



# Programming Guide

## VLT<sup>®</sup> Compressor Drive CDS 803





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# 1 Introduction

## 1.1 Purpose of the Manual

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

The programming guide is intended for use by qualified personnel.

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

## 1.2 Safety Symbols

The following symbols are used in this document:

### **⚠ WARNING**

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

### **⚠ CAUTION**

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

### **NOTICE**

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

## 1.3 Safety Precautions

### **⚠ WARNING**

#### **HIGH VOLTAGE**

Frequency converters contain high voltage when connected to AC mains input, DC power 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 by means of 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 power 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 1.1*.

Voltage [V]	Cooling capacity [TR]	Minimum waiting time (min)
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 1.1 Discharge Time

**⚠ WARNING**

**LEAKAGE CURRENT HAZARD**

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

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

**⚠ WARNING**

**EQUIPMENT HAZARD**

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

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

1.4 Additional Resources

- *VLT® Compressor Drive CDS 803 Quick Guide* entails information on safety, installation and how to programme. It provides a list of warnings and alarms and general specifications.
- *VLT® Compressor Drive CDS 803 Programming Guide* provides information on how to programme 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.

Danfoss technical literature is available in print from your local Danfoss Sales Office or at: [www.danfoss.com/BusinessAreas/DrivesSolutions/Documentations/Technical+Documentation.htm](http://www.danfoss.com/BusinessAreas/DrivesSolutions/Documentations/Technical+Documentation.htm)

1.5 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, coasting stop, Reset and Coasting stop, Quick-stop, DC braking, Stop, and the [Off] key.
	Group 2	Start, Pulse start, Reversing, Start reversing, Jog, and Freeze output

Table 1.2 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 rated 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).

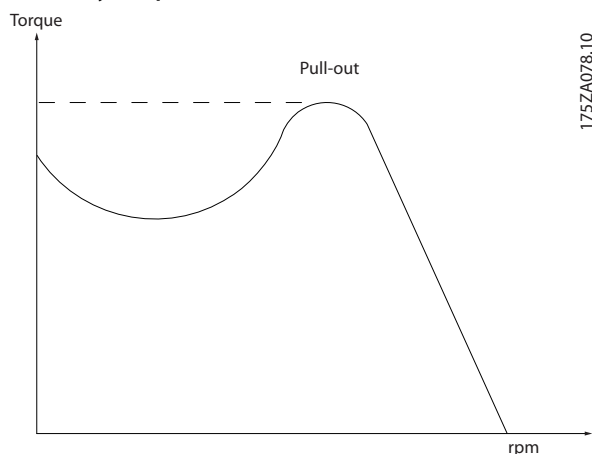
**Break-away torque**

Illustration 1.1 Break-away Torque

 **$\eta_{VLT}$** 

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 1.2*.

**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<sub>MAX</sub>**

Determines the relationship between the reference input at 100% full scale value (typically 10 V, 20 mA) and the resulting reference. The maximum reference value set in *3-03 Maximum Reference*.

**Ref<sub>MIN</sub>**

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 set in *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 (max. 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.

**Initialising**

If initialising is carried out (*parameter 14-22 Operation Mode*), the programmable parameters of the frequency converter return to their default settings.

*Parameter 14-22 Operation Mode* does not initialise communication parameters.

**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, i.e. 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, etc. 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, e.g. if the frequency converter is subject to an over temperature 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 cancelled by activating reset or, in some cases, by being programmed to reset automatically. Trip may not be used for personal safety.

**Trip locked**

A state entered in fault situations when the frequency converter is protecting itself and requiring physical intervention, for example, if the frequency converter is subject to a short circuit on the output. A locked trip can only be cancelled by cutting off mains, removing the cause of the fault, and reconnecting the frequency converter. Restart is prevented until the trip state is cancelled by activating reset or, in some cases, by being programmed to reset automatically. Trip locked 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.



1.6 Electrical Overview

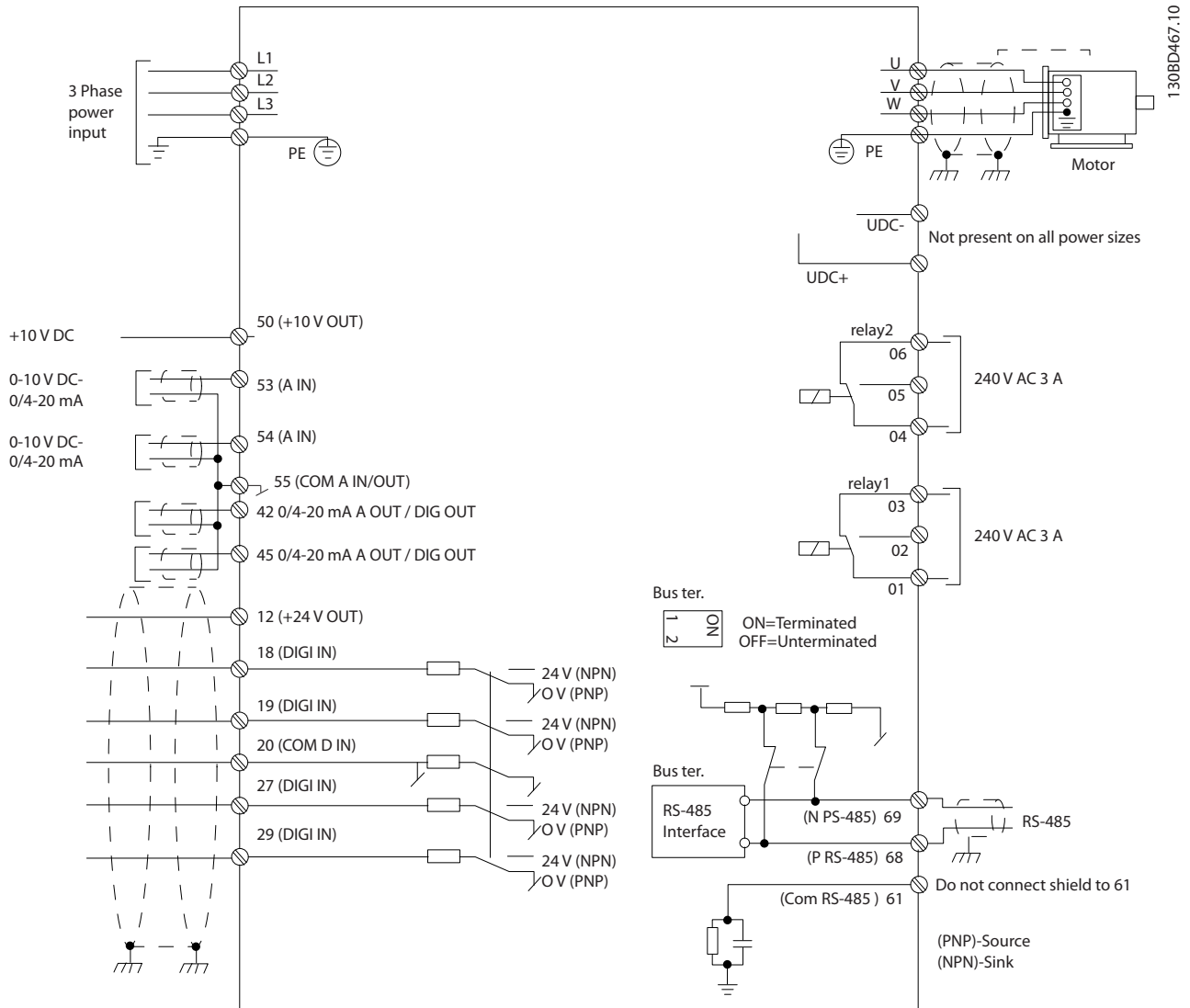


Illustration 1.2 Basic Wiring Schematic Drawing

## 2 How to Programme

# 2

### 2.1 Programming with MCT 10 Set-up Software

The frequency converter can be programmed from a PC via RS-485 COM port by using the MCT 10 Set-up Software. Contact the local supplier for the software, or download it from [www.danfoss.com/BusinessAreas/DrivesSolutions/softwaredownload](http://www.danfoss.com/BusinessAreas/DrivesSolutions/softwaredownload)

### 2.2 Local Control Panel (LCP)

**NOTICE**

LCP is NOT supported in SW 1.0X!

