goes high. Otherwise, it is low.
[71]	Logic rule 1	See parameter group *13-4* Logic Rules*. If logic rule 1 is evaluated as *true*, the output goes high. Otherwise, it is low.
[72]	Logic rule 2	See parameter group *13-4* Logic Rules*. If logic rule 2 is evaluated as *true*, the output goes high. Otherwise, it is low.
[73]	Logic rule 3	See parameter group *13-4* Logic Rules*. If logic rule 3 is evaluated as *true*, the output goes high. Otherwise, it is low.
[74]	Logic rule 4	See parameter group *13-4* Logic Rules*. If logic rule 4 is evaluated as *true*, the output goes high. Otherwise, it is low.
[75]	Logic rule 5	See parameter group *13-4* Logic Rules*. If logic rule 5 is evaluated as *true*, the output goes high. Otherwise, it is low.
[80]	SL digital output A	See *parameter 13-52 SL Controller Action*. The input goes high whenever the smart logic action *[38] Set dig. out. A high* is executed. The input goes low whenever the smart logic *[32] Action Set dig. out.* A low is executed.
[81]	SL digital output B	See *parameter 13-52 SL Controller Action*. The input goes high whenever the smart logic action *[39] Set dig. out. B high* is executed. The input goes low whenever the smart logic *[33] Action Set dig. out. B low* is executed.

5-40 Function Relay

Array (Relay 1 [0], Relay 2 [1])

Select options to define the function of the relays.

The selection of each mechanical relay is realised in an array parameter. When *parameter 0-03 Regional Settings* is set to *[0] International*, the default value is *[9] Alarm*; When *parameter 0-03 Regional Settings* is set to *[1] North America*, the default value is *[160] No alarm*

Option:		Function:
[82]	SL digital output C	See *parameter 13-52 SL Controller Action*. The input goes high whenever the smart logic action *[40] Set dig. out. C high* is executed. The input goes low whenever the smart logic *[34] Action Set dig. out. C low* is executed.
[83]	SL digital output D	See *parameter 13-52 SL Controller Action*. The input goes high whenever the smart logic *[41] Action Set dig. out. D* high is executed. The input goes low whenever the smart logic *[35] Action 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 ref. active	The output is high when *3-13 Reference Site=[2] Local* or when *3-13 Reference Site=[0] Linked to hand auto* at the same time as the LCP is in [Hand on] mode.
[166]	Remote ref. active	The output is high when *3-13 Reference Site [1] or Linked to hand/auto [0]* while the LCP is in [Auto on] mode.
[167]	Start command activ	The output is high when there is an active *Start* command (that is, via digital input bus connection or [Hand on] or [Auto on], and no *Stop* command is active.
[168]	Drive in hand mode	The output is high when the frequency converter is in *Hand on* mode (as indicated by the LED light above [Hand on].
[169]	Drive in auto mode	The output is high when the frequency converter is in *Auto on* mode (as indicated by the LED light above [Auto on].
[193]	Sleep Mode	The frequency converter/system has turned into sleep mode. See parameter group *22-4* Sleep Mode*.
[194]	Broken Belt Function	A broken belt condition has been detected. This function must be enabled in *parameter 22-60 Broken Belt Function*.

5-40 Function Relay		
Array (Relay 1 [0], Relay 2 [1])		
Select options to define the function of the relays.		
The selection of each mechanical relay is realised in an array parameter. When *parameter 0-03 Regional Settings* is set to *[0] International*, the default value is *[9] Alarm*; When *parameter 0-03 Regional Settings* is set to *[1] North America*, the default value is *[160] No alarm*		
Option:		**Function:**
[196]	Fire Mode	The frequency converter is operating in fire mode. See parameter group *24-0* Fire Mode*.
[198]	Drive Bypass	To be used as a signal for activating an external electromechanical bypass, switching the motor directly on line. See parameter group *24-1* Drive Bypass*.

5-41 On Delay, Relay		
Array [2], (Relay 1 [0], Relay 2 [1])		
Range:		**Function:**
0.01 s*	[0.01 - 600 s]	Enter the delay of the relay cut-in time. Select one of 2 internal mechanical relays in an array function. See *parameter 5-40 Function Relay* for details.

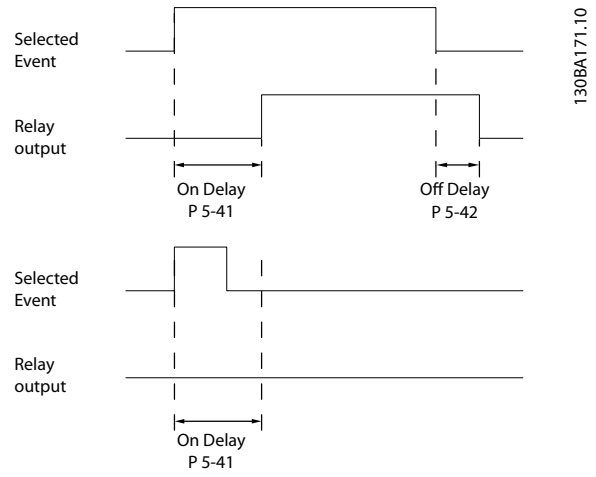

Illustration 3.7 On Delay, Relay

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. Select one of 2 internal mechanical relays in an array function. See *parameter 5-40 Function Relay* for details. If the selected event condition changes before a delay timer expires, the relay output is unaffected.

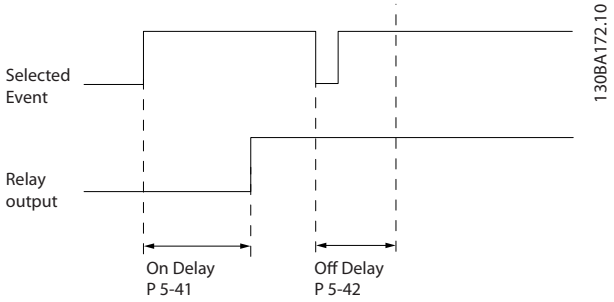

Illustration 3.8 Off Delay, Relay

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

3.6.5 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, set *5-01 Terminal 27 Mode* to *[0] Input*.

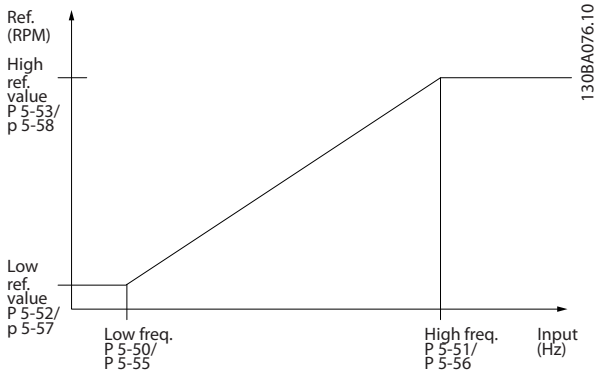

Illustration 3.9 Pulse Input

5-50 Term. 29 Low Frequency		
Range:		**Function:**
20 Hz*	[20 - 31999 Hz]	Enter the low frequency limit corresponding to the low motor shaft speed (i.e. low reference value) in *5-52 Term. 29 Low Ref./Feedb. Value*. See *Illustration 3.9*.

5-51 Term. 29 High Frequency		
Range:		**Function:**
32000 Hz*	[21 - 32000 Hz]	Enter the high frequency limit corresponding to the high motor shaft speed (that is, high reference value) in *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 [RPM]. This is also the lowest feedback value. Set terminal 29 to digital input (*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 [RPM] for the motor shaft speed and the high feedback value. Select terminal 29 as a digital input (*5-13 Terminal 29 Digital Input*=applicable value).

3.6.6 5-9* Bus Controlled

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

5-90 Digital & Relay Bus Control		
Range:		**Function:**
0*	[0 - 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 3.5 Bit Functions

3.7 Main Menu - Analog In/Out - Group 6

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)

3.7.1 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	

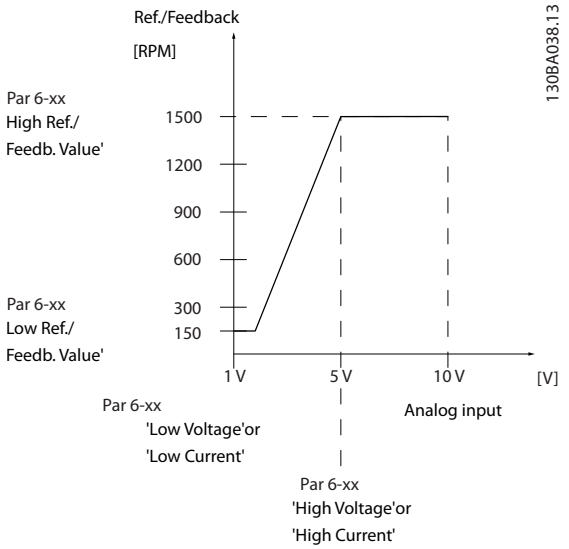

Illustration 3.10 Live Zero Time-out Function

6-02 Fire Mode Live Zero Timeout Function		
Option:		**Function:**
		Select the time-out function when the fire mode is active. The function set in this parameter is activated if the input signal on analog inputs is below 50% of the low value for a time period defined in *parameter 6-00 Live Zero Timeout Time*.
[0] *	Off	
[1]	Freeze output	
[2]	Stop	
[3]	Jogging	
[4]	Max. speed	

3.7.2 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*).

3

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	

3.7.3 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	

3.7.4 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:**
		Select the function of terminal 45 as an analog current output. See also *parameter 6-70 Terminal 45 Mode*.
[0] *	No operation	
[100]	Output frequency	0–100 Hz
[101]	Reference	$Min_{Ref.}$–$Max_{Ref.}$
[102]	Feedback	Min_{FB}–Max_{FB}
[103]	Motor Current	0-I_{max}
[106]	Power	0-P_{nom}
[139]	Bus Control	0-100%

6-72 Terminal 45 Digital Output		
Option:		**Function:**
		Select the function of terminal 45 as a digital current output. See also *parameter 6-70 Terminal 45 Mode*. See *parameter 5-40 Function Relay* for description of the options.
[0] *	No operation	
[1]	Control Ready	
[2]	Drive ready	
[3]	Drive ready/remote control	
[4]	Standby / no warning	
[5]	Drive running	
[6]	Running / no warning	
[7]	Run in range/no warning	
[8]	Run on ref/no warning	
[9]	Alarm	
[10]	Alarm or warning	
[12]	Out of current range	
[13]	Below current, low	
[14]	Above current, high	
[16]	Below speed, low	
[17]	Above speed, high	
[19]	Below feedback, low	
[20]	Above feedback, high	
[21]	Thermal warning	
[22]	Ready, no thermal warning	
[23]	Remote, ready, no thermal warning	
[24]	Ready, Voltage OK	
[25]	Reverse	
[26]	Bus OK	
[35]	External Interlock	
[36]	Control word bit 11	
[37]	Control word bit 12	
[41]	Below reference, low	
[42]	Above ref, high	
[45]	Bus Control	
[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	

3

6-72 Terminal 45 Digital Output		
Option:		**Function:**
[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	
[193]	Sleep Mode	
[194]	Broken Belt Function	
[196]	Fire Mode	
[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*.

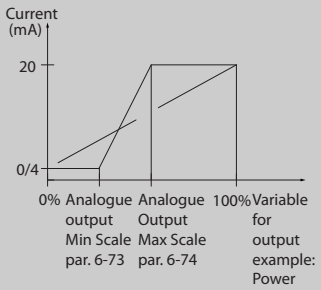

Illustration 3.11 Output Max Scale

6-76 Terminal 45 Output Bus Control		
Range:		**Function:**
0*	[0 - 16384]	

3.7.5 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:**
		Select the function of terminal 42 as an analog current output. See also *6-90 Terminal 42 Mode*.
[0] *	No operation	
[100]	Output frequency	0-100 Hz
[101]	Reference	$Min_{Ref.}$ - $Max_{Ref.}$
[102]	Feedback	Min_{FB} - Max_{FB}
[103]	Motor Current	0-I_{max}
[106]	Power	0-P_{nom}
[139]	Bus Control	0-100%

6-92 Terminal 42 Digital Output		
Option:		**Function:**
		Select the function of Terminal 42 as an analog current output. See also *6-90 Terminal 42 Mode*. See *parameter 5-40 Function Relay* for description of the choices.
[0] *	No operation	
[1]	Control Ready	
[2]	Drive ready	
[3]	Drive ready/remote control	
[4]	Standby / no warning	
[5]	Drive running	
[6]	Running / no warning	
[7]	Run in range/no warning	
[8]	Run on ref/no warning	
[9]	Alarm	
[10]	Alarm or warning	
[12]	Out of current range	
[13]	Below current, low	
[14]	Above current, high	
[16]	Below speed, low	
[17]	Above speed, high	

6-92 Terminal 42 Digital Output

Option:		Function:
[19]	Below feedback, low	
[20]	Above feedback, high	
[21]	Thermal warning	
[22]	Ready, no thermal warning	
[23]	Remote, ready, no thermal warning	
[24]	Ready, Voltage OK	
[25]	Reverse	
[26]	Bus OK	
[35]	External Interlock	
[36]	Control word bit 11	
[37]	Control word bit 12	
[41]	Below reference, low	
[42]	Above ref, high	
[45]	Bus Control	
[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	
[193]	Sleep Mode	
[194]	Broken Belt Function	
[196]	Fire Mode	
[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 *6-91 Terminal 42 Analog Output*.

6-94 Terminal 42 Output Max Scale

Range:		Function:
100 %*	[0 - 200 %]	Scale for the 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 *6-91 Terminal 42 Analog Output*.

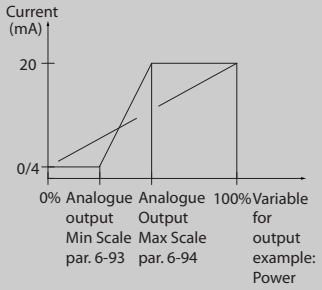

Illustration 3.12 Output Max Scale

6-96 Terminal 42 Output Bus Control

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

3.8 Main Menu - Communications and Options - Group 8

3.8.1 8-0* General Settings

3

8-01 Control Site

Option:		Function:
		This parameter overrules 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.** Select the source of the control word.
[0]	None	
[1] *	FC Port	

8-03 Control Timeout Time

Range:		Function:
Size related*	[0.1 - 6500 s]	Enter the maximum time expected to pass between the reception of 2 consecutive telegrams. If this time is exceeded, it indicates that the serial communication has stopped. The function selected in *parameter 8-04 Control Timeout Function Control Time-out Function* is carried out.

8-04 Control Timeout Function

Option:		Function:
		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*.
[0] *	Off	

3.8.2 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.

8-31 Address

Range:		Function:
Size related*	[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 Default refers to the FC protocol. Changing the protocol in *parameter 8-30 Protocol* may change the Baud Rate. Changing Protocol in *parameter 8-30 Protocol* may change the baud rate.
[0]	2400 Baud	
[1]	4800 Baud	Default setting for FLN.
[2]	9600 Baud	Default setting for • BACnet • Metasys N2
[3]	19200 Baud	Default setting for Modbus RTU.
[4]	38400 Baud	
[5]	57600 Baud	
[6]	76800 Baud	
[7]	115200 Baud	

8-33 Parity / Stop Bits

Option:		Function:
		Parity and stop bits for the protocol using the FC port. For some of the protocols, not all options are available. Default refers to the FC protocol. Changing protocol in *8-30 Protocol* may change the baud rate.
[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

Specify the minimum delay time between receiving a request and transmitting a response. This is used for overcoming modem turnaround delays.

Range:		Function:
Size related*	[0.0010 - 0.5 s]	

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

8-37 Maximum Inter-char delay		
Specify the maximum delay time between 2 characters in a message. Exceeding this delay time causes the message to be discarded.		
Range:		**Function:**
Size related*	[0.005 - 0.025 s]	

3.8.3 8-4* FC MC Protocol Set

This parameter group is for PCD write and read configurations.

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 will be 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		
Different parameters can be assigned to PCD 3 to 10 of the PPOs (the number of PCDs depends on the PPO type). PCD 3 to 10 will hold the actual data value of the selected parameters.		
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]	[1618] Motor Thermal	
[17]	[1630] DC Link Voltage	
[18]	[1634] Heatsink Temp.	
[19]	[1635] Inverter Thermal	
[20]	[1638] SL Controller State	
[21]	[1650] External Reference	
[22]	[1652] Feedback [Unit]	
[23]	[1660] Digital Input 18,19,27,33	
[24]	[1661] Terminal 53 Switch Setting	
[25]	[1662] Analog Input 53(V)	
[26]	[1663] Terminal 54 Switch Setting	
[27]	[1664] Analog Input 54	
[28]	[1665] Analog Output 42 [mA]	
[29]	[1671] Relay Output [bin]	
[30]	[1672] Counter A	
[31]	[1673] Counter B	
[32]	[1690] Alarm Word	
[33]	[1692] Warning Word	
[34]	[1694] Ext. Status Word	

3.8.4 8-5* Digital/Bus

Parameters for configuring the control word digital/bus merging.

3

8-50 Coasting Select		
Option:		**Function:**
		Select control of the coasting function via the terminals (digital input) and/or via the bus. ***NOTICE*** **This parameter is active only when *parameter 8-01 Control Site* is set to *[0] Digital and control word*.**
[0]	Digital input	Activates coast via a digital input.
[1]	Bus	Activates coast via the serial communication port.
[2]	Logic AND	Activates coast via the fieldbus/serial communication port, and via one of the digital inputs.
[3] *	Logic OR	Activates coast via the serial communication port or via one of the digital inputs.

8-51 Quick Stop Select		
Option:		**Function:**
		Select control of the *Quick Stop* function via the terminals (digital input) and/or via the bus. ***NOTICE*** **This parameter is active only when *parameter 8-01 Control Site* is set to *[0] Digital and control word*.**
[0]	Digital input	Activates quick stop via a digital input.
[1]	Bus	Activates quick stop via the serial communication port.
[2]	Logic AND	Activates quick stop via the serial communication port, and via one of the digital inputs.
[3] *	Logic OR	Activates quick stop via the serial communication port or via one of the digital inputs.

8-52 DC Brake Select		
Option:		**Function:**
		Select control of the DC brake via the terminals (digital input). ***NOTICE*** **This parameter is active only when *parameter 8-01 Control Site* is set to *[0] Digital and control word*.**
[0]	Digital input	Activates DC brake via a digital input.
[1]	Bus	Activates DC brake via the serial communication port.
[2]	Logic AND	Activates DC brake via the serial communication port, and via one of the digital inputs.

8-52 DC Brake Select		
Option:		**Function:**
[3]	Logic OR	Activates DC brake via the 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). ***NOTICE*** **This parameter is active only when *parameter 8-01 Control Site* is set to *[0] Digital and control word*.**
[0]	Digital input	Activates a start command via a digital input.
[1]	Bus	Activates a start command via the serial communication port or fieldbus options.
[2]	Logic AND	Activates a start command via the serial communication port, and via one of the digital inputs.
[3] *	Logic OR	Activates a start command via the serial communication port or via one of the digital inputs.

8-54 Reversing Select		
Option:		**Function:**
		Select control of the frequency converter *Reverse* function via the terminals (digital input) and/or via the serial communication port. ***NOTICE*** **This parameter is active only when *parameter 8-01 Control Site* is set to *[0] Digital and control word*.**
[0] *	Digital input	Activates a reverse command via a digital input.
[1]	Bus	Activates a reverse command via the serial communication port.
[2]	Logic AND	Activates a reverse command via the serial communication port, and via one of the digital inputs.
[3]	Logic OR	Activates a reverse command via the serial communication port or via one 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 serial communication port.

8-55 Set-up Select		
Option:		**Function:**
		NOTICE **This parameter is active only when *parameter 8-01 Control Site* is set to *[0] Digital and control word*.**
[0]	Digital input	Activates the set-up selection via a digital input.
[1]	Bus	Activates the set-up selection via the serial communication port.
[2]	Logic AND	Activates the set-up selection via the serial communication port, and via one of the digital inputs.
[3] *	Logic OR	Activate the set-up selection via the serial communication port or via one of the digital inputs.

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

3.8.5 8-7* BACnet

8-70 BACnet Device Instance		
Range:		**Function:**
1*	[0 - 4194303]	Enter a unique ID number for the BACnet device.

8-72 MS/TP Max Masters		
Range:		**Function:**
127*	[0 - 127]	Define the address of the master, which holds the highest address in this network. Decreasing this value optimises polling for the token.

8-73 MS/TP Max Info Frames		
Range:		**Function:**
1*	[1 - 65534]	Define how many info/data frames the device is allowed to send while holding the token.

8-74 "I am" Service		
Option:		**Function:**
[0] *	Send at power-up	Select when the device should send the "I-Am" service message only at power-up.
[1]	Continuously	Select when the device should send the "I-Am" service message continuously with an interval of approximately 1 minute.

8-75 Intialisation Password		
Range:		**Function:**
admin*	[1 - 1]	Enter the password needed for execution of Drive Reinitialisation.

8-79 Protocol Firmware version		
Range:		**Function:**
Size related*	[0 - 65535]	

3.8.6 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 (for example, CRC fault), detected on the bus.

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

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 follower.

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

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

3.8.7 8-9* Bus Feedback

8-94 Bus Feedback 1		
Write a feedback to this parameter via the serial communication port. This parameter must be selected in *parameter 20-00 Feedback 1 Source* or *parameter 20-03 Feedback 2 Source* as a feedback source. (Hex-value 4000 h corresponds to 100% feedback/range is ±200%)		
Range:		**Function:**
0*	[-32768 - 32767]	

8-95 Bus Feedback 2		
Write a feedback to this parameter via the serial communication port. This parameter must be selected in *parameter 20-00 Feedback 1 Source* or *parameter 20-03 Feedback 2 Source* as a feedback source. The hexadecimal value 4000 h corresponds to ±200% in 100% feedback/range.		
Range:		**Function:**
0*	[-32768 - 32767]	

3.9 Main Menu - Smart Logic - Group 13

3.9.1 13-** Prog. Features

Smart logic control (SLC) is a sequence of user-defined actions (see *parameter 13-52 SL Controller Action* [x]) executed by the SLC when the associated user-defined *event* (see *parameter 13-51 SL Controller Event* [x]) is evaluated as *true* by the SLC. Events and actions are each numbered and linked in pairs. This means that when *[0] event* is fulfilled (attains the value *true*), *[0] action* is executed. After this, the conditions of *[1] event* is evaluated and if evaluated *true*, *[1] action* is executed and so on. Only one 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 *[0] event* (and only *[0] event*) each scan interval. Only when *[0] event* is evaluated *true*, the SLC executes *[0] action* and start evaluating *[1] event*. It is possible to programme from 1 to 20 events and actions. When the last event/action has been executed, the sequence starts over again from *[0] event*/*[0] action*.

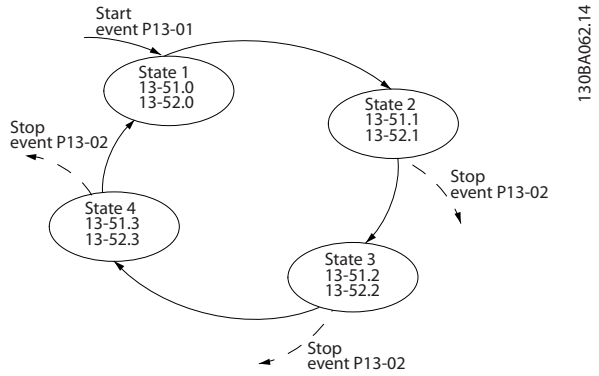

Illustration 3.13 Example with 3 Event/Actions

Starting and stopping the SLC
Select *[1] On* or *[2] Off* in *parameter 13-00 SL Controller Mode* to start or stop the SLC. The SLC always starts in state 0 (where it evaluates *[0] event*). The SLC starts when the start event (defined in *parameter 13-01 Start Event*) is evaluated as *true* (if *[1] On* is selected in *parameter 13-00 SL Controller Mode*). The SLC stops when the stop event (*parameter 13-02 Stop Event*) is *true*. *Parameter 13-03 Reset SLC* resets all SLC parameters and starts programming from the beginning.

3.9.2 13-0* SLC Settings

Use the SLC settings to activate, deactivate and reset the smart logic control sequence. The logic functions and comparators are always running in the background, which opens for separate control of digital inputs and outputs.

13-00 SL Controller Mode		
Option:		**Function:**
		Select *[1] On* to enable the smart logic control to start when a start command is present, for example, via a digital input. Select *[0] Off* to disable the smart logic control.
[0] *	Off	Disables the smart logic controller.
[1]	On	Enables the smart logic controller.

13-01 Start Event		
Option:		**Function:**
		Select the boolean (*true* or *false*) input to activate smart logic control.
[0]	False	Enters the fixed value of *false* in the logic rule.
[1]	True	Enters the fixed value *true* in the logic rule.
[2]	Running	The motor is running.
[3]	In range	The motor runs within programmed current ranges (*parameter 4-50 Warning Current Low* and *parameter 4-51 Warning Current High*)
[4]	On reference	The motor runs at reference speed.
[7]	Out of current range	The motor current is outside the range set in *parameter 4-18 Current Limit*.
[8]	Below I low	The motor current is lower than set in *parameter 4-50 Warning Current Low*.
[9]	Above I high	The motor current is higher than set in *parameter 4-51 Warning Current High*.
[16]	Thermal warning	The thermal warning turns on when the temperature exceeds the limit in the motor, the frequency converter, or the thermistor.
[17]	Mains out of range	Mains phase loss warning or alarm, if *parameter 14-12 Function at Mains Imbalance* is not set at *[2] Disabled*.
[18]	Reversing	The frequency converter is reversing.
[19]	Warning	A warning is present.
[20]	Alarm (trip)	An alarm is present.
[21]	Alarm (trip lock)	A trip lock alarm is present.
[22]	Comparator 0	Use the result of comparator 0 in the logic rule.
[23]	Comparator 1	Use the result of comparator 1 in the logic rule.
[24]	Comparator 2	Use the result of comparator 2 in the logic rule.
[25]	Comparator 3	Use the result of comparator 3 in the logic rule.

3

13-01 Start Event		
Option:		**Function:**
[26]	Logic rule 0	Use the result of logic rule 0 in the logic rule.
[27]	Logic rule 1	Use the result of logic rule 1 in the logic rule.
[28]	Logic rule 2	Use the result of logic rule 2 in the logic rule.
[29]	Logic rule 3	Use the result of logic rule 3 in the logic rule.
[33]	Digital input DI18	Use the value of DI18 in the logic rule (High=*true*).
[34]	Digital input DI19	Use the value of DI19 in the logic rule (High=*true*).
[35]	Digital input DI27	Use the value of DI27 in the logic rule (High=*true*).
[36]	Digital input DI29	Use the value of DI29 in the logic rule (High=*true*).
[39] *	Start command	This event is *true* if the frequency converter is started (either via digital input, field bus or other).
[40]	Drive stopped	This event is *true* if the frequency converter is stopped or coasted (either via digital input, fieldbus or other).
[42]	Auto Reset Trip	This event is *true* if the frequency converter is tripped (but not trip-locked) and an automatic reset is issued.
[50]	Comparator 4	Use the result of comparator 4 in the logic rule.
[51]	Comparator 5	Use the result of comparator 5 in the logic rule.
[60]	Logic rule 4	Use the result of logic rule 4 in the logic rule.
[61]	Logic rule 5	Use the result of logic rule 5 in the logic rule.
[83]	Broken Belt	A broken belt condition has been detected. This function must be enabled in *parameter 22-60 Broken Belt Function*.

13-02 Stop Event		
Option:		**Function:**
		Select the condition (*true* or *false*) which deactivates the smart logic controller.
[0]	False	Enters the fixed value of *false* in the logic rule.
[1]	True	Enters the fixed value *true* in the logic rule.
[2]	Running	See *parameter 13-01 Start Event* for further description.
[3]	In range	See *parameter 13-01 Start Event* for further description.
[4]	On reference	See *parameter 13-01 Start Event* for further description.
[7]	Out of current range	See *parameter 13-01 Start Event* for further description.
[8]	Below I low	See *parameter 13-01 Start Event* for further description.
[9]	Above I high	See *parameter 13-01 Start Event* for further description.
[16]	Thermal warning	See *parameter 13-01 Start Event* for further description.
[17]	Mains out of range	See *parameter 13-01 Start Event* for further description.
[18]	Reversing	See *parameter 13-01 Start Event* for further description.
[19]	Warning	See *parameter 13-01 Start Event* for further description.
[20]	Alarm (trip)	See *parameter 13-01 Start Event* for further description.
[21]	Alarm (trip lock)	See *parameter 13-01 Start Event* for further description.
[22]	Comparator 0	Use the result of comparator 0 in the logic rule.
[23]	Comparator 1	Use the result of comparator 1 in the logic rule.
[24]	Comparator 2	Use the result of comparator 2 in the logic rule.
[25]	Comparator 3	Use the result of comparator 3 in the logic rule.
[26]	Logic rule 0	Use the result of logic rule 0 in the logic rule.
[27]	Logic rule 1	Use the result of logic rule 1 in the logic rule.
[28]	Logic rule 2	Use the result of logic rule 2 in the logic rule.
[29]	Logic rule 3	Use the result of logic rule 3 in the logic rule.
[30]	SL Time-out 0	Use the result of timer 0 in the logic rule.
[31]	SL Time-out 1	Use the result of timer 1 in the logic rule.
[32]	SL Time-out 2	Use the result of timer 2 in the logic rule.
[33]	Digital input DI18	Use the value of DI18 in the logic rule (High=*true*).
[34]	Digital input DI19	Use the value of DI19 in the logic rule (High=*true*).

13-02 Stop Event		
Option:		**Function:**
[35]	Digital input DI27	Use the value of DI27 in the logic rule (High=*true*).
[36]	Digital input DI29	Use the value of DI29 in the logic rule (High=*true*).
[39]	Start command	This event is *true* if the frequency converter is started by any means (either via digital input, fieldbus or other).
[40] *	Drive stopped	This event is *true* if the frequency converter is stopped or coasted by any means (either via digital input, fieldbus or other).
[42]	Auto Reset Trip	This event is *true* if the frequency converter is tripped (but not trip-locked) and an automatic reset is issued.
[50]	Comparator 4	Use the result of comparator 4 in the logic rule.
[51]	Comparator 5	Use the result of comparator 5 in the logic rule.
[60]	Logic rule 4	Use the result of logic rule 4 in the logic rule.
[61]	Logic rule 5	Use the result of logic rule 5 in the logic rule.
[70]	SL Time-out 3	Use the result of timer 3 in the logic rule.
[71]	SL Time-out 4	Use the result of timer 4 in the logic rule.
[72]	SL Time-out 5	Use the result of timer 5 in the logic rule.
[73]	SL Time-out 6	Use the result of timer 6 in the logic rule.
[74]	SL Time-out 7	Use the result of timer 7 in the logic rule.
[83]	Broken Belt	A broken-belt condition has been detected. Enable this function in *parameter 22-60 Broken Belt Function*.

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

3.9.3 13-1* Comparators

Comparators are used for comparing continuous variables (that is, output frequency, output current, analog input and so on) to fixed preset values.

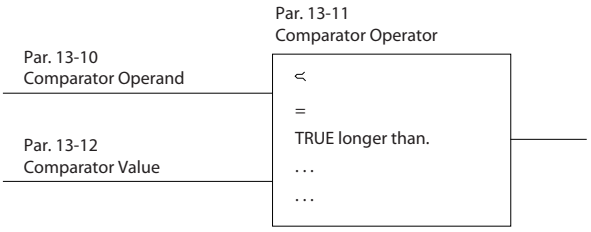

Illustration 3.14 Comparators

In addition, there are digital values that are compared to fixed time values. See the explanation in *parameter 13-10 Comparator Operand*. Comparators are evaluated once in each scan interval. Use the result (*true* or *false*) directly. All parameters in this parameter group are array parameters with index 0 to 5. Select index 0 to programme comparator 0, select index 1 to programme comparator 1, and so on.

13-10 Comparator Operand		
Array [6]		
Option:		**Function:**
		Select the variable to be monitored by the comparator.
[0] *	Disabled	
[1]	Reference	
[2]	Feedback	
[3]	Motor speed	
[4]	Motor Current	
[6]	Motor power	
[7]	Motor voltage	
[12]	Analog input AI53	
[13]	Analog input AI54	
[20]	Alarm number	
[30]	Counter A	
[31]	Counter B	

13-11 Comparator Operator		
Array [6]		
Option:		**Function:**
[0]	Less Than (<)	Select *[0]* < for the result of the evaluation to be *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 (~)	Select *[1]* ≈ for the result of the evaluation to be *true*, when the variable selected in *parameter 13-10 Comparator Operand* is approximately equal to the fixed value in *parameter 13-12 Comparator Value*.

3

13-11 Comparator Operator		
Array [6]		
Option:		**Function:**
[2]	Greater Than (>)	Select *[2]* > for the inverse logic of option *[0]* <.

13-12 Comparator Value		
Array [6]		
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.

3.9.4 13-2* Timers

Use the result (*true* or *false*) from timers directly to define an event (see *parameter 13-51 SL Controller Event*), or as boolean input in a logic rule (see *parameter 13-40 Logic Rule Boolean 1*, *parameter 13-42 Logic Rule Boolean 2* or *parameter 13-44 Logic Rule Boolean 3*). A timer is only *false* when started by an action (i.e. *[29] Start timer 1*) until the timer value entered in this parameter is 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		
Array [8]		
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 (see *13-52 SL Controller Action* [29-31] and *13-52 SL Controller Action* [70-74] Start timer X) and until the timer value has elapsed. Array parameters contain timers 0 to 7.

3.9.5 13-4* Logic Rules

Combine up to 3 boolean inputs (*true*/*false* inputs) from timers, comparators, digital inputs, status bits and events using the logical operators AND, OR, and NOT. Select boolean inputs for the calculation in *parameter 13-40 Logic Rule Boolean 1*, *parameter 13-42 Logic Rule Boolean 2*, and *parameter 13-44 Logic Rule Boolean 3*. Define the operators used to logically combine the selected inputs in *parameter 13-41 Logic Rule Operator 1*, and *parameter 13-43 Logic Rule Operator 2*.

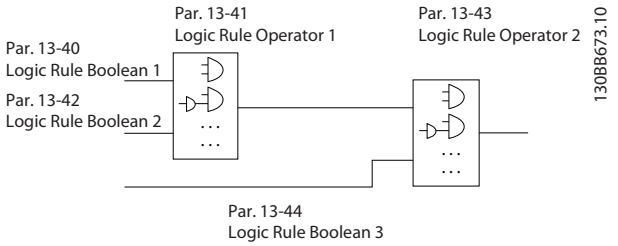

Illustration 3.15 Logic Rules

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

13-40 Logic Rule Boolean 1		
Array [6]		
Option:		**Function:**
[0] *	False	Enters the fixed value of *false* in the logic rule.
[1]	True	Enters the fixed value *true* in the logic rule.
[2]	Running	See *parameter 13-01 Start Event* for further description.
[3]	In range	See *parameter 13-01 Start Event* for further description.
[4]	On reference	See *parameter 13-01 Start Event* for further description.
[7]	Out of current range	See *parameter 13-01 Start Event* for further description.
[8]	Below I low	See *parameter 13-01 Start Event* for further description.
[9]	Above I high	See *parameter 13-01 Start Event* for further description.
[16]	Thermal warning	See *parameter 13-01 Start Event* for further description.
[17]	Mains out of range	See *parameter 13-01 Start Event* for further description.
[18]	Reversing	See *parameter 13-01 Start Event* for further description.
[19]	Warning	See *parameter 13-01 Start Event* for further description.
[20]	Alarm (trip)	See *parameter 13-01 Start Event* for further description.
[21]	Alarm (trip lock)	See *parameter 13-01 Start Event* for further description.

13-40 Logic Rule Boolean 1		
Array [6]		
Option:		**Function:**
[22]	Comparator 0	Use the result of comparator 0 in the logic rule.
[23]	Comparator 1	Use the result of comparator 1 in the logic rule.
[24]	Comparator 2	Use the result of comparator 2 in the logic rule.
[25]	Comparator 3	Use the result of comparator 3 in the logic rule.
[26]	Logic rule 0	Use the result of logic rule 0 in the logic rule.
[27]	Logic rule 1	Use the result of logic rule 1 in the logic rule.
[28]	Logic rule 2	Use the result of logic rule 2 in the logic rule.
[29]	Logic rule 3	Use the result of logic rule 3 in the logic rule.
[30]	SL Time-out 0	Use the result of timer 0 in the logic rule.
[31]	SL Time-out 1	Use the result of timer 1 in the logic rule.
[32]	SL Time-out 2	Use the result of timer 2 in the logic rule.
[33]	Digital input DI18	Use the value of DI18 in the logic rule (High=*true*).
[34]	Digital input DI19	Use the value of DI19 in the logic rule (High=*true*).
[35]	Digital input DI27	Use the value of DI27 in the logic rule (High=*true*).
[36]	Digital input DI29	Use the value of DI29 in the logic rule (High=*true*).
[39]	Start command	This logic rule is *true* if the frequency converter is started by any means (either via digital input, or other).
[40]	Drive stopped	This logic rule is *true* if the frequency converter is stopped or coasted by any means (either via digital input, or other).
[42]	Auto Reset Trip	This logic rule is *true* if the frequency converter is tripped (but not trip-locked) and an automatic reset is issued.
[50]	Comparator 4	Use the result of comparator 4 in the logic rule.
[51]	Comparator 5	Use the result of comparator 5 in the logic rule.
[60]	Logic rule 4	Use the result of logic rule 4 in the logic rule.
[61]	Logic rule 5	Use the result of logic rule 5 in the logic rule.
[70]	SL Time-out 3	Use the result of timer 3 in the logic rule.

13-40 Logic Rule Boolean 1		
Array [6]		
Option:		**Function:**
[71]	SL Time-out 4	Use the result of timer 4 in the logic rule.
[72]	SL Time-out 5	Use the result of timer 5 in the logic rule.
[73]	SL Time-out 6	Use the result of timer 6 in the logic rule.
[74]	SL Time-out 7	Use the result of timer 7 in the logic rule.
[83]	Broken Belt	A broken-belt condition has been detected. Enable this function in *parameter 22-60 Broken Belt Function*.

13-41 Logic Rule Operator 1		
Option:		**Function:**
[0] *	Disabled	
[1]	AND	
[2]	OR	
[3]	AND NOT	
[4]	OR NOT	
[5]	NOT AND	
[6]	NOT OR	
[7]	NOT AND NOT	
[8]	NOT OR NOT	

13-42 Logic Rule Boolean 2		
Array [6]		
Option:		**Function:**
		Select the second boolean (*true* or *false*) input for the selected logic rule. See *parameter 13-40 Logic Rule Boolean 1* for further descriptions of options and their functions.
[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	

3

13-42 Logic Rule Boolean 2

Array [6]

Option:		Function:
[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	A broken-belt condition has been detected. Enable this function in *parameter 22-60 Broken Belt Function*.

13-43 Logic Rule Operator 2

Array [6]

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*. [13-44] signifies the boolean input of *parameter 13-44 Logic Rule Boolean 3*. [13-40/13-42] signifies the boolean input calculated in *parameter 13-40 Logic Rule Boolean 1*, *parameter 13-41 Logic Rule Operator 1*, and *parameter 13-42 Logic Rule Boolean 2*. *[0] Disabled* (factory setting): select this option to ignore *parameter 13-44 Logic Rule Boolean 3*.
[0] *	Disabled	
[1]	AND	
[2]	OR	
[3]	AND NOT	
[4]	OR NOT	
[5]	NOT AND	
[6]	NOT OR	

13-43 Logic Rule Operator 2

Array [6]

Option:		Function:
[7]	NOT AND NOT	
[8]	NOT OR NOT	

13-44 Logic Rule Boolean 3

Array [6]

Option:		Function:
		Select the third boolean (*true* or *false*) input for the selected logic rule. See *parameter 13-40 Logic Rule Boolean 1* for further descriptions of options and their functions.
[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	

13-44 Logic Rule Boolean 3		
Array [6]		
Option:		**Function:**
[73]	SL Time-out 6	
[74]	SL Time-out 7	
[83]	Broken Belt	

3.9.6 13-5* States

13-51 SL Controller Event		
Array [20]		
Option:		**Function:**
		Select the boolean input (*true* or *false*) to define the smart logic controller event. See *parameter 13-02 Stop Event* for further descriptions of options and their functions.
[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	

13-51 SL Controller Event		
Array [20]		
Option:		**Function:**
[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		
Array [20]		
Option:		**Function:**
		Select the action corresponding to the SLC event. Actions are executed when the corresponding event (defined in *parameter 13-51 SL Controller Event*) is evaluated as true. The following actions are available for selection:
[0] *	Disabled	
[1]	No action	
[2]	Select set-up 1	Changes the active set-up (*parameter 0-10 Active Set-up*) to 1.
[3]	Select set-up 2	Changes the active set-up (*parameter 0-10 Active Set-up*) to 2.
[10]	Select preset ref 0	Selects preset reference 0.
[11]	Select preset ref 1	Selects preset reference 1.
[12]	Select preset ref 2	Selects preset reference 2.
[13]	Select preset ref 3	Selects preset reference 3.
[14]	Select preset ref 4	Selects preset reference 4.
[15]	Select preset ref 5	Selects preset reference 5.
[16]	Select preset ref 6	Selects preset reference 6.
[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.

3

13-52 SL Controller Action		
Array [20]		
Option:		**Function:**
[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 stop command to the frequency converter.
[27]	Coast	The frequency converter coasts immediately. All stop commands including the coast command stop the SLC.
[28]	Freeze output	Freezes the output frequency of the frequency converter.
[29]	Start timer 0	Starts timer 0, see *parameter 13-20 SL Controller Timer* for further description.
[30]	Start timer 1	Starts timer 1, see *parameter 13-20 SL Controller Timer* for further description.
[31]	Start timer 2	Starts timer 2, see *parameter 13-20 SL Controller Timer* for further description.
[32]	Set digital out A low	Any output with *digital output 1*selected is low (off).
[33]	Set digital out B low	Any output with *digital output 2* selected is low (off).
[34]	Set digital out C low	Any output with *digital output 3* selected is low (off).
[35]	Set digital out D low	Any output with *digital output 4* selected is low (off).
[38]	Set digital out A high	Any output with *digital output 1* selected is high (closed).
[39]	Set digital out B high	Any output with *digital output 2* selected is high (closed).
[40]	Set digital out C high	Any output with *digital output 3* selected is high (closed).
[41]	Set digital out D high	Any output with *digital output 4* selected is high (closed).
[60]	Reset Counter A	Resets counter A to zero.
[61]	Reset Counter B	Resets counter B to zero.
[70]	Start Timer 3	Starts timer 3, see *parameter 13-20 SL Controller Timer* for further description.
[71]	Start Timer 4	Starts timer 4, see *parameter 13-20 SL Controller Timer* for further description.
[72]	Start Timer 5	Starts timer 5, see *parameter 13-20 SL Controller Timer* for further description.
[73]	Start Timer 6	Starts timer 6, see *parameter 13-20 SL Controller Timer* for further description.

13-52 SL Controller Action		
Array [20]		
Option:		**Function:**
[74]	Start Timer 7	Starts timer 7, see *parameter 13-20 SL Controller Timer* for further description.

3.10 Main Menu - Special Functions - Group 14

3.10.1 14-0* Inverter Switching

14-01 Switching Frequency

Option:		Function:
		Select the inverter switching frequency. Changing the switching frequency can help to reduce acoustic noise from the motor. ***NOTICE*** **The output frequency value of the frequency converter must never exceed 1/10 of the switching frequency. When the motor is running, adjust the switching frequency in *parameter 14-01 Switching Frequency* until the motor is as quiet as possible.** ***NOTICE*** **High switching frequencies increase heat generation in the frequency converter and may reduce its lifetime.** ***NOTICE*** **Not all options are available in all power sizes.**
[0]	Ran3	3 kHz true random PWM (White noise modulation)
[1]	Ran5	5 kHz true random 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	Selects no overmodulation of the output voltage to avoid torque ripple on the motor shaft.
[1]	On	The overmodulation function generates an extra voltage of up to 8% of U_{max} output voltage without overmodulation, which results in an extra torque of 10–12% in the middle of the over-synchronous range (from 0% at nominal speed rising to approximately 12% at double nominal speed).

14-07 Dead Time Compensation Level

Level of applied dead time compensation in percentage. A high level (>90%) optimises the dynamic motor response. A level from 50% to 90% is suitable for both motor-torque-ripple minimisation and motor dynamics. A 0 level turns off the dead time compensation.

Range:		Function:
Size related*	[0 - 100]	

14-08 Damping Gain Factor

Set the damping factor for DC-link voltage compensation. See *parameter 14-51 DC-Link Voltage Compensation*.

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

14-09 Dead Time Bias Current Level

Set a bias signal (in percentage) to add to the current-sense signal for dead time compensation for some motors.

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

3.10.2 14-1* Mains On/Off

Parameters for configuring mains failure monitoring and handling.

14-10 Mains Failure

Configure the action of the frequency converter when the mains voltage is below the mains voltage limit configured in *parameter 14-11 Mains Voltage at Mains Fault*.

Option:		Function:
[0] *	No function	
[3]	Coasting	

14-11 Mains Voltage at Mains Fault

Use this parameter to define at which AC voltage the function selected in *parameter 14-10 Mains Failure* should be activated.

Range:		Function:
Size related*	[100 - 800 V]	

3

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 continuously near nominal load. When a severe mains imbalance is detected, select one of the available functions.
[0] *	Trip	Trips the frequency converter.
[1]	Warning	Issues a warning.
[2]	Disabled	***NOTICE*** **Selecting this option may reduce the life time of the frequency converter.** No action.

3.10.3 14-2* Trip Reset

14-20 Reset Mode		
Option:		**Function:**
		NOTICE **Automatic reset is also active for resetting the safe stop function.** 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.
[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.

14-21 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:**
		Select *[2] Initialisation* to reset all parameter values to default.
[0] *	Normal operation	Select *[0] Normal operation* for normal operation of the frequency converter with the motor in the selected application.
[2]	Initialisation	Select *[2] Initialisation* to reset all parameter values to default settings, excluding bus communication parameters, parameter groups *15-0** and *15-3**. The frequency converter is reset during the next power-up. *Parameter 14-22 Operation Mode* also reverts to the default setting *[0] Normal operation*.

14-27 Action At Inverter Fault		
Select how the frequency converter acts in the case of overvoltage, overcurrent, short-circuit, or grounding errors.		
Option:		**Function:**
[0]	Trip	
[1] *	Warning	

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

3.10.4 14-3* Current Limit Control

14-30 Current Lim Ctrl, Proportional Gain		
Range:		**Function:**
100 %*	[0 - 500 %]	

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.

3.10.5 14-4* Energy Optimisation

Parameters for adjusting the energy optimisation level in both variable torque (VT) and automatic eEnergy optimisation (AEO) mode.

Automatic energy optimisation is only active if *parameter 1-03 Torque Characteristics*, is set for *[3] Auto Energy Optim*.

14-40 VT Level

Range:		Function:
90 %*	[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.

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.

3.10.6 14-5* Environment

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

14-50 RFI Filter

This parameter is only valid for frequency converters of the following enclosure sizes:

- IP20, 3x200–240 V, enclosure sizes H6–H8
- IP20, 3x380–480 V, enclosure sizes H6–H8
- IP54, 3x380–480 V, enclosure sizes I6–I8
- IP20, 3x525–600 V, enclosure sizes H6–H10

Option:		Function:
[0]	Off	Select *[0] Off* only if the frequency converter is fed by an isolated mains source (IT mains). In this mode, the internal RFI filter capacitors between chassis and the mains RFI filter circuit are cut-out to reduce the ground capacity currents.
[1] *	On	Select *[1] On* to ensure that the frequency converter complies with EMC standards.

14-51 DC-Link Voltage Compensation

Option:		Function:
[0]	Off	The overmodulation for output voltage is off to avoid torque ripple on the motor shaft.

14-51 DC-Link Voltage Compensation

Option:		Function:
[1] *	On	Enables the overmodulation for output voltage to obtain an output voltage up to 15% greater than the mains voltage.

14-52 Fan Control

This parameter is only valid for frequency converters of the following enclosure sizes:

- IP20, 3x200–240 V, enclosure sizes H6–H8
- IP20, 3x380–480 V, enclosure sizes H6–H8
- IP54, 3x380–480 V, enclosure sizes I6–I8
- IP20, 3x525–600 V, enclosure sizes H6–H10

Option:		Function:
[0] *	Auto	
[4]	Auto Low Temp Env.	

14-53 Fan Monitor

Select which reaction the frequency converter should take in case a fan fault is detected. This parameter is only valid for frequency converters of the following enclosure sizes:

- IP20, 3x200–240 V, enclosure sizes H6–H8.
- IP20, 3x380–480 V, enclosure sizes H6–H8.
- IP54, 3x380–480 V, enclosure sizes I6–I8.
- IP20, 3x525–600 V, enclosure sizes H6–H10.

Option:		Function:
[0]	Disabled	
[1] *	Warning	
[2]	Trip	

14-55 Output Filter

Select whether an output filter is present.

Option:		Function:
[0] *	No Filter	
[1]	Sine-Wave Filter	
[3]	Sine-Wave Filter with Feedback	
[4]	dv/dt	This option in only valid for the frequency converter of the following enclosure sizes: • IP20, 3x200-240 V, enclosure sizes H6-H8 • IP20, 3x380-480 V, enclosure sizes H6-H8 • IP54, 3x380-480 V, enclosure sizes I6-I8 • IP20, 3x525-600 V, enclosure sizes H6-H10

3.10.7 14-6* Auto Derate

Parameter group for configuring automatic derating based on the output frequency of the frequency converter.

14-63 Min Switch Frequency		
Set the minimum switch frequency allowed by the output filter.		
Option:		**Function:**
[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		
If a long motor cable is used, set the parameter to *[0] Disabled* to minimise the motor-torque ripple.		
Option:		**Function:**
[0] *	Disabled	
[1]	Enabled	

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

3.10.8 14-9* Fault Settings

The parameter group for fault customisation settings.

14-90 Fault Level		
Use this parameter to customise fault levels. Only index 7, which indicates overcurrent faults, is supported.		
Option:		**Function:**
[3] *	Trip lock	Alarm is set to trip lock level.
[4]	Trip w. delayed reset	Alarm is configured into trip alarm, which can be reset after a delay time. For example, if overcurrent alarm is configured to this option, it can be reset 3 minutes after the alarm is reported.
[5]	Flystart	The frequency converter tries to catch a motor spinning when starting. If this option is selected, *1-73 Flying Start* s set to *[1] Enabled*.

3.11 Main Menu - Drive Information - Group 15

Parameter group containing frequency converter information such as operating data, hardware configuration, and software versions.

3.11.1 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 motor has run. Reset the counter in *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 - 65535 kWh]	View the output power of the frequency converter in kWh 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 that have occurred.

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

15-06 Reset kWh Counter		
Option:		**Function:**
		NOTICE **Press [OK] to reset.**
[0] *	Do not reset	

15-06 Reset kWh Counter		
Option:		**Function:**
[1]	Reset counter	Select *[1] Reset* and press [OK] to reset the kWh counter to 0 (see *parameter 15-02 kWh Counter*).

Option:		**Function:**
[0] *	Do not reset	
[1]	Reset counter	Select *[1] Reset counter* and press [OK] to reset the running hours counter (*parameter 15-01 Running Hours*) to zero (see also *parameter 15-01 Running Hours*).

3.11.2 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] 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 4 Troubleshooting*.

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

3.11.3 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 - 6]	View the FC type code. The readout is identical to the frequency converter series power field of the type code definition, characters 1–6.

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

3

15-42 Voltage		
Range:		**Function:**
0*	[0 - 20]	View the FC type code. The read-out is identical to the frequency converter series power field of the type code definition, characters 11–12.

15-43 Software Version		
Range:		**Function:**
0*	[0 - 0]	View the software version of the frequency converter.

15-44 Ordered TypeCode		
Range:		**Function:**
0*	[0 - 40]	View the type code string used for reordering the frequency converter in its original configuration.

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

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

15-48 LCP Id No		
Range:		**Function:**
0*	[0 - 0]	View the LCP ID number.

15-49 SW ID Control Card		
Range:		**Function:**
0*	[0 - 0]	View the control card software version number.

15-50 SW ID Power Card		
Range:		**Function:**
0*	[0 - 0]	View the power card software version number.

15-51 Drive Serial Number		
Range:		**Function:**
0*	[0 - 10]	View the frequency converter serial number.

15-53 Power Card Serial Number		
Range:		**Function:**
0*	[0 - 0]	View the power card serial number.

15-59 CSIV Filename		
View the current CSIV file name.		
Range:		**Function:**
0	[0 - 16]	

3.12 Main Menu - Data Readouts - Group 16

3.12.1 16-0* General Status

16-00 Control Word

View the control word sent from the frequency converter via the serial communication port in hex code.

Range:		Function:
0*	[0 - 65535]	

Bit	Bit=0	Bit=1
00	Preset reference choice lsb	
01	Preset reference choice second bit of preset references	
02	DC brake	Ramp
03	Coasting	Enable
04	Quick stop	Ramp
05	Freeze output	Ramp
06	Ramp stop	Start
07	No function	Reset
08	No function	Jog
09	Ramp 1	Ramp 2
10	Data not valid	Valid
11	Relay_A not active	Relay_A activated
12	Relay_B not active	Relay_B activated
13	Choice of set-up lsb	
14	No function	No function
15	No function	Reversing

Table 3.6 Control Word

16-01 Reference [Unit]

Range:		Function:
0*	[-4999 - 4999]	View the present reference value applied on impulse or analog basis in the unit resulting from the configuration selected in *parameter 1-00 Configuration Mode* (Hz).

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.

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.

Bit	Bit=0	Bit=1
00	Control not ready	Ready
01	VLT not ready	Ready
02	Coasting	Enable
03	No fault	Trip
04	No warning	Warning
05	Reserved	
06	No trip lock	Trip lock
07	No warning	Warning
08	Speed≠ref.	Speed=ref.
09	Local control	Bus control
10	Out of range	Frequency OK
11	Not running	Running
12	No function	No function
13	Voltage OK	Above limit
14	Current OK	Above limit
15	Temperature OK	Above limit

Table 3.7 Status Word

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

View the user-defined readouts as defined in *parameter 0-30 Custom Readout Unit*, *parameter 0-31 Custom Readout Min Value*, and *parameter 0-32 Custom Readout Max Value*. Custom Readout

Range:		Function:
0 CustomReadoutUnit*	[0 - 9999 CustomReadoutUnit]	

3.12.2 16-1* Motor Status

16-10 Power [kW]

Displays the actual motor power in kW. The value shown is calculated on the basis of the actual motor voltage and motor current.

Range:		Function:
0 kW*	[0 - 1000 kW]	

16-11 Power [hp]

View the actual motor power in hp. The value shown is calculated based on the actual motor voltage and motor current.

Range:		Function:
0 hp*	[0 - 1000 hp]	

3

16-12 Motor Voltage

View the motor voltage, a calculated value used for controlling the motor.

Range:		Function:
0 V*	[0 - 65535 V]	

16-13 Frequency

View the motor frequency, without resonance damping.

Range:		Function:
0 Hz*	[0 - 6553.5 Hz]	

16-14 Motor current

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

Range:		Function:
0 A*	[0 - 655.35 A]	

16-15 Frequency [%]

View a 2-byte word reporting the actual motor frequency (without resonance damping) as a percentage (scale 0000-4000 Hex) of *parameter 4-19 Max Output Frequency*.

Range:		Function:
0 %*	[0 - 6553.5 %]	

16-16 Torque [Nm]

View the torque value that is applied on the motor shaft. Some motors supply more than 160% torque. Consequently, the minimum value and the maximum value depends on the minimum/maximum motor current as well as the motor used.

Range:		Function:
0 Nm*	[-30000 - 30000 Nm]	

16-18 Motor Thermal

View the calculated motor temperature in percentage of allowed maximum. At 100%, a trip occurs, if selected in *parameter 1-90 Motor Thermal Protection*. The basis for the calculation is the ETR function selected in *parameter 1-90 Motor Thermal Protection*.

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

16-22 Torque [%]

View the torque in percentage (in relation to the nominal torque) that is applied to the motor shaft.

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

3.12.3 16-3* Drive Status

16-30 DC Link Voltage

Display the actual DC link voltage.

Range:		Function:
0 V*	[0 - 65535 V]	

16-34 Heatsink Temp.

View the heat sink temperature of the frequency converter.

Range:		Function:
0 °C*	[-128 - 127 °C]	

16-35 Inverter Thermal

View the percentage of thermal load on the frequency converter. At 100%, a trip occurs.

Range:		Function:
0 %*	[0 - 255 %]	

16-36 Inv. Nom. Current

View the inverter nominal current. The data is used for motor protection, etc.

Range:		Function:
0 A*	[0 - 655.35 A]	

16-37 Inv. Max. Current

Range:		Function:
0 A*	[0 - 655.35 A]	View the inverter maximum current. The data is used for calculation of frequency converter protection, etc.

16-38 SL Controller State

Range:		Function:
0*	[0 - 20]	View the actual state of the smart logic controller (SLC).

3.12.4 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.

16-52 Feedback[Unit]

Range:		Function:
0*	[-4999 - 4999]	View the feedback resulting from the selection of scaling in *3-02 Minimum Reference* and *parameter 3-03 Maximum Reference*.

16-54 Feedback 1 [Unit]

View the feedback 1 value resulting from the selection of scaling in *3-02 Minimum Reference* and *parameter 3-03 Maximum Reference*.

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

16-55 Feedback 2 [Unit]

View the feedback 2 value resulting from the selection of scaling in *3-02 Minimum Reference* and *parameter 3-03 Maximum Reference*.

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

3.12.5 16-6* Inputs and Outputs

16-60 Digital Input

Range:		Function:
0*	[0 - 65535]	View 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 3.8 Bits Definition

16-61 Terminal 53 Setting

Option:		Function:
		View the setting of input terminal 53. Current=0; Voltage=1.
[0] *	Current mode	
[1]	Voltage mode	

16-62 Analog Input AI53

View the actual value at input 53.

Range:		Function:
1*	[0 - 20]	

16-63 Terminal 54 Setting

View the setting of input terminal 54. Current=0; Voltage=1.

Option:		Function:
[0] *	Current mode	
[1]	Voltage mode	

16-64 Analog Input AI54

View the actual value at input 54.

Range:		Function:
1*	[0 - 20]	

16-65 Analog Output AO42 [mA]

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

16-66 Digital Output

Range:		Function:
0*	[0 - 15]	View the binary value of all digital outputs. **Definition:** X: Not used 0: Low 1: High

XX	None used
X0	Terminal 42 not used, terminal 45 low
X1	Terminal 42 not used, terminal 45 high
0X	Terminal 42 low, terminal 45 not used
0	Terminal 42 low, terminal 45 low
1	Terminal 42 low, terminal 45 high
1X	Terminal 42 high, terminal 45 not used
10	Terminal 42 high, terminal 45 low
11	Terminal 42 high, terminal 45 high

Table 3.9 Binary Value of Digital Outputs

16-67 Pulse Input #29 [Hz]

Range:		Function:
0*	[0 - 130000]	View the actual frequency rate on terminal 29.

16-71 Relay Output [bin]

Range:		Function:
0*	[0 - 65535]	View the setting of the relay. Bits definition:

Bit 0~2	Unused
Bit 3	Relay 02
Bit 4	Relay 01
Bit 5~15	Unused

Table 3.10 Relay Setting

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*.

3

16-72 Counter A		
Range:		**Function:**
		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 (*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		
View the actual value at output 45 in mA. The value shown reflects the selection in *parameter 6-70 Terminal 45 Mode* and *parameter 6-71 Terminal 45 Analog Output*.		
Range:		**Function:**
0 mA*	[0 - 20 mA]	

3.12.6 16-8* Fieldbus & FC Port

Parameters for reporting the bus references and control words.

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

3.12.7 16-9* Diagnosis Read-Outs

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

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

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

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

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

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

3.13 Main Menu - Data Readouts 2 - Group 18

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

3.13.1 18-1* Fire Mode Log

18-10 FireMode Log:Event		
Range:		**Function:**
0*	[0 - 255]	View Firemode event.

3

3.14 Main Menu - FC Closed Loop - Group 20

This parameter group is used for configuring the closed loop PI controller, that controls the output frequency of the frequency converter.

3.14.1 20-0* Feedback

This parameter group is used to configure the feedback signal for the closed loop PI control of the frequency converter.

20-00 Feedback 1 Source

Option:		Function:
		This parameter defines which input is used as the source of the feedback signal.
[0] *	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[3]	Pulse input 29	
[100]	Bus Feedback 1	
[101]	Bus Feedback 2	

20-01 Feedback 1 Conversion

Option:		Function:
		This parameter allows a conversion function to be applied to Feedback 1.
[0] *	Linear	*[0] Linear* has no effect on the feedback.
[1]	Square root	*[1] Square root* is commonly used when a pressure sensor is used to provide flow feedback ($(flow \propto \sqrt{pressure})$).

20-03 Feedback 2 Source

Option:		Function:
[0] *	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[3]	Pulse input 29	
[100]	Bus Feedback 1	
[101]	Bus Feedback 2	

20-04 Feedback 2 Conversion

Option:		Function:
[0] *	Linear	
[1]	Square root	

3.14.2 20-2* Feedback/Setpoint

Parameter group for feedback function and setpoints. Select which setpoint and feedback to use. The setpoint and feedback can be a fixed pair or selected separately based on logic comparisons.

20-20 Feedback Function

Select how the feedback should be calculated. The feedback can be either a single feedback source or a combination of several feedbacks.

Option:		Function:
[3] *	Minimum	
[4]	Maximum	

3.14.3 20-8* PI Basic Settings

Parameters for configuring the process PI control.

20-81 PI Normal/ Inverse Control

Option:		Function:
[0] *	Normal	Causes the frequency converter output frequency to decrease when the feedback is greater than the setpoint reference. This is common for pressure-controlled supply fan and pump applications.
[1]	Inverse	Causes the frequency converter output frequency to increase when the feedback is greater than the setpoint reference. This is common for temperature-controlled cooling applications, such as cooling towers.

20-83 PI Start Speed [Hz]

Range:		Function:
0 Hz*	[0 - 200.0 Hz]	Enter the motor speed to be attained as a start signal for commencement of PI control. Upon power-up, the frequency converter operates using speed open loop control. When the process PI start speed is reached, the frequency converter changes to PI control.

20-84 On Reference Bandwidth

Range:		Function:
5 %*	[0 - 200 %]	When the difference between the feedback and the setpoint reference is less than the value of this parameter, the frequency converter display shows *Run on Reference*. This status can be communicated externally by programming the function of a digital output for *[8] Run on Reference/No Warning*. In addition, for serial communications, the On Reference status bit of the frequency converter status word is high (1). The *On Reference Bandwidth* is calculated as a percentage of the setpoint reference.

3.14.4 20-9* PI Controller

20-91 PI Anti Windup		
Option:	**Function:**	
[0]	Off	Continue regulation of an error even when the output frequency cannot be increased or decreased.
[1] *	On	Cease regulation of an error when the output frequency can no longer be adjusted.

20-93 PI Proportional Gain		
Range:		**Function:**
0.50*	[0 - 10]	Enter the process controller proportional gain. Quick control is obtained at high amplification. However if amplification is too great, the process may become unstable.

20-94 PI Integral Time		
Range:		**Function:**
20 s*	[0.10 - 9999 s]	Enter the process controller integral time. Obtain quick control through a short integral time, though if the integral time is too short, the process becomes unstable. An excessively long integral time disables the integral action.

20-97 PI Feed Forward Factor		
Range:		**Function:**
0 %*	[0 - 400 %]	Enter the PI feed forward factor. The FF factor sends a constant fraction of the reference signal to bypass PI control. Therefore, the PI can affect only the remaining fraction of the control signal. The FF factor can increase dynamic performance.

3.15 Main Menu - Application Functions - Group 22

3.15.1 22-0* Miscellaneous

3

Parameter group for extra settings.

22-02 Sleepmode CL Control Mode		
Option:		**Function:**
[0] *	Normal	The feedback is detected. Some parameters are checked.
[1]	Simplified	The feedback is not detected. Only sleep speed and time are checked.

This parameter is for sleep mode running in process close loop mode. Use this parameter to configure whether to detect the feedback for sleep mode.

3.15.2 22-4* Sleep Mode

The purpose of sleep mode is to allow the frequency converter to stop itself in situations where the system is in balance. This saves energy, and keeps the system from being over-satisfied (excessive pressure, water excessively cooled in cooling towers, building pressurisation problems). This is also important as some applications prevent the frequency converter from adjusting motor down to low speed. This might damage pumps, cause insufficient lubrication in gearboxes, and make fans unstable.

The sleep controller has 2 important functions: The ability to go to sleep at right time; and the ability to come out of a sleep mode at right time. The goal is to keep the frequency converter in sleep mode as long as possible to avoid cycling the motor on and off frequently, and, at the same, time keep the controlled system variable within the acceptable range.

The sequence when running sleep mode in open loop:

1. The motor speed is less than the speed set in *parameter 22-47 Sleep Speed [Hz]*; The motor has been running longer than the time duration set in *parameter 22-40 Minimum Run Time*; The sleep condition lasts longer than the time set in *parameter 22-48 Sleep Delay 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 *parameter 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 a wake up situation.
5. The speed setpoint is greater than *parameter 22-43 Wake-Up Speed [Hz]*; The sleep condition has lasted longer than the time set in *parameter 22-41 Minimum Sleep Time*; The wake-up condition lasts longer than the time set in *parameter 22-49 Wake-Up Delay 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. The frequency converter goes into boost status if the following conditions are met.
   - If *parameter 22-02 Sleepmode CL Control Mode* is set to *[0] Normal*:
     - The motor speed is less than the value in *parameter 22-47 Sleep Speed [Hz]*.
     - The feedback is above the reference.
     - The motor has been running longer than the time in *parameter 22-40 Minimum Run Time*.
     - The sleep condition lasts longer than the time in *parameter 22-48 Sleep Delay Time*.
   - If *parameter 22-02 Sleepmode CL Control Mode* is set to *[1] Simplified*:
     - The motor speed is less than the value in *parameter 22-47 Sleep Speed [Hz]*.
     - The motor has been running longer than the time in *parameter 22-40 Minimum Run Time*.
     - The sleep condition lasts longer than the time in *parameter 22-48 Sleep Delay Time*.

     If *parameter 22-45 Setpoint Boost* is not set, the frequency converter goes into sleep mode.
2. After the time in *parameter 22-46 Maximum Boost Time* has passed, the frequency converter ramps down the motor speed to the speed in *parameter 1-82 Min Speed for Function at Stop [Hz]*.
3. The frequency converter activates *parameter 1-80 Function at Stop*. The frequency converter is now in sleep mode.

4. When the error between the reference and the feedback is greater than *parameter 22-44 Wake-Up Ref./FB Diff*, and the sleep time is longer than the time in *parameter 22-41 Minimum Sleep Time*, and the wake-up condition lasts longer than the time set in *parameter 22-48 Sleep Delay Time*, the frequency converter is out of sleep mode.
5. The frequency converter goes back to close loop control.

NOTICE

Sleep mode is not active when local reference is active (set speed manually using the navigation keys on the LCP).
Sleep mode does not work in local mode. Perform an auto set-up in open loop 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 set point for the pressure (Pset) 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 e.g. constant pressure control, it is advantageous to increase the system pressure before the motor is stopped.

22-45 Setpoint Boost

Range:		Function:
		This extends the time the motor is stopped and helps to avoid frequent start/stop. Set the desired over pressure/temperature in percentage of set point for the pressure (P_{set})/ temperature before entering the sleep mode. If setting for 5%, the boost pressure is P_{set}*1.05. The negative values can be used for cooling tower control where a negative change is needed.

22-46 Maximum Boost Time

Range:		Function:
60 s*	[0 - 600 s]	Only to be used 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, the frequency converter enters the sleep mode without 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.

22-48 Sleep Delay Time

Set the delay time the motor waits before entering sleep mode when the condition to entering sleep mode is met.

Range:		Function:
0 s	[0 - 3600 s]	

22-49 Wake-Up Delay Time

Set the delay time the motor waits before waking up from sleep mode when the condition for wake-up is met.

Range:		Function:
0 s	[0 - 3600 s]	

3.15.3 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, *parameter 22-60 Broken Belt Function* is performed.

22-60 Broken Belt Function

Selects the action to be performed if the broken belt condition is detected.

Option:		Function:
[0] *	Off	
[1]	Warning	The frequency converter continues to run, but activates a broken belt warning [W95]. A

3

22-60 Broken Belt Function		
Selects the action to be performed if the broken belt condition is detected.		
Option:		**Function:**
		frequency converter digital output or a serial communication bus can communicate a warning to other equipment.
[2]	Trip	The frequency converter stops running and activates a broken belt alarm [A 95]. A frequency converter digital output or a serial communication bus can communicate an alarm to other equipment.

NOTICE

Do not set *parameter 14-20 Reset Mode*, to *[13] Infinite auto reset*, when *parameter 22-60 Broken Belt Function* is set to *[2] Trip*. Doing so causes the frequency converter to continuously cycle between running and stopping when a broken belt condition is detected.

NOTICE

If the automatic bypass function is enabled, the bypass starts when the frequency converter experiences a persistent alarm condition. In this case, disable the automatic bypass function if *[2] Trip* is selected as the broken belt function.

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]	Sets the time for which the broken belt conditions must be active before carrying out the action selected in *parameter 22-60 Broken Belt Function*.

3.16 Main Menu - Application Functions 2 - Group 24

3.16.1 24-0* Fire Mode

⚠CAUTION

EQUIPMENT DAMAGE AND PERSONAL INJURY

Non-interruption of the frequency converter due to fire mode operation could cause over pressure and result in damage to the system and components, hereunder dampers and air ducts. The frequency converter itself could be damaged and it may cause damage or fire.

- **Ensure the system is properly designed and components used are carefully selected.**
- **Ensure the ventilation systems working in life safety applications are approved by the local fire authorities.**

Background

Fire mode is for use in critical situations, where it is imperative for the motor to keep running, regardless of the frequency converter's normal protective functions. These could be ventilation fans in tunnels or stairwells for instance, where continued operation of the fan facilitates safe evacuation of personnel in the event of a fire. Some selections of fire mode function cause alarms and trip conditions to be ignored, enabling the motor to run without interruption.

Activation

Fire mode is activated only via digital input terminals. See parameter group *5-1* Digital Inputs*.

Messages in display

When fire mode is activated, the display shows a status message *Fire Mode*.
Once the fire mode is again deactivated, the status message disappears.
If, while the frequency converter is active in fire mode, an alarm with warranty implications (see *24-09 FM Alarm Handling*) occurs, the display shows the status message *Fire Mode Limits Exceeded*. Once this status message appears, it remains permanently, and cannot be removed.
Digital and relay outputs can be configured for the status messages *Fire Mode Active*. See parameter group *5-3* Digital Outputs* and parameter group *5-4* Relays*.
The status messages *Fire Mode* and *Fire Mode Limits Exceeded* can be accessed via the extended status word.

Message	Type	LCP	Message	Warning Word 2	Ext. Status Word 2
Fire Mode	Status	+	+		+ (bit 25)
Fire Mode Limits Exceeded	Status	+	+		+ (bit 27)

Table 3.11 Fire Mode Display Messages

Log

An overview of events related to fire mode can be viewed in the fire mode log, parameter group *18-1* Fire Mode Log*. The log includes up to 10 of the latest events. *Fire Mode Limits Exceeded* has a higher priority than *Fire Mode Active*. The log cannot be reset.
The following events are logged:

- Fire mode activated.
- Fire mode limits exceeded (warranty affecting alarms).

All other alarms occurring while fire mode activated are logged as usual.

NOTICE

During fire mode operation, all stop commands to the frequency converter are ignored, including coast/coast inverse and external interlock.

NOTICE

If setting the command *[11] Start Reversing* on a digital input terminal in *parameter 5-10 Terminal 18 Digital Input*, the frequency converter understands this as a reversing command.

24-00 FM Function		
Option:		**Function:**
[0] *	Disabled	Fire mode function is not active.
[1]	Enabled-Run Forward	In this mode, the motor continues to operate in a clockwise direction.
[2]	Enabled-Run Reverse	In this mode, the motor continues to operate in a counterclockwise direction.
[3]	Enabled-Coast	While this mode is selected, the output is disabled, and the motor is allowed to coast to stop. When *parameter 24-01 Fire Mode Configuration* is set to *[3] Closed Loop*, this mode cannot be selected.
[4]	Enabled-Run Fwd/Rev	In this mode, the motor operates in a clockwise direction. When receiving a reversing signal, the motor operates in counterclockwise direction. The motor cannot operate in counterclockwise direction if *parameter 24-01 Fire Mode Configuration* is set to *[3] Closed Loop*.

NOTICE

In fire mode, alarms are produced or ignored in accordance with the selection in *24-09 FM Alarm Handling*.

3

24-01 Fire Mode Configuration		
Select to use closed-loop or open-loop operations.		
Option:		**Function:**
[0] *	Open Loop	
[3]	Closed Loop	***NOTICE*** **When set to *Closed Loop*, the commands *Reversing* and *Start Reversing* do not reverse the direction of the motor.** Motor speed is determined by a reference from the built-in PI controller varying the motor speed as of a closed-loop control process (e.g. constant pressure or flow). Configure the PI controller in parameter group *20-** Drive Closed Loop*.

24-05 FM Preset Reference		
Range:		**Function:**
0 %*	[-100 - 100 %]	Enter the required preset reference/set point as a percentage of the fire mode maximum reference set in Hz.

24-06 Fire Mode Reference Source		
Option:		**Function:**
[0] *	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[7]	Pulse input 29	

24-07 Fire Mode 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]	Pulse input 29	
[100]	Bus Feedback 1	
[101]	Bus Feedback 2	

24-09 Fire Mode Alarm Handling		
Option:		**Function:**
[0]	Trip+Reset, Critical Alarms	If this mode is selected, the frequency converter continues to run, ignoring most alarms, even if doing so it may result in damage of the frequency converter. Critical alarms are alarms that cannot be suppressed but a restart attempt is possible (infinity automatic reset).
[1] *	Trip, Critical Alarms	In case of a critical alarm, the frequency converter trips and does not auto-restart (manual reset).

24-09 Fire Mode Alarm Handling		
Option:		**Function:**
[2]	Trip, All Alarms/Test	It is possible to test the operation of fire mode, but all alarm states are activated normally (manual reset).

NOTICE

Certain alarms can affect the lifetime of the frequency converter. If one of these ignored alarms occurs while in fire mode, a log of the event is stored in the fire mode log.
In fire mode log, the 10 latest events of alarms that affect warranty, fire mode activation, and fire mode deactivation are stored.

NOTICE

The setting in *14-20 Reset Mode* is disregarded in case of fire mode being active (see parameter group *24-0* Fire Mode*).

Number	Description	Critical alarms	Warranty affecting alarms
4	Mains ph. Loss		x
7	DC over volt	x	x
9	Inverter overloaded		x
13	Overcurrent	x	x
14	Ground fault	x	x
16	Short circuit	x	x
38	Internal fault	x	
69	Power card temp		x

Table 3.12 Fire Mode Alarm Handling

3.16.2 24-1* Drive Bypass

The frequency converter includes a feature that can automatically activate an external electro-mechanical bypass if a fire mode coast occurs (see *parameter 24-00 FM Function*).

The bypass switches the motor to operation directly on line. The external bypass is activated by 1 of the digital outputs or relays in the frequency converter, when programmed in parameter group *5-3* Digital Outputs* or parameter group *5-4* Relays*.

NOTICE

The drive bypass cannot be deactivated if in fire mode. It can be deactivated only by either removing the fire mode command signal or the power supply to the frequency converter.

When the drive bypass function is activated, the display on the LCP shows the status message *Drive Bypass*. This message has a higher priority than the fire mode status messages. When the automatic drive bypass function is enabled, it cuts in the external bypass according to *Illustration 3.16*

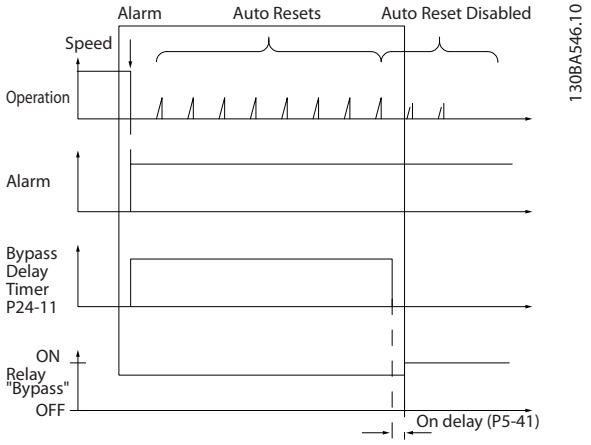

Illustration 3.16 Drive Bypass Function

Status can be read in the extended status word 2, bit number 24.

24-10 Drive Bypass Function		
Option:		**Function:**
		This parameter determines which circumstances activate the drive bypass function:
[0] *	Disabled	
[2]	Enabled (Fire Mode only)	The bypass function operates at trip at critical alarms, coast, or bypass delay timer if the timer expires before reset attempts have completed.

24-11 Drive Bypass Delay Time		
Range:		**Function:**
0 s*	[0 - 600 s]	Programmable in 1 s increments. Once the bypass function is activated in accordance with the setting in *parameter 24-10 Drive Bypass Function*, the bypass delay timer begins to operate. If the frequency converter has been set for a number of restart attempts, the timer continues to run while the frequency converter tries to restart. If the motor has restarted within the time period of the bypass delay timer, the timer is reset.

24-11 Drive Bypass Delay Time		
Range:		**Function:**
		If the motor fails to restart at the end of the bypass delay time, the frequency converter bypass relay, which has been programmed for bypass in *parameter 5-40 Function Relay*, is activated. Where no restart attempts are programmed, the timer runs for the delay period set in this parameter and then activates the drive bypass relay, which has been programmed for bypass in *parameter 5-40 Function Relay*.

3.17 Main Menu - Special Features - Group 30

3.17.1 30-2* Adv. Start Adjust

3

Parameter group for advanced start adjustments.

30-22 Locked Rotor Detection		
Set the locked rotor detection for PM motors.		
Option:		**Function:**
[0] *	Off	
[1]	On	

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

4 Troubleshooting

4.1 Introduction to Alarms and Warnings

A warning or alarm is signalled by the relevant indicator light on the front of the frequency converter and indicated by a code on the display.

A warning remains active until its cause is no longer present. Under certain circumstances, operation of the motor may still continue. Warning messages may be critical, but are not necessarily so.

If an alarm occurs, the frequency converter has tripped. Alarms must be reset to restart operation once their cause has been rectified.

This may be done in 4 ways:

1. By pressing [Reset].
2. Via a digital input with the *Reset* function.
3. Via serial communication.
4. By resetting automatically using the [Auto Reset] function, see *parameter 14-20 Reset Mode*.

NOTICE

After a manual reset pressing [Reset], press [Auto On] or [Hand On] to restart the motor.

If an alarm cannot be reset, the reason may be that its cause has not been rectified, or the alarm is trip-locked, see *Table 4.1*.

Alarms that are trip-locked offer extra protection, means that the mains supply must be switched off before the alarm can be reset. After being switched back on, the frequency converter is no longer blocked and may be reset as described above once the cause has been rectified.
Alarms that are not trip-locked can also be reset using the automatic reset function in *parameter 14-20 Reset Mode* (Warning: automatic wake-up is possible.)
If a warning and alarm is marked against a code in the table on the following page, this means that either a warning occurs before an alarm, or it can be specified whether it is a warning or an alarm that is to be displayed for a given fault.
This is possible, for instance, in *parameter 1-90 Motor Thermal Protection*. After an alarm or trip, the motor carries on coasting, and the alarm and warning flash on the frequency converter. Once the problem has been rectified, only the alarm continues flashing.

4

No.	Description	Warning	Alarm	Trip Lock	Parameter Reference
2	Live zero error	(X)	(X)		6-01
3	No motor	(X)			1-80
4	Mains phase loss	(X)	(X)	(X)	14-12
7	DC over voltage	X	X		
8	DC under voltage	X	X		
9	Inverter overloaded	X	X		
10	Motor ETR overtemperature	(X)	(X)		1-90
11	Motor thermistor overtemperature	(X)	(X)		1-90
13	Overcurrent	X	X	X	
14	Ground fault	X	X	X	
16	Short circuit		X	X	
17	Control word time-out	(X)	(X)		8-04
24	Fan fault (Only on 400 V 30–90kW)	X	X		14-53
30	Motor phase U missing		(X)	(X)	4-58
31	Motor phase V missing		(X)	(X)	4-58
32	Motor phase W missing		(X)	(X)	4-58
38	Internal fault		X	X	
44	Ground fault 2		X	X	
46	Gate drive voltage fault		X	X	
47	24 V supply low		X	X	
50	AMA calibration failed		X		
51	AMA check U_{nom} and I_{nom}		X		
52	AMA low I_{nom}		X		

No.	Description	Warning	Alarm	Trip Lock	Parameter Reference
53	AMA motor too large		X		
54	AMA motor too small		X		
55	AMA parameter out of range		X		
56	AMA interrupted		X		
57	AMA time-out		X		
58	AMA internal fault	X	X		
59	Current limit	X			
60	External interlock		X		
66	Heat sink temperature low	X			
69	Power card temperature	X	X	X	
79	Illegal PS config	X	X		
80	Frequency converter initialised to default value		X		
84	LCP error	X			
87	Auto DC brake	X			
95	Broken belt	X	X		22-6*
126	Motor rotating		X		
127	Back EMF too high	X			
201	Fire mode	X			
202	Fire mode limits exceeded	X			
250	New spare parts		X	X	
251	New type code		X	X	

Table 4.1 Alarm/Warning Code List

(X) Dependent on parameter

A trip is the action when an alarm has appeared. The trip coasts the motor and can be reset by pressing [Reset] or via a digital input (parameter group *5-1* Digital Inputs* [1]). The original event that caused an alarm cannot damage the frequency converter or cause dangerous conditions. A trip lock is an action when an alarm occurs, which may cause damage to the frequency converter or connected parts. A trip lock situation can only be reset by a power cycling.

Warning	yellow
Alarm	flashing red

Table 4.2 LED Indication

The alarm words, warning words, and extended status words can be read out via fieldbus or optional fieldbus for diagnosis. See also *parameter 16-90 Alarm Word*, *parameter 16-92 Warning Word*, and *parameter 16-94 Ext. Status Word*.

4.2 Alarm Words

Bit	Hex	Dec	Parameter 16-90 Alarm Word	Parameter 16-91 Alarm Word 2
0	1	1	0	Gate drive voltage fault
1	2	2	Pwr.Card Temp	0
2	4	4	Earth Fault	ServiceTrip, Typecode
3	8	8	0	Sparepart
4	10	16	Ctrl. Word TO	Illegal FC config.
5	20	32	Over Current	0
6	40	64	0	0
7	80	128	Motor Th. Over	0
8	100	256	Motor ETR Over	Broken Belt
9	200	512	Inverter Overld.	0
10	400	1024	DC under Volt	0
11	800	2048	DC over Volt.	0
12	1000	4096	Short Circuit	External Interlock
13	2000	8192	0	0
14	4000	16384	Mains ph. loss	0
15	8000	32768	AMA Not OK	0
16	10000	65536	Live Zero Error	0
17	20000	131072	Internal Fault	0
18	40000	262144	0	Fans error
19	80000	524288	U phase Loss	0
20	100000	1048576	V phase Loss	0
21	200000	2097152	W phase Loss	0
22	400000	4194304	0	0
23	800000	8388608	24 V supply low	0
24	1000000	16777216	0	0
25	2000000	33554432	0	Current limit
26	4000000	67108864	0	0
27	8000000	134217728	0	0
28	10000000	268435456	Earth fault	0
29	20000000	536870912	Drive Initialised	0
30	40000000	1073741824	0	0
31	80000000	2147483648	0	0

4.3 Warning Words

Bit	Hex	Dec	Parameter 16-92 Warning Word	Parameter 16-93 Warning Word 2
0	1	1	0	0
1	2	2	Pwr.Card Temp	0
2	4	4	Earth Fault	0
3	8	8	0	0
4	10	16	Ctrl. Word TO	0
5	20	32	Over Current	0
6	40	64	0	0
7	80	128	Motor Th. Over	0
8	100	256	Motor ETR Over	Broken Belt
9	200	512	Inverter Overld.	0
10	400	1024	DC under Volt	0
11	800	2048	DC over Volt.	0
12	1000	4096	0	0
13	2000	8192	0	0
14	4000	16384	Mains ph. loss	0
15	8000	32768	No Motor	Auto DC Braking
16	10000	65536	Live Zero Error	0
17	20000	131072	0	0
18	40000	262144	0	Fans Warning
19	80000	524288	0	0
20	100000	1048576	0	0
21	200000	2097152	0	0
22	400000	4194304	0	Memory Module
23	800000	8388608	24 V Supply Low	0
24	1000000	16777216	0	0
25	2000000	33554432	Current Limit	0
26	4000000	67108864	Low temp.	0
27	8000000	134217728	0	0
28	10000000	268435456	0	0
29	20000000	536870912	0	Back-EMF too High
30	40000000	1073741824	0	0
31	80000000	2147483648	0	0

Note that *0* in *Table 4.3* indicates this status word is not supported.

4

4.4 Extended Status Words

Bit	Hex	Dec	parameter 16 -94 Ext. Status Word	parameter 16-95 Ext. Status Word 2
0	1	1	Ramping	Off
1	2	2	AMA running	Hand/Auto
2	4	4	Start CW/CCW	0
3	8	8	0	0
4	10	16	0	0
5	20	32	Feedback high	0
6	40	64	Feedback low	0
7	80	128	Output current high	Control Ready
8	100	256	Output current low	Drive Ready
9	200	512	Output frequency high	Quick Stop
10	400	1024	Output frequency low	DC Brake
11	800	2048	0	Stop
12	1000	4096	0	0
13	2000	8192	Braking	Freeze Output Request
14	4000	16384	0	Freeze Output
15	8000	32768	OVC active	Jog Request
16	10000	65536	AC brake	Jog
17	20000	131072	0	Start request
18	40000	262144	0	Start
19	80000	524288	Reference high	0
20	100000	1048576	Reference low	Start Delay
21	200000	2097152	Local Ref./ Remote Ref.	Sleep
22	400000	4194304	0	Sleep boost
23	800000	8388608	0	Running
24	1000000	16777216	0	Bypass
25	2000000	33554432	0	Fire Mode
26	4000000	67108864	0	External Interlock
27	8000000	134217728	0	Firemodelimi-texceed
28	10000000	268435456	0	FlyStart Active
29	20000000	536870912	0	0
30	40000000	1073741824	0	0
31	80000000	2147483648	Database busy	0

Table 4.3 Extended Status Words

4.5 List of Warnings and Alarms

WARNING/ALARM 2, Live zero error
This warning or alarm only appears if *parameter 6-01 Live Zero Timeout Function* is configured. The signal on 1 of the analog inputs is less than 50% of the minimum value programmed for that input. This condition can be caused by broken wiring or a faulty device sending the signal.

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 matches the analog signal type.

WARNING/ALARM 3, No motor
No motor is connected to the output of the frequency converter. Check the cable connection between the frequency converter and the motor.

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 at *parameter 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 DC-link voltage exceeds the limit, the frequency converter trips after a time.

Troubleshooting

- Extend the ramp time.
- Activate functions in *parameter 2-10 Brake Function*.
- Activate overvoltage control in *parameter 2-17 Over-voltage Control*.

WARNING/ALARM 8, DC under voltage
If the DC-link voltage (DC) drops below the under voltage 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 an input voltage test.

WARNING/ALARM 9, Inverter overloaded
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 issuing an alarm. The frequency converter cannot be reset until the counter is below 90%.
The fault is that the frequency converter is overloaded by more than 100% 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.

NOTICE

See the derating section in the Design Guide for more details, if a high switching frequency is required.

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 *parameter 1-90 Motor Thermal Protection*. The fault is that the motor is overloaded by more than 100% for too long.

Troubleshooting

- Check if the motor is overheating.
- Check if the motor is mechanically overloaded
- Ensure that the motor *parameter 1-24 Motor Current* is set correctly.
- Ensure motor data in parameters 1-20 through 1-25 are set correctly.
- Run AMA in *parameter 1-29 Automatic Motor Adaption (AMA)*.

WARNING/ALARM 11, Motor thermistor over temp
The thermistor or the thermistor connection is disconnected. Select whether the frequency converter issues a warning or an alarm in *parameter 1-90 Motor Thermal Protection*.

Troubleshooting

- Check if the motor is overheating.
- Check if the motor is mechanically overloaded.
- Ensure that the thermistor is connected correctly.
- If using a thermal switch or thermistor, ensure that the programming of *parameter 1-93 Thermistor Source* matches sensor wiring.

WARNING/ALARM 13, Overcurrent
The inverter peak current limit is exceeded. The warning lasts about 1.5 s, then the frequency converter trips and issues an alarm.

Troubleshooting

- This fault may be caused by shock loading or fast acceleration with high inertia loads.
- Turn off the frequency converter. Check if the motor shaft can be turned.
- Check that the motor size matches the frequency converter.
- Incorrect motor data in parameters 1-20 through 1-25.

ALARM 14, Earth (ground) fault
There is a discharge from the output phases to ground, either in the cable between the frequency converter and the motor or in the motor itself.

Troubleshooting

- Turn off the frequency converter and remove the ground fault.
- Measure the resistance to ground the motor cables and the motor with a megohmmeter to check for ground faults in the motor.

ALARM 16, Short circuit
There is short-circuiting in the motor or on the motor terminals.

Turn off the frequency converter and remove the short circuit.

WARNING/ALARM 17, Control word timeout
There is no communication to the frequency converter. The warning is only active when *parameter 8-04 Control Timeout Function* is not set to *[0] Off*.
If *parameter 8-04 Control Timeout Function* is set to *Stop* and *Trip*, a warning appears and the frequency converter ramps down until it trips, while giving an alarm.

Troubleshooting

- Check connections on the serial communication cable.
- Increase *parameter 8-03 Control Timeout Time*.
- Check operation of the communication equipment.
- Verify proper installation based on EMC requirements.

WARNING/ALARM 24, Fan fault
The fan warning function is an extra protection function that checks whether the fan is running/mounted. The fan warning can be disabled in *parameter 14-53 Fan Monitor* ([0] Disabled).

Troubleshooting

- Check fan resistance.

ALARM 30, Motor phase U missing
Motor phase U between the frequency converter and the motor is missing.

Turn off 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.

Turn off 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.

Turn off the frequency converter and check motor phase W.

ALARM 38, Internal fault
It is necessary to contact your Danfoss supplier.

ALARM 44, Earth fault II
There is a discharge from the output phases to ground, either in the cable between the frequency converter and the motor or in the motor itself.

Troubleshooting
- Turn off the frequency converter and remove the ground fault.
- Measure the resistance to ground of the motor cables and the motor with a megohmmeter to check for a ground fault in the motor.

ALARM 46, Gate drive voltage low
The supply on the power card is out of range. There are 3 supplies generated by the switch mode power supply (SMPS) on the power card: 24 V, 5 V, and ±18 V.

Troubleshooting
- Check the power card.

ALARM 47, 24 V supply low
The 24 V DC is measured on the control card.It occurs when the detected voltage on terminal 12 is lower than 18 V. Check the control card and the load connected.

ALARM 51, AMA check Unom and Inom
The setting of motor voltage, motor current, and motor power is presumably wrong. Check the settings.

ALARM 52, AMA low Inom
The motor current is too low. Check the settings.

ALARM 53, AMA motor too big
The motor is too large for the AMA to be performed.

ALARM 54, AMA motor too small
The motor is too small for the AMA to be performed.

ALARM 55, AMA Parameter out of range
The parameter values found from the motor are outside the acceptable range.

ALARM 56, AMA interrupted by user
The AMA is interrupted.

ALARM 57, AMA timeout
Try to start the AMA again a number of times, until the AMA is performed. Note that repeated runs may heat the motor to a level where the resistance Rs and Rr are increased. In most cases, this is not critical.

ALARM 58, AMA internal fault
Contact your Danfoss supplier.

WARNING 59, Current limit
The current is higher than the value in *parameter 4-18 Current Limit*.

ALARM 60, External interlock
External interlock has been activated. To resume normal operation, apply 24 V DC to the terminal programmed for external Interlock and reset the frequency converter (via serial communication, digital I/O, or by pressing [Reset]).

ALARM 69, Power card temperature
The temperature on the power card is either too high or too low.

Troubleshooting
- Ensure that the ambient operating temperature is within the limits.
- Check if the filters are clogged.
- Check the fan operation.
- Check the power card.

ALARM 70, Illegal power section configuration
The control card and power card are incompatible. Contact your supplier with the type code of the unit from the nameplate and the part numbers of the cards to check compatibility.

ALARM 80, Drive initialised to default value
Parameter settings are initialised to default settings after a manual reset.

WARNING/ALARM 95, Broken belt
Torque is below the torque level set for no load, indicating a broken belt. See parameter group *22-6* Broken Belt Detection*.

ALARM 126, Motor Rotating
High back EMF voltage. Stop the rotor of the PM motor.

WARNING 127, Back EMF too high
This warning only applies to PM motors. When the back EMF is larger than 90%*U_{invmax} (overvoltage threshold), and does not fall to a normal level within 5 s, this warning occurs.

WARNING 200, Fire Mode
Fire mode has been activated.

WARNING 202, Fire Mode Limits Exceeded
Fire Mode has suppressed one or more warranty-voiding alarms.

ALARM 250, New Spare Part
The power or switch mode supply has been exchanged.

ALARM 251, New Type Code
The frequency converter has a new type code.

4.6 List of LCP Errors

LCP errors are not warnings or alarms. They do not affect the operation of the frequency converter. *Illustration 4.1* shows an LCP error on the LCP.

Illustration 4.1 LCP Error Example

LCP error code	Error message	Description
Err 84	LCP comm. Lost	Communication between the LCP and the frequency converter is lost.
Err 85	Button disabled	The LCP key is disabled. One of the LCP keys has been disabled in parameter group *0-4* LCP Keypad*.
Err 86	LCP copy failed	Data copy failure. This error occurs when data is copied from frequency converter to LCP, or from LCP to frequency converter (*parameter 0-50 LCP Copy*).
Err 88	Data not compatible	LCP data incompatible. This error occurs when data is being copied from LCP to frequency converter (*parameter 0-50 LCP Copy*). The typical reason is that data is moved between frequency converter and LCP that have major software differences.
Err 89	Read only	Parameter read only. An operation is issued via LCP to write a value to a parameter that is read-only.
Err 90	Database busy	The parameter database of the frequency converter is busy.
Err 91	Parameter invalid	The parameter value that is input via the LCP is invalid.
Err 92	Exceeds limits	The parameter value that is input via the LCP exceeds limits.
Err 93	Motor is running	The LCP copy operation cannot be performed when the frequency converter is running.
Err 95	Not while running	The parameter cannot be changed while the frequency converter is running.
Err 96	Password rejected	The password that is input via the LCP is incorrect.

Table 4.4 LCP Error List

5 Parameter Lists

5.1 Parameter Options

5.1.1 Default Settings

Changes during operation
True: The parameter can be changed while the frequency converter is in operation
False: The parameter can only be changed when the frequency converter stops.

2-Set-up
All set-up: The parameter can be set individually in each of the 2 set-ups. 1 single parameter can have 2 different data values.

1 set-up: Data value is the same in all set-ups.

ExpressionLimit
Size-related

N/A
No default value available.

Conversion index
This number refers to a conversion figure used when writing or reading via a frequency converter.

Conv. index	100	75	74	70	67	6	5	4	3	2	1	0	-1	-2	-3	-4	-5	-6
Conv. factor	1	3600000	3600	60	1/60	1000000	100000	10000	1000	100	10	1	0.1	0.01	0.001	0.0001	0.00001	0.000001

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

Table 5.1 Data Type

5.1.2 0-** Operation/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	ExpressionLimit	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
0-3* LCP Custom Readout						
0-30	Custom readout unit	[1] %	1 set-up	True	-	Uint8
0-31	Custom readout minimum value	0 CustomReadoutUnit	1 set-up	True	-2	Int32
0-32	Custom readout maximum 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

5.1.3 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	[1] Variable Torque	All set-ups	False	–	Uint8
1-06	Clockwise direction	[0] Normal	1 set-up	False	–	Uint8
1-08	Motor control bandwidth	[1] Medium	All set-ups	False	–	Uint8
1-1* Motor Selection						
1-10	Motor construction	[0] Asynchron	All set-ups	False	-	Uint8
1-14	Damping gain	120%	All set-ups	True	0	Int16
1-15	Low speed filter time constant	ExpressionLimit	All set-ups	True	-2	Uint16
1-16	High speed filter time constant	ExpressionLimit	All set-ups	True	-2	Uint16
1-17	Voltage filter time constant	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

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
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	0	Uint16
1-26	Motor cont. rated torque	ExpressionLimit	All set-ups	False	-1	Uint32
1-29	Automatic motor adaption (AMA)	[0] Off	1 set-up	False	–	Uint8
1-3* Adv. Motor Data						
1-30	Stator resistance (Rs)	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	-3	Int32
1-39	Motor ples	4 N/A	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	0	Int32
1-45	q-axis inductance sat. (LqSat)	ExpressionLimit	All set-ups	False	0	Int32
1-46	Position detection gain	100 %	All set-ups	True	0	Uint16
1-48	Current at minimum inductance for d-axis	100 %	All set-ups	False	0	Int16
1-49	Current at minimum inductance for q-axis	100 %	All set-ups	False	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]	0 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						
1-62	Slip compensation	0 %	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
1-66	Minimum 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	[0] Disabled	All set-ups	False	–	Uint8
1-8* Stop Adjustments						
1-80	Function at stop	[0] Coast	All set-ups	True	–	Uint8
1-82	Minimum speed for function at stop [Hz]	0 Hz	All set-ups	True	-1	Uint16
1-9* Motor Temperature						
1-90	Motor thermal protection	ExpressionLimit	All set-ups	True	–	Uint8
1-93	Thermistor source	[0] None	All set-ups	False	–	Uint8

5.1.4 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	True	-	Uint8
2-16	AC brake, maximum current	100 %	All set-ups	True	-1	Uint16
2-17	Overvoltage control	[2] Enabled	All set-ups	True	-	Uint8

5.1.5 3-** Reference/Ramps

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
3-0* Reference Limits						
3-02	Minimum reference	0	All set-ups	True	-3	Int32
3-03	Maximum reference	ExpressionLimit	All set-ups	True	-3	Int32
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
3-14	Preset relative reference	0 %	All set-ups	True	-2	Int16
3-15	Reference 1 source	[1] Analog in 53	All set-ups	True	-	Uint8
3-16	Reference 2 source	[2] Analog in 54	All set-ups	True	-	Uint8
3-17	Reference 3 source	[11] Local bus reference	All set-ups	True	-	Uint8
3-4* Ramp 1						
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						
3-51	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
3-8* 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

5.1.6 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
4-18	Current limit	110 %	All set-ups	True	0	Uint16
4-19	Max output frequency	ExpressionLimit	All set-ups	False	-1	Uint16
4-4* Adj. Warnings 2						
4-40	Warning frequency low	ExpressionLimit	All set-ups	True	-1	uint16
4-41	Warning frequency high	ExpressionLimit	All set-ups	True	-1	uint16
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	All set-ups	True	-3	Int32
4-57	Warning feedback high	4999	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
4-64	Semi-auto bypass set-up	[0] Off	All set-ups	True	-	Uint8

5.1.7 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 input mode	[0] PNP	1 set-up	False	-	Uint8
5-03	Digital input 29 mode	[0] PNP	1 set-up	False	-	Uint8
5-1* Digital Inputs						
5-10	Terminal 18 digital input	[8] Start	All set-ups	True	-	Uint8
5-11	Terminal 19 digital input	[0] No operation	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
5-3* Digital Outputs						
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 delay	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	Terminal 29 low frequency	4 Hz	All set-ups	True	0	Uint32
5-51	Terminal 29 high frequency	32000 Hz	All set-ups	True	0	Uint32
5-52	Terminal 29 low reference/feedback value	0 N/A	All set-ups	True	-3	Int32
5-53	Terminal 29 high reference/feedback value	50 N/A	All set-ups	True	-3	Int32
5-9* Bus Controlled						
5-90	Digital & relay bus control	0 N/A	All set-ups	True	0	Uint32

5.1.8 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
6-02	Fire mode 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	-2	Uint16
6-13	Terminal 53 high current	20 mA	All set-ups	True	-2	Uint16
6-14	Terminal 53 low reference/feedback value	0 N/A	All set-ups	True	-3	Int32
6-15	Terminal 53 high reference/feedback 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						
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	-2	Uint16
6-23	Terminal 54 high current	20 mA	All set-ups	True	-2	Uint16
6-24	Terminal 54 low reference/feedback value	0 N/A	All set-ups	True	-3	Int32
6-25	Terminal 54 high reference/feedback 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 minimum scale	0 %	All set-ups	True	-2	Uint16
6-74	Terminal 45 output maximum 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 minimum scale	0 %	All set-ups	True	-2	Uint16
6-94	Terminal 42 output maximum scale	100 %	All set-ups	True	-2	Uint16
6-96	Terminal 42 output bus control	0 N/A	All set-ups	True	0	Uint16

5.1.9 8-** Comm. 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	[1] FC Port	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
8-3* 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	[0] None	2 set-ups	True	–	
8-43	PCD read configuration	[0] None	1 set-up	True	–	Uint8
8-5* Digital/Bus						
8-50	Coasting select	[3] Logic OR	All set-ups	True	–	Uint8
8-51	Quick stop select	[3] Logic OR	All set-ups	True	–	Uint8
8-52	DC brake select	ExpressionLimit	All set-ups	True	–	Uint8
8-53	Start select	[3] Logic OR	All set-ups	True	–	Uint8
8-54	Reversing select	[0] Digital input	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
8-7* BACnet						
8-70	BACnet device instance	1 N/A	1 set-up	True	0	Uint32
8-72	MS/TP maximum masters	127 N/A	1 set-up	True	0	Uint8
8-73	MS/TP maximum info frames	1 N/A	1 set-up	True	0	Uint16
8-74	I am service	[0] Send at power-up	1 set-up	True	-	Uint8
8-75	Intialisation password	[admin]	1 set-up	True	0	VisStr[21]
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 received	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						
8-94	Bus feedback 1	0 N/A	All set-ups	True	0	Int16
8-95	Bus feedback 2	0 N/A	All set-ups	True	0	Int16

5.1.10 13-** Smart Logic

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	-1	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

5.1.11 14-** Special Functions

Par. No. #	Parameter description	Default value	4-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
14-08	Damping Gain Factor	96 %	All set-ups	TRUE	0	Uint8
14-1* Mains On/Off						
14-10	Mains Failure	[0] No function	All set-ups	FALSE	-	Uint8
14-12	Function at Mains Imbalance	[0] Trip	1 set-up	TRUE	-	Uint8
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
14-23	Typecode Setting	0 N/A	1 set-up	FALSE	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
14-4* Energy Optimising						
14-40	VT Level	90 %	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	[1] On	1 set-up	FALSE	-	Uint8
14-51	DC-Link Voltage Compensation	[1] On	All set-ups	FALSE	-	Uint8
14-52	Fan Control	[0] Auto	1 set-up	TRUE	-	Uint8
14-53	Fan Monitor	[1] Warning	1 set-up	TRUE	-	Uint8

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
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

5.1.12 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	All set-ups	True	74	Uint32
15-01	Running hours	0 h	All set-ups	True	74	Uint32
15-02	kWh counter	0 kWh	All set-ups	True	75	Uint32
15-03	Power up's	0 N/A	All set-ups	True	0	Uint32
15-04	Over temp's	0 N/A	All set-ups	True	0	Uint16
15-05	Over volt's	0 N/A	All set-ups	True	0	Uint16
15-06	Reset kWh counter	[0] Do not reset	All set-ups	True	-	Uint8
15-07	Reset running hours counter	[0] Do not reset	All set-ups	True	-	Uint8
15-3* Alarm Log						
15-30	Alarm log: error code	0 N/A	All set-ups	True	0	Uint8
15-31	Internal fault reason	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[6]
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[40]
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[8]
15-48	LCP ID number	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[10]
15-53	Power card serial number	0 N/A	1 set-up	False	0	VisStr[20]
15-59	CSIV filename	0 N/A	1 set-up	False	–	VisStr[16]

5.1.13 16-** Data Readouts

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	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	0	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
16-34	Heatsink temperature	0 °C	1 set-up	True	100	Int8
16-35	Inverter thermal	0%	1 set-up	True	0	Uint8
16-36	Inverter nominal current	0 A	1 set-up	True	-2	Uint16
16-37	Inverter maximum current	0 A	1 set-up	True	-2	Uint16
16-38	SL controller state	0 N/A	1 set-up	True	0	Uint8
16-5* Ref. & Feedb.						
16-50	External reference	0%	1 set-up	True	-1	Int16
16-52	Feedback[Unit]	0	1 set-up	True	-3	Int32
16-54	Feedback 1 [Unit]	0	All set-ups	True	-3	Int32
16-55	Feedback 2 [Unit]	0	All set-ups	False	-3	Int32
16-6* Inputs & Outputs						
16-60	Digital input	0 N/A	1 set-up	True	0	Uint16
16-61	Terminal 53 setting	[0] Current mode	1 set-up	True	-	Uint8
16-62	Analog input AI53	1 N/A	1 set-up	True	-2	Uint16
16-63	Terminal 54 setting	[0] Current mode	1 set-up	True	-	Uint8
16-64	Analog input AI54	1 N/A	1 set-up	True	-2	Uint16
16-65	Analog output AO42 [mA]	0 mA	1 set-up	True	-2	Uint16
16-66	Digital output	0 N/A	1 set-up	True	0	VisStr[4]
16-67	Pulse input #29 [Hz]	0 N/A	All set-ups	False	0	Int32
16-71	Relay output [bin]	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						
16-86	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	External status word	0 N/A	1 set-up	True	0	Uint32
16-95	External status word 2	0 N/A	1 set-up	True	0	Uint32

5.1.14 18-** Info & Readouts

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
18-1* Fire Mode Log						
18-10	Fire mode log:event	0 N/A	1 set-up	True	0	Uint8

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5.1.15 20-** Drive Closed Loop

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
20-0* Feedback						
20-00	Feedback 1 source	[0] No function	All set-ups	True	–	Uint8
20-01	Feedback 1 conversion	[0] Linear	All set-ups	True	–	Uint8
20-03	Feedback 2 source	[0] No function	All set-ups	True	–	Uint8
20-04	Feedback 2 conversion	[0] Linear	All set-ups	False	–	Uint8
20-2* Feedback/Setpoint						
20-20	Feedback function	[3] Minimum	All set-ups	True	–	Uint8
20-8* PI Basic Settings						
20-81	PI normal/inverse control	[0] Normal	All set-ups	True	–	Uint8
20-83	PI start speed [Hz]	0 Hz	All set-ups	True	-1	Uint16
20-84	On reference bandwidth	5%	All set-ups	True	0	Uint8
20-9* PI Controller						
20-91	PI anti windup	[1] On	All set-ups	True	–-	Uint8
20-93	PI proportional gain	0.50 N/A	All set-ups	True	-2	Uint16
20-94	PI integral time	20 s	All set-ups	True	-2	Uint32
20-97	PI feed forward factor	0%	All set-ups	True	0	Uint16

5.1.16 22-** Appl. Functions

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
22-0* Miscellaneous						
22-02	Sleep mode CL control mode	[0] Normal	All set-ups	True	–	Uint8
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 reference/feedback difference	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
22-48	Sleep delay time	0 s	All set-ups	True	0	Uint16
22-49	Wake-up delay time	0 s	All set-ups	True	0	Uint16
22-6* Broken Belt Detection						
22-60	Broken belt function	[0] Off	All set-ups	True	-	Uint8
22-61	Broken belt torque	10%	All set-ups	True	0	Uint8
22-62	Broken belt delay	10 s	All set-ups	True	0	Uint16

5.1.17 24-** Appl. Functions 2

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
24-0* Fire Mode						
24-00	FM function	[0] Disabled	1 set-up	True	–	Uint8
24-01	Fire mode configuration	[0] Open Loop	All set-ups	True	–	Uint8
24-05	FM preset reference	0%	All set-ups	True	0	Int16
24-06	Fire mode reference source	[0] No function	All set-ups	True	–	Uint8
24-07	Fire mode feedback source	[0] No function	All set-ups	True	–	Uint8
24-09	FM alarm handling	[1] Trip, Crit.Alarms	1 set-up	False	–	Uint8
24-1* Drive Bypass						
24-10	Drive bypass function	[0] Disabled	1 set-up	True	–	Uint8
24-11	Drive bypass delay time	0 s	1 set-up	True	0	Uint16

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