



Programming Guide

VLT[®] Compressor Drive CDS 803



Contents

1 Introduction	3
1.1 Purpose of the Manual	3
1.2 Document and Software Version	3
1.3 Safety Symbols	3
1.4 Safety Precautions	3
1.5 Conventions	4
1.6 Additional Resources	4
1.7 Definitions	5
1.8 Electrical Overview	7
2 How to Program	8
2.1 Programming with MCT 10 Set-up Software	8
2.2 Local Control Panel (LCP)	8
2.3 Menus	9
2.3.1 Status Menu	9
2.3.2 Quick Menu	9
2.3.3 Main Menu	16
2.4 Quick Transfer of Parameter Settings between Multiple Frequency Converters	17
2.5 Readout and Programming of Indexed Parameters	17
2.6 Initialize the Frequency Converter to Default Settings in 2 Ways	17
3 Parameters	18
3.1 Main Menu - Operation and Display - Group 0	18
3.2 Main Menu - Load and Motor - Group 1	21
3.3 Main Menu - Brakes - Group 2	23
3.4 Main Menu - Reference/Ramps - Group 3	23
3.5 Main Menu - Limits/Warnings - Group 4	26
3.6 Main Menu - Digital In/Out - Group 5	27
3.7 Main Menu - Analog In/Out - Group 6	35
3.8 Main Menu - Communications and Options - Group 8	40
3.9 Main Menu - Smart Logic - Group 13	45
3.10 Main Menu - Special Functions - Group 14	54
3.11 Main Menu - Drive Information - Group 15	57
3.12 Main Menu - Data Readouts - Group 16	58
3.13 Main Menu - Drive Closed Loop - Group 20	63
3.14 Main Menu - Compressor Functions - Group 28	64
4 Troubleshooting	66
4.1 Alarms and Warnings	66
4.2 Alarm Words	69

4.3 Warning Words	70
4.4 Extended Status Words	70
4.5 List of Warnings and Alarms	71
4.6 List of LCP Errors	74
5 Parameter Lists	75
5.1 Parameter Options	75
5.1.1 Default Settings	75
5.1.2 0-** Operation/Display	76
5.1.3 1-** Load and Motor	77
5.1.4 2-** Brakes	78
5.1.5 3-** Reference/Ramps	78
5.1.6 4-** Limits/Warnings	78
5.1.7 5-** Digital In/Out	79
5.1.8 6-** Analog In/Out	80
5.1.9 8-** Comm. and Options	81
5.1.10 13-** Smart Logic	82
5.1.11 14-** Special Functions	82
5.1.12 15-** Drive Information	83
5.1.13 16-** Data Readouts	83
5.1.14 20-** Drive Closed Loop	85
5.1.15 28-** Compressor Functions	85
Index	86

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 and description of 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
MG18P2xx	Update to new software version.	2.0

Table 1.1 Document and Software Version

1.3 Safety Symbols

The following symbols are used in this guide:

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

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 power supply, or load sharing, the compressor may start at any time. Unintended start during programming, service, or repair work can result in death, serious injury, or property damage. The Compressor can start with an external switch, a serial bus command, an input reference signal from the LCP, or after a cleared fault condition.

To prevent unintended Compressor start:

- Disconnect the frequency converter from the mains.
- Press [Off/Reset] on the LCP before programming parameters.
- The frequency converter, compressor, and any driven equipment must be fully wired and assembled when the frequency converter is connected to AC mains, DC supply, or load sharing.

⚠ WARNING**DISCHARGE TIME**

The frequency converter contains DC-link capacitors, which can remain charged even when the frequency converter is not powered. Failure to wait the specified time after power has been removed before performing service or repair work, could result in death or serious injury.

1. Stop the Compressor.
2. Disconnect the AC mains, permanent magnet type motors, and remote DC-link power supplies, including battery back-ups, UPS, and DC-link connections to other frequency converters.
3. Wait for the capacitors to discharge fully before performing any service or repair work. The duration of waiting time is specified in *Table 1.2*.

Voltage [V]	Cooling capacity [TR]	Minimum waiting time (minutes)
3x200	4–6.5	15
3x400	4–5	4
3x400	6.5	15

High voltage may be present even when the warning LED indicator lights are off.

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 these operating instructions.

⚠ WARNING**UNINTENDED MOTOR ROTATION WINDMILLING**

Unintended rotation of permanent magnet motors can result in serious injury or equipment damage.

- Ensure that permanent magnet motors are blocked to prevent unintended rotation.

⚠ 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 Conventions

- Numbered lists indicate procedures.
- Bulleted lists indicate other information.
- Italicized text indicates the following:
 - Cross-reference
 - Link
 - Parameter name
 - Parameter option
 - Parameter group name
- All dimensions in drawings are in mm (inch).
- An asterisk (*) indicates default setting of a parameter.

1.6 Additional Resources

- *VLT® Compressor Drive CDS 803 Operating Guide* entails information on safety, installation and how to program. It provides a list of warnings and alarms and general specifications.
- *VLT® Compressor Drive CDS 803 Programming Guide* provides information on how to program and includes complete parameter descriptions.
- *VLT® Compressor Drive CDS 803 Design Guide* entails all technical information about the frequency converter and customer design and applications.
- *MCT 10 Set-up Software* enables the user to configure the frequency converter from a Windows™-based PC environment.

Supplementary publications and manuals are available from Danfoss. See www.danfoss.com and search for documentation.

1.7 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 compressor can start and stop with the LCP and the digital inputs. Functions are divided into 2 groups. Functions in group 1 have higher priority than functions in group 2.	Group 1	Reset, coast stop, Reset and coast stop, quick stop, DC brake, Stop, and the [Off] key.
	Group 2	Start, 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).

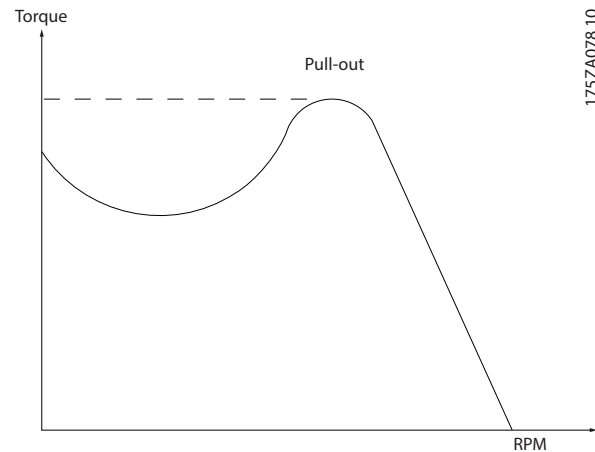
U_M

The instantaneous motor voltage.

$U_{M,N}$

The rated motor voltage (nameplate data).

Break-away torque



175ZA078:10

Illustration 1.1 Break-away Torque

η_{VLT}

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

Start-disable command

A stop command belonging to the group 1 control commands, see Table 1.3.

Stop command

See Control commands.

References

Analog reference

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

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 is set in parameter 3-03 Maximum Reference.

Ref_{MIN}

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

Miscellaneous**Analog inputs**

The analog inputs are used for controlling various functions of the frequency converter.

There are 2 types of analog inputs:

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

Analog outputs

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

Automatic Motor Adaptation, AMA

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

Digital inputs

Use the digital inputs for controlling various functions of the frequency converter.

Digital outputs

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

Relay outputs

The frequency converter features 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 compressor temperature.

Initializing

If initializing 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 initialize communication parameters.

Intermittent duty cycle

An intermittent duty rating refers to a sequence of duty cycles. Each cycle consists of an on-load and an off-load period. The operation can be either periodic duty or non-periodic duty.

LCP

The local control panel (LCP) makes up a complete interface for control and programming of the frequency converter. The control panel is detachable and can be installed up to 3 m from the frequency converter, 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. $1 \text{ MCM} \equiv 0.5067 \text{ mm}^2$.

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 one set-up, while another set-up is active.

Slip compensation

The frequency converter compensates for the compressor slip by giving the frequency a supplement that follows the measured compressor load keeping the compressor 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 compressor).

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 compressor, process, or mechanism. Restart is prevented until the cause of the fault has disappeared and the trip state is canceled by activating reset or, sometimes, by being programmed to reset automatically. Trip may not be used 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 canceled by cutting off mains, removing the cause of the fault, and reconnecting the frequency converter. Restart is prevented until the trip state is canceled by activating reset or, sometimes, by being programmed to reset automatically. Trip lock may not be used for personal safety.

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.

1.8 Electrical Overview

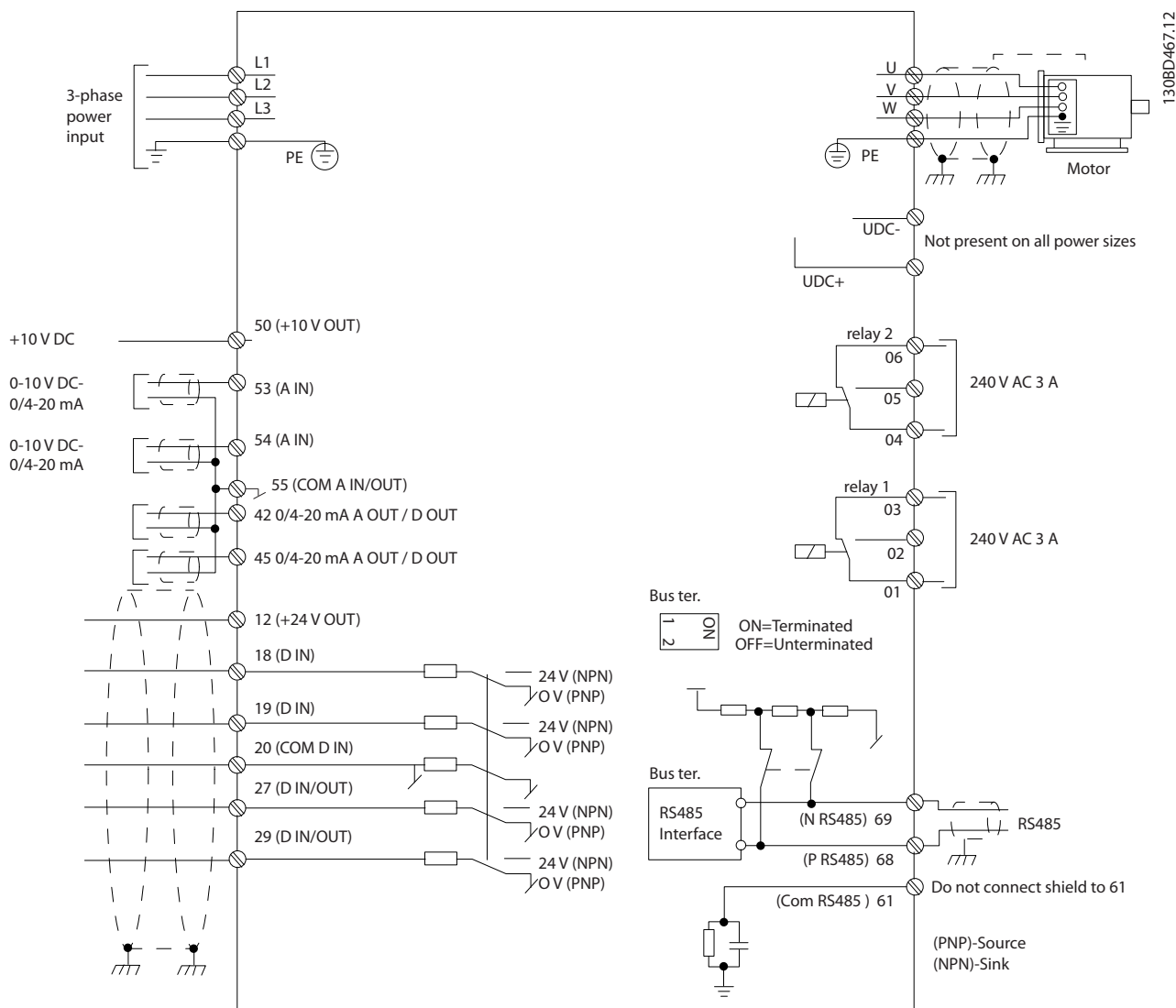


Illustration 1.2 Basic Wiring Schematic Drawing

2 How to Program

2

2.1 Programming with MCT 10 Set-up Software

The frequency converter can be programmed from the LCP or from a PC via the RS485 COM port by installing the MCT 10 Set-up Software. Refer to *chapter 1.6 Additional Resources* 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 (LEDs)
- D. Operation keys and indicator lights (LEDs)

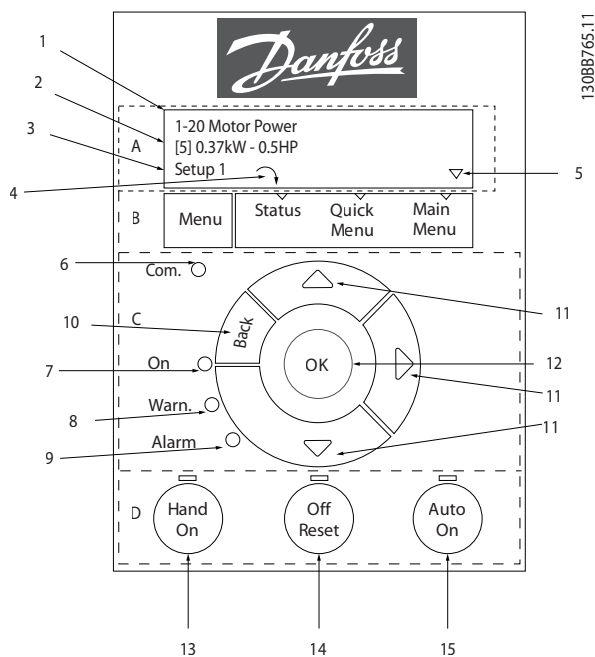


Illustration 2.1 Local Control Panel (LCP)

A. Display

The LCD-display is back-lit with 2 alphanumeric lines. All data is shown on the LCP.

Information 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-ups differ, both numbers are shown in the display (set-up 12). The number flashing, indicates the edit set-up.
4	Compressor 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 <i>Status</i> , <i>Quick Menu</i> , or <i>Main Menu</i> .

Table 2.1 Legend to Illustration 2.1

B. Menu key

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

C. Navigation keys and indicator lights (LEDs)

6	Com LED: Flashes during bus communication.
7	Green LED/On: Control section is working.
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 maneuvering between parameter groups, parameters and within parameters. 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

D. Operation keys and indicator lights (LEDs)

13	[Hand On]: Starts the compressor and enables control of the frequency converter via the LCP. NOTICE Terminal 27 Digital Input (<i>parameter 5-12 Terminal 27 Digital Input</i>) has stop inverse as default setting. This means that [Hand On] does not start the compressor if there is no 24 V to terminal 27. Connect terminal 12 to terminal 27.
14	[Off/Reset]: Stops the compressor (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

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, *parameter 16-10 Power [kW]*.
- Custom readout, *parameter 16-09 Custom Readout*.

2.3.2 Quick Menu

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

- Quick menu for open loop applications.
- Closed loop set-up quick menu.
- Changes made.
- Compressor functions.

The Start-up quick guide for open loop applications

Parameter	Option	Default	Function
<i>Parameter 0-01 Language</i>	[0] English [1] Deutsch [2] Francais [3] Dansk [4] Spanish [5] Italiano [28] Bras.port	[0] English	Select the language for the display.

Parameter	Option	Default	Function
<i>Parameter 0-06 GridType</i>	[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 operating mode for restart after reconnection of the frequency converter to mains voltage after power-down.
<i>Parameter 0-60 Main Menu Password</i>	0–999	0	Define the password for access to the LCP.
<i>Parameter 1-13 Compressor Selection</i>	[24] VZH028-R410A [25] VZH035-R410A [26] VZH044-R410A [27] VLZ028 [28] VLZ035 [29] VLZ044	Size related	Select which compressor to use.
<i>Parameter 3-03 Maximum Reference</i>	0–200 Hz	200 Hz	The maximum reference is the highest obtainable by summing all references.
<i>Parameter 3-15 Reference 1 Source</i>	[0] No function [1] Analog in 53 [2] Analog in 54 [7] Pulse input 29 [11] Local bus reference	[1] Analog in 53	Select the input to be used for the reference signal.
<i>Parameter 3-41 Ramp 1 Ramp Up Time</i>	0.05–3600.0 s	90.00 s	Ramp-up time from 0 to <i>parameter 1-25 Motor Nominal Speed</i> .
<i>Parameter 3-42 Ramp 1 Ramp Down Time</i>	0.05–3600.0 s	30.00 s	Ramp-down time from nominal motor speed to 0.

Parameter	Option	Default	Function
<i>Parameter 5-12 Terminal 27 Digital Input</i>	[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] Speed up [22] Speed down [23] Set-up select bit 0 [34] Ramp bit 0 [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	[6] Stop inverse	Select the input function for terminal 27.
<i>Parameter 5-40 Function Relay [0] Function relay</i>	See <i>parameter 5-40 Function Relay</i>	Alarm	Select the function to control output relay 1.
<i>Parameter 5-40 Function Relay [1] Function relay</i>	See <i>parameter 5-40 Function Relay</i>	Drive running	Select the function to control output relay 2.
<i>Parameter 6-10 Terminal 53 Low Voltage</i>	0–10 V	0.07 V	Enter the voltage that corresponds to the low reference value.
<i>Parameter 6-11 Terminal 53 High Voltage</i>	0–10 V	10 V	Enter the voltage that corresponds to the high reference value.
<i>Parameter 8-01 Control Site</i>	[0] Digital and ctrl.word [1] Digital only [2] Controlword only	[0] Digital and ctrl. word	Select if digital, bus, or a combination of both should control the frequency converter.
<i>Parameter 8-30 Protocol</i>	[0] FC [2] Modbus RTU	[0] FC	Select the protocol for the integrated RS485 port.
<i>Parameter 8-32 Baud Rate</i>	[0] 2400 Baud [1] 4800 Baud *[2] 9600 Baud [3] 19200 Baud [4] 38400 Baud [5] 57600 Baud [6] 76800 Baud [7] 115200 Baud	9600	Select the baud rate for the RS485 port.

Table 2.4 Open Loop Applications Set-up

2

The Start-up quick guide for compressor functions

- 1 28-00 Short Cycle Protection [1] Enabled
- 2 28-01 Interval between Starts 300 s
- 3 28-02 Minimum Run Time 60 s
- 4 28-10 Oil Return Management [1] On
- 5 28-11 Low Speed Running Time 120 s
- 6 28-12 Fixed Boost Interval 24 h
- 7 28-13 Boost Duration 60 s
- 8 28-17 ORM Boost Speed [Hz] 80Hz

e30bd874.13

Illustration 2.2 Compressor Function Quick Guide

Compressor function quick guide

Parameter	Option	Default	Function
Parameter 28-00 Short Cycle Protection	[0] Disabled [1] Enabled	[1] Enabled	Select if short cycle protection is to be used.
Parameter 28-01 Interval between Starts	0–3600 s	300 s	Enter the minimum allowed time between starts.
Parameter 28-02 Minimum Run Time	10–3600 s	60 s	Enter the minimum allowed time to run before stop.
Parameter 28-10 Oil Return Management	[0] Off [1] On	[1] On	Select if oil return management is to be used.
Parameter 28-11 Low Speed Running Time	1–1440 min	120 min	Enter the low speed running time.
Parameter 28-12 Fixed Boost Interval	1–168 h	24 h	Oil Boosts is performed at fixed time intervals
Parameter 28-13 Boost Duration	60–300 s	60 s	Enter the boost duration for the oil return.
Parameter 28-17 ORM Boost Speed [Hz]	80–200 Hz	120 Hz	Enter speed of the compressor during oil return boost.

Table 2.5 Compressor Function

The Start-up quick guide for compressor closed loop applications

1	0-01 Language [0] English
2	0-06 Grid Type Size related
3	0-60 Main Menu Password [0]
4	1-13 Compressor Selection Size related
5	1-00 Configuration Mode [0] Open loop
6	3-02 Minimum Reference 30 Hz
7	3-03 Maximum Reference 200.000 Hz
8	3-10 Preset Reference [0] 0.00 %
9	3-15 Reference 1 Source [1] Analog in 53
10	3-41 Ramp 1 Ramp Up Time 90.00 s
11	3-42 Ramp 1 Ramp Down Time 30.00 s
12	5-12 Terminal 27 Digital Input [2] Coast inverse
13	5-40 Function Relay 1 [0] [9] Alarm
14	6-19 Terminal 53 mode [1] Voltage mode
15	6-10 Terminal 53 Low Voltage 0.07 V
16	6-11 Terminal 53 High Voltage 10.00 V
17	6-14 Terminal 53 Low Ref./Feedb. Size related
18	6-15 Terminal 53 High Ref./Feedb. 200.000 Hz
19	6-29 Terminal 54 mode [0] Current mode
20	6-22 Terminal 54 Low Current 4.00 mA
21	6-23 Terminal 54 High Current 20.00 mA
22	6-24 Terminal 54 Low Ref./Feedb. 0.000
23	6-25 Terminal 54 High Ref./Feedb. 50.000
24	20-00 Feedback 1 Source [0] No function
25	20-81 PI Normal/Inverse control [0] Normal
26	8-01 Control Site [0] Digital and ctrl.word
27	8-30 Protocol [0] FC
28	8-32 Baud [2] 9600 Baud

e30bd875.12

Illustration 2.3 Closed loop Quick Guide

Closed loop quick guide

Parameter	Option	Default	Function
<i>Parameter 0-01 Language</i>	[0] English [1] Deutsch [2] Francais [3] Dansk [4] Spanish [5] Italiano [28] Bras.port	0	Select the language for the display.
<i>Parameter 0-06 GridType</i>	[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 after reconnection of the frequency converter to mains voltage after power-down.
<i>Parameter 0-60 Main Menu Password</i>	0–999	0	Define the password for access to the LCP.
<i>Parameter 1-00 Configuration Mode</i>	[0] Open loop [3] Closed loop	[0] Open loop	Select closed loop.
<i>Parameter 1-13 Compressor Selection</i>	[24] VZH028-R410A [25] VZH035-R410A [26] VZH044-R410A [27] VLZ028 [28] VLZ035 [29] VLZ044	Size related	Select the used compressor.
<i>Parameter 3-02 Minimum Reference</i>	0–200 Hz	30 Hz	The minimum reference is the lowest value obtainable by summing all references.
<i>Parameter 3-03 Maximum Reference</i>	0–200 Hz	200 Hz	The maximum reference is the highest obtainable by summing all references.
<i>Parameter 3-10 Preset Reference</i>	-100 – 100 %	0%	Set up a fix setpoint in preset reference [0].
<i>Parameter 3-15 Reference 1 Source</i>	[0] No function [1] Analog in 53 [2] Analog in 54 [7] Pulse input 29 [11] Local bus reference	[1] Analog in 53	Select the input to be used for the reference signal.
<i>Parameter 3-41 Ramp 1 Ramp Up Time</i>	0.05–3600.0 s	90.00 s	Ramp-up time from 0 to <i>parameter 1-25 Motor Nominal Speed</i> .

Parameter	Option	Default	Function
<i>Parameter 3-42 Ramp 1 Ramp Down Time</i>	0.05–3600.0 s	30.00 s	Ramp-down time from nominal motor speed to 0.
<i>Parameter 5-12 Terminal 27 Digital Input</i>	[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] Speed up [22] Speed down [23] Set-up select bit 0 [34] Ramp bit 0 [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	[6] Stop inverse	Select the input function for terminal 27.
<i>Parameter 5-40 Function Relay [0] Function relay</i>	See <i>parameter 5-40 Function Relay</i>	Alarm	Select the function to control output relay 1.
<i>Parameter 5-40 Function Relay [1] Function relay</i>	See <i>parameter 5-40 Function Relay</i>	Drive running	Select the function to control output relay 2.
<i>Parameter 6-10 Terminal 53 Low Voltage</i>	0–10 V	0.07 V	Enter the voltage that corresponds to the low reference value.
<i>Parameter 6-11 Terminal 53 High Voltage</i>	0–10 V	10 V	Enter the voltage that corresponds to the high reference value.
<i>Parameter 6-14 Terminal 53 Low Ref./ Feedb. Value</i>	-4999 – 4999	Size related	Enter the reference value that corresponds to the voltage set in <i>parameter 6-10 Terminal 53 Low Voltage</i> .
<i>Parameter 6-15 Terminal 53 High Ref./ Feedb. Value</i>	-4999 – 4999	200	Enter the reference value that corresponds to the voltage set in <i>parameter 6-11 Terminal 53 High Voltage</i> .
<i>Parameter 6-22 Terminal 54 Low Current</i>	0.00–20.00 mA	4.00 mA	Enter the current that corresponds to the low reference value.
<i>Parameter 6-23 Terminal 54 High Current</i>	0–10 V	10 V	Enter the current that corresponds to the high reference value.
<i>Parameter 6-24 Terminal 54 Low Ref./ Feedb. Value</i>	-0.00–20.00 mA	20.00 mA	Enter the reference value that corresponds to the current set in <i>parameter 6-20 Terminal 54 Low Voltage</i> .

Parameter	Option	Default	Function
<i>Parameter 6-25 Terminal 54 High Ref./ Feedb. Value</i>	-4999 – 4999	Size related	Enter the reference value that corresponds to the current set in <i>parameter 6-21 Terminal 54 High Voltage</i> .
<i>Parameter 8-01 Control Site</i>	[0] Digital and ctrl.word [1] Digital only [2] Controlword only	[0] Digital and ctrl.word	Select if digital, bus, or a combination of both should control the frequency converter.
<i>Parameter 8-30 Protocol</i>	[0] FC [2] Modbus RTU	[0] FC	Select the protocol for the integrated RS485 port.
<i>Parameter 8-32 Baud Rate</i>	[0] 2400 Baud [1] 4800 Baud [2] 9600 Baud [3] 19200 Baud [4] 38400 Baud [5] 57600 Baud [6] 76800 Baud [7] 115200 Baud	[2] 9600 Baud	Select the baud rate for the RS485 port.
<i>Parameter 20-00 Feedback 1 Source</i>	[0] No function [1] Analog Input 53 [2] Analog Input 54 [3] Pulse input 29 [100] Bus Feedback 1 [101] Bus Feedback 2	[0] No function	Select which input to use as the source of the feedback signal.
<i>Parameter 20-01 Feedback 1 Conversion</i>	[0] Linear [1] Square root	[0] Linear	Select how to calculate the feedback.

Table 2.6 Closed loop Applications Set-up

Changes made

Changes Made lists all parameters changed from default settings.

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

To change parameter settings

1. To enter the *Quick Menu*, press [Menu] until indicator in display is placed above *Quick Menu*.
2. Press [▲] [▼] to select quick guide, closed loop set-up, compressor 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 *Main Menu*.

The *Main Menu* accesses all parameters

1. Press [Menu] until indicator in 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.

2.3.3 Main Menu

Press [Main Menu] to access and program 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 compressor applications, it is not necessary to access the *Main Menu* parameters. Instead the *Quick Menu* provides the simplest and quickest access to the typical required parameters.

The *Main Menu* accesses all parameters.

1. Press [Menu] until indicator in 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.

Press [Back] to go back one level.

2.4 Quick Transfer of Parameter Settings between Multiple Frequency Converters

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

Data transfer from frequency converter to LCP:



Stop the compressor before performing this operation.

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 LCP to frequency converter:



Stop the compressor before performing this operation.

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 Initialize the Frequency Converter to Default Settings in 2 Ways

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

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

Except the following parameters:

- *Parameter 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 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*
- *Parameter group 15-4* Drive identification parameters*

2-finger initialization

1. Power off the frequency converter.
2. Press [OK] and [Menu].
3. Power up the frequency converter while still pressing the keys above 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*
 - *Parameter group 15-4* Drive identification parameters*

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

3 Parameters

3.1 Main Menu - Operation and Display - Group 0

3

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

0-04 Operating State at Power-up		
Select the operating mode after reconnection of the frequency converter to mains voltage after power-down when operating in <i>Hand (local) mode</i> .		
Option:	Function:	
[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		
Select the grid type of the supply voltage/frequency. 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.		
Option:	Function:	
		NOTICE Not all options are supported in all power sizes.
[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	
[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	

0-06 GridType		
Select the grid type of the supply voltage/frequency. 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.		
Option:	Function:	
[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		
Protective function against overvoltage at coast.		
Option:	Function:	
		NOTICE Can cause PWM when coasted.
[0]	Off	This function is not active.
[1] *	On	This function is active.

3.1.1 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-up1
- Set-up2

Furthermore, a fixed set of factory settings can be copied into 1 or more set-ups.

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

- Run compressor in 1 set-up (active set-up) while updating parameters in another set-up (edit set-up).
- Connect various compressors (one at a time) to the frequency converter. Compressor data for various compressors can be placed in different set-ups.
- Rapidly change settings of the frequency converter and/or compressor while the compressor runs. For example change 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 a set-up to the other set-ups. To avoid conflicting settings of the same parameter within 2 different set-ups, link the set-ups together 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 which are 'not changeable during operation' are marked FALSE in *chapter 5 Parameter Lists*.

0-10 Active Set-up		
Select the set-up in which the frequency converter operates.		
Option:	Function:	
[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 <i>parameter 0-12 Link Setups</i> .

0-11 Programming Set-up		
The number of the set-up being edited is shown in the LCP, flashing.		
Option:	Function:	
[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		
If the set-ups are not linked, a change between them is not possible while the compressor is running.		
Option:	Function:	
[0]	Not linked	When selecting a different set-up for operation, the set-up change does not occur until the compressor is coasted.
[20] *	Linked	Copies "not changeable during operation" parameters from one set-up to the other. It is possible to switch set-up while the compressor is running.

3.1.2 0-3* LCP Custom Readout and Display Text

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

3

Custom readout

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

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

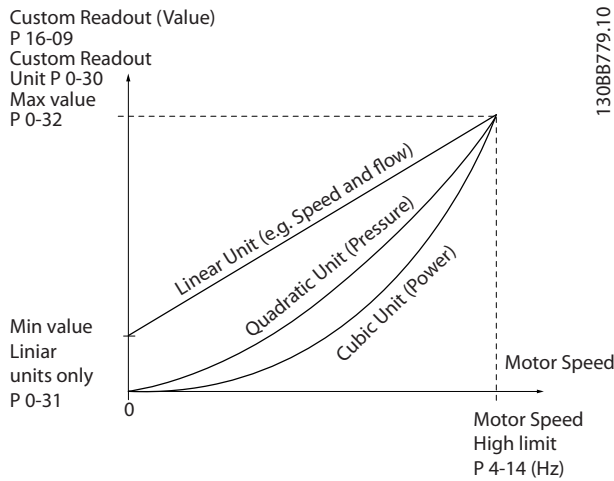


Illustration 3.1 Custom Readout

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		
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.		
Option:	Function:	
[0]	None	
[1] *	%	
[5]	PPM	
[10]	l/Min	
[11]	RPM	
[12]	Pulse/s	
[20]	l/s	
[21]	l/min	
[22]	l/h	
[23]	m ³ /s	
[24]	m ³ /min	
[25]	m ³ /h	
[30]	kg/s	
[31]	kg/min	
[32]	kg/h	
[33]	t/min	
[34]	t/h	
[40]	m/s	
[41]	m/min	
[45]	m	
[60]	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]	ft ³ /h	
[140]	ft/s	
[141]	ft/min	
[160]	Degree Fahr	
[170]	psi	
[171]	lb/in ²	
[172]	in WG	
[173]	ft WG	
[180]	hp	

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

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

3.1.3 0-4* LCP Keypad

Enable and disable individual keys on the LCP keypad.

0-40 [Hand on] Key on LCP		
Option:		Function:
[0]	Disabled	To avoid unintended start of the frequency converter in <i>hand-on mode</i> , select [0] Disabled.
[1] *	Enabled	[Hand On] is enabled.

0-42 [Auto on] Key on LCP		
Option:		Function:
[0]	Disabled	To avoid unintended start of the frequency converter from the LCP, select [0] Disabled.
[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 unintended stop of the frequency converter.

3.1.4 0-5* Copy/Save

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, to 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 compressor size. The latter selection can be used to program several frequency converters with the same function without disturbing compressor data which are 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 setup (selected in <i>parameter 0-11 Programming Setup</i>).

3.1.5 0-6* Password

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

3.2 Main Menu - Load and Motor - Group 1

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

3.2.1 1-0* General Settings

3

1-00 Configuration Mode		
Select which application control principle should be used.		
Option:	Function:	
[0] *	Open Loop	<p>NOTICE</p> <p>This parameter cannot be adjusted when compressor runs.</p> <p>Compressor speed is determined by applying a speed reference or by setting speed when in <i>Hand Mode</i>. 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.</p>
[3]	Process Closed Loop	Compressor speed is determined by a reference from the built-in PI controller varying the compressor speed as of a closed loop control process (for example, constant pressure or flow). Configure the PI controller in <i>parameter group 20-** Drive Closed Loop</i> .

1-13 Compressor Selection		
The default setting of most of the parameters in the frequency converter (for example, compressor data, limits, ramps) depends after the compressor and system refrigerant selected for the frequency converter. The frequency converter selects the default compressor based on the power size and voltage range for the frequency converter.		
Range:	Function:	
		<p>NOTICE</p> <p>If the compressor selection is changed, all dependent parameters reset to default and any user settings are lost.</p>
[24]	VZH028-R410A	
[25]	VZH035-R410A	
[26]	VZH044-R410A	
[27]	VLZ028	
[28]	VLZ035	
[29]	VLZ044	

1-71 Start Delay		
Range:	Function:	
60 s*	[0 - 120 s]	This parameter specifies the delay of the starting time after each start.

1-90 Motor Thermal Protection		
Using ETR (Electronic thermal relay), the compressor motor temperature is calculated based on frequency, current, and time. Danfoss recommends using the ETR function, if a thermistor is not present.		
Option:	Function:	
[0]	No protection	Disables temperature monitoring.
[1]	Thermistor warning	A thermistor gives a warning if the upper limit of the compressor temperature range is exceeded.
[2]	Thermistor trip	A thermistor gives an alarm and makes the frequency converter trip if the upper limit of the compressor temperature range is exceeded.
[3]	ETR warning 1	Calculates the load of the compressor and gives a warning if overloaded.
[4]	ETR trip 1	Calculates the load of the compressor and gives a trip if overloaded.
[22]	ETR Trip - Extended Detection	Start motor thermal calculation based on actual load and time as well as motor frequency, when the motor current is above 110% of the nominal motor current. Another situation is to start motor thermal calculation when the motor current is less than 110% of the nominal motor current and trigger current limit.

1-93 Thermistor Source		
Select the input to which the thermistor (PTC sensor) should be connected. When using an analog input, the same analog input cannot be used as a reference in <i>parameter 3-15 Reference 1 Source</i> to <i>parameter 3-17 Reference 3 Source</i> .		
Option:	Function:	
		<p>NOTICE</p> <p>This parameter cannot be adjusted while the compressor runs.</p> <p>NOTICE</p> <p>Digital input should be set to [0] PNP - Active at 24 V in <i>parameter 5-03 Digital Input 29 Mode</i>.</p>
[0] *	None	
[1]	Analog input AI53	
[6]	Digital input 29	

3.3 Main Menu - Brakes - Group 2

2-01 DC Brake Current		
Set the current as % of the rated motor current, see <i>parameter 1-24 Motor Current</i> . When the speed is below the limit set in <i>parameter 2-04 DC Brake Cut In Speed</i> , or when the DC-brake inverse function is active (in <i>parameter group 5-1* Digital Inputs</i> set to [5] <i>DC-brake inverse</i> ; or via the serial port), a DC-brake current is applied on a stop command. See <i>parameter 2-02 DC Braking Time</i> for duration.		
Range:		Function:
Size related*	[0 - 150 %]	NOTICE MOTOR OVERHEATING The maximum value depends on the rated motor current. To avoid motor damage caused by overheating, do not run at 100% for too long.

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

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

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:
Size related*	[0 - 200 Reference-FeedbackUnit]	The minimum reference is the lowest value obtainable by summing all references.

3-03 Maximum Reference		
Range:		Function:
200 Reference-FeedbackUnit*	[0 - 200 Reference-FeedbackUnit]	The maximum reference is the highest value obtainable by summing all references. The maximum reference unit matches the configuration selected in <i>parameter 1-00 Configuration Mode</i> .

3.4.2 3-1* References

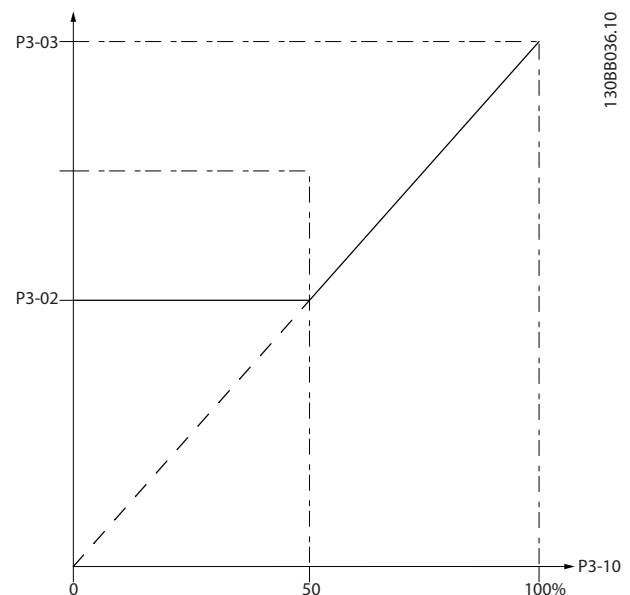


Illustration 3.2 References

3-10 Preset Reference		
Range:		Function:
0 %*	[-100 - 100 %]	Enter up to 8 different preset references (0-7) in this parameter, using array programming. For

3-10 Preset Reference		
Range:		Function:
		selecting dedicated references, select <i>preset reference bit 0/1/2 [16], [17], or [18]</i> for the corresponding digital inputs in <i>parameter group 5-1* Digital Inputs</i> .

3-11 Jog Speed [Hz]		
Range:		Function:
30 Hz*	[0 - 500.0 Hz]	The jog speed is a fixed output speed at which the frequency converter is running when the jog function is activated. See also <i>parameter 3-80 Jog Ramp Time</i> .

3-14 Preset Relative Reference		
Define the fixed value in %.		
Range:		Function:
0 %*	[-100 - 100 %]	The sum of fixed and variable values (labeled Y in <i>Illustration 3.3</i>) is multiplied by actual reference (labeled X in <i>Illustration 3.3</i>). This product is added to actual reference $X + X \times \frac{Y}{100}$

Illustration 3.3 Preset Relative Reference

3-15 Reference 1 Source		
Select the input to be used for the 1 st reference signal. <i>Parameter 3-15 Reference 1 Source, parameter 3-16 Reference 2 Source, and parameter 3-17 Reference 3 Source</i> define up to 3 different reference signals. The sum of these reference signals defines the actual reference.		
Option:		Function:
[0]	No function	
[1] *	Analog Input 53	
[2]	Analog Input 54	
[7]	Pulse input 29	
[11]	Local bus reference	

3-16 Reference 2 Source		
Select the input to be used for the 2 nd reference signal. <i>Parameter 3-15 Reference 1 Source, parameter 3-16 Reference 2 Source, and parameter 3-17 Reference 3 Source</i> define up to 3 different reference signals. The sum of these reference signals defines the actual reference. See also <i>parameter 1-93 Thermistor Source</i> .		
Option:		Function:
[0]	No function	
[1]	Analog Input 53	
[2] *	Analog Input 54	
[7]	Pulse input 29	
[11]	Local bus reference	

3-17 Reference 3 Source		
Select the reference input to be used for the 3 rd reference signal. <i>Parameter 3-15 Reference 1 Source, parameter 3-16 Reference 2 Source, and parameter 3-17 Reference 3 Source</i> define up to 3 different reference signals. The sum of these reference signals defines the actual reference.		
Option:		Function:
[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.

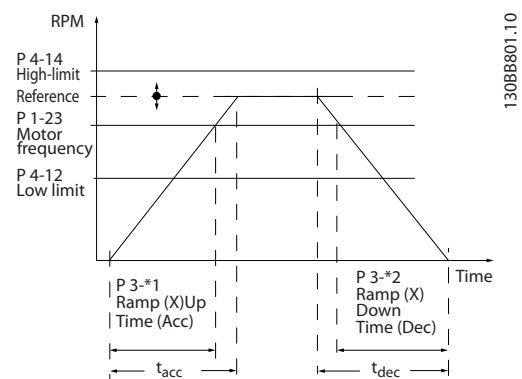


Illustration 3.4 Ramps

3-41 Ramp 1 Ramp Up Time		
Range:		Function:
Size related*	[0.05 - 3600 s]	Enter acceleration time from 0 RPM to <i>parameter 1-25 Motor Nominal Speed</i> . Select a ramp-up time such that the output current does not exceed the current limit in <i>parameter 4-18 Current Limit</i> during ramping. See ramp-down time in <i>parameter 3-42 Ramp 1 Ramp Down Time</i> .

3-42 Ramp 1 Ramp Down Time		
Range:		Function:
Size related*	[0.05 - 3600 s]	Enter deceleration time from <i>parameter 1-25 Motor Nominal Speed</i> to 0 RPM. Select a ramp-down time such that the output current does not exceed the current limit in <i>parameter 4-18 Current Limit</i> during ramping. See ramp-up time in <i>parameter 3-41 Ramp 1 Ramp Up Time</i> .

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 <i>parameter 1-23 Motor Frequency</i> if asynchronous motor is selected. Enter acceleration time from 0 RPM to <i>parameter 1-25 Motor Nominal Speed</i> if PM motor is selected. Select a ramp-up time such that the output current does not exceed the current limit in <i>parameter 4-18 Current Limit</i> during ramping. See ramp-down time in <i>parameter 3-52 Ramp 2 Ramp Down Time</i> .

3-52 Ramp 2 Ramp Down Time		
Range:		Function:
Size related*	[0.05 - 3600 s]	Enter the ramp-down time, that is, the deceleration time from <i>parameter 1-25 Motor Nominal Speed</i> to 0 RPM. Select a ramp-down time such that no overvoltage occur in the inverter due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in <i>parameter 4-18 Current Limit</i> . See

3-52 Ramp 2 Ramp Down Time		
Range:		Function:
		ramp-up time in <i>parameter 3-51 Ramp 2 Ramp Up Time</i> . $par. 3 - 52 = \frac{t_{dec} \times n_{nom} [par. 1 - 25]}{ref [rpm]} [s]$

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, that is, the acceleration/deceleration time between 0 Hz to <i>parameter 1-25 Motor Nominal Speed</i> . Ensure that the resulting output current required for the given jog ramp time does not exceed the current limit in <i>parameter 4-18 Current Limit</i> . The jog ramp time starts after 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:
10.00 s*	[0.05 - 3600 s]	Enter the quick stop ramp time from the <i>parameter 1-25 Motor Nominal Speed</i> to 0 Hz. During ramping, no overvoltage may occur in the inverter, nor may the generated current exceed the limit in <i>parameter 4-18 Current Limit</i> . It is activated with a signal on a selected digital input or via the serial communication port.

3-82 Starting Ramp Up Time		
Range:		Function:
15 s	[0.01 - 3600 s]	To ensure proper lubrication within the shortest possible time, a fast ramp needs to be used during start up, until start speed is reached.

3-83 Stopping Ramp Down Time		
Range:		Function:
15 s	[0.01 - 3600 s]	When a stop command is applied, the speed shall ramp down.

3.5 Main Menu - Limits/Warnings - Group 4

3.5.1 4-1* Motor Limits

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

4-12 Motor Speed Low Limit [Hz]		
Range:		Function:
Size related*	[0 - 200 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 <i>parameter 4-14 Motor Speed High Limit [Hz]</i> .

4-14 Motor Speed High Limit [Hz]		
Range:		Function:
200 Hz*	[30 - 205 Hz]	Enter the maximum limit for compressor speed. <i>Parameter 4-14 Motor Speed High Limit [Hz]</i> can be set to match the manufacturer's recommended maximum compressor speed. The motor speed high limit must exceed the value in <i>parameter 4-12 Motor Speed Low Limit [Hz]</i> .
<p>NOTICE Motor speed high limit cannot be set higher than <i>parameter 4-19 Max Output Frequency</i>.</p>		

4-18 Current Limit		
Range:		Function:
Size related*	[0 - 1000 %]	Enter the current limit for compressor operation (in % of rated compressor current. If the value is higher than the maximum rated output from the frequency converter, the current is still limited to the frequency converters maximum output current). If a setting in <i>parameter 1-13 Compressor Selection</i> is changed, <i>parameter 4-18 Current Limit</i> is automatically reset to the default value.

4-19 Max Output Frequency		
Range:		Function:
Size related*	[0.0 - 400 Hz]	Enter the maximum output frequency value. <i>Parameter 4-19 Max Output Frequency</i> specifies the absolute limit on the frequency converter output frequency for improved safety in applications where accidental overspeeding must be avoided. This absolute limit applies to all configurations and is independent of the setting in <i>parameter 1-00 Configuration Mode</i> .

3.5.2 4-4* Adjustable Warnings 2

4-40 Warning Freq. Low		
Use this parameter to set a lower limit for the frequency range.		
Range:		Function:
Size related*	[0 - 500 Hz]	When the compressor speed drops below this limit, the display reads SPEED LOW. Warning bit 10 is set in <i>parameter 16-94 Ext. Status Word</i> . Output relay can be configured to indicate this warning. The LCP warning light does not light when this parameter set limit is reached.

4-41 Warning Freq. High		
Use this parameter to set a higher limit for the frequency range.		
Range:		Function:
Size related*	[0 - 500 Hz]	When the compressor speed exceeds this limit, the display reads SPEED HIGH. Warning bit 9 is set in <i>parameter 16-94 Ext. Status Word</i> . Output relay can be configured to indicate this warning. The LCP warning light does not light when this parameter set limit is reached.

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 - 500 A]	Enter the I _{LOW} value. When the compressor current drops below this limit, a bit in the status word is set. This value can also be programmed to produce a signal

4-50 Warning Current Low		
Range:		Function:
		on the digital output or the relay output.

4-51 Warning Current High		
Range:		Function:
Size related*	[0 - 500.00 A]	Enter the I _{HIGH} value. When the compressor 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:
0*	[0 - 6010]	Enter the lower reference limit. When the actual reference drops below this limit, the display indicates Ref _{Low} . Terminal 27 and 29 could not be set to output. Only AO42/45 could be set to DO mode.

4-55 Warning Reference High		
Use this parameter to set a higher limit for the reference range.		
Range:		Function:
6010*	[0 - 6010]	When the actual reference exceeds this limit, the display reads Reference High. Warning bit 19 is set in <i>parameter 16-94 Ext. Status Word</i> . Output relay can be configured to indicate this warning. The LCP warning light does not light when this parameter set limit is reached.

4-56 Warning Feedback Low		
Use this parameter to set a lower limit for the feedback range.		
Range:		Function:
0 ProcessCtrl Unit*	[0 - 6010 ProcessCtrlUnit]	When the feedback drops below this limit, the display reads Feedback Low. Warning bit 6 is set in <i>parameter 16-94 Ext. Status Word</i> . Output relay can be configured to indicate this warning. The LCP warning light does not light when this parameter set limit is reached.

4-57 Warning Feedback High		
Use this parameter to set a higher limit for the feedback range.		
Range:		Function:
6010 ProcessCtrl Unit*	[0 - 6010 ProcessCtrlUnit]	When the feedback exceeds this limit, the display reads Feedback High. Warning bit 5 is set in

4-57 Warning Feedback High		
Use this parameter to set a higher limit for the feedback range.		
Range:		Function:
		<i>parameter 16-94 Ext. Status Word</i> . Output relay can be configured to indicate this warning. The LCP warning light does not light when this parameter set limit is reached.

4-58 Missing Motor Phase Function		
Option:		Function:
[0]	Off	No alarm is shown if a missing motor phase occurs.
[1] *	On	An alarm is shown 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]		
Some systems call for avoiding certain output speeds due to resonance problems in the system.		
Range:		Function:
0 Hz	[0 - 500 Hz]	Enter the lower limits of the speeds to be avoided.

4-63 Bypass Speed To [Hz]		
Some systems call for avoiding certain output speeds due to resonance problems in the system.		
Range:		Function:
0 Hz*	[0 - 500 Hz]	Enter the upper limits of the speeds to be avoided.

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 compressor is running.

5-00 Digital Input Mode		
Set NPN or PNP mode for digital inputs 18, 19, 27 and 29. Digital input mode.		
Option:		Function:
[0] *	PNP	Action on positive directional pulses (0). PNP systems are pulled down to GND.

5-00 Digital Input Mode		
Set NPN or PNP mode for digital inputs 18, 19, 27 and 29. Digital input mode.		
Option:		Function:
[1]	NPN	Action on negative directional pulses (1). NPN systems are pulled up to +24 V, internally in the frequency converter.

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 terminal.
[1] Reset	Resets frequency converter after a TRIP/ALARM. Trip lock alarms can be reset.
[2] Coast inverse	Leaves compressor in free mode. Logic 0⇒coast stop.
[3] Coast and reset inverse	Reset and coast stop inverted input (NC). Leaves compressor 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 <i>parameter 3-81 Quick Stop Ramp Time</i> . After ramping down, the shaft is in free mode.
[5] DC-brake inverse	Inverted input for DC braking (NC). Stops compressor by energizing it with DC current for a certain time period, see <i>parameter 2-01 DC Brake Current</i> . The function is only active when the value in <i>parameter 2-02 DC Braking Time</i> is different from 0. This selection is not possible when <i>parameter 1-10 Motor Construction</i> is set to [1] <i>PM non-salient SPM</i> .
[6] Stop inverse	Stop inverted function. Generates stop function when selected terminal goes from logic 1 to 0 (not latched). Stop is performed according to the selected ramp time.

Digital input function	Description
[7] External Interlock	Same function as [2] <i>Coasting stop, inverse</i> , but [7] <i>External Interlock</i> generates the alarm message <i>external fault</i> on the display when the terminal which is programmed for [2] <i>Coast inverse</i> is logic 0. The alarm message is also active via digital outputs and relay outputs, if programmed for [7] <i>External interlock</i> . 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	The compressor starts if a pulse is applied for minimum 2 ms. The compressor stops when [6] <i>Stop inverse</i> is activated.
[10] Reversing	Change direction of compressor shaft rotation. Reversing signal only changes direction of rotation; it does not activate the start function. Select [2] <i>Both directions</i> in <i>parameter 4-10 Motor Speed Direction</i> . 0=normal, 1=reversing.
[11] Start reversing	Use for start/stop and for reversing at the same time. Signals on [8] <i>start</i> are not allowed at the same time. 0=stop, 1=start reversing.
[14] Jog	Used for activating jog speed. See <i>parameter 3-11 Jog Speed [Hz]</i> . (Default digital input 29).
[16] Preset ref bit 0	Enables a selection between one of the 8 preset references according to <i>Table 3.3</i> .
[17] Preset ref bit 1	Enables a selection between one of the 8 preset references according to <i>Table 3.3</i> .
[18] Preset ref bit 2	Enables a selection between one of the 8 preset references according to <i>Table 3.3</i> .
[19] Freeze reference	Freeze the actual reference. The frozen reference is now the point of enable/condition for [21] <i>Speed up</i> and [22] <i>Speed down</i> to be used. If Speed up/down is used, speed change always follows ramp 2 (<i>parameter 3-51 Ramp 2 Ramp Up Time</i> and <i>parameter 3-52 Ramp 2 Ramp Down Time</i>) in the range <i>parameter 3-02 Minimum Reference - parameter 3-03 Maximum Reference</i> .
[20] Freeze output	Freezes actual reference. The frozen reference is now the point of enable/condition for [21] <i>Speed up</i> and [22] <i>Speed down</i> to be used. If Speed up/down is used, the speed change always follows ramp 2.

Digital input function	Description
[21] Speed up	Select [21] <i>Speed up</i> for digital control of the up/down speed. Activate this function by selecting either [19] <i>Freeze reference</i> or [20] <i>Freeze output</i> . When [21] <i>Speed up</i> is activated for less than 400 ms, the resulting reference is increased by 0.1%. If [21] <i>Speed up</i> is activated for more than 400 ms, the resulting reference ramps according to Ramp 1 in <i>parameter 3-41 Ramp 1 Ramp Up Time</i> .
[22] Speed down	Same as [21] <i>Speed up</i> , but reference decreases.
[23] Set-up select bit 0	Selects one of the 2 set-ups. Set <i>parameter 0-10 Active Set-up</i> to [9] <i>Multi Set-up</i> .
[32] Pulse Input	Select [32] <i>Pulse input</i> when using a pulse sequence as either reference or feedback. Scaling is done in <i>parameter group 5-5* Pulse Input</i> . 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.
[52] Run permissive	<p>The input terminal, for which [52] <i>Run permissive</i> has been programmed must be logic 1 before a start command can be accepted. [52] <i>Run permissive</i> has a logic 'AND' function related to the terminal which is programmed for [8] <i>Start</i>, [14] <i>Jog</i>, or [20] <i>Freeze Output</i>. To start running the compressor, both conditions must be fulfilled. If [52] <i>Run permissive</i> is programmed on multiple terminals, it only has to be logic 1 on one of the terminals for the function to be carried out. The digital output signal for Run Request ([8] <i>Start</i>, [14] <i>Jog</i>, or [20] <i>Freeze Output</i>) programmed in <i>parameter group 5-3* Digital Outputs</i>, or <i>parameter group 5-4* Relays</i>, is not affected by [52] <i>Run permissive</i>.</p> <p>NOTICE</p> <p>If no [52] <i>Run permissive</i> signal is applied but either <i>Run</i>, <i>Jog</i> or <i>Freeze</i> commands is activated, the status line in the display shows either <i>Run Requested</i>, <i>Jog Requested</i> or <i>Freeze Requested</i>.</p>

Digital input function	Description
[53] Hand Start	A signal applied puts the frequency converter into <i>Hand</i> mode as if [Hand On] has been pressed and a normal stop command is overridden. If disconnecting the signal, the compressor stops. To make any other start commands valid, another digital input must be assigned to [54] <i>Auto Start</i> and a signal applied to this. The [Hand On] and [Auto On] keys have no impact. The [Off] key overrides [53] <i>Hand Start</i> and [54] <i>Auto Start</i> . Press either [Hand On] or [Auto On] to make [53] <i>Hand Start</i> and [54] <i>Auto Start</i> active again. If no signal on neither [53] <i>Hand Start</i> nor [54] <i>Auto Start</i> , the compressor stops regardless of any normal start command applied. If signal applied to both [53] <i>Hand Start</i> and [54] <i>Auto Start</i> , the function is <i>Auto Start</i> .
[54] Auto start	A signal applied puts the frequency converter into <i>Auto</i> mode as if [Auto On] has been pressed. See also [53] <i>Hand Start</i> .
[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.
[64] Counter B (down)	Input for decrement counting in the SLC counter.
[65] Reset Counter B	Input for reset of counter B

Table 3.2 Digital Input Functions

Selected preset reference:	Preset reference bit 2	Preset reference bit 1	Preset reference 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 3.3 Selected Preset Reference

5-10 Terminal 18 Digital Input		
Parameter for configuring the input function on input terminal 18. Refer to Table 3.2 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	
[34]	Ramp bit 0	

5-10 Terminal 18 Digital Input		
Parameter for configuring the input function on input terminal 18. Refer to Table 3.2 for setting options.		
Option:	Function:	
[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	
[52]	Run permissive	
[53]	Hand start	
[54]	Auto start	

5-11 Terminal 19 Digital Input		
Parameter for configuring the input function on input terminal 19.		
Option:	Function:	
[60]	Counter A (up)	
[61]	Counter A (down)	
[62]	Reset Counter A	
[63]	Counter B (up)	
[64]	Counter B (down)	
[65]	Reset Counter B	

5-12 Terminal 27 Digital Input		
Parameter for configuring the input function on input terminal 27.		
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	
[52]	Run permissive	
[53]	Hand start	
[54]	Auto start	
[60]	Counter A (up)	
[61]	Counter A (down)	

5-12 Terminal 27 Digital Input		
Parameter for configuring the input function on input terminal 27.		
Option:	Function:	
[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	
[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	
[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)	

5-13 Terminal 29 Digital Input		
Parameter for configuring the input function on input terminal 29.		
Option:	Function:	
[64]	Counter B (down)	
[65]	Reset Counter B	

3.6.3 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 realized in an array parameter.		
Option:	Function:	
[0]	No operation	Default for both relays.
[1]	Control Ready	The control board receives supply voltage.
[2]	Drive ready	The frequency converter is ready for operation and applies a supply signal on the control board.
[3]	Drive ready/ remote control	The frequency converter is ready for operation in <i>Auto On</i> -mode.
[4]	Standby / no warning	The frequency converter is ready for operation. No start or stop command is given. No warnings are present.
[5]	Drive running	The compressor runs.
[6]	Running / no warning	The compressor runs, and no warnings are present.
[7]	Run in range/no warning	The compressor runs within programmed current ranges, see <i>parameter 4-50 Warning Current Low</i> and <i>parameter 4-51 Warning Current High</i> . No warnings are present.
[8]	Run on ref/no warning	The compressor 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	The compressor current is outside the range set in <i>parameter 4-50 Warning Current Low</i> and <i>parameter 4-51 Warning Current High</i> .

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 realized in an array parameter.		
Option:	Function:	
[13]	Below current, low	The compressor current is lower than set in <i>parameter 4-50 Warning Current Low</i> .
[14]	Above current, high	The compressor current is higher than set in <i>parameter 4-51 Warning Current High</i> .
[16]	Below speed, low	The frequency converter output speed is lower than the limit set in <i>parameter 4-40 Warning Freq. Low</i> .
[17]	Above speed, high	The frequency converter output speed is higher than the limit set in <i>parameter 4-41 Warning Freq. High</i> .
[19]	Below feedback, low	The feedback is lower than the limit set in <i>parameter 4-56 Warning Feedback Low</i> .
[20]	Above feedback, high	<i>parameter 4-57 Warning Feedback High</i> .
[21]	Thermal warning	The thermal warning turns on when the temperature exceeds the limit in the compressor, 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 <i>Auto</i> mode, and no overtemperature warning is present.
[24]	Ready, Voltage OK	The frequency converter is ready for operation and mains voltage is within specified voltage range.
[25]	Reverse	The compressor runs/is ready to run clockwise when logic=0 and counterclockwise when logic=1. The output changes when the reversing signal is applied.
[26]	Bus OK	Active communication (no timeout) via serial communication port.
[35]	External Interlock	See <i>5-1* Digital Inputs</i> .
[36]	Control word bit 11	Bit 11 in control word controls the relay.
[37]	Control word bit 12	Bit 12 in control word controls the relay.

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 realized in an array parameter.		
Option:	Function:	
[41]	Below reference, low	The reference is lower than the limit set in <i>parameter 4-54 Warning Reference Low</i> .
[42]	Above ref, high	The reference is higher than the limit set in <i>parameter 4-55 Warning Reference High</i> .
[44]	Oil boost active	
[45]	Bus Control	The output is configured in <i>parameter 5-90 Digital & Relay Bus Control</i> .
[60]	Comparator 0	See <i>parameter group 13-1* Comparators</i> . If Comparator 0 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[61]	Comparator 1	See <i>parameter group 13-1* Comparators</i> . If Comparator 2 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[62]	Comparator 2	See <i>parameter group 13-1* Comparators</i> . If Comparator 2 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[63]	Comparator 3	See <i>parameter group 13-1* Comparators</i> . If Comparator 3 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[64]	Comparator 4	See <i>parameter group 13-1* Comparators</i> . If Comparator 4 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[65]	Comparator 5	See <i>parameter group 13-1* Comparators</i> . If Comparator 5 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[70]	Logic rule 0	See <i>parameter group 13-4* Logic Rules</i> . If Logic rule 0 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[71]	Logic rule 1	See <i>parameter group 13-4* Logic Rules</i> . If Logic rule 1 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[72]	Logic rule 2	See <i>parameter group 13-4* Logic Rules</i> . If Logic rule 2 is evaluated as

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 realized in an array parameter.		
Option:	Function:	
		TRUE, the output goes high. Otherwise, it is low.
[73]	Logic rule 3	See <i>parameter group 13-4* Logic Rules</i> . If Logic rule 3 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[74]	Logic rule 4	See <i>parameter group 13-4* Logic Rules</i> . If Logic rule 4 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[75]	Logic rule 5	See <i>parameter group 13-4* Logic Rules</i> . If Logic rule 5 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[80]	SL digital output A	See <i>parameter 13-52 SL Controller Action</i> . The input goes high whenever the smart logic action [38] <i>Set dig. out. A high</i> is executed. The input goes low whenever the smart logic [32] <i>Action Set dig. out. A low</i> is executed.
[81]	SL digital output B	See <i>parameter 13-52 SL Controller Action</i> . The input goes high whenever the smart logic action [39] <i>Set dig. out. B high</i> is executed. The input goes low whenever the smart logic [33] <i>Action Set dig. out. B low</i> is executed.
[82]	SL digital output C	See <i>parameter 13-52 SL Controller Action</i> . The input goes high whenever the smart logic action [40] <i>Set dig. out. C high</i> is executed. The input goes low whenever the smart logic [34] <i>Action Set dig. out. C low</i> is executed.
[83]	SL digital output D	See <i>parameter 13-52 SL Controller Action</i> . The input goes high whenever the smart logic [41] <i>Action Set dig. out. D high</i> is executed. The input goes low whenever the smart logic [35] <i>Action Set dig. out. D low</i> 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 runs counter-

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 realized in an array parameter.		
Option:	Function:	
		clockwise (the logical product of the status bits <i>running AND reverse</i>).
[165]	Local ref. active	The output is high when <i>parameter 3-13 Reference Site=[2] Local</i> or when <i>parameter 3-13 Reference Site=[0] Linked to hand auto</i> at the same time as the LCP is in [Hand on] mode.
[166]	Remote ref. active	The output is high when <i>parameter 3-13 Reference Site</i> is set to [0] <i>Linked to Hand / Auto</i> or [1] <i>Remote</i> , while the LCP is in <i>Auto on</i> mode.
[167]	Start command activ	The output is high when there is an active start command (that is, via digital input, bus connection, [Hand on] or [Auto on]), and no stop command is active.
[168]	Drive in hand mode	The output is high when the frequency converter is in <i>Auto on</i> 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 <i>Auto on</i> mode (as indicated by the LED light above [Auto on]).

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

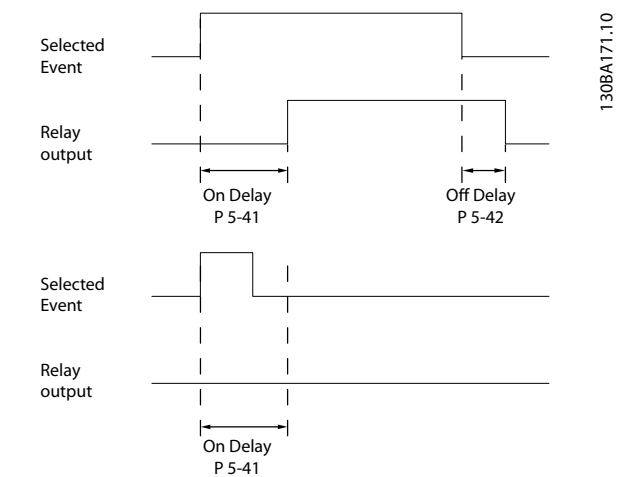


Illustration 3.5 On Delay, Relay

5-42 Off Delay, Relay		
Array[2]: Relay1[0], Relay2[1]		
Range:	Function:	
0.01 s*	[0 - 600 s]	Enter the delay of the relay cut out time. Select one of 2 internal mechanical relays in an array function. See <i>parameter 5-40 Function Relay</i> for details. If the selected event condition changes before a delay timer expires, the relay output is unaffected.

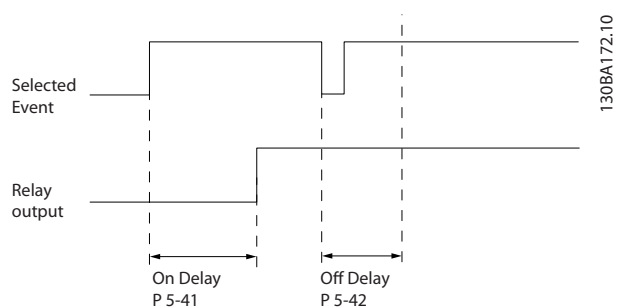


Illustration 3.6 Off Delay, Relay

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

3.6.4 5-5* Pulse Input

The pulse input parameters are used to define an appropriate window for the impulse reference area by configuring the scaling and filter settings for the pulse inputs. Input terminals 29 or 33 act as frequency reference inputs. Set terminal 29 (*parameter 5-13 Terminal 29 Digital Input*) or terminal 33 (*parameter 5-15 Terminal 33 Digital*

Input) to [32] Pulse input. If terminal 29 is used as an input, set parameter 5-01 Terminal 27 Mode to [0] Input.

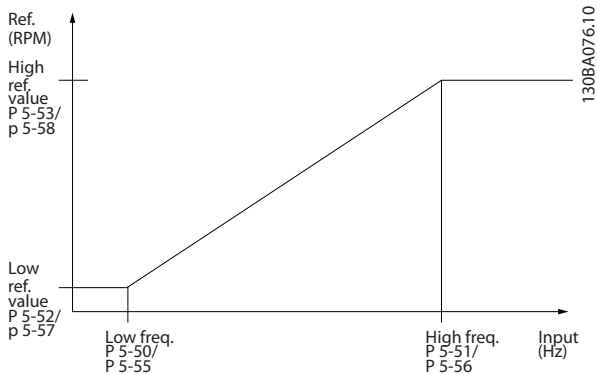


Illustration 3.7 Pulse Input

5-50 Term. 29 Low Frequency		
Range:	Function:	
20 Hz*	[20 - 31999 Hz]	Enter the low frequency limit corresponding to the low compressor shaft speed (that is, low reference value) in parameter 5-52 Term. 29 Low Ref./Feedb. Value. See Illustration 3.7.

5-51 Term. 29 High Frequency		
Range:	Function:	
32000 Hz*	[21 - 32000 Hz]	Enter the high frequency limit corresponding to the high compressor shaft speed (that is, high reference value) in parameter 5-53 Term. 29 High Ref./Feedb. Value.

5-52 Term. 29 Low Ref./Feedb. Value		
Range:	Function:	
0*	[-4999 - 4999]	Enter the low reference value limit for the compressor shaft speed [RPM]. This is also the lowest feedback value. Set terminal 29 to digital input.

5-53 Term. 29 High Ref./Feedb. Value		
Range:	Function:	
Size related*	[-4999 - 4999]	Enter the high reference value [RPM] for the compressor shaft speed and the high feedback value. Select terminal 29 as a digital input.

3.6.5 5-9* Bus Controlled

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

5-90 Digital & Relay Bus Control		
This parameter holds the state of the buscontrolled digital outputs and relays.		
Range:	Function:	
0*	[0 - 0xFFFFFFFF]	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 6-23	Reserved
Bit 24	Terminal 42 digital output
Bit 26-31	Reserved

Table 3.4 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 provides 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 timeout time.

6-01 Live Zero Timeout Function		
Select the timeout 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.		
Option:	Function:	
[0] *	Off	
[1]	Freeze output	
[2]	Stop	
[3]	Jogging	
[4]	Max. speed	
[5]	Stop and trip	

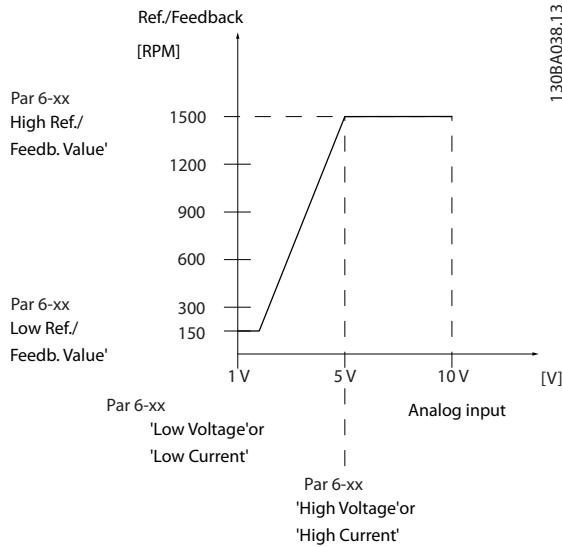


Illustration 3.8 Live Zero Timeout Function

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 <i>parameter 6-14 Terminal 53 Low Ref./Feedb. Value</i> . To activate <i>parameter 6-01 Live Zero Timeout Function</i> , set the value to >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 <i>parameter 6-15 Terminal 53 High Ref./Feedb. Value</i>).

6-12 Terminal 53 Low Current		
Range:	Function:	
4 mA*	[0 - 20 mA]	Enter the low current value. This reference signal corresponds to the low reference/ feedback value that is set in <i>parameter 6-14 Terminal 53 Low Ref./Feedb. Value</i> . To activate <i>parameter 6-01 Live Zero Timeout Function</i> , 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 <i>parameter 6-15 Terminal 53 High Ref./Feedb. Value</i> .

6-14 Terminal 53 Low Ref./Feedb. Value		
Range:	Function:	
Size related*	[-4999 - 4999]	Enter the reference or feedback value that corresponds to the voltage or current set in <i>parameter 6-10 Terminal 53 Low Voltage</i> to <i>parameter 6-12 Terminal 53 Low Current</i> .

6-15 Terminal 53 High Ref./Feedb. Value		
Range:	Function:	
200*	[-4999 - 4999]	Enter the reference or feedback value that corresponds to the voltage or current set in <i>parameter 6-11 Terminal 53 High Voltage</i> to <i>parameter 6-13 Terminal 53 High Current</i> .

6-16 Terminal 53 Filter Time Constant		
Range:	Function:	
0.01 s*	[0.01 - 10 s]	Enter the time constant. This constant 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		
Select whether terminal 53 is used for current or voltage input.		
Option:	Function:	
[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 <i>parameter 6-24 Terminal 54 Low Ref./Feedb. Value</i>). To activate

6-20 Terminal 54 Low Voltage		
Range:	Function:	
		parameter 6-01 Live Zero Timeout Function, set the value to >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 corresponds 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*	[0 - 20 mA]	Enter the high current value corresponding to the high reference/feedback value set in parameter 6-25 Terminal 54 High Ref./Feedb. Value.

6-24 Terminal 54 Low Ref./Feedb. Value		
Range:	Function:	
0*	[-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, which is a firstorder digital low-pass filter time

6-26 Terminal 54 Filter Time Constant		
Range:	Function:	
		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		
Select if terminal 54 is used for current- or voltage input.		
Option:	Function:	
[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		
Set terminal 45 to act as analog output or as digital output.		
Option:	Function:	
[0] *	0-20 mA	
[1]	4-20 mA	
[2]	Digital Output	

6-71 Terminal 45 Analog Output		
Select the function of terminal 45 as an analog current output. See also parameter 6-70 Terminal 45 Mode.		
Option:	Function:	
[0] *	No operation	
[100]	Output frequency	0–400 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%
[254]	DC Link Voltage	

6-72 Terminal 45 Digital Output		
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.		
Option:	Function:	
[0] *	No operation	
[1]	Control Ready	
[2]	Drive ready	

6-72 Terminal 45 Digital Output		
Select the function of terminal 45 as a digital current output. See also <i>parameter 6-70 Terminal 45 Mode</i> . See <i>parameter 5-40 Function Relay</i> for description of the options.		
Option:	Function:	
[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	

6-72 Terminal 45 Digital Output		
Select the function of terminal 45 as a digital current output. See also <i>parameter 6-70 Terminal 45 Mode</i> . See <i>parameter 5-40 Function Relay</i> for description of the options.		
Option:	Function:	
[42]	Above ref, high	
[44]	Oil boost active	
[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	

6-73 Terminal 45 Output Min Scale		
Range:	Function:	
0 %*	[0 - 200 %]	Scale for the minimum output (0 mA 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 <i>parameter 6-71 Terminal 45 Analog Output</i> .

6-74 Terminal 45 Output Max Scale		
Scale for the maximum output (20 mA) of the analog signal at terminal 45.		
Range:	Function:	
100 %*	[0 - 200 %]	Set the value to be the percentage of the full range of the variable selected in <i>parameter 6-71 Terminal 45 Analog Output</i> .
<p>Illustration 3.9 Output Maximum Scale</p>		

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

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

6-91 Terminal 42 Analog Output		
Select the function of terminal 42 as an analog current output. See also <i>parameter 6-90 Terminal 42 Mode</i> .		
Option:	Function:	
[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}

6-91 Terminal 42 Analog Output		
Select the function of terminal 42 as an analog current output. See also <i>parameter 6-90 Terminal 42 Mode</i> .		
Option:	Function:	
[139]	Bus Control	0–100%
[254]	DC Link Voltage	

6-92 Terminal 42 Digital Output		
Select the function of Terminal 42 as an analog current output. See also <i>parameter 6-90 Terminal 42 Mode</i> . See <i>parameter 5-40 Function Relay</i> for description of the choices.		
Option:	Function:	
[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	

6-92 Terminal 42 Digital Output		
Select the function of Terminal 42 as an analog current output. See also <i>parameter 6-90 Terminal 42 Mode</i> . See <i>parameter 5-40 Function Relay</i> for description of the choices.		
Option:	Function:	
[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	
[44]	Oil boost active	
[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	

6-93 Terminal 42 Output Min Scale		
Range:	Function:	
0 %*	[0 - 200 %]	Scale for the minimum output (0 mA or 4 mA) of the analog signal at terminal 42. Set the value to be the percentage of the full range of the variable selected in <i>parameter 6-91 Terminal 42 Analog Output</i> .

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 <i>parameter 6-91 Terminal 42 Analog Output</i> .

Illustration 3.10 Output Maximum Scale

6-96 Terminal 42 Output Bus Control		
Range:	Function:	
0*	[0 - 16384]	Hold 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

8-01 Control Site		
This parameter overrules settings in <i>parameter 8-50 Coasting Select</i> to <i>parameter 8-56 Preset Reference Select</i> .		
Option:	Function:	
[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		
Select the source of the control word. This parameter cannot be adjusted while the compressor is running.		
Option:		Function:
[0]	None	
[1] *	FC Port	

8-03 Control Timeout Time		
Range:		Function:
20 s*	[0.1 - 200 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 <i>parameter 8-04 Control Timeout Function</i> is carried out.

8-04 Control Timeout Function		
Select the timeout function. The timeout function is activated when the control word fails to be updated within the time period specified in <i>parameter 8-03 Control Timeout Time</i> .		
Option:		Function:
[0] *	Off	
[1]	Freeze output	
[2]	Stop	
[3]	Jogging	
[4]	Max. speed	
[5]	Stop and trip	
[20]	N2 Override Release	

3.8.2 8-3* FC Port Settings

8-30 Protocol		
Select the protocol for the integrated RS485 port.		
Option:		Function:
[0] *	FC	Communication according to the FC Protocol.
[2]	Modbus RTU	Communication according to the Modbus RTU protocol.

8-31 Address		
Range:		Function:
1*	[0.0 - 247]	Enter the address for the RS485 port. Valid range: 1-126 for FC-bus OR 1-247 for Modbus.

8-32 Baud Rate		
Select the baud rate for the RS485 port. Default refers to the FC Protocol. Changing Protocol in <i>parameter 8-30 Protocol</i> may change the baud rate.		
Changing Protocol in <i>parameter 8-30 Protocol</i> may change the Baud Rate.		
Option:		Function:
[0]	2400 Baud	
[1]	4800 Baud	
[2]	9600 Baud	
[3]	19200 Baud	
[4]	38400 Baud	
[5]	57600 Baud	
[6]	76800 Baud	
[7]	115200 Baud	

8-33 Parity / Stop Bits		
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 <i>parameter 8-30 Protocol</i> may change the baud rate.		
Option:		Function:
[0]	Even Parity, 1 Stop Bit	
[1]	Odd Parity, 1 Stop Bit	
[2]	No Parity, 1 Stop Bit	
[3]	No Parity, 2 Stop Bits	

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

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

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

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] Terminal 45 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		
Select the parameters to be assigned to PCD's of the telegrams. The number of available PCDs depends on the telegram type. PCDs contain the actual data values 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]	[1616] Torque [Nm]	
[17]	[1618] Motor Thermal	
[18]	[1630] DC Link Voltage	
[19]	[1634] Heatsink Temp.	
[20]	[1635] Inverter Thermal	
[21]	[1638] SL Controller State	
[22]	[1650] External Reference	

8-43 PCD Read Configuration		
Select the parameters to be assigned to PCD's of the telegrams. The number of available PCDs depends on the telegram type. PCDs contain the actual data values of the selected parameters.		
Option:	Function:	
[23]	[1652] Feedback [Unit]	
[24]	[1660] Digital Input 18,19,27,33	
[25]	[1661] Terminal 53 Switch Setting	
[26]	[1662] Analog input 53	
[27]	[1663] Terminal 54 Switch Setting	
[28]	[1664] Analog input 54	
[29]	[1665] Analog output 42 [mA]	
[30]	[1671] Relay output	
[31]	[1672] Counter A	
[32]	[1673] Counter B	
[33]	[1690] Alarm Word	
[34]	[1692] Warning Word	
[35]	[1694] Ext. Status Word	
[37]	[2860] RPS Readout	
[39]	[1691] Alarm Word 2	
[40]	[1693] Warning Word 2	
[43]	[1617] Speed [RPM]	
[44]	[1666] Digital Output	

3.8.4 8-5* Digital/Bus

Parameters for configuring the control word digital/bus merging.

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

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

8-52 DC Brake Select		
Select control of the DC brake via the terminals (digital input). This parameter is only active when <i>parameter 8-01 Control Site</i> is set to [0] Digital and control word.		
Option:	Function:	
[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 also via one of the digital inputs.
[3] *	Logic OR	Activates DC brake via the serial communication port OR via one of the digital inputs.

8-53 Start Select

Select control of the frequency converter start function via the terminals (digital input). This parameter is only active when *parameter 8-01 Control Site* is set to [0] *Digital and control word*.

Option:	Function:	
[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 1 of the digital inputs.
[3] *	Logic OR	Activates a start command via the serial communication port or via 1 of the digital inputs.

8-54 Reversing Select

Select control of the frequency converter reverse function via the terminals (digital input) and/or via the serial communication port. This parameter is only active when *parameter 8-01 Control Site* is set to [0] *Digital and control word*.

Option:	Function:	
[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 1 of the digital inputs.
[3]	Logic OR	Activates a reverse command via the serial communication port or via 1 of the digital inputs.

8-55 Set-up Select

Select control of the frequency converter set-up selection via the terminals (digital input) and/or via the serial communication port. This parameter is only active when *parameter 8-01 Control Site* is set to [0] *Digital and control word*.

Option:	Function:	
[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 1 of the digital inputs.
[3] *	Logic OR	Activate the set-up selection via the serial communication port or via 1 of the digital inputs.

8-56 Preset Reference Select

Select control of the frequency converter preset reference selection via the terminals (digital input) and/or via the serial communication port.

Option:	Function:	
[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 1 of the digital inputs.
[3] *	Logic OR	Activates the preset reference selection via the serial communication port or via 1 of the digital inputs.

3.8.5 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 - 4294967295]	This parameter shows the number of valid telegrams detected on the bus.

8-81 Bus Error Count

Range:	Function:	
0*	[0 - 4294967295]	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 - 4294967295]	This parameter shows the number of valid telegrams addressed to the slave, sent by the frequency converter.

8-83 Slave Error Count

Range:	Function:	
0*	[0 - 4294967295]	This parameter shows the number of error telegrams, which the frequency converter could not execute.

8-84 Slave Messages Sent		
Range:	Function:	
0*	[0 - 4294967295]	This parameter shows the number of messages sent from the slave.

8-85 Slave Timeout Errors		
Range:	Function:	
0*	[0 - 4294967295]	This parameter shows the number of slave timeout errors.

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

3.8.6 8-9* Bus Feedback

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

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

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 SLC evaluates the associated user-defined event (see *parameter 13-51 SL Controller Event [x]*) as true.

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 executing this action, the conditions of [1] event is evaluated. If it is evaluated as true, [1] action is executed, and so on. Only 1

event is evaluated at any time. If an event is evaluated as false, nothing happens (in the SLC) during the current scan interval and no other events are evaluated. This means that when the SLC starts, it evaluates [0] event (and only [0] event) each scan interval. Only when [0] event is evaluated as true, the SLC executes [0] action and starts evaluating [1] event. It is possible to program from 1–20 events and actions. When the last event/action has been executed, the sequence starts over again from [0] event/[0] action.

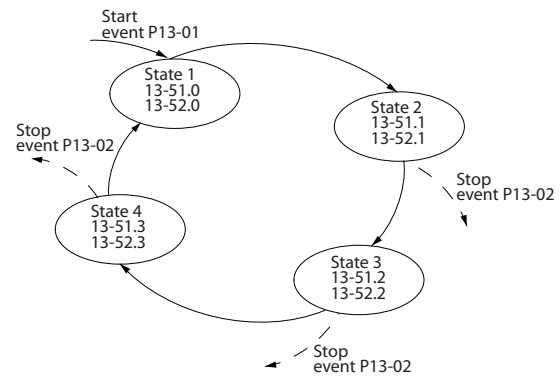


Illustration 3.11 Example with 3 Event/Actions

Starting and stopping the SLC

To start or stop the SLC, select [1] On or [2] Off in *parameter 13-00 SL Controller Mode*. 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

To activate, deactivate, and reset the smart logic control sequence, use the SLC settings. 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		
To enable the smart logic control to start when a start command is present, for example, via a digital input, Select [1] On. To disable the smart logic control, select [0] Off.		
Option:	Function:	
[0] *	Off	Disables the smart logic controller.
[1]	On	Enables the smart logic controller.

13-01 Start Event		
To activate smart logic controller, select the boolean (TRUE or FALSE) input.		
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	The compressor runs.
[3]	In range	The compressor runs within the programmed current ranges (<i>parameter 4-50 Warning Current Low</i> and <i>parameter 4-51 Warning Current High</i>).
[4]	On reference	The compressor runs at reference speed.
[7]	Out of current range	The compressor current is outside the range set in <i>parameter 4-18 Current Limit</i> .
[8]	Below I low	The compressor current is lower than set in <i>parameter 4-50 Warning Current Low</i> .
[9]	Above I high	The compressor current is higher than set in <i>parameter 4-51 Warning Current High</i> .
[16]	Thermal warning	The thermal warning turns on when the temperature exceeds the limit in the compressor, the frequency converter, or the thermistor.
[17]	Mains out of range	
[18]	Reversing	The frequency converter reverses.
[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.
[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.

13-01 Start Event		
To activate smart logic controller, select the boolean (TRUE or FALSE) input.		
Option:	Function:	
[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, fieldbus, 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 lock) 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.

13-02 Stop Event		
Select the condition (TRUE or FALSE) which deactivates the smart logic controller.		
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 <i>parameter 13-01 Start Event</i> for further description.
[3]	In range	See <i>parameter 13-01 Start Event</i> for further description.
[4]	On reference	See <i>parameter 13-01 Start Event</i> for further description.

13-02 Stop Event		
Select the condition (TRUE or FALSE) which deactivates the smart logic controller.		
Option:	Function:	
[7]	Out of current range	See <i>parameter 13-01 Start Event</i> for further description.
[8]	Below I low	See <i>parameter 13-01 Start Event</i> for further description.
[9]	Above I high	See <i>parameter 13-01 Start Event</i> for further description.
[16]	Thermal warning	See <i>parameter 13-01 Start Event</i> for further description.
[17]	Mains out of range	See <i>parameter 13-01 Start Event</i> for further description.
[18]	Reversing	See <i>parameter 13-01 Start Event</i> for further description.
[19]	Warning	See <i>parameter 13-01 Start Event</i> for further description.
[20]	Alarm (trip)	See <i>parameter 13-01 Start Event</i> for further description.
[21]	Alarm (trip lock)	See <i>parameter 13-01 Start Event</i> 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		
Select the condition (TRUE or FALSE) which deactivates the smart logic controller.		
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 lock) 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.

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

3.9.3 13-1* Comparators

Comparators are used for comparing continuous variables (such as output frequency, output current, and analog input) to fixed preset values.

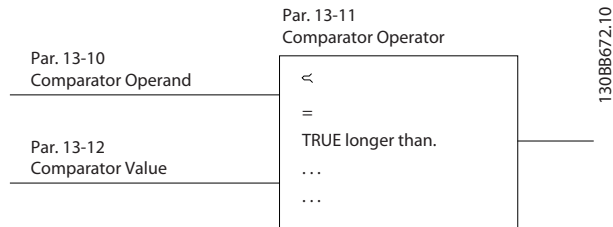


Illustration 3.12 Comparators

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

13-10 Comparator Operand		
Array [6] Select the variable to be monitored by the comparator.		
Option:	Function:	
[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	
[18]	Pulse input FI29	
[20]	Alarm number	
[30]	Counter A	
[31]	Counter B	

13-11 Comparator Operator		
Array [6] Select the operator to be used in the comparison.		
Option:	Function:	
[0]	Less Than (<)	Select [0] < for the result of the evaluation to be true, when the variable selected in <i>parameter 13-10 Comparator Operand</i> is smaller than the fixed

13-11 Comparator Operator		
Array [6] Select the operator to be used in the comparison.		
Option:	Function:	
		value in <i>parameter 13-12 Comparator Value</i> . The result is false, if the variable selected in <i>parameter 13-10 Comparator Operand</i> is greater than the fixed value in <i>parameter 13-12 Comparator Value</i> .
[1] *	Approx.Equal (~)	Select [1] ≈ for the result of the evaluation to be true, when the variable selected in <i>parameter 13-10 Comparator Operand</i> is approximately equal to the fixed value in <i>parameter 13-12 Comparator Value</i> .
[2]	Greater Than (>)	Select [2] > for the inverse logic of option [0] <.

13-12 Comparator Value		
Array [6] Enter the trigger level for the variable that is monitored by this comparator.		
Range:	Function:	
0*	[-9999 - 9999]	Enter the trigger level for the variable that is monitored by this comparator. This parameter is an array parameter containing comparator values 0–5.

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 (for example [29] *Start timer 1*) until the timer value entered in this parameter has elapsed. Then it becomes true again.

All parameters in this parameter group are array parameters with index 0–2. Select index 0 to program timer 0, select index 1 to program timer 1, and so on.

13-20 SL Controller Timer		
Range:	Function:	
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 <i>parameter 13-52 SL Controller Action</i> [29–31] and [70–

13-20 SL Controller Timer	
Range:	Function:
	74] Start timer X) and until the timer value has elapsed. Array parameters contain timers 0–7.

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 combine the selected inputs logically in *parameter 13-41 Logic Rule Operator 1* and *parameter 13-43 Logic Rule Operator 2*.

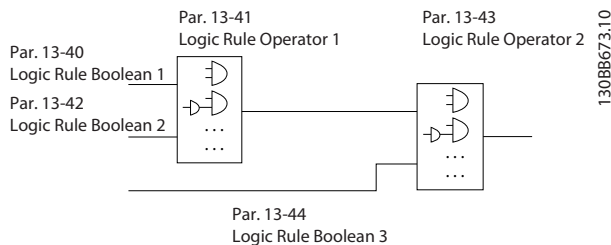


Illustration 3.13 Logic Rules

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] Select the first boolean (TRUE or FALSE) input for the selected logic rule.	
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 <i>parameter 13-01 Start Event</i> for further description.
[3]	In range See <i>parameter 13-01 Start Event</i> for further description.
[4]	On reference See <i>parameter 13-01 Start Event</i> for further description.

13-40 Logic Rule Boolean 1	
Array [6] Select the first boolean (TRUE or FALSE) input for the selected logic rule.	
Option:	Function:
[7]	Out of current range See <i>parameter 13-01 Start Event</i> for further description.
[8]	Below I low See <i>parameter 13-01 Start Event</i> for further description.
[9]	Above I high See <i>parameter 13-01 Start Event</i> for further description.
[16]	Thermal warning See <i>parameter 13-01 Start Event</i> for further description.
[17]	Mains out of range See <i>parameter 13-01 Start Event</i> for further description.
[18]	Reversing See <i>parameter 13-01 Start Event</i> for further description.
[19]	Warning See <i>parameter 13-01 Start Event</i> for further description.
[20]	Alarm (trip) See <i>parameter 13-01 Start Event</i> for further description.
[21]	Alarm (trip lock) See <i>parameter 13-01 Start Event</i> 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).

13-40 Logic Rule Boolean 1		
Array [6] Select the first boolean (TRUE or FALSE) input for the selected logic rule.		
Option:		Function:
[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 lock) 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.

13-41 Logic Rule Operator 1		
Select the first logical operator to use on the Boolean inputs from <i>parameter</i> and <i>parameter</i> .		
Option:		Function:
[0] *	Disabled	
[1]	AND	
[2]	OR	
[3]	AND NOT	

13-41 Logic Rule Operator 1		
Select the first logical operator to use on the Boolean inputs from <i>parameter</i> and <i>parameter</i> .		
Option:		Function:
[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] Select the second boolean (TRUE or FALSE) input for the selected logic rule. See <i>parameter 13-40 Logic Rule Boolean 1</i> for further descriptions of options and their functions.		
Option:		Function:
[0] *	False	
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL Time-out 0	
[31]	SL Time-out 1	
[32]	SL Time-out 2	
[33]	Digital input DI18	
[34]	Digital input DI19	
[35]	Digital input DI27	
[36]	Digital input DI29	

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

13-43 Logic Rule Operator 2		
Array [6]		
Select the 2 nd logical operator to be used on the boolean input calculated in <i>parameter 13-40 Logic Rule Boolean 1</i> , <i>parameter 13-41 Logic Rule Operator 1</i> , <i>parameter 13-42 Logic Rule Boolean 2</i> , and the boolean input coming from <i>parameter 13-42 Logic Rule Boolean 2</i> .		
[13-44] signifies the boolean input of <i>parameter 13-44 Logic Rule Boolean 3</i> .		
[13-40/13-42] signifies the boolean input calculated in <i>parameter 13-40 Logic Rule Boolean 1</i> , <i>parameter 13-41 Logic Rule Operator 1</i> , and <i>parameter 13-42 Logic Rule Boolean 2</i> . [0] Disabled (factory setting): Select this option to ignore <i>parameter 13-44 Logic Rule Boolean 3</i> .		
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	

13-44 Logic Rule Boolean 3		
Array [6]		
Select the third boolean (TRUE or FALSE) input for the selected logic rule.		
See <i>parameter 13-40 Logic Rule Boolean 1</i> for further descriptions of options and their functions.		
Option:	Function:	
[0] *	False	

13-44 Logic Rule Boolean 3		
Array [6]		
Select the third boolean (TRUE or FALSE) input for the selected logic rule.		
See <i>parameter 13-40 Logic Rule Boolean 1</i> for further descriptions of options and their functions.		
Option:	Function:	
[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]		
Select the third boolean (TRUE or FALSE) input for the selected logic rule.		
See <i>parameter 13-40 Logic Rule Boolean 1</i> for further descriptions of options and their functions.		
Option:	Function:	
[73]	SL Time-out 6	
[74]	SL Time-out 7	

3.9.6 13-5* States

13-51 SL Controller Event		
Array [20]		
Select the boolean input (TRUE or FALSE) to define the smart logic controller event.		
See <i>parameter 13-02 Stop Event</i> for further descriptions of options and their functions.		
Option:	Function:	
[0] *	False	
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL Time-out 0	
[31]	SL Time-out 1	
[32]	SL Time-out 2	
[33]	Digital input DI18	
[34]	Digital input DI19	
[35]	Digital input DI27	

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

13-52 SL Controller Action		
Array [20]		
Select the action corresponding to the SLC event. Actions are executed when the corresponding event (defined in <i>parameter 13-51 SL Controller Event</i>) is evaluated as true. The following actions are available for selection:		
Option:	Function:	
[0] *	Disabled	
[1]	No action	
[2]	Select set-up 1	Changes the active set-up (<i>parameter 0-10 Active Set-up</i>) to 1.
[3]	Select set-up 2	Changes the active set-up (<i>parameter 0-10 Active Set-up</i>) 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

13-52 SL Controller Action		
Array [20]		
Select the action corresponding to the SLC event. Actions are executed when the corresponding event (defined in <i>parameter 13-51 SL Controller Event</i>) is evaluated as true. The following actions are available for selection:		
Option:		Function:
		reference commands coming from either the digital inputs or via a fieldbus.
[18]	Select ramp 1	Selects ramp 1.
[19]	Select ramp 2	Selects ramp 2.
[22]	Run	Issues a start command to the frequency converter.
[23]	Run reverse	Issues a start reverse command to the frequency converter.
[24]	Stop	Issues a stop command to the frequency converter.
[25]	Qstop	Issues a quick stop command to the frequency converter.
[26]	DC Brake	Issues a DC 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 <i>parameter 13-20 SL Controller Timer</i> for further description.
[30]	Start timer 1	Starts timer 1, see <i>parameter 13-20 SL Controller Timer</i> for further description.
[31]	Start timer 2	Starts timer 2, see <i>parameter 13-20 SL Controller Timer</i> for further description.
[32]	Set digital out A low	Any output with <i>digital output 1</i> selected is low (off).
[33]	Set digital out B low	Any output with <i>digital output 2</i> selected is low (off).
[34]	Set digital out C low	Any output with <i>digital output 3</i> selected is low (off).
[35]	Set digital out D low	Any output with <i>digital output 4</i> selected is low (off).
[38]	Set digital out A high	Any output with <i>digital output 1</i> selected is high (closed).
[39]	Set digital out B high	Any output with <i>digital output 2</i> selected is high (closed).

13-52 SL Controller Action		
Array [20]		
Select the action corresponding to the SLC event. Actions are executed when the corresponding event (defined in <i>parameter 13-51 SL Controller Event</i>) is evaluated as true. The following actions are available for selection:		
Option:		Function:
[40]	Set digital out C high	Any output with <i>digital output 3</i> selected is high (closed).
[41]	Set digital out D high	Any output with <i>digital output 4</i> 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 <i>parameter 13-20 SL Controller Timer</i> for further description.
[71]	Start Timer 4	Starts timer 4, see <i>parameter 13-20 SL Controller Timer</i> for further description.
[72]	Start Timer 5	Starts timer 5, see <i>parameter 13-20 SL Controller Timer</i> for further description.
[73]	Start Timer 6	Starts timer 6, see <i>parameter 13-20 SL Controller Timer</i> for further description.
[74]	Start Timer 7	Starts timer 7, see <i>parameter 13-20 SL Controller Timer</i> for further description.
[100]	ResetAlarm	

3.10 Main Menu - Special Functions - Group 14

3.10.1 14-0* Inverter Switching

3

14-01 Switching Frequency		
Select the inverter switching frequency. Changing the switching frequency can help to reduce acoustic noise from the compressor.		
Option:	Function:	
	<p>NOTICE</p> <p>The output frequency value of the frequency converter must never exceed 1/10 of the switching frequency. When the compressor runs, adjust the switching frequency in <i>parameter 14-01 Switching Frequency</i> until the compressor is as noiseless as possible.</p> <p>NOTICE</p> <p>High switching frequencies heat the frequency converter and may reduce its lifetime.</p> <p>NOTICE</p> <p>Not all options are available in all power sizes.</p>	
[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 compressor 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

14-03 Overmodulation		
Option:	Function:	
		extra torque of 10–12% in the middle of the oversynchronous range (from 0% at nominal speed rising to approximately 12% at double nominal speed).

3.10.2 14-1* Mains On/Off

Parameters for configuring mains failure monitoring and handling.

14-10 Mains Failure		
Select what the frequency converter does when the mains voltage drops below the limit set in <i>parameter</i> .		
Option:	Function:	
[0] *	No function	
[3]	Coasting	

14-11 Mains Fault Voltage Level		
Range:	Function:	
Size related*	[100 - 800 V]	This parameter defines the threshold voltage at which the selected function in <i>parameter 14-10 Mains Failure</i> should be activated. The detection level is at a factor $\sqrt{2}$ of the value in this parameter.

14-12 Response to Mains Imbalance		
Operation under severe mains imbalance conditions reduces the lifetime of the compressor. If the compressor is operated continuously near nominal load, conditions are considered severe. When a severe mains imbalance is detected, select one of the available functions.		
Option:	Function:	
[0]	Trip	Trips the frequency converter.
[1] *	Warning	Issues a warning.
[2]	Disabled	No action.
		<div style="border: 1px solid black; padding: 5px; display: inline-block;"> CAUTION May cause reduced life time. </div>
[3]	Derate	Derates the load by mains imbalance.

3.10.3 14-2* Trip Reset

14-20 Reset Mode		
Select the reset function after tripping. Once reset, the frequency converter can be restarted.		
Option:	Function:	
		NOTICE Automatic reset is also active for resetting the STO function.
[0]	Manual reset	To perform a reset via [Reset] or via the digital inputs, select [0] <i>Manual reset</i> .
[1]	Automatic reset x 1	Select [1]-[12] <i>Automatic reset x 1... x20</i> to perform 1–20 automatic resets after tripping.
[2]	Automatic reset x 2	
[3]	Automatic reset x 3	
[4]	Automatic reset x 4	
[5]	Automatic reset x 5	
[6]	Automatic reset x 6	
[7]	Automatic reset x 7	
[8]	Automatic reset x 8	
[9]	Automatic reset x 9	
[10] *	Automatic reset x 10	
[11]	Automatic reset x 15	
[12]	Automatic reset x 20	
[13]	Infinite auto reset	Select [13] <i>Infinite Automatic Reset</i> for continuous resetting after tripping.

14-21 Automatic Restart Time		
Range:	Function:	
30 s*	[0 - 600 s]	To start of the automatic reset function, enter the time interval from trip. This parameter is active when <i>parameter 14-20 Reset Mode</i> is set to [1] - [13] <i>Automatic reset</i> .

14-22 Operation Mode		
To reset all parameter values to default, select [2] <i>Initialisation</i> .		
Option:	Function:	
[0] *	Normal operation	Select [0] <i>Normal operation</i> for normal operation of the frequency converter with the compressor in the selected application.
[2]	Initialisation	To reset all parameter values to default settings, select [2] <i>Initialisation</i> except for <i>parameter 15-03 Power Up's</i> , <i>parameter 15-04 Over Temp's</i> , and <i>parameter 15-05 Over Volt's</i> . The frequency converter is reset during the next power-up. <i>Parameter 14-22 Operation Mode</i> also reverts to the default setting [0] <i>Normal operation</i> .

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

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		
For use by service technicians only.		
Range:	Function:	
0*	[0 - 0x7FFFFFFF]	

3.10.4 14-3* Current Limit Control

Parameters for configuring the current limit controller, which is activated when the motor current exceeds the preset current limits (see *parameter 4-18 Current Limit*). These parameters are used to reduce torque as quickly as possible without losing control of the motor.

14-30 Current Lim Ctrl, Proportional Gain		
Range:	Function:	
100 %*	[0 - 500 %]	Enter the proportional gain value for the current limit controller. A

14-30 Current Lim Ctrl, Proportional Gain		
Range:		Function:
		higher value makes the controller react faster. Excessive value setting leads to controller instability.

14-31 Current Lim Ctrl, Integration Time		
Range:		Function:
Size related*	[0.002 - 2 s]	Control 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:
Size related*	[1 - 100 ms]	Set a time constant for the current limit controller low-pass filter.

3.10.5 14-5* Environment

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

14-51 DC-Link Voltage Compensation		
The rectified AC-DC voltage at the frequency converter's DC-link is associated with voltage ripples. These ripples can increase in magnitude with increased load. A compensation method is used to reduce these voltage ripples at DC link. In field-weakening, it is recommended to turn DC link compensation off.		
Option:		Function:
[0]	Off	The overmodulation for output voltage is off to avoid torque ripple on the motor shaft.
[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 used to select the fan control operating mode. The acoustic noise of the frequency converter is different from running heavy load (high heat sink temperature) to running light load or stand-by mode.		
Option:		Function:
[0]	Auto	The fan runs with full speed for a short time and then automatically adjusts the speed according to the load and ambient temperature. The fan also runs at minimum speed even if the reference is 0 Hz due to the heat generated from the IGBT. The fan stops if sleep mode function is activated. This is the

14-52 Fan Control		
This parameter is used to select the fan control operating mode. The acoustic noise of the frequency converter is different from running heavy load (high heat sink temperature) to running light load or stand-by mode.		
Option:		Function:
		default setting for all frequency converters except H1 enclosure sizes.
[5]	Constant-on mode	For on-site fan test or if the fan must run 100% speed constantly. Only valid for H1-H5 & I2-I4 enclosure sizes.
[6]	Constant-off mode	If convection cooling is sufficient or the frequency converter is mounted in a demonstration panel, exhibitions and so on. The frequency converter trips on heat sink overtemperature if loaded more than the convection cooling allows. Only valid for H1-H5 & I2-I4 enclosure sizes.
[7]	On-when-Inverter-is-on-else-off Mode	The fan runs at maximum speed if in hand-on mode or reference is above 0 Hz. The fan is stopped if sleep mode is active. This is the default setting for H1 enclosure size only but can also be selected for H2-H5 & I2-I4 enclosure sizes.

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	

3.10.6 14-6* Auto Derate

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

14-61 Function at Inverter Overload		
When the frequency converter issues an inverter overload warning, select whether to continue and probably trip the frequency converter or derate the output current.		
Option:		Function:
[0] *	Trip	
[1]	Derate	

14-63 Min Switch Frequency		
Set the minimum switching 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	

14-90 Fault Level		
To customize fault levels, use this parameter. Use [0] Off with caution as it ignores all warnings and alarms for the selected source.		
Option:	Function:	
[3]	Trip lock	
[4] *	Trip w. delayed reset	
[5]	Flystart	

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 - 0x7ffffff. 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 - 0x7ffffff. h]	View how many hours the compressor has run. Reset the counter in <i>parameter 15-07 Reset Running Hours Counter</i> . The value is saved when the frequency converter is turned off.

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:	
[0] *	Do not reset	
[1]	Reset counter	To reset the kWh counter to 0, select [1] Reset and press [OK].

15-07 Reset Running Hours Counter		
Option:	Function:	
[0] *	Do not reset	
[1]	Reset counter	To reset the running hours counter, select [1] Reset counter and press [OK] (see also <i>parameter 15-01 Running Hours</i>).

15-08 Number of Starts		
Range:	Function:	
0	[0 - 2147483647]	States the number of starts executed on the frequency converter. The counter can be reset in <i>parameter 15-07 Reset Running Hours Counter</i> . The value is saved when the frequency converter is turned off.

15-09 Number of Auto Resets		
Range:	Function:	
0	[0 - 2147483647]	States the number of auto resets executed by the frequency converter.

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. Fault 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 fault code and lookup its meaning in <i>chapter 4 Troubleshooting</i> .

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

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.

15-42 Voltage		
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 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		
Range:	Function:	
0*	[0 - 40]	View the actual type code string.

15-46 Drive Ordering No		
Range:	Function:	
0*	[0 - 8]	View the 8-digit ordering number for reordering the frequency

15-46 Drive Ordering No		
Range:	Function:	
		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.

15-57 File Version		
Range:	Function:	
0*	[0 - 255]	Shows the file version.

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

3.12 Main Menu - Data Readouts - Group 16

3.12.1 16-0* General Status

16-00 Control Word		
Range:	Function:	
0*	[0 - 65535]	View the control word sent from the frequency converter via the serial communication port in hex code.

Bit	Bit = 0	Bit = 1
00	Preset reference option lsb	–
01	Preset reference option 2 nd 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 3.5 Control Word

16-01 Reference [Unit]		
Range:		Function:
0 ReferenceFeedback Unit*	[-4999 - 4999 Reference-FeedbackUnit]	View the present reference value applied on impulse or analog basis in the unit resulting from the configuration selected in <i>parameter 1-00 Configuration Mode</i> .

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 3.6 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		
Range:		Function:
0 Custom-ReadoutUnit*	[0 - 9999 CustomReadoutUnit]	View the user-defined readouts as defined in <i>parameter 0-30 Custom Readout Unit</i> , <i>parameter 0-31 Custom Readout Min Value</i> , and <i>parameter 0-32 Custom Readout Max Value</i> .

3.12.2 16-1* Motor Status

16-10 Power [kW]		
Range:		Function:
0 kW*	[0 - 1000 kW]	Shows the actual compressor power in kW. The value shown is calculated based on the actual compressor voltage and compressor current.

16-11 Power [hp]		
Range:		Function:
0 hp*	[0 - 1000 hp]	View the actual compressor power in hp. The value shown is calculated based on the actual compressor voltage and compressor current.

16-12 Motor Voltage		
Range:		Function:
0 V*	[0 - 65535 V]	View the compressor voltage, a calculated value used for controlling the compressor.

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

16-14 Motor current		
Range:		Function:
0 A*	[0 - 655.35 A]	View the compressor current measured as an average value, I_{RMS} .

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

16-16 Torque [Nm]		
Range:		Function:
0 Nm*	[-30000 - 30000 Nm]	View the torque value with sign, applied to the motor shaft. Linearity is not exact between 160% motor current and torque in relation to the rated torque. Some motors supply more than 160% torque. Therefore, the minimum value and the maximum value depend on the maximum motor current and the motor used. The value is filtered, and thus approximately 30 ms may pass from when an input changes value to when the data readout values change.

16-17 Speed [RPM]		
Range:		Function:
0 RPM*	[-30000 - 30000 RPM]	View the actual motor RPM. The motor RPM is estimated in open-loop process or closed-loop process control modes and the motor RPM is measured in speed closed-loop mode.

16-18 Motor Thermal		
Range:		Function:
0 %*	[0 - 100 %]	View the calculated compressor motor temperature in percentage of allowed maximum. At 100%, a trip occurs, if selected in <i>parameter 1-90 Motor Thermal Protection</i> . The basis for the calculation is the ETR function selected in <i>parameter 1-90 Motor Thermal Protection</i> .

16-22 Torque [%]		
Range:		Function:
0 %*	[-200 - 200 %]	This is a readout parameter only. Shows the actual torque yielded in percentage of the rated torque, based on the setting of the motor size, and rated speed in <i>parameter 1-20 Motor Power</i> or <i>parameter 1-21 Motor Power [HP]</i> and <i>parameter 1-25 Motor Nominal Speed</i> . This is the value monitored by the <i>Broken Belt Function</i> set in <i>parameter group 22-6* Broken Belt Detection</i> .

3.12.3 16-3* Drive Status

16-30 DC Link Voltage		
Range:		Function:
0 V*	[0 - 65535 V]	Shows the actual DC-link voltage.

16-34 Heatsink Temp.		
Range:		Function:
0 °C*	[-128 - 127 °C]	View the heat sink temperature of the frequency converter.

16-35 Inverter Thermal		
Range:		Function:
0 %*	[0 - 255 %]	View the percentage of thermal load on the frequency converter. At 100%, a trip occurs.

16-36 Inv. Nom. Current		
Range:		Function:
0 A*	[0 - 655.35 A]	View the inverter nominal current. The data is used for compressor protection, and so on.

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 and so on.

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 ProcessCtrl Unit*	[-4999 - 4999 ProcessCtrlUnit]	View the feedback resulting from the selection of scaling in <i>parameter 3-02 Minimum Reference</i> and <i>parameter 3-03 Maximum Reference</i> .

16-54 Feedback 1 [Unit]		
Range:		Function:
0 ProcessCtrl Unit*	[-999999.999 - 999999.999 ProcessCtrlUnit]	View the feedback resulting from the selection of scaling in <i>parameter 3-02 Minimum Reference</i> and <i>parameter 3-03 Maximum Reference</i> .

16-55 Feedback 2 [Unit]		
Range:		Function:
0 ProcessCtrl Unit*	[-999999.999 - 999999.999 ProcessCtrlUnit]	View value of feedback 2, see parameter group <i>20-0* Feedback</i> . The value is limited by settings in <i>parameter 20-13 Minimum Reference/Feedb.</i> and <i>parameter 20-14 Maximum Reference/Feedb.</i> Units as set in <i>parameter 20-12 Reference/Feedback Unit</i> .

3.12.5 16-6* Inputs and Outputs

16-60 Digital Input		
Range:		Function:
0*	[0 - 4095]	View actual state of the digital inputs 18, 19, 27, and 29.

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

Table 3.7 Bits Definition

16-61 Terminal 53 Setting		
View the setting of input terminal 54.		
Option:		Function:
[0] *	Current mode	
[1]	Voltage mode	

16-62 Analog input 53		
View actual input on analog input 53.		
Range:		Function:
1*	[0 - 20]	

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

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

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

16-66 Digital Output		
Range:		Function:
0*	[0 - 63]	View the binary value of all digital outputs. Definition: X: Not used 0: Low

16-66 Digital Output		
Range:	Function:	
		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 3.8 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		
Range:	Function:	
0*	[0 - 31]	View the setting of the relay.
	Bit 0~2	Unused
	Bit 3	Relay 02
	Bit 4	Relay 01
	Bit 5~15	Unused
Table 3.9 Bits Definition		

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

16-73 Counter B		
View the present value of counter B. Counters are useful as comparator operands (<i>parameter 13-10 Comparator Operand</i>).		
Range:	Function:	
0*	[-32768 - 32767]	The value can be reset or changed either via digital inputs (<i>parameter group 5-1* Digital Inputs</i>) or by using an SLC action (<i>parameter 13-52 SL Controller Action</i>).

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

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		
Range:	Function:	
0*	[0 - 0xFFFFFFFFFUL]	View the alarm word sent via the serial communication port in hex code.

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

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

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

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

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

16-97 Alarm Word 3		
Range:		Function:
0*	[0 - 0xFFFFFFFFUL]	View the alarm word 3 sent via the serial communication port in hex code.

3.13 Main Menu - Drive Closed Loop - Group 20

3.13.1 20-0* Feedback

20-00 Feedback 1 Source		
Up to 3 different feedback signals can be used to provide the feedback signal for the frequency converter's PID controller. This parameter defines which input is used as the source of the first feedback signal. Analog input X30/11 and analog input X30/12 refer to inputs on the optional General Purpose I/O board.		
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	

NOTICE

If feedback is not used, set its source to [0] No Function. Parameter 20-20 Feedback Function determines how the PID controller uses the 3 possible feedbacks.

20-01 Feedback 1 Conversion		
This parameter allows a conversion to be applied to feedback.		
Option:	Function:	
[0] *	Linear	
[1]	Square root	

20-03 Feedback 2 Source		
The effective feedback signal is made up of up to 3 different input signals. Select which drive input should be treated as the source of the second of these signals.		
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		
Select a conversion for the feedback 2 signal. Select Linear to leave the feedback signal unchanged.		
Option:	Function:	
[0] *	Linear	
[1]	Square root	

3.13.2 20-2* Feedback/Setpoint

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:	
[0]	Sum	
[1]	Difference	
[2]	Average	
[3] *	Minimum	
[4]	Maximum	

3.13.3 20-8* PI Basic Settings

20-81 PI Normal/ Inverse Control		
Select either [0] Normal or [1] Inverse to control the output speed when the process error is positive.		
Option:	Function:	
[0] *	Normal	Set the process control to increase the output speed when the process error is positive.
[1]	Inverse	Reduce the output speed when the process error is positive.

20-83 PI Start Speed [Hz]

Enter the motor speed to be attained as a start signal for commencement of PI control. Upon power up, the drive operates using speed open loop control. When the Process PI start speed is reached, the drive will change to PI control.

Range: **Function:**

0 Hz*	[0 - 200.0 Hz]
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20-84 On Reference Bandwidth

Enter the on reference bandwidth. When the PI control error (the difference between the reference and the feedback) is greater than the value of this parameter, then the on reference status bit is set high.

Range: **Function:**

5 %*	[0 - 200 %]
------	--------------

3.13.4 20-9* PI Controller
20-91 PI Anti Windup

Select the regulation of an error.

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

Enter the process controller proportional gain. Quick control is obtained at high amplification. However if amplification is too great, the process may become unstable.

Range: **Function:**

0.50*	[0 - 10]
-------	------------

20-94 PI Integral Time

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.

Range: **Function:**

20 s*	[0.10 - 9999 s]
-------	---------------------

20-97 PI Feed Forward Factor

Enter the PI feed forward factor. The FF factor sends a constant fraction of the reference signal to bypass PI control, so the PI only has an effect on the remaining fraction of the control signal. Increases dynamic performance.

Range: **Function:**

0 %*	[0 - 400 %]
------	--------------

3.14 Main Menu - Compressor Functions - Group 28

When controlling compressors, there is often a need for limiting the numbers of starts. One way to limit the starts is to ensure a minimum run-time (time between a start and a stop) and a minimum interval between starts. *Parameter 28-02 Minimum Run Time* can override any normal stop command and *parameter 28-01 Interval between Starts* can override any normal start command.

28-00 Short Cycle Protection

Option: **Function:**

[0]	Disabled	Short-cycle protection is disabled.
[1] *	Enabled	Short-cycle protection is enabled.

28-01 Interval between Starts

Range: **Function:**

300 s*	[0 - 3600 s]	Sets the time desired as minimum time between 2 starts. Any normal start command (start/jog/freeze) is disregarded until the timer has expired.
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28-02 Minimum Run Time

Range: **Function:**

12 s*	[10 - 3600 s]	Sets the time desired as minimum run-time after a normal start command (start/jog/freeze). Any normal stop command is disregarded until the set time has expired. The timer starts counting following a normal start command (start/jog/freeze). A coast (inverse) or an external interlock command overrides the timer.
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3.14.1 28-1* Oil Return Management

Insufficient lubrication can be the result of oil depositing itself in pipes and bends. Return oil deposits to the crankcase by increasing velocity for short periods at regular time intervals or by ensuring adequate oil return when velocity is too low.

With oil return management enabled, the frequency converter performs oil return by boosting the compressor speed for a selectable duration. Program the duration in *parameter 28-13 Boost Duration*. The boosts are performed if the compressor speed has been less than 40 rps (80 Hz) for too long. A text message on the LCP indicates oil return boosts.

NOTICE

If *parameter 4-13 Motor Speed High Limit [RPM]* or *parameter 4-14 Motor Speed High Limit [Hz]* is set to the boost speed 4200 RPM, an oil boost may cause unwanted staging or destaging if *parameter group 25-** Cascade Controller* is active.

28-10 Oil Return Management		
Option:	Function:	
[0]	Off	No function
[1] *	On	Oil return mechanism is active.

28-11 Low Speed Running Time		
Running at low speeds for extended periods may result in inadequate oil return to the compressor crankcase. Set this parameter to the maximum running time the compressor is allowed to run at a speed below 40 rps/80 Hz. If the compressor has run below ORM Min Speed Limit and the timer has expired, the oil return management is activated.		
Range:	Function:	
120 min*	[1 - 1440 min]	

28-12 Fixed Boost Interval		
An oil return boost is performed at fixed time intervals to complement the oil return boosts triggered by inadequate flow speeds (<i>parameter 28-11 Low Speed Running Time</i>). The fixed interval boosts ensure that oil return boosts are performed even when no boosts have occurred due to low flow speed.		
Range:	Function:	
24 h*	[1 - 168 h]	

28-13 Boost Duration		
Range:	Function:	
60 s*	[60 - 300 s]	This parameter controls the duration of oil return boosts.

28-15 ORM Min Speed Limit [Hz]		
Range:	Function:	
80 Hz*	[80 - 200 Hz]	Minimum speed limit for activating the Oil Return Management.

28-17 ORM Boost Speed [Hz]		
Range:	Function:	
120 Hz*	[80 - 200 Hz]	<i>Parameter 28-17 ORM Boost Speed [Hz]</i> controls the speed of the compressor during oil return boost.

3.14.2 28-4* Anti-reverse Protection

A compressor may have a preferred rotation direction and the instructions for cabling should always be followed, but the consequences of a reverse rotation are normally not fatal. Set up *parameter group 28-4* Anti-reverse Protection* to prevent reverse rotation at stop by injecting a DC brake current into the compressor a few seconds after stop followed by the eventual coast of the compressor when the discharge valve has closed.

NOTICE

The DC brake function is not operational before any start function has completed. If there is an emergency stop before the starting sequence has completed, the compressor may rotate reverse for a short moment after stop. Under normal circumstances, the short-cycle protection feature ensures the correct sequence.

28-40 Reverse Protection Control		
Activate a DC brake current when the compressor is stopped.		
Option:	Function:	
[0]	Disabled	
[1] *	Enabled	

28-60 RPS		
Range:	Function:	
0 /s*	[0 - 250 /s]	View the actual compressor frequency in rps (rounds per second).

4 Troubleshooting

4.1 Alarms and Warnings

A warning or an alarm is signaled by the relevant LED 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 compressor may still be continued. Warning messages may be critical.

In the event of an alarm, the frequency converter has tripped. To restart operation, reset alarms once their cause has been rectified.

This may be done in 4 ways:

- By pressing [Reset].
- Via a digital input with the *Reset* function.
- Via serial communication.
- 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 compressor.

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*.

CAUTION

Alarms that are trip-locked offer extra protection, meaning that the mains supply must be switched off before the alarm can be reset. After being switched back on, the frequency converter is no longer blocked and 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!) *Table 4.1* specifies whether a warning occurs before an alarm, or whether to show a warning or an alarm for a given fault.

This is possible, for instance, in *parameter 1-90 Motor Thermal Protection*. After an alarm or trip, the compressor carries on coasting, and the alarm and warning flash on the frequency converter. Once the problem has been rectified, only the alarm continues flashing.

Fault number	Alarm/Warning bit number	Fault text	Warning	Alarm	Trip locked	Cause of problem
2	16	Live zero error	X	X		Signal on terminal 53 or 54 is less than 50% of the value set in <i>parameter 6-10 Terminal 53 Low Voltage</i> , <i>parameter 6-12 Terminal 53 Low Current</i> , <i>parameter 6-20 Terminal 54 Low Voltage</i> , or <i>parameter 6-22 Terminal 54 Low Current</i> . See also parameter group 6-0* <i>Analog I/O Mode</i> .
4	14	Mains ph. loss	X	X	X	Missing phase on the supply side or too high voltage imbalance. Check the supply voltage. See <i>parameter 14-12 Response to Mains Imbalance</i> .
7	11	DC over volt	X	X		DC-link voltage exceeds limit.
8	10	DC under volt	X	X		DC-link voltage drops below <i>voltage warning low</i> limit.
9	9	Inverter overload	X	X		More than 100% load for too long.
10	8	Motor ETR overtemperature	X	X		The motor is too hot due to more than 100% load for too long. See <i>parameter 1-90 Motor Thermal Protection</i> .
11	7	Motor thermistor overtemperature	X	X		The thermistor or the thermistor connection is disconnected. See <i>parameter 1-90 Motor Thermal Protection</i> .
13	5	Overcurrent	X	X	X	Inverter peak current limit is exceeded.
14	2	Earth Fault	X	X	X	Discharge from output phases to ground.
16	12	Short Circuit		X	X	Short circuit in the compressor or on the compressor terminals.
17	4	Ctrl. word TO	X	X		No communication to the frequency converter. See parameter group 8-0* <i>General Settings</i> .

Fault number	Alarm/Warning bit number	Fault text	Warning	Alarm	Trip locked	Cause of problem
18	42 (parameter 1 6-91 Alarm Word 2)	Start failed		X		The speed has not been able to exceed <i>parameter 1-78 Compressor Start Min Speed [Hz]</i> during start within the allowed time.
30	19	U phase loss		X	X	Motor phase U is missing. Check the phase. See <i>parameter 4-58 Missing Motor Phase Function</i> .
31	20	V phase loss		X	X	Motor phase V is missing. Check the phase. See <i>parameter 4-58 Missing Motor Phase Function</i> .
32	21	W phase loss		X	X	Motor phase W is missing. Check the phase. See <i>parameter 4-58 Missing Motor Phase Function</i> .
36	24	Mains failure	X			Supply voltage to the frequency converter is lost.
38	17	Internal fault		X	X	Contact the local Danfoss supplier.
44	28	Earth Fault		X	X	Discharge from output phases to ground, using the value of <i>parameter 15-31 InternalFaultReason</i> if possible.
46	33	Gate drive voltage low		X	X	The supply on the power card is out of range.
47	23	Control Voltage Fault	X	X	X	24 V DC may be overloaded.
50	43	AMA calibration failed	X			AMA calibration failed
51		AMA check U_{nom} and I_{nom}		X		Motor voltage, current and power configured wrong in parameters.
52		AMA low I_{nom}		X		Motor current too low.
53		AMA motor too large		X		Motor is too large for the AMA to be performed.
54		AMA motor too small		X		Motor is too small for the AMA to be performed.
55		AMA parameter out of range		X		Parameter values found is outside of the acceptable range.
56		AMA interrupted		X		The AMA is interrupted by user.
57		AMA time-out		X		The AMA takes too long time to complete.
58	15	AMA internal		X		Contact the local Danfoss supplier.
59	25	Current limit	X	X		The current is higher than the value in <i>parameter 4-18 Current Limit</i> .
60	12	External Interlock		X		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 [Off/Reset]).
69	1	Pwr. Card Temp	X	X	X	The temperature sensor on the power card is either too hot or too cold.
80	29	Drive initialised		X		All parameter settings are initialized to default settings.
87	15	Auto DC Braking	X			The frequency converter is auto DC braking.
126		Motor Rotating				High back EMF voltage. Stop the rotor of the PM motor.
208	4 (in <i>parameter 16-97 Alarm Word 3</i>)	ORM Fault		X		Running in hand mode with low speed for too long time

Table 4.1 Warnings and Alarms

A trip is the action when an alarm has appeared. The trip coasts the compressor and can be reset by pressing [Reset] or make a reset by 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 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 serial bus 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	Parameter 16-97 Alarm Word 3
0	1	1	0	0	0
1	2	2	Pwr. Card Temp	0	0
2	4	4	Earth Fault	0	0
3	8	8	0	0	0
4	10	16	Ctrl. Word TO	0	ORM Fault
5	20	32	Overcurrent	0	0
6	40	64	0	0	0
7	80	128	Motor Th. Over	0	0
8	100	256	Motor ETR Over	0	0
9	200	512	Inverter Overld.	0	0
10	400	1024	DC under Volt	Start Failed	0
11	800	2048	DC over Volt.	0	0
12	1000	4096	Short Circuit	External Interlock	0
13	2000	8192	0	0	0
14	4000	16384	Mains ph. loss	0	0
15	8000	32768	AMA Not OK	0	0
16	10000	65536	Live Zero Error	0	0
17	20000	131072	Internal Fault	0	0
18	40000	262144	0	0	0
19	80000	524288	U phase Loss	0	0
20	100000	1048576	V phase Loss	0	0
21	200000	2097152	W phase Loss	0	0
22	400000	4194304	0	0	0
23	800000	8388608	Control Voltage Fault	0	0
24	1000000	16777216	0	0	0
25	2000000	33554432	0	0	0
26	4000000	67108864	0	0	0
27	8000000	134217728	0	0	0
28	10000000	268435456	0	0	0
29	20000000	536870912	Drive Initialised	0	0
30	40000000	1073741824	0	0	0
31	80000000	2147483648	0	0	0

4.3 Warning Words

Bit	Hex	Dec	Parameter 16-92 Warning Word	Parameter 16-93 Warning Word 2
0	1	1	Brake Check	Start Delayed
1	2	2	Pwr.Card Temp	Stop Delayed
2	4	4	Earth Fault	0
3	8	8	Ctrl. Card Temp	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	0
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	0	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	Overload T27
21	200000	2097152	0	Overload T29
22	400000	4194304	0	Memory Module
23	800000	8388608	0	0
24	1000000	16777216	Mains Failure	0
25	2000000	33554432	Current Limit	0
26	4000000	67108864	Low temp.	0
27	8000000	134217728	0	0
28	10000000	268435456	0	Feedback Fault
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 that this status word is not supported.

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	0	0
22	400000	4194304	0	0
23	800000	8388608	0	Running
24	1000000	16777216	0	Bypass
25	2000000	33554432	0	0
26	4000000	67108864	0	0
27	8000000	134217728	0	0
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 programmed by the user in *parameter 6-01 Live Zero Timeout Function*. The signal on 1 of the analog inputs is less than 50% of the minimum value programmed for that input. This condition can be caused by broken wiring or 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 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 Response to 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*.

WARNING/ALARM 8, DC under voltage

If the DC-link voltage (DC) drops below the undervoltage limit, the frequency converter trips after a fixed time delay. The time delay varies with unit size.

Troubleshooting

- Check that the supply voltage matches the frequency converter voltage.
- Perform 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 gives a warning at 90% and trips at 100%, while giving 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 compressor current.

- Show the thermal drive load on the LCP and monitor the value. When running above the frequency converter continuous current rating, the counter should increase. When running below the frequency converter continuous current rating, the counter should decrease.

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 compressor is too hot. Select whether the frequency converter gives a warning or an alarm when the counter reaches 100% in *parameter 1-90 Motor Thermal Protection*. The fault is that the compressor is overloaded by more than 100% for too long.

Troubleshooting

- Check if compressor is overheating.
- Check if the compressor is mechanically overloaded.
- Check that the compressor *parameter 1-24 Motor Current* is set correctly.
- Check that compressor 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 gives a warning or an alarm in *parameter 1-90 Motor Thermal Protection*.

Troubleshooting

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

WARNING/ALARM 13, Over current

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 compressor shaft can be turned.
- Check that the compressor size matches the frequency converter.

- Incorrect compressor 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 compressor or in the compressor itself.

Troubleshooting

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

ALARM 16, Short circuit

There is short-circuiting in the compressor or on the compressor 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 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.

ALARM 18, Start failed

The speed has not been able to exceed *1-77 Compressor Start Max Speed [RPM]* during start within the allowed time (set in *parameter 1-79 Compressor Start Max Time to Trip*). This may be caused by a blocked motor.

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 may be 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 compressor or in the compressor itself.

Troubleshooting

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

ALARM 46, Gate drive voltage low

The supply on the power card is out of range.

WARNING 47, Control Voltage Fault

The 24 V DC is measured on the control card. The external 24 V DC back-up supply may be overloaded, otherwise contact your Danfoss supplier.

ALARM 49, Min. speed limit

When the speed is not within the specified range in *4-11 Motor Speed Low Limit [RPM]* and *4-13 Motor Speed High Limit [RPM]*, the frequency converter shows a warning. When the speed is below, the specified limit in *1-86 Trip Speed Low [RPM]* (except when starting or stopping) the frequency converter trips.

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 80, Drive initialized to default value

Parameter settings are initialized to default settings after a manual reset.

WARNING 87, Auto DC Braking

The frequency converter is auto DC braking.

ALARM 126, Motor Rotating

High back-emf voltage. Stop the rotor of the PM motor.

ALARM 208, ORM Fault

If running in Hand Mode with low speed for too long time the oil return management function stops the drive to protect the compressor. When running in Hand mode, ensure the compressor speed is boosted according to settings in parameters 28-** *Compressor Functions*.

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.

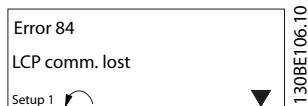


Illustration 4.1 LCP Error Example

4

LCP error code	Error message	Description
Err 84	LCP comm. Lost	Communication between the LCP and the frequency converter is lost.
Err 85	Key disabled	The LCP key is disabled. One of the LCP keys has been disabled in <i>parameter group 0-4* LCP Keypad</i> .
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 (<i>parameter 0-50 LCP Copy</i>).
Err 88	Data not compatible	LCP data incompatible. This error occurs when data is being copied from LCP to frequency converter (<i>parameter 0-50 LCP Copy</i>). 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-ups: 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	Normalized 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
0-04	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 Min Value	0 CustomReadoutUnit	1 set-up	TRUE	-2	Int32
0-32	Custom Readout Max Value	100 CustomReadoutUnit	1 set-up	TRUE	-2	Int32
0-4* 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

Parameter number	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
1-06	Clockwise Direction	[0] Normal	1 set-up	FALSE	-	Uint8
1-1* Motor Selection						
1-13	Compressor Selection	ExpressionLimit	2 set-ups	TRUE	-	Uint8
1-2* Motor Data						
1-20	Motor Power	ExpressionLimit	All set-ups	FALSE	-	Uint8
1-22	Motor Voltage	ExpressionLimit	All set-ups	FALSE	0	Uint16
1-23	Motor Frequency	ExpressionLimit	All set-ups	FALSE	0	Uint16
1-24	Motor Current	ExpressionLimit	All set-ups	FALSE	-2	Uint32
1-25	Motor Nominal Speed	ExpressionLimit	All set-ups	FALSE	67	Uint16
1-26	Motor Cont. Rated Torque	ExpressionLimit	All set-ups	FALSE	-1	Uint32
1-29	Automatic Motor Adaption (AMA)	[0] Off	All set-ups	FALSE	-	Uint8
1-4* Adv. Motor Data II						
1-42	Motor Cable Length	10 m	All set-ups	FALSE	0	Uint8
1-43	Motor Cable Length Feet	33 ft	All set-ups	FALSE	0	Uint16
1-44	d-axis Inductance Sat. (LdSat)	ExpressionLimit	All set-ups	FALSE	-6	Int32
1-45	q-axis Inductance Sat. (LqSat)	ExpressionLimit	All set-ups	FALSE	-6	Int32
1-48	Current at Min Inductance for d-axis	70 %	All set-ups	FALSE	0	Int16
1-49	Current at Min Inductance for q-axis	70 %	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						
1-66	Min. Current at Low Speed	50 %	All set-ups	TRUE	0	Uint32
1-7* Start Adjustments						
1-70	Start Mode	[1] Parking	All set-ups	TRUE	-	Uint8
1-71	Start Delay	60 s	All set-ups	TRUE	-1	Uint8
1-72	Start Function	[2] Coast/delay time	All set-ups	TRUE	-	Uint8
1-73	Flying Start	[1] Enabled Always	All set-ups	TRUE	-	Uint8
1-75	Start Speed [Hz]	100 Hz	All set-ups	TRUE	-1	Uint16
1-78	Compressor Start Min. Speed [Hz]	29 Hz	All set-ups	TRUE	-1	Uint16
1-79	Compressor Start Max Time to Trip	3 s	All set-ups	TRUE	-1	Uint8
1-8* Stop Adjustments						
1-80	Function at Stop	[0] Coast	All set-ups	TRUE	-	Uint8
1-82	Min Speed for Function at Stop [Hz]	0 Hz	All set-ups	TRUE	-1	Uint16
1-87	Compressor Min. Speed for Trip [Hz]	28 Hz	All set-ups	TRUE	-1	Uint16
1-9* Motor Temperature						
1-90	Motor Thermal Protection	[4] ETR trip 1	All set-ups	TRUE	-	Uint8
1-93	Thermistor Source	[0] None	All set-ups	FALSE	-	Uint8

Table 5.2

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	0%	All set-ups	FALSE	0	Uint16
2-01	DC Brake Current	Expression Limit	All set-ups	FALSE	0	Uint16
2-02	DC Braking Time	0.8 s	All set-ups	FALSE	-1	Uint16
2-04	DC Brake Cut In Speed	0.1 Hz	All set-ups	FALSE	-1	Uint16
2-06	Parking Current	60%	All set-ups	FALSE	0	Uint16
2-07	Parking Time	2 s	All set-ups	FALSE	-1	Uint16
2-1* Brake Energy Funct.						
2-17	Over-voltage Control	[2] Enabled	All set-ups	FALSE	-	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	30 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Int32
3-03	Maximum Reference	200 ReferenceFeedbackUnit	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]	30 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 Input 53	All set-ups	TRUE	-	Uint8
3-16	Reference 2 Source	[2] Analog Input 54	All set-ups	TRUE	-	Uint8
3-17	Reference 3 Source	[11] Local bus reference	All set-ups	TRUE	-	Uint8
3-4* Ramp 1						
3-41	Ramp 1 Ramp Up Time	90 s	All set-ups	TRUE	-2	Uint32
3-42	Ramp 1 Ramp Down Time	30 s	All set-ups	TRUE	-2	Uint32
3-5* Ramp 2						
3-51	Ramp 2 Ramp Up Time	30 s	All set-ups	TRUE	-2	Uint32
3-52	Ramp 2 Ramp Down Time	30 s	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	10.00 s	1 set-up	TRUE	-2	Uint32
3-82	Starting Ramp Up Time	15.00 s	2 set-ups	TRUE	-2	Uint32
3-83	Stopping Ramp Down Time	15.00 s	All set-ups	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	[0] Clockwise	All set-ups	FALSE	-	Uint8
4-12	Motor Speed Low Limit [Hz]	ExpressionLimit	All set-ups	FALSE	-1	Uint16
4-14	Motor Speed High Limit [Hz]	200 Hz	All set-ups	FALSE	-1	Uint16
4-18	Current Limit	ExpressionLimit	All set-ups	TRUE	0	Uint16
4-19	Max Output Frequency	200 Hz	All set-ups	FALSE	-1	Uint16

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
4-4* Adj. Warnings 2						
4-40	Warning Freq. Low	30 Hz	All set-ups	TRUE	-1	uint16
4-41	Warning Freq. High	200 Hz	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	0 N/A	All set-ups	TRUE	-3	Int32
4-55	Warning Reference High	6010 N/A	All set-ups	TRUE	-3	Int32
4-56	Warning Feedback Low	0 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
4-57	Warning Feedback High	6010 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
4-58	Missing Motor Phase Function	[1] On	All set-ups	FALSE	-	UInt8
4-6* Speed Bypass						
4-61	Bypass Speed From [Hz]	0 Hz	All set-ups	TRUE	-1	UInt16
4-63	Bypass Speed To [Hz]	0 Hz	All set-ups	TRUE	-1	UInt16

5.1.7 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
5-1* 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	[2] Coast inverse	All set-ups	TRUE	-	UInt8
5-13	Terminal 29 Digital Input	[12] Jog	All set-ups	TRUE	-	UInt8
5-4* Relays						
5-40	Function Relay	ExpressionLimit	All set-ups	TRUE	-	UInt8
5-41	On Delay, Relay	0.01 s	All set-ups	TRUE	-2	UInt16
5-42	Off Delay, Relay	0.01 s	All set-ups	TRUE	-2	UInt16
5-5* Pulse Input						
5-50	Term. 29 Low Frequency	20 Hz	All set-ups	TRUE	0	UInt32
5-51	Term. 29 High Frequency	32000 Hz	All set-ups	TRUE	0	UInt32
5-52	Term. 29 Low Ref./Feedb. Value	0 N/A	All set-ups	TRUE	-3	Int32
5-53	Term. 29 High Ref./Feedb. Value	50	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
6-1* Analog Input 53						
6-10	Terminal 53 Low Voltage	0.07 V	All set-ups	TRUE	-2	Uint16
6-11	Terminal 53 High Voltage	10 V	All set-ups	TRUE	-2	Uint16
6-12	Terminal 53 Low Current	4 mA	All set-ups	TRUE	-5	Uint16
6-13	Terminal 53 High Current	20 mA	All set-ups	TRUE	-5	Uint16
6-14	Terminal 53 Low Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
6-15	Terminal 53 High Ref./Feedb. Value	200 N/A	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	-5	Uint16
6-23	Terminal 54 High Current	20 mA	All set-ups	TRUE	-5	Uint16
6-24	Terminal 54 Low Ref./Feedb. Value	30	All set-ups	TRUE	-3	Int32
6-25	Terminal 54 High Ref./Feedb. Value	200	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	[0] Current mode	1 set-up	TRUE	-	Uint8
6-7* Analog/Digital Output 45						
6-70	Terminal 45 Mode	[0] 0-20 mA	All set-ups	TRUE	-	Uint8
6-71	Terminal 45 Analog Output	[0] No operation	All set-ups	TRUE	-	Uint8
6-72	Terminal 45 Digital Output	[0] No operation	All set-ups	TRUE	-	Uint8
6-73	Terminal 45 Output Min Scale	0 %	All set-ups	TRUE	-2	Uint16
6-74	Terminal 45 Output Max Scale	100 %	All set-ups	TRUE	-2	Uint16
6-76	Terminal 45 Output Bus Control	0 N/A	All set-ups	TRUE	0	Uint16
6-9* Analog/Digital Output 42						
6-90	Terminal 42 Mode	[0] 0-20 mA	All set-ups	TRUE	-	Uint8
6-91	Terminal 42 Analog Output	[0] No operation	All set-ups	TRUE	-	Uint8
6-92	Terminal 42 Digital Output	[0] No operation	All set-ups	TRUE	-	Uint8
6-93	Terminal 42 Output Min Scale	0 %	All set-ups	TRUE	-2	Uint16
6-94	Terminal 42 Output Max Scale	100 %	All set-ups	TRUE	-2	Uint16
6-96	Terminal 42 Output Bus Control	0 N/A	All set-ups	TRUE	0	Uint16

5.1.9 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	20 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	9600	1 set-up	TRUE	-	Uint8
8-33	Parity / Stop Bits	Even Parity, 1Stop Bit	1 set-up	TRUE	-	Uint8
8-35	Minimum Response Delay	0.01 s	1 set-up	TRUE	-3	Uint16
8-36	Maximum Response Delay	5.00 s	1 set-up	TRUE	-3	Uint16
8-37	Maximum Inter-char delay	0.025 s	1 set-up	TRUE	-3	Uint16
8-4* FC MC protocol set						
8-42	PCD Write Configuration	ExpressionLimit	2 set-ups	TRUE	-	Uint8
8-43	PCD Read Configuration	ExpressionLimit	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	[3] Logic OR	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
8-8* FC Port Diagnostics						
8-80	Bus Message Count	0 N/A	1 set-up	TRUE	0	Uint32
8-81	Bus Error Count	0 N/A	1 set-up	TRUE	0	Uint32
8-82	Slave Messages Rcvd	0 N/A	1 set-up	TRUE	0	Uint32
8-83	Slave Error Count	0 N/A	1 set-up	TRUE	0	Uint32
8-84	Slave Messages Sent	0 N/A	1 set-up	TRUE	0	Uint32
8-85	Slave Timeout Errors	0 N/A	1 set-up	TRUE	0	Uint32
8-88	Reset FC port Diagnostics	[0] Do not reset	1 set-up	TRUE	-	Uint8
8-9* Bus Jog / Feedback						
8-94	Bus Feedback 1	0 N/A	All set-ups	TRUE	0	Int16
8-95	Bus Feedback 2	0 N/A	1 set-up	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	-3	Int32
13-2* Timers						
13-20	SL Controller Timer	0 s	1 set-up	TRUE	-2	Uint32
13-4* Logic Rules						
13-40	Logic Rule Boolean 1	[0] False	1 set-up	TRUE	-	Uint8
13-41	Logic Rule Operator 1	[0] Disabled	1 set-up	TRUE	-	Uint8
13-42	Logic Rule Boolean 2	[0] False	1 set-up	TRUE	-	Uint8
13-43	Logic Rule Operator 2	[0] Disabled	1 set-up	TRUE	-	Uint8
13-44	Logic Rule Boolean 3	[0] False	1 set-up	TRUE	-	Uint8
13-5* States						
13-51	SL Controller Event	[0] False	1 set-up	TRUE	-	Uint8
13-52	SL Controller Action	[0] Disabled	1 set-up	TRUE	-	Uint8

5.1.11 14-** Special Functions

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
14-0* Inverter Switching						
14-01	Switching Frequency	5.0 kHz	All set-ups	TRUE	-	Uint8
14-03	Overmodulation	[1] On	All set-ups	FALSE	-	Uint8
14-1* Mains On/Off						
14-10	Mains Failure	[0] No function	All set-ups	FALSE	-	Uint8
14-11	Mains Voltage at Mains Fault	ExpressionLimit	All set-ups	TRUE	0	Uint16
14-12	Function at Mains Imbalance	[1] Warning	1 set-up	TRUE	-	Uint8
14-2* Reset Functions						
14-20	Reset Mode	[10] Automatic reset x 10	All set-ups	TRUE	-	Uint8
14-21	Automatic Restart Time	30 s	All set-ups	TRUE	0	Uint16
14-22	Operation Mode	[0] Normal operation	1 set-up	TRUE	-	Uint8
14-24	Trip Delay at Current Limit	60 s	All set-ups	TRUE	0	Uint8
14-29	Service Code	0 N/A	1 set-up	TRUE	0	Uint32
14-3* Current Limit Ctrl.						
14-30	Current Lim Ctrl, Proportional Gain	100	All set-ups	FALSE	0	Uint16
14-31	Current Lim Ctrl, Integration Time	0.016 s	All set-ups	FALSE	-3	Uint16
14-32	Current Lim Ctrl, Filter Time	5.0 ms	All set-ups	FALSE	-4	Uint16
14-5* Environment						
14-55	Output Filter	[0] No Filter	1 set-up	FALSE	-	Uint8
14-6* Auto Derate						
14-61	Function at Inverter Overload	Trip	All set-ups	FALSE	-	Uint8
14-63	Min Switch Frequency	[2] 2.0 kHz	1 set-up	FALSE	-	Uint8
14-9* Fault Settings						

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
14-90	Fault Level	[4] Trip w. delayed reset	All set-ups	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	1 set-up	TRUE	74	Uint32
15-01	Running Hours	0 h	1 set-up	TRUE	74	Uint32
15-03	Power Up's	0 N/A	1 set-up	TRUE	0	Uint32
15-04	Over Temp's	0 N/A	1 set-up	TRUE	0	Uint16
15-05	Over Volt's	0 N/A	1 set-up	TRUE	0	Uint16
15-06	Reset kWh Counter	[0] Do not reset	1 set-up	TRUE	-	Uint8
15-07	Reset Running Hours Counter	[0] Do not reset	1 set-up	TRUE	-	Uint8
15-08	Number of Starts	0 N/A	All set-ups	FALSE	0	Uint32
15-09	Number of Auto Resets	0 N/A	All set-ups	FALSE	0	Uint32
15-3* Alarm Log						
15-30	Alarm Log: Error Code	0 N/A	1 set-up	TRUE	0	Uint8
15-31	InternalFaultReason	0 N/A	1 set-up	TRUE	0	Int16
15-4* Drive Identification						
15-40	FC Type	0 N/A	1 set-up	FALSE	0	VisStr[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 No	0 N/A	1 set-up	FALSE	0	VisStr[21]
15-49	SW ID Control Card	0 N/A	1 set-up	FALSE	0	VisStr[21]
15-50	SW ID Power Card	0 N/A	1 set-up	FALSE	0	VisStr[21]
15-51	Drive Serial Number	0 N/A	1 set-up	FALSE	0	VisStr[10]
15-53	Power Card Serial Number	0 N/A	1 set-up	FALSE	0	VisStr[20]
15-57	File version	0 N/A	1 set-up	FALSE	0	Uint8
15-59	File name	0 N/A	1 set-up	FALSE	0	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 ReferenceFeedbackUnit	1 set-up	TRUE	-3	Int32
16-02	Reference [%]	0 %	1 set-up	TRUE	-1	Int16
16-03	Status Word	0 N/A	1 set-up	TRUE	0	Uint16
16-05	Main Actual Value [%]	0 %	1 set-up	TRUE	-2	Int16
16-09	Custom Readout	0 CustomReadoutUnit	1 set-up	TRUE	-2	Int32
16-1* Motor Status						
16-10	Power [kW]	0 kW	1 set-up	TRUE	-3	Uint32
16-11	Power [hp]	0 hp	1 set-up	TRUE	-3	Uint32

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
16-12	Motor Voltage	0 V	1 set-up	TRUE	-1	Uint32
16-13	Frequency	0 Hz	1 set-up	TRUE	-1	Uint32
16-14	Motor current	0 A	1 set-up	TRUE	-2	Uint16
16-15	Frequency [%]	0 %	1 set-up	TRUE	-1	Uint16
16-16	Torque [Nm]	0 Nm	All set-ups	FALSE	-1	Int32
16-18	Motor Thermal	0 %	1 set-up	TRUE	0	Uint8
16-22	Torque [%]	0 %	All set-ups	FALSE	0	Int16
16-3* Drive Status						
16-30	DC Link Voltage	0 V	1 set-up	TRUE	0	Uint32
16-34	Heatsink Temp.	0 °C	1 set-up	TRUE	100	Int8
16-35	Inverter Thermal	0 %	1 set-up	TRUE	0	Uint8
16-36	Inv. Nom. Current	0 A	1 set-up	TRUE	-2	Uint16
16-37	Inv. Max. Current	0 A	1 set-up	TRUE	-2	Uint16
16-38	SL Controller State	0 N/A	1 set-up	TRUE	0	Uint8
16-5* Ref. & Feedb.						
16-50	External Reference	0 %	1 set-up	TRUE	-1	Int16
16-52	Feedback[Unit]	0 ProcessCtrlUnit	1 set-up	TRUE	-3	Int32
16-54	Feedback 1 [Unit]	0 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
16-55	Feedback 2 [Unit]	0 ProcessCtrlUnit	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	Ext. Status Word	0 N/A	1 set-up	TRUE	0	Uint32
16-95	Ext. Status Word 2	0 N/A	1 set-up	TRUE	0	Uint32
16-97	Alarm Word 3	0 N/A	1 set-up	TRUE	0	Uint32

5.1.14 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	TRUE	-	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

5.1.15 28-** Compressor Functions

Par. No. #	Parameter description	Default value	2-set-up	Change during operation	Conversion index	Type
28-0* Short Cycle Protection						
28-00	Short Cycle Protection	[1] Enabled	All set-ups	TRUE	-	Uint8
28-01	Interval between Starts	300 s	All set-ups	TRUE	0	Uint16
28-02	Minimum Run Time	12 s	All set-ups	TRUE	0	Uint16
28-1* Oil Return Management						
28-10	Oil Return Management	[1] On	All set-ups	FALSE	-	Uint8
28-11	Low Speed Running Time	120 min	All set-ups	TRUE	70	Uint16
28-12	Fixed Boost Interval	24 h	All set-ups	TRUE	0	Uint8
28-13	Boost Duration	60 s	All set-ups	FALSE	0	Uint16
28-15	ORM Min Speed Limit (Hz)	80 Hz	All set-ups	TRUE	0	Uint16
28-17	ORM Boost Speed (Hz)	120 Hz	All set-ups	TRUE	0	Uint16
28-4* Anti-reverse Protection at Stop						
28-40	Reverse Protection Control	[1] Enabled	All set-ups	TRUE	-	Uint8
28-6* Compressor Readouts						
28-60	RPS	0 /s	All set-ups	FALSE	-1	uint16

Index

A

Active Set-up..... 19
 Address..... 41
 Advanced Vector Control..... 5
 Alarm log..... 57
 Alarm word..... 62, 0
 Alarm word 2..... 62
 Alarm word 3..... 63
 Alarm/Warning code list..... 66
 Alarms..... 66, 67
 Analog inputs..... 5
 Auto DC braking IT..... 19
 Automatic restart time..... 55

B

Baud rate..... 41
 Break-away torque..... 5
 Bus feedback..... 45

C

Changes made..... 9
 Closed loop..... 22
 Closed loop set-up quick menu..... 9
 Coast inverse..... 28
 Coasting..... 5
 Comparator
 Comparator..... 48
 Control
 word..... 58
 Control timeout function..... 41
 Control timeout time..... 41
 Conventions..... 4
 Current limit..... 26

D

Data readouts..... 58
 DC brake current..... 23
 Default setting..... 75
 Definitions..... 5
 Digital input function..... 28
 Digital input mode..... 27
 Digital Inputs..... 28
 Discharge time..... 4
 Display..... 8

Documentation..... 4

E

Electrical overview..... 7
 Environment..... 56
 Extended status word..... 63, 70
 Extended status word 2..... 63
 External interlock..... 28

F

Fan control..... 56
 FC port diagnostic..... 44
 FC port setting..... 41
 Fieldbus & drive port..... 62
 Fieldbus & FC port..... 62
 Fire mode..... 28
 Freeze output..... 5, 28
 Frequency converter identification..... 58
 Function at mains imbalance..... 54
 Function relay..... 32

G

Grid type..... 18

H

Hand start..... 28
 High voltage..... 3

I

Indicator lights (LEDs)..... 8
 Initialize, frequency converter..... 17
 Inputs
 Digital input..... 61
 Introduction..... 3
 Inverter switching..... 54

J

Jog..... 5, 28
 Jog ramp time..... 25
 Jog speed [Hz]..... 24

L

Latched start..... 28
 LCP..... 5, 6, 64
 LCP copy..... 17
 LCP custom readout..... 20
 Leakage current..... 4

Literature.....	4
Load sharing.....	3
Local Control Panel (LCP).....	8
Logic rule.....	49
Logic rule boolean 2.....	50
Logic rule boolean 3.....	51
Logic rule operator 2.....	51
M	
Main menu.....	16
Mains	
on/off.....	54
Max output frequency.....	26
Maximum inter-char delay.....	41
Maximum reference.....	23
Maximum response delay.....	41
Menu key.....	8
Menus.....	9
Minimum reference.....	23
Motor	
status.....	59
Motor set-up.....	9
Motor speed high limit.....	26
Motor speed low limit.....	26
Motor Thermal Protection.....	22
N	
Navigation key.....	8
NPN.....	27
O	
Open loop.....	22
Operating data.....	57
Operating hours.....	57
Operation key.....	8
Overmodulation.....	54
P	
Parameter lists.....	75
Parity/Stop bits.....	41
PNP.....	27
Preset ref bit 0.....	28
Preset ref bit 1.....	28
Preset ref bit 2.....	28
Preset relative reference.....	24
Program, how to.....	8

Programming	
Programming.....	8
with MCT 10 Set-up Software.....	8
Protocol.....	41
Pulse input.....	35
Q	
Quick menu.....	9
Quick menu, closed loop set-up.....	9
Quick menu, open loop applications.....	9
Quick stop ramp time.....	25
Quick transfer, parameter settings (multiple frequency converters).....	17
R	
Ramp 1 Ramp down time.....	25
Ramp 1 Ramp up time.....	25
Ramp 2 Ramp up time.....	25
Rated compressor speed.....	5
RCD.....	5
Readout/programming, indexed parameter.....	17
Recommended initialisation.....	17
Relay.....	32
Relay output [bin].....	62
Reset mode.....	55
Reversing.....	28
Run permissive.....	28
Running hours.....	57
S	
Safety.....	4
Serial communication.....	32
Serial communication port.....	5
SL controller action.....	52
SLC setting.....	45
Smart logic.....	45
Smart logic controller event.....	52
Special functions.....	54
Speed bypass.....	27
Speed down.....	28
Speed up.....	28
Start.....	28
Start delay.....	22
Start event.....	45
Start reversing.....	28
Status menu.....	9
Status word.....	59

Stop event..... 46
 Switching frequency..... 54

T

Terminal 18 digital input..... 30
 Terminal 27 digital input..... 31
 Terminal 29 digital input..... 31
 Terminal 42 analog output..... 39
 Terminal 42 digital output..... 39
 Terminal 45
 Terminal 45 output max scale..... 39
 Terminal 45 analog output..... 37
 Terminal 45 digital output..... 37
 Terminal 54 high current..... 37
 Terminal 54 mode..... 37
 Thermistor..... 5
 Timer..... 48
 Trip reset..... 55
 Troubleshooting..... 66
 Two-finger initialisation..... 17

U

Unintended motor rotation..... 4
 Unintended start..... 3

V

VVC+..... 6

W

Warning word..... 62, 0
 Warning word 2..... 63
 Warnings..... 66, 67
 Warnings, alarms..... 67
 Windmilling..... 4



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