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)

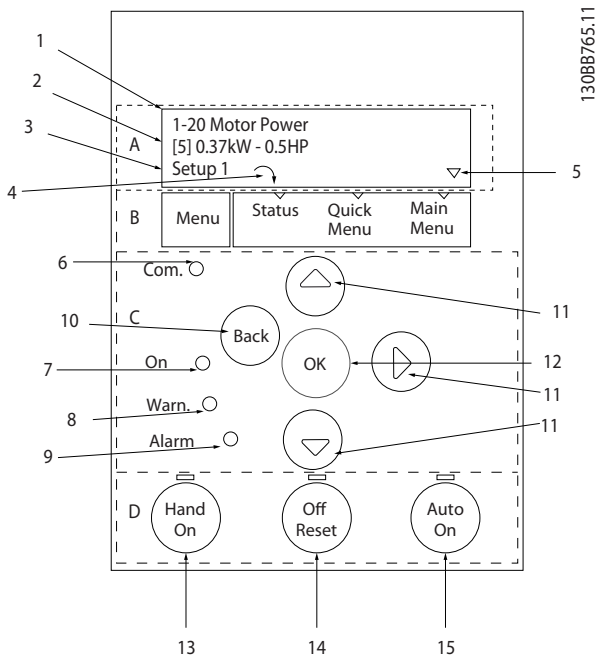


Illustration 2.1 Local Control Panel (LCP)

**A. Display**

The LCD-display is back-lit with 2 alphanumeric lines. All data is displayed 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. <b>NOTICE</b> Terminal 27 Digital Input (5-12 Terminal 27 Digital Input) 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 [kW] (if *0-03 Regional Settings* is set to [1] *North America*, Motor Power is shown in the unit of hp instead of kW), *parameter 16-10 Power [kW]* for kW, *parameter 16-11 Power [hp]* for hp.
- Custom Readout *parameter 16-09 Custom Readout*.

### 2.3.2 Quick Menu

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

- Wizard for open-loop applications, see *chapter 2.3.3 The Start-up Wizard*.
- Closed loop set-up wizard, see *chapter 2.3.3 The Start-up Wizard*.
- Changes made.

### 2.3.3 The Start-up Wizard

The built-in wizard menu guides the installer through the set-up of the frequency converter in a clear and structured way to set-up an open loop application. An open loop application is here an application with a start signal, analog reference (voltage or current) and optionally also relay signals (but no feedback signal from the process applied).

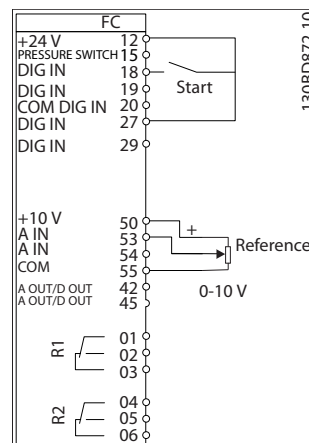


Illustration 2.2 Open Loop Application

The wizard is initially shown after power-up until any parameter has been changed. The wizard can always be accessed again through the *Quick Menu*. Press [OK] to start the wizard. Press [Back] to return to the status screen.

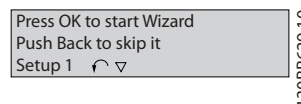
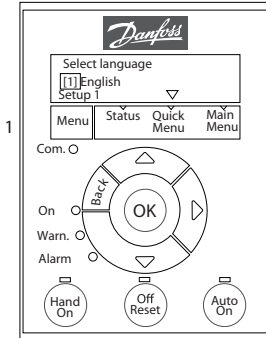


Illustration 2.3 Start-up/Quit Wizard

2

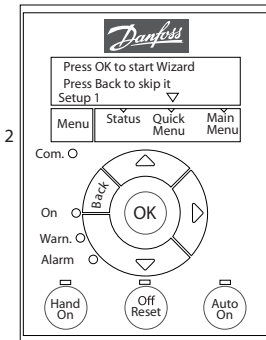
At power up the user is asked to choose the preferred language.



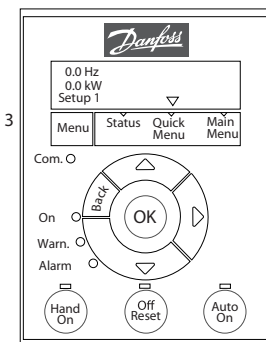
Power Up Screen



The next screen will be the Wizard screen.



Wizard Screen



Status Screen

The Wizard can always be reentered via the Quick Menu!

... the CDS 803 Wizard starts

- 4 Select Language  
01 English  
Setup 1 ▼
- 5 Select Grid Type  
Size related  
Setup 1 ▼
- 6 Select Main Menu Password  
01  
Setup 1 ▼
- 7 Select Compressor Selection  
Size related  
Setup 1 ▼
- 8 Select Max. reference  
200 Hz  
Setup 1 ▼
- 9 Select Reference 1 Source  
01 Analog in 53  
Setup 1 ▼
- 10 Select Ramp 1 Ramp Up Time  
30 s  
Setup 1 ▼
- 11 Select Ramp 1 Ramp Down Time  
80 s  
Setup 1 ▼
- 12 Select Terminal 27 Digital In  
06 Stop inverse  
Setup 1 ▼
- 13 Select Relay 1  
09 Alarm  
Setup 1 ▼
- 14 Select Relay 2  
05 Drive Running  
Setup 1 ▼
- 15 Select Terminal 53 Low Voltage  
0.07 V  
Setup 1 ▼
- 16 Select Terminal 53 High Voltage  
10 V  
Setup 1 ▼
- 17 Select Control Site  
01 Digital and ctrl.word  
Setup 1 ▼
- 18 Select Protocol  
01 FC  
Setup 1 ▼
- 19 Select Address  
1  
Setup 1 ▼

if



## The Start-up wizard for open-loop applications

Parameter	Option	Default	Function
0-01 Language	[0] English [1] Deutsch [2] Francais [3] Dansk [4] Spanish [5] Italiano [28] Bras.port	[0] English	Select the language for the display.
0-06 GridType	[0] 200-240 V/50 Hz/IT-grid [1] 200-240 V/50 Hz/Delta [2] 200-240 V/50 Hz [10] 380-440 V/50 Hz/IT-grid [11] 380-440 V/50 Hz/Delta [12] 380-440 V/50 Hz [20] 440-480 V/50 Hz/IT-grid [21] 440-480 V/50 Hz/Delta [22] 440-480 V/50 Hz [30] 525-600 V/50 Hz/IT-grid [31] 525-600 V/50 Hz/Delta [32] 525-600 V/50 Hz [100] 200-240 V/60 Hz/IT-grid [101] 200-240 V/60 Hz/Delta [102] 200-240 V/60 Hz [110] 380-440 V/60 Hz/IT-grid [111] 380-440 V/60 Hz/Delta [112] 380-440 V/60 Hz [120] 440-480 V/60 Hz/IT-grid [121] 440-480 V/60 Hz/Delta [122] 440-480 V/60 Hz [130] 525-600 V/60 Hz/IT-grid [131] 525-600 V/60 Hz/Delta [132] 525-600 V/60 Hz	Size related	Select operating mode for restart upon reconnection of the frequency converter to mains voltage after power-down.
Parameter 0-60 Main Menu Password	0-999	0	Define the password for access to the LCP.
1-13 Compressor Selection	[24] VZH028-R410A [25] VZH035-R410A [26] VZH044-R410A	Size related	Select the used compressor.
3-03 Maximum Reference	0-200 Hz	200 Hz	The maximum reference is the highest obtainable by summing all references.
Parameter 3-15 Reference 1 Source	[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.
3-41 Ramp 1 Ramp Up Time	0.05-3600.0 s	30.00 s	Ramp-up time from 0 to 1-25 Motor Nominal Speed.
3-42 Ramp 1 Ramp Down Time	0.05-3600.0 s	30.00 s	Ramp down time from rated motor speed to 0.

Parameter	Option	Default	Function
5-12 Terminal 27 Digital Input	[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.
5-40 Function Relay [0] Function relay	See 5-40 Function Relay	Alarm	Select the function to control output relay 1.
5-40 Function Relay [1] Function relay	See 5-40 Function Relay	Drive running	Select the function to control output relay 2.
Parameter 6-10 Terminal 53 Low Voltage	0-10 V	0.07 V	Enter the voltage that corresponds to the low reference value.
Parameter 6-11 Terminal 53 High Voltage	0-10 V	10 V	Enter the voltage that corresponds to the high reference value.
Parameter 8-01 Control Site	[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.
8-30 Protocol	[0] FC [2] Modbus RTU	[0] FC	Select the protocol for the integrated RS-485 port.
8-32 Baud Rate	[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 RS-485 port.

Table 2.4 Open-loop Applications Set-up

The Start-up wizard for compressor functions

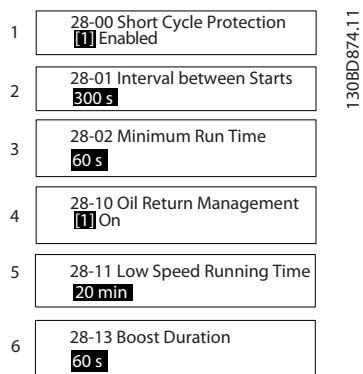


Illustration 2.5 Compressor Function Wizard

Compressor function wizard

Parameter	Option	Default	Function
28-00 Short Cycle Protection	[0] Disabled [1] Enabled	[1] Enabled	Select if short cycle protection is to be used.
28-01 Interval between Starts	0-3600 s	300 s	Enter the minimum allowed time between starts.
28-02 Minimum Run Time	10-3600 s	60 s	Enter the minimum allowed time to run before stop.
28-10 Oil Return Management	[0] Off [1] On	[1] On	Select if oil return management is to be used.
28-11 Low Speed Running Time	1-1400 min	20 min	Enter the low speed running time.
28-13 Boost Duration	10-3600 s	60 s	Enter the boost duration for the oil return.

Table 2.5 Compressor Function

2

The Start-up wizard 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 1-00 Configuration Mode  
[0] Size related
- 5 1-13 Compressor Selection  
[1] Closed loop
- 6 3-02 Minimum Reference  
[0] Hz
- 7 3-03 Maximum Reference  
200 Hz
- 8 3-10 Preset Reference  
0%
- 9 3-15 Reference 1 Source  
[1] Analog in 53
- 10 3-41 Ramp 1 Ramp Up Time  
30.00 s
- 11 3-42 Ramp 1 Ramp Down Time  
30.00 s
- 12 5-12 Terminal 27 Digital Input  
[6] Stop inverse
- 13 5-40 Function Relay 1  
Alarm
- 14 5-40 Function Relay 2  
Drive running
- 15 6-10 Terminal 53 Low Voltage  
0.07 V
- 16 6-11 Terminal 53 High Voltage  
10 V
- 17 6-14 Terminal 53 Low Ref./Feedb.  
30.000 Hz
- 18 6-15 Terminal 53 High Ref./Feedb.  
200.000 Hz
- 19 6-22 Terminal 54 Low Current  
4.00 mA
- 20 6-23 Terminal 54 High Current  
20.00 mA
- 21 6-24 Terminal 54 Low Ref./Feedb.  
0.000
- 22 6-25 Terminal 54 High Ref./Feedb.  
4999.000
- 23 20-00 Feedback 1 Source  
[2] Analog input 54
- 24 20-04 Feedback 2 Conversion  
[0] Linear
- 25 8-01 Control Site  
[0] Digital and ctrl.word
- 26 8-30 Protocol  
[0] FC
- 27 8-31 Address  
[1]

130BD0875.12

Illustration 2.6 Closed-loop Wizard



## Closed-loop wizard

Parameter	Option	Default	Function
0-01 Language	[0] English [1] Deutsch [2] Francais [3] Dansk [4] Spanish [5] Italiano [28] Bras.port	0	Select the language for the display.
0-06 GridType	[0] 200-240 V/50 Hz/IT-grid [1] 200-240 V/50 Hz/Delta [2] 200-240 V/50 Hz [10] 380-440 V/50 Hz/IT-grid [11] 380-440 V/50 Hz/Delta [12] 380-440 V/50 Hz [20] 440-480 V/50 Hz/IT-grid [21] 440-480 V/50 Hz/Delta [22] 440-480 V/50 Hz [30] 525-600 V/50 Hz/IT-grid [31] 525-600 V/50 Hz/Delta [32] 525-600 V/50 Hz [100] 200-240 V/60 Hz/IT-grid [101] 200-240 V/60 Hz/Delta [102] 200-240 V/60 Hz [110] 380-440 V/60 Hz/IT-grid [111] 380-440 V/60 Hz/Delta [112] 380-440 V/60 Hz [120] 440-480 V/60 Hz/IT-grid [121] 440-480 V/60 Hz/Delta [122] 440-480 V/60 Hz [130] 525-600 V/60 Hz/IT-grid [131] 525-600 V/60 Hz/Delta [132] 525-600 V/60 Hz	Size related	Select the operating mode for restart upon reconnection of the frequency converter to mains voltage after power down.
Parameter 0-60 Main Menu Password	0-999	0	Define the password for access to the LCP.
1-00 Configuration Mode	[0] Open loop [3] Closed loop	[0] Open loop	Select closed loop.
Parameter 1-13 Compressor Selection	[24] VZH028-R410A [25] VZH035-R410A [26] VZH044-R410A	Size related	Select the used compressor.
3-02 Minimum Reference	-4999.0 - 200 Hz	0 Hz	The minimum reference is the lowest value obtainable by summing all references.
3-03 Maximum Reference	0 - 200 Hz	200 Hz	The maximum reference is the highest obtainable by summing all references.
Parameter 3-10 Preset Reference	-100 - 100 %	0 %	Set-up a fix setpoint in preset reference [0].
Parameter 3-15 Reference 1 Source	[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.
3-41 Ramp 1 Ramp Up Time	0.05-3600.0 s	30.00 s	Ramp-up time from 0 to 1-25 Motor Nominal Speed.
3-42 Ramp 1 Ramp Down Time	0.05-3600.0 s	30.00 s	Ramp-down time from rated motor speed to 0.

Parameter	Option	Default	Function
5-12 Terminal 27 Digital Input	[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.
5-40 Function Relay [0] Function relay	See 5-40 Function Relay	Alarm	Select the function to control output relay 1.
5-40 Function Relay [1] Function relay	See 5-40 Function Relay	Drive running	Select the function to control output relay 2.
Parameter 6-10 Terminal 53 Low Voltage	0-10 V	0.07 V	Enter the voltage that corresponds to the low reference value.
Parameter 6-11 Terminal 53 High Voltage	0-10 V	10 V	Enter the voltage that corresponds to the high reference value.
6-14 Terminal 53 Low Ref./Feedb. Value	-4999 - 4999	30	Enter the reference value that corresponds to the voltage set in parameter 6-10 Terminal 53 Low Voltage.
6-15 Terminal 53 High Ref./Feedb. Value	-4999 - 4999	200	Enter the reference value that corresponds to the voltage set in parameter 6-11 Terminal 53 High Voltage.
6-22 Terminal 54 Low Current	0.00-20.00 mA	4.00 mA	Enter the current that corresponds to the low reference value.
Parameter 6-23 Terminal 54 High Current	0-10 V	10 V	Enter the current that corresponds to the high reference value.
Parameter 6-24 Terminal 54 Low Ref./Feedb. Value	-0.00-20.00 mA	20.00 mA	Enter the reference value that corresponds to the current set in 6-20 Terminal 54 Low Voltage.
6-25 Terminal 54 High Ref./Feedb. Value	-4999 - 4999	Size related	Enter the reference value that corresponds to the current set in 6-21 Terminal 54 High Voltage.
Parameter 8-01 Control Site	[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.

Parameter	Option	Default	Function
8-30 Protocol	[0] FC [2] Modbus RTU	[0] FC	Select the protocol for the integrated RS-485 port.
8-32 Baud Rate	[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 RS-485 port.
Parameter 20-00 Feedback 1 Source	[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.
Parameter 20-01 Feedback 1 Conversion	[0] Linear [1] Square root	[0] Linear	Select how 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-setup.
- 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. Press [Menu] to enter the *Quick Menu* until indicator in display is placed above *Quick Menu*.
2. Press [▲] [▼] to select wizard, 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.

**2.3.4 Main Menu**

Press [Main Menu] to access and programme all parameters. The *Main Menu* parameters can be accessed readily unless a password has been created via *parameter 0-60 Main Menu Password*.

For the majority of 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 to store 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 Read-out 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 Initialise the Frequency Converter to Default Settings in 2 Ways

**Recommended initialisation (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:

- 8-30 Protocol
- 8-31 Address
- 8-32 Baud Rate
- 8-33 Parity / Stop Bits
- Parameter 8-35 Minimum Response Delay
- 8-36 Maximum Response Delay
- Parameter 8-37 Maximum Inter-char delay
- 8-75 Initialisation Password
- 15-00 Operating hours to parameter 15-05 Over Volt's
- Parameter 15-03 Power Up's
- Parameter 15-04 Over Temp's
- Parameter 15-05 Over Volt's
- Parameter 15-30 Alarm Log: Error Code
- 15-4\* Drive identification parameters

**2-finger initialisation**

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:
  - 15-00 Operating hours
  - Parameter 15-03 Power Up's
  - Parameter 15-04 Over Temp's
  - Parameter 15-05 Over Volt's
  - 15-4\* Drive identification parameters

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

### 3 Parameters

#### 3.1 Main Menu - Operation and Display - Group 0

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

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

0-04 Operating State at Power-up		
Option:	Function:	
		Select the operating mode upon reconnection of the frequency converter to mains voltage after power-down when operating in <i>Hand (local) mode</i> .
[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 Hand 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 retain the local speed reference in memory before powering down. After mains voltage is reconnected, and after receiving a start command (pressing [Hand

0-04 Operating State at Power-up		
Option:	Function:	
		On] key or using the Hand Start command via a digital input) the frequency converter restarts and operates at the retained speed reference.

0-06 GridType		
Option:	Function:	
		Select the grid type of the supply voltage/frequency. <p><b>NOTICE</b></p> <p>Not all options are supported in all power sizes.</p> <p>IT grid is a supply mains, where there are no connections to ground.</p> <p>Delta is a supply mains where the secondary part of the transformer is delta connected and one phase is connected to ground.</p>
[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	
[121]	440-480V/60Hz/Delta	
[122]	440-480V/60Hz	
[130]	525-600V/60Hz/IT-grid	
[131]	525-600V/60Hz/Delta	
[132]	525-600V/60Hz	

0-07 Auto DC Braking		
Option:	Function:	
		Protective function against overvoltage at coast.
		<b>NOTICE</b> Can cause PWM when coasted.
[0]	Off	Function is not active.
[1]	On	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 one or more set-ups.

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

- Run compressor in one set-up (active set-up) while updating parameters in another set-up (edit set-up)
- Connect various compressors (one at a time) to frequency converter. Compressor data for various compressors can be placed in different set-ups.
- Rapidly change settings of frequency converter and/or compressor while compressor is running e.g. 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		
Option:	Function:	
		Select the set-up in which the frequency converter is to operate.
[1]	Set-up 1	Set-up 1 is active.

0-10 Active Set-up		
Option:	Function:	
[2]	Set-up 2	Set-up 2 is active.
[9]	Multi Set-up	Is used for remote selection of set-ups using digital inputs and the serial communication port. This set-up uses the settings from <i>parameter 0-12 Link Setups</i> .

0-11 Programming Set-up		
Option:	Function:	
		The number of the set-up being edited is displayed in the LCP, flashing.
[1]	Set-up 1	Edit Set-up 1
[2]	Set-up 2	Edit Set-up 2
[9]	Active Set-up	Edit parameters in the set-up selected via digital I/Os

0-12 Link Setups		
Option:	Function:	
		If the set-ups are not linked, a change between them is not possible while the compressor is running.
[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 customise the display elements for various purposes.

#### Custom Readout

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

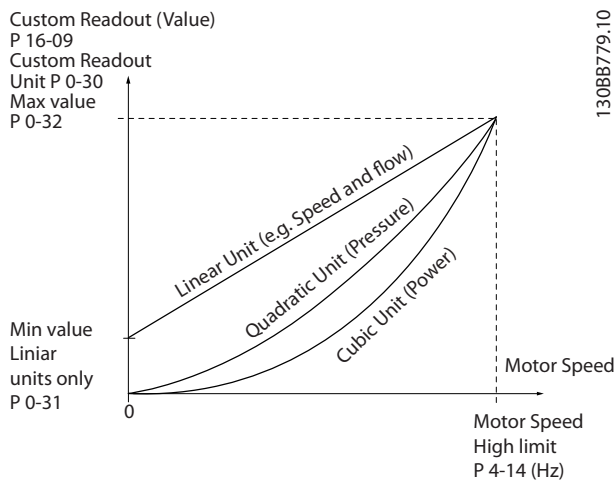


Illustration 3.1 Custom Readout

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

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

Table 3.1 Relation

0-30 Custom Readout Unit		
Option:	Function:	
	Program a value to be shown in the display of the LCP. The value has a linear, squared or cubed relation to speed. This relation depends on the unit selected (see Table 3.1). The actual calculated value can be read in parameter 16-09 Custom Readout.	
[0]	None	
[1]	%	
[5]	PPM	
[10]	l/Min	
[11]	RPM	
[12]	Pulse/s	
[20]	l/s	
[21]	l/min	
[22]	l/h	
[23]	m3/s	
[24]	m3/min	
[25]	m3/h	

0-30 Custom Readout Unit		
Option:	Function:	
[30]	kg/s	
[31]	kg/min	
[32]	kg/h	
[33]	t/min	
[34]	t/h	
[40]	m/s	
[41]	m/min	
[45]	m	
[60]	Degree Celsius	
[70]	mbar	
[71]	bar	
[72]	Pa	
[73]	kPa	
[74]	m Wg	
[80]	kW	
[120]	GPM	
[121]	gal/s	
[122]	gal/min	
[123]	gal/h	
[124]	CFM	
[127]	ft3/h	
[140]	ft/s	
[141]	ft/min	
[160]	Degree Fahr	
[170]	psi	
[171]	lb/in2	
[172]	in WG	
[173]	ft WG	
[180]	hp	

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

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

**0-40 [Hand on] Key on LCP**

Option:		Function:
[0]	Disabled	Select [0] <i>Disabled</i> to avoid accidental start of the frequency converter in <i>Hand Mode</i> .
[1]	Enabled	[Hand On] is enabled.

**0-42 [Auto on] Key on LCP**

Option:		Function:
[0]	Disabled	Select [0] <i>Disabled</i> to avoid accidental start of the frequency converter from LCP.
[1]	Enabled	[Auto On] is enabled.

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

Option:		Function:
[0]	Disabled	
[1]	Enabled	
[7]	Enable Reset Only	

**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 it is recommended 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 programme 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 set-up (selected in <i>parameter 0-11 Programming Set-up</i> ).

**0-60 Main Menu Password**

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



### 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

1-00 Configuration Mode	
Option:	Function:
[0] * Open Loop	<p><b>NOTICE</b></p> <p>This parameter cannot be adjusted when compressor is running.</p> <p>Compressor speed is determined by applying a speed reference or by setting desired speed when in <i>Hand Mode</i>.</p> <p>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] Closed Loop	<p>Compressor speed is determined by a reference from the built-in PI controller varying the compressor speed as of a closed-loop control process (e.g. constant pressure or flow). Configure the PI controller in parameter group 20-** <i>Drive Closed Loop</i>.</p>

1-13 Compressor Selection	
Range:	Function:
	<p>The default setting of most of the parameters in the frequency converter (e.g. compressor data, limits, ramps etc.) depends upon the compressor and system refrigerant selected for the frequency converter.</p> <p>The frequency converter selects the default compressor based upon the power size and voltage range for the frequency converter.</p> <p><b>NOTICE</b></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	

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		
Option:	Function:	
		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.
[0]	No protection	Disables temperature monitoring.
[1]	Thermistor warning	A thermistor gives a warning if upper limit of compressor temperature range is exceeded,
[2]	Thermistor trip	A thermistor gives an alarm and makes the frequency converter trip if upper limit of 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.

1-93 Thermistor Source		
Option:	Function:	
		<p><b>NOTICE</b></p> <p>This parameter cannot be adjusted while the compressor is running.</p> <p><b>NOTICE</b></p> <p>Digital input should be set to [0] PNP - Active at 24 V in 5-03 Digital Input 29 Mode.</p> <p>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 3-15 Reference Resource 1 to 3-17 Reference Resource 3.</p>
[0]	None	
[1]	Analog input AI53	
[6]	Digital input 29	

### 3.3 Main Menu - Reference/Ramps - Group 3

#### 3.3.1 3-0\* Reference Limits

Parameters for setting the reference unit, limits and ranges.

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

3-02 Minimum Reference		
Range:		Function:
0 Hz*	[ 0 - 200.000 Hz]	The minimum reference is the lowest value obtainable by summing all references.

3-03 Maximum Reference		
Range:		Function:
200.000 Hz*	[ 0 - 200.000 Hz]	The maximum reference is the highest value obtainable by summing all references. The maximum reference unit matches the configuration selected in 1-00 Configuration Mode.

#### 3.3.2 3-1\* References

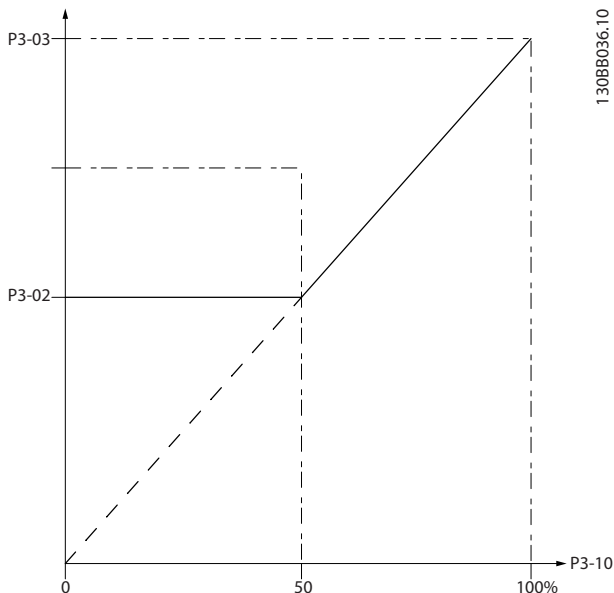


Illustration 3.2 References

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

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

3-14 Preset Relative Reference		
Range:		Function:
0 %*	[-100 - 100 %]	<p>Define the fixed value in % to be added to the variable value defined in 3-18 Relative Scaling Reference Resource, Relative Scaling Reference Source.</p> <p>The sum of fixed and variable values (labelled Y in Illustration 3.3) is multiplied with actual reference (labelled X in Illustration 3.3). This product is added to actual reference <math>X + X \times \frac{Y}{100}</math></p> <div style="text-align: center;"> </div> <p>Reference ID 1308BA059.12</p>

Illustration 3.3 Preset Relative Reference

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

3-16 Reference 2 Source		
Option:	Function:	
		Select the input to be used for the second reference signal. <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> .
[0]	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[7]	Pulse input 29	
[11]	Local bus reference	

3-17 Reference 3 Source		
Option:	Function:	
		Select the reference input to be used for the third reference signal. <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.
[0]	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[7]	Pulse input 29	
[11]	Local bus reference	

### 3.3.3 3-4\* Ramp 1

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

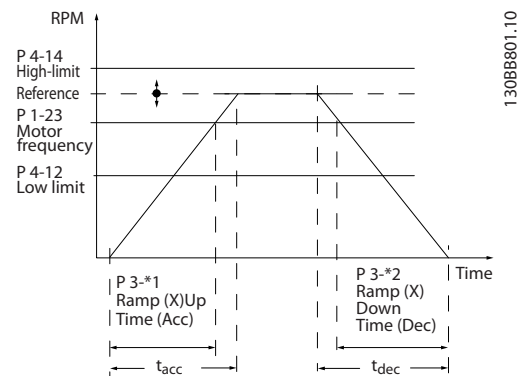


Illustration 3.4 Ramps

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

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

### 3.3.4 3-5\* Ramp 2

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

3-51 Ramp 2 Ramp Up Time		
Range:	Function:	
30.00 s*	[0.05 - 3600 s]	Enter acceleration time from 0 Hz to 1-23 <i>Motor Frequency</i> if asynchronous motor is selected. Enter acceleration time from 0 RPM to 1-25 <i>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 4-18 <i>Current Limit</i> during ramping. See ramp-down time in 3-52 <i>Ramp 2 Ramp Down Time</i> .

3-52 Ramp 2 Ramp Down Time		
Range:	Function:	
30.00 s*	[0.05 - 3600 s]	Enter the ramp-down time, i.e. the deceleration time from <i>1-25 Motor Nominal Speed</i> to 0 RPM. Select a ramp-down time such that no overvoltage arises in the inverter due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in <i>parameter 4-18 Current Limit</i> . See ramp-up time in <i>parameter 3-51 Ramp 2 Ramp Up Time</i> .  $par. 3 - 52 = \frac{t_{dec} \times n_{nom} [par. 1 - 25]}{ref [rpm]} [s]$

### 3.3.5 3-8\* Other Ramps

3-80 Jog Ramp Time		
Range:	Function:	
30.00 s*	[0.05 - 3600 s]	Enter the jog ramp time, i.e. the acceleration/ deceleration time between 0 Hz to <i>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>4-18 Current Limit</i> . The jog ramp time starts upon activation of a jog signal via the control panel, a selected digital input, or the serial communication port.

3-81 Quick Stop Ramp Time		
Range:	Function:	
3.00 s*	[0.05 - 3600 s]	Enter the quick stop ramp time from the <i>1-25 Motor Nominal Speed</i> to 0 Hz. During ramping, no over-voltage may arise in the inverter, nor may the generated current exceed the limit in <i>4-18 Current Limit</i> is activated by means of a signal on a selected digital input or via the serial communication port.

### 3.4 Main Menu - Limits/Warnings - Group 4

#### 3.4.1 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:	
30 Hz* [ 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:	
200.0 Hz* [ 30 - 205 Hz]	Enter the maximum limit for compressor speed. <i>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>4-12 Motor Speed Low Limit [Hz]</i> .	

**NOTICE**

Motor speed high limit cannot be set higher than 4-19 Max Output Frequency.

4-18 Current Limit		
Range:	Function:	
Size related* [ 0 - 300 %]	Enter the current limit for compressor operation (in % of rated compressor current. If the value is higher than maximum rated output from frequency converter, current is still limited to the frequency converters maximum output current). If a setting in <i>1-13 Compressor Selection</i> is changed, <i>4-18 Current Limit</i> is automatically reset to the default value.	

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

#### 3.4.2 4-4\* Adjustable Warnings 2

4-40 Warning Freq. Low		
Range:	Function:	
0.00 Hz* [ 0 - 400 Hz]	Use this parameter to set a lower limit for the frequency range. 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		
Range:	Function:	
400 Hz* [ 0 - 400 Hz]	Use this parameter to set a higher limit for the frequency range. 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.	

#### 3.4.3 4-5\* Adj. Warnings

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

4-50 Warning Current Low		
Range:	Function:	
0 A* [ 0 - 194.0 A]	Enter the I <sub>LOW</sub> 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 on the digital output or the relay output.	

4-51 Warning Current High		
Range:	Function:	
Size related* [ 0.0 - 194.0 A]	Enter the I <sub>HIGH</sub> 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:	
0.000* [ 0 - 6010 ]	Enter the lower reference limit. When the actual reference drops below this limit, the display indicates Ref <sub>LOW</sub> . Terminal 27 and 29 could not be set to output. Only AO42/45 could be set to DO mode.	

4-55 Warning Reference High		
Range:	Function:	
6010* [0 - 6010 ]	Use this parameter to set a higher limit for the reference range. When the actual reference exceeds this limit, the display reads Reference High. Warning bit 19 is set in <i>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		
Range:	Function:	
0 ProcessCtrlUnit*	[0 - 6010 ProcessCtrlUnit]	Use this parameter to set a lower limit for the feedback range. When the feedback drops below this limit, the display reads Feedback Low. Warning bit 6 is set in <i>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		
Range:	Function:	
6010* [0 - 6010]	Use this parameter to set a higher limit for the feedback range. When the feedback exceeds this limit, the display reads Feedback High. Warning bit 5 is set in <i>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:	
	Select [1] On to display an alarm in the event of a missing motor phase. Select [0] Off for no missing motor phase alarm. However, it is strongly recommended to select [1] On to avoid motor damage.	
[0]	Off	No alarm is displayed if a missing motor phase occurs.
[1]	On	An alarm is displayed if a missing motor phase occurs.

### 3.4.4 4-6\* Speed Bypass

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

4-61 Bypass Speed From [Hz]		
Array [3]		
Range:	Function:	
0 Hz*	[0 - 500 Hz]	Some systems call for avoiding certain output speeds due to resonance problems in the system. Enter the lower limits of the speeds to be avoided.

4-63 Bypass Speed To [Hz]		
Array [3]		
Range:	Function:	
0 Hz*	[0 - 500 Hz]	Some systems call for avoiding certain output speeds due to resonance problems in the system. Enter the upper limits of the speeds to be avoided.

### 3.4.5 Semi-Automatic Bypass Speed Set-up

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

Procedure:

1. Stop the compressor.

#### **NOTICE**

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

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

#### **NOTICE**

*5-12 Terminal 27 Digital Input* 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.

4. When sweeping through a resonance band, press [OK] on the LCP when leaving the band. The actual frequency is stored as the first element in parameter *4-63 Bypass Speed To [Hz]* (array).

- Repeat this for each resonance band identified at the ramp-up (maximum of 3 can be adjusted).
5. When maximum speed has been reached, the compressor automatically begins to ramp down. Repeat the above procedure when speed is leaving the resonance bands during the deceleration. The actual frequencies registered when pressing [OK] are stored in *parameter 4-61 Bypass Speed From [Hz]*.
  6. When the compressor has ramped down to stop, press [OK]. The *parameter 4-64 Semi-Auto Bypass Set-up* automatically resets to Off. The frequency converter stays in *Hand On* mode until [Off] or [Auto On] is pressed.

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

4-64 Semi-Auto Bypass Set-up		
Option:	Function:	
[0]	Off	
[1]	Enable	

### 3.5 Main Menu - Digital In/Out - Group 5

#### 3.5.1 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		
Option:	Function:	
		Set NPN or PNP mode for digital inputs 18,19, 27 and 29. Digital input mode
[0] *	PNP	Action on positive directional pulses (0). PNP systems are pulled down to GND.
[1]	NPN	Action on negative directional pulses (1). NPN systems are pulled up to +24 V, internally in the frequency converter.

#### 3.5.2 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 locked alarms can be reset.
[2] Coast inverse	Leaves compressor in free mode. Logic 0⇒coasting stop.
[3] Coast and reset inverse	Reset and coasting stop inverted input (NC). Leaves compressor in free mode and resets the frequency converter. Logic 0⇒coasting stop and reset.
[4] Quick Stop inverse	Inverted input (NC). Generates a stop in accordance with the quick-stop ramp time set in 3-81 <i>Quick Stop Ramp Time</i> . After ramping down, the shaft is in free mode.

Digital input function	Description
[5] DC-brake inverse	Inverted input for DC braking (NC). Stops compressor by energising it with DC current for a certain time period, see 2-01 <i>DC Brake Current</i> . The function is only active when the value in 2-02 <i>DC Braking Time</i> is different from 0. This selection is not possible when 1-10 <i>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.
[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 4-10 <i>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 3-11 <i>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> .



Digital input function	Description
[19] Freeze reference	Freeze the actual reference. The frozen reference is now the point of enable/condition for [21] Speed up and [22] Speed down to be used. If Speed up/down is used, speed change always follows ramp 2 (3-51 Ramp 2 Ramp Up Time and 3-52 Ramp 2 Ramp Down Time) in the range 3-02 Minimum Reference - 3-03 Maximum Reference.
[20] Freeze output	Freezes actual reference. The frozen reference is now the point of enable/condition for [21] Speed up and [22] Speed down to be used. If Speed up/down is used, the speed change always follows ramp 2
[21] Speed up	For digital control of the up/down speed is desired (compressor potentiometer). Activate this function by selecting either [19] Freeze reference or [20] Freeze output. When [21] Speed up is activated for less than 400 ms, the resulting reference is increased by 0.1%. If [21] Speed up is activated for more than 400 ms, the resulting reference ramps according to Ramp 1 in 3-41 Ramp 1 Ramp Up Time.
[22] Speed down	Same as [21] Speed up, but reference decreases.
[23] Set-up select bit 0	Selects one of the 2 set-ups. Set parameter 0-10 Active Set-up to [9] Multi Set-up.
[32] Pulse Input	Select [32] Pulse input when using a pulse sequence as either reference or feedback. Scaling is done in parameter group 5-5* Pulse Input. Available only for terminal 29
[34] Ramp bit 0	Select which ramp to use. Logic 0 selects ramp 1 while logic 1 selects ramp 2.

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

Digital input function	Description
[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 ref.:	Preset ref. bit 2	Preset ref. bit 1	Preset ref. bit 0
Preset reference 0	0	0	0
Preset reference 1	0	0	1
Preset reference 2	0	1	0
Preset reference 3	0	1	1
Preset reference 4	1	0	0
Preset reference 5	1	0	1
Preset reference 6	1	1	0
Preset reference 7	1	1	1

Table 3.3 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	

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:	
[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)	
[62]	Reset Counter A	
[63]	Counter B (up)	
[64]	Counter B (down)	
[65]	Reset Counter B	

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

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)	
[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	

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

### 3.5.3 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 realised 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 (Relay 2)	The compressor runs.
[6]	Running / no warning	The compressor runs, and no warning are present.
[7]	Run in range/no warning	The compressor runs within programmed current ranges, see 4-50 <i>Warning Current Low</i> and 4-51 <i>Warning Current High</i> . No warnings are present.
[8]	Run on ref/no warning	The compressor runs at reference speed and with no warnings.

**5-40 Function Relay**
**Array (Relay 1 [0], Relay 2 [1])**

Select options to define the function of the relays.

The selection of each mechanical relay is realised in an array parameter.

**Option:**
**Function:**

[9] *	Alarm (Relay 1)	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 4-50 <i>Warning Current Low</i> and 4-51 <i>Warning Current High</i> .
[13]	Below current, low	The compressor current is lower than set in 4-50 <i>Warning Current Low</i> .
[14]	Above current, high	The compressor current is higher than set in 4-51 <i>Warning Current High</i> .
[16]	Below speed, low	
[17]	Above speed, high	
[19]	Below feedback, low	
[20]	Above feedback, high	
[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 counter clockwise when logic=1. The output changes as soon as the reversing signal is applied.
[26]	Bus OK	Active communication (no time-out) via serial communication port.
[35]	External Interlock	See chapter 3.5.2 5-1* <i>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.
[41]	Below reference, low	
[42]	Above ref, high	
[45]	Bus Control	

**5-40 Function Relay**
**Array (Relay 1 [0], Relay 2 [1])**

Select options to define the function of the relays.

The selection of each mechanical relay is realised in an array parameter.

**Option:**
**Function:**

[60]	Comparator 0	See parameter group 13-1* <i>Comparators</i> . If Comparator 0 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[61]	Comparator 1	See parameter group 13-1* <i>Comparators</i> . If Comparator 2 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[62]	Comparator 2	See parameter group 13-1* <i>Comparators</i> . If Comparator 2 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[63]	Comparator 3	See parameter group 13-1* <i>Comparators</i> . If Comparator 3 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[64]	Comparator 4	See parameter group 13-1* <i>Comparators</i> . If Comparator 4 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[65]	Comparator 5	See parameter group 13-1* <i>Comparators</i> . If Comparator 5 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[70]	Logic rule 0	See parameter group 13-4* <i>Logic Rules</i> . If Logic rule 0 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[71]	Logic rule 1	See parameter group 13-4* <i>Logic Rules</i> . If Logic rule 1 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[72]	Logic rule 2	See parameter group 13-4* <i>Logic Rules</i> . If Logic rule 2 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[73]	Logic rule 3	See parameter group 13-4* <i>Logic Rules</i> . If Logic rule 3 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[74]	Logic rule 4	See parameter group 13-4* <i>Logic Rules</i> . If Logic rule 4 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[75]	Logic rule 5	See parameter group 13-4* <i>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 parameter 13-52 <i>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 parameter 13-52 <i>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 parameter 13-52 <i>SL Controller Action</i> . The input goes high whenever the smart

**5-40 Function Relay**

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

Select options to define the function of the relays.  
The selection of each mechanical relay is realised in an array parameter.

**Option:                      Function:**

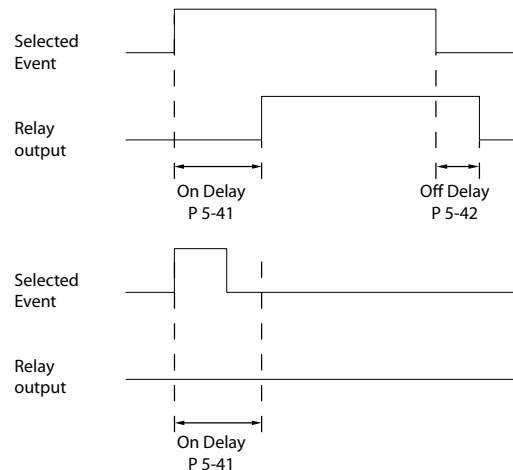
		logic action [40] Set dig. out. C high is executed. The input goes low whenever the smart logic [34] Action Set dig. out. C low is executed.
[83]	SL digital output D	See parameter 13-52 SL Controller Action. The input goes high whenever the smart logic [41] Action Set dig. out. D high is executed. The input goes low whenever the smart logic [35] Action Set dig. out. D low is executed.
[160]	No alarm	The output is high when no alarm is present.
[161]	Running reverse	The output is high when the frequency converter runs counterclockwise (the logical product of the status bits <i>running</i> AND <i>reverse</i> ).
[165]	Local ref. active	The output is high when 3-13 Reference Site=[2] Local or when 3-13 Reference Site=[0] Linked to hand auto at the same time as the LCP is in [Hand on] mode.
[166]	Remote ref. active	The output is high when 3-13 Reference Site is set to [0] Linked to Hand / Auto or [1] Remote, while the LCP is in Auto on mode.
[167]	Start command activ	The output is high when there is an active start command (i.e. 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 Auto on mode (as indicated by the LED light above [Hand on]).
[169]	Drive in auto mode	The output is high when the frequency converter is in Auto on mode (as indicated by the LED light above [Auto on]).

**5-41 On Delay, Relay**

Array [9], (Relay 1 [0], Relay 2 [1], Relay 3 [2], Relay 4 [3], Relay 5 [4], Relay 6 [5], Relay 7 [6], Relay 8 [7], Relay 9 [8])

**Range:                      Function:**

0.01 s*	[0 - 600 s]	Enter the delay of the relay cut-in time. The relay only cuts in if the condition in 5-40 Function Relay is uninterrupted during the specified time.
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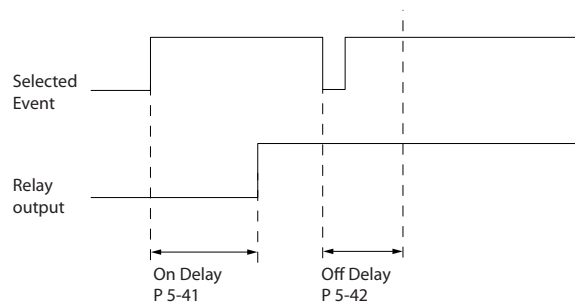
Illustration 3.5 On Delay, Relay

**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.
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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.

**3.5.4 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 (5-13 Terminal 29 Digital Input) or terminal 33 (5-15 Terminal 33 Digital Input) to [32] Pulse input. If terminal 29 is used as an input, set 5-01 Terminal 27 Mode to [0] Input.

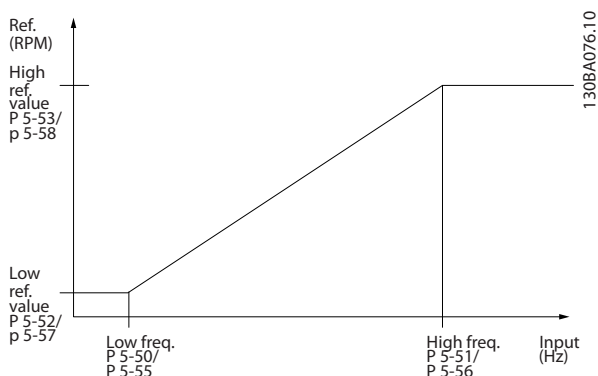


Illustration 3.7 Pulse Input

### 3.5.5 5-9\* Bus Controlled

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

5-90 Digital & Relay Bus Control		
Range:	Function:	
0 *	[0 - 0xFFFFFFFF ]	This parameter holds the state of the digital outputs and relays that is controlled by bus. A logical 1 indicates that the output is high or active. A logical 0 indicates that the output is low or inactive.

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 (i.e. low reference value) in 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 (i.e. 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, see also 5-57 Term. 33 Low Ref./Feedb. Value. Set terminal 29 to digital input (5-02 Terminal 29 Mode=[0] input (default) and 5-13 Terminal 29 Digital Input=applicable value).

5-53 Term. 29 High Ref./Feedb. Value		
Range:	Function:	
50*	[-4999 - 4999 ]	Enter the high reference value [RPM] for the compressor shaft speed and the high feedback value, see also 5-58 Term. 33 High Ref./Feedb. Value. Select terminal 29 as a digital input (5-02 Terminal 29 Mode=[0] input (default) and 5-13 Terminal 29 Digital Input=applicable value).

Bit 0-3	Reserved
Bit 4	Relay 1 output terminal
Bit 5	Relay 2 output terminal
Bit 6-23	Reserved
Bit 24	Terminal 42 digital output
Bit 25	Terminal 45 digital output
Bit 26-31	Reserved

Table 3.4 Bit Functions

### 3.6 Main Menu - Analog In/Out - Group 6

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

- Terminal 53
- Terminal 54

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

#### 3.6.1 6-0\* Analog I/O Mode

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

6-01 Live Zero Timeout Function		
Option:	Function:	
	Select the time-out function. The function set in <i>parameter 6-01 Live Zero Timeout Function</i> is activated, if the input signal on terminal 53 or 54 is below 50% of the value 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> for a time period defined in <i>parameter 6-00 Live Zero Timeout Time</i> .	
[0]	Off	
[1]	Freeze output	
[2]	Stop	
[3]	Jogging	
[4]	Max. speed	
[5]	Stop and trip	

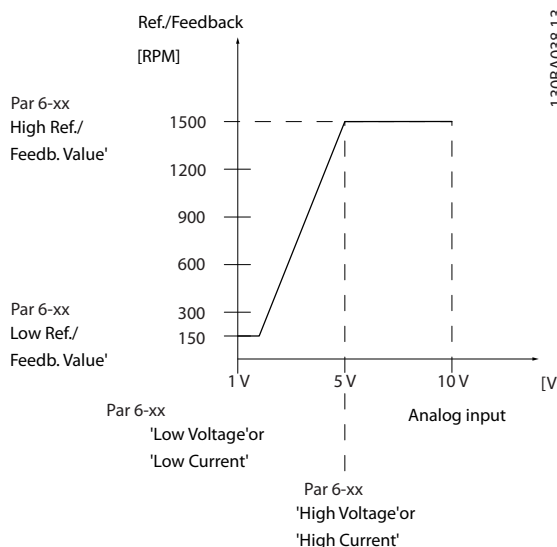


Illustration 3.8 Live Zero Time-out Function

#### 3.6.2 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>6-14 Terminal 53 Low Ref./Feedb. Value</i> . The value must be set at >1 V to activate <i>parameter 6-01 Live Zero Timeout Function</i> .

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>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 should correspond to the low reference/feedback value, set in <i>6-14 Terminal 53 Low Ref./Feedb. Value</i> . The value must be set to >2 mA to activate <i>parameter 6-01 Live Zero Timeout Function</i> .

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>6-15 Terminal 53 High Ref./Feedb. Value</i> .

6-14 Terminal 53 Low Ref./Feedb. Value		
Range:	Function:	
30.000* [-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:	
200.000* [-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 is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal 53. A high time constant value improves dampening, but also increases the time delay through the filter.	

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

### 3.6.3 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> ). The value must be set at >1 V to activate <i>parameter 6-01 Live Zero Timeout Function</i> .	

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 <i>6-25 Terminal 54 High Ref./Feedb. Value</i> ).	

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

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 <i>6-25 Terminal 54 High Ref./Feedb. Value</i> .	

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 <i>parameter 6-21 Terminal 54 High Voltage/parameter 6-22 Terminal 54 Low Current</i> .	

6-25 Terminal 54 High Ref./Feedb. Value		
Range:	Function:	
50.000* [-4999 - 4999 ]	Enter the reference or feedback value that corresponds to the voltage or current set in <i>parameter 6-21 Terminal 54 High Voltage/6-23 Terminal 54 High Current</i> .	

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

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

### 3.6.4 6-7\* Analog/Digital Output 45

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



6-70 Terminal 45 Mode		
Option:	Function:	
		Set terminal 45 to act as analog output or as digital output.
[0]	0-20 mA	
[1]	4-20 mA	
[2]	Digital Output	

6-71 Terminal 45 Analog Output		
Option:	Function:	
		Select the function of terminal 45 as an analog current output. See also <i>parameter 6-70 Terminal 45 Mode</i> .
[0] *	No operation	
[100]	Output frequency	0-400 Hz
[101]	Reference	Min <sub>Ref.</sub> - Max <sub>Ref.</sub>
[102]	Feedback	Min <sub>FB</sub> - Max <sub>FB</sub>
[103]	Motor Current	0-I <sub>max</sub>
[106]	Power	0-P <sub>nom</sub>
[139]	Bus Control	0-100%
[254]	DC Link Voltage	

6-72 Terminal 45 Digital Output		
Option:	Function:	
		Select the function of terminal 45 as a digital current output. See also <i>parameter 6-70 Terminal 45 Mode</i> . See <i>5-40 Function Relay</i> for description of the options.
[0] *	No operation	
[1]	Control Ready	
[2]	Drive ready	
[3]	Drive ready/remote control	
[4]	Standby / no warning	
[5]	Drive running	
[6]	Running / no warning	
[7]	Run in range/no warning	
[8]	Run on ref/no warning	
[9]	Alarm	
[10]	Alarm or warning	
[12]	Out of current range	
[13]	Below current, low	
[14]	Above current, high	
[16]	Below speed, low	
[17]	Above speed, high	
[19]	Below feedback, low	
[20]	Above feedback, high	
[21]	Thermal warning	
[22]	Ready, no thermal warning	

6-72 Terminal 45 Digital Output		
Option:	Function:	
[23]	Remote, ready, no thermal warning	
[24]	Ready, Voltage OK	
[25]	Reverse	
[26]	Bus OK	
[35]	External Interlock	
[36]	Control word bit 11	
[37]	Control word bit 12	
[41]	Below reference, low	
[42]	Above ref, high	
[45]	Bus Control	
[60]	Comparator 0	
[61]	Comparator 1	
[62]	Comparator 2	
[63]	Comparator 3	
[64]	Comparator 4	
[65]	Comparator 5	
[70]	Logic rule 0	
[71]	Logic rule 1	
[72]	Logic rule 2	
[73]	Logic rule 3	
[74]	Logic rule 4	
[75]	Logic rule 5	
[80]	SL digital output A	
[81]	SL digital output B	
[82]	SL digital output C	
[83]	SL digital output D	
[160]	No alarm	
[161]	Running reverse	
[165]	Local ref. active	
[166]	Remote ref. active	
[167]	Start command activ	
[168]	Drive in hand mode	
[169]	Drive in auto mode	

6-73 Terminal 45 Output Min Scale		
Range:	Function:	
0 %*	[0 - 200 %]	Scale for the minimum output (0 or 4 mA) of the analog signal at terminal 45. Set the value to be the percentage of the full range of the variable selected in <i>6-71 Terminal 45 Analog Output</i> .
0.0%*	[0.0-200.0%]	

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

6-74 Terminal 45 Output Max Scale		
Range:	Function:	
100.0%*	[0.0-200.0%]	<p><b>Illustration 3.9 Output Max Scale</b></p>

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

### 3.6.5 6-9\* Analog/Digital Output 42

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

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

6-91 Terminal 42 Analog Output		
Option:	Function:	
		Select the function of terminal 42 as an analog current output. See also 6-90 Terminal 42 Mode.
[0] *	No operation	
[100]	Output frequency	0-100 Hz
[101]	Reference	Min <sub>Ref.</sub> - Max <sub>Ref.</sub>
[102]	Feedback	Min <sub>FB</sub> - Max <sub>FB</sub>
[103]	Motor Current	0-I <sub>max</sub>
[106]	Power	0-P <sub>nom</sub>
[139]	Bus Control	0-100%
[254]	DC Link Voltage	

6-92 Terminal 42 Digital Output		
Option:	Function:	
		Select the function of Terminal 42 as an analog current output. See also 6-90 Terminal 42 Mode. See 5-40 Function Relay for description of the choices.
[0] *	No operation	
[1]	Control Ready	
[2]	Drive ready	
[3]	Drive ready/remote control	
[4]	Standby / no warning	
[5]	Drive running	
[6]	Running / no warning	
[7]	Run in range/no warning	
[8]	Run on ref/no warning	
[9]	Alarm	
[10]	Alarm or warning	
[12]	Out of current range	
[13]	Below current, low	
[14]	Above current, high	
[16]	Below speed, low	
[17]	Above speed, high	
[19]	Below feedback, low	
[20]	Above feedback, high	
[21]	Thermal warning	
[22]	Ready, no thermal warning	
[23]	Remote, ready, no thermal warning	
[24]	Ready, Voltage OK	
[25]	Reverse	
[26]	Bus OK	
[35]	External Interlock	
[36]	Control word bit 11	
[37]	Control word bit 12	
[41]	Below reference, low	
[42]	Above ref, high	
[45]	Bus Control	
[60]	Comparator 0	
[61]	Comparator 1	
[62]	Comparator 2	
[63]	Comparator 3	
[64]	Comparator 4	
[65]	Comparator 5	
[70]	Logic rule 0	
[71]	Logic rule 1	
[72]	Logic rule 2	
[73]	Logic rule 3	
[74]	Logic rule 4	
[75]	Logic rule 5	
[80]	SL digital output A	
[81]	SL digital output B	

**6-92 Terminal 42 Digital Output**

Option:		Function:
[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 or 4 mA) of the analog signal at terminal 42. Set the value to be the percentage of the full range of the variable selected in 6-91 Terminal 42 Analog Output.

**6-94 Terminal 42 Output Max Scale**

Range:	Function:
100 %* [0 - 200 %]	<p>Scale for the maximum output (20 mA) of the scaling at terminal 42. Set the value to be the percentage of the full range of the variable selected in 6-91 Terminal 42 Analog Output.</p> <p style="text-align: center;"> <small>Current (mA)</small>  <small>20</small>  <small>0/4</small>  <small>0% Analogue output Min Scale par. 6-93</small>              <small>Analogue Output Max Scale par. 6-94</small>              <small>100% Variable for output example: Power</small> </p> <p><b>Illustration 3.10 Output Max Scale</b></p>

**6-96 Terminal 42 Output Bus Control**

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

### 3.7 Main Menu - Communications and Options - Group 8

#### 3.7.1 8-0\* General Settings

8-01 Control Site		
Option:	Function:	
		This parameter overrules settings in <i>parameter 8-50 Coasting Select</i> to <i>parameter 8-56 Preset Reference Select</i> .
[0]	Digital and ctrl.word	Control by using both digital input and control word.
[1]	Digital only	Control by using digital inputs only.
[2]	Controlword only	Control by using control word only.

8-02 Control Source		
Option:	Function:	
		<b>NOTICE</b> This parameter cannot be adjusted while the compressor is running.  Select the source of the control word.
[0]	None	
[1]	FC Port	

8-03 Control Timeout Time		
Range:	Function:	
20.0 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>8-04 Control Timeout Function Control Time-out Function</i> is carried out.

8-04 Control Timeout Function		
Option:	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>8-03 Control Timeout Time</i> .
[0] *	Off	
[1]	Freeze output	
[2]	Stop	
[3]	Jogging	
[4]	Max. speed	
[5]	Stop and trip	
[20]	N2 Override Release	

#### 3.7.2 8-3\* FC Port Settings

8-30 Protocol		
Option:	Function:	
		Select the protocol for the integrated RS-485 port.
[0] *	FC	Communication according to the FC Protocol.
[2]	Modbus RTU	Communication according to the Modbus RTU protocol.

8-31 Address		
Range:	Function:	
1* [0.0 - 247 ]		Enter the address for the RS-485 port. Valid range: 1-126 for FC-bus OR 1-247 for Modbus.

8-32 Baud Rate		
Option:	Function:	
		Select the baud rate for the RS-485 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>8-30 Protocol</i> may change the Baud Rate.
[0]	2400 Baud	
[1]	4800 Baud	
[2] *	9600 Baud	
[3]	19200 Baud	
[4]	38400 Baud	
[5]	57600 Baud	
[6]	76800 Baud	
[7]	115200 Baud	

8-33 Parity / Stop Bits		
Option:	Function:	
		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.
[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:
Size related*	[ 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:
5.0 s*	[ 0.1 - 10.0 s]	Specify the maximum permissible delay time between receiving a request and transmitting the response. If this time is exceeded, no response is returned.

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

8-42 PCD Write Configuration		
Range:		Function:
[0] *	None	
[1]	[302] Minimum Reference	
[2]	[303] Maximum Reference	
[3]	[341] Ramp 1 Ramp up time	
[4]	[342] Ramp 1 Ramp down time	
[5]	[351] Ramp 2 Ramp up time	
[6]	[352] Ramp 2 Ramp down time	
[7]	[380] Jog Ramp Time	
[8]	[381] Quick Stop Time	
[9]	[412] Motor Speed Low Limit [Hz]	
[10]	[414] Motor Speed High Limit [Hz]	
[11]	[590] Digital & Relay Bus Control	
[12]	[676] Terminal45 Output Bus Control	
[13]	[696] Terminal 42 Output Bus Control	
[14]	[894] Bus Feedback 1	
[15]	FC Port CTW	
[16]	FC Port REF	

8-43 PCD Read Configuration		
Range:		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]	

8-43 PCD Read Configuration		
Range:		Function:
[11]	[1611] Power [hp]	
[12]	[1612] Motor Voltage	
[13]	[1613] Frequency	
[14]	[1614] Motor Current	
[15]	[1615] Frequency [%]	
[16]	[1618] Motor Thermal	
[17]	[1630] DC Link Voltage	
[18]	[1634] Heatsink Temp.	
[19]	[1635] Inverter Thermal	
[20]	[1638] SL Controller State	
[21]	[1650] External Reference	
[22]	[1652] Feedback [Unit]	
[23]	[1660] Digital Input 18,19,27,33	
[24]	[1661] Terminal 53 Switch Setting	
[25]	[1662] Analog Input 53(V)	
[26]	[1663] Terminal 54 Switch Setting	
[27]	[1664] Analog Input 54	
[28]	[1665] Analog Output 42 [mA]	
[29]	[1671] Relay Output [bin]	
[30]	[1672] Counter A	
[31]	[1673] Counter B	
[32]	[1690] Alarm Word	
[33]	[1692] Warning Word	
[34]	[1694] Ext. Status Word	
[36]	[2860] RPS Readout	

### 3.7.3 8-5\* Digital/Bus

Parameters for configuring the control word Digital/Bus merging.

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

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

8-52 DC Brake Select		
Option:	Function:	
		Select control of the DC brake via the terminals (digital input). <b>NOTICE</b> This parameter is active only when <i>parameter 8-01 Control Site</i> is set to [0] <i>Digital and control word</i> .
[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 additionally 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		
Option:	Function:	
		Select control of the frequency converter <i>Start</i> function via the terminals (digital input). <b>NOTICE</b> This parameter is active only when <i>parameter 8-01 Control Site</i> is set to [0] <i>Digital and control word</i> .
[0]	Digital input	Activates a start command via a digital input.
[1]	Bus	Activates a start command via the serial communication port.

8-53 Start Select		
Option:	Function:	
[2]	Logic AND	Activates a start command via the serial communication port, AND additionally via one of the digital inputs.
[3]	Logic OR	Activates a start command via the serial communication port OR via one of the digital inputs.

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

8-55 Set-up Select		
Option:	Function:	
		Select control of the frequency converter set-up selection via the terminals (digital input) and/or via the serial communication port. <b>NOTICE</b> This parameter is active only when <i>parameter 8-01 Control Site</i> is set to [0] <i>Digital and control word</i> .
[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 additionally via one of the digital inputs.
[3]	Logic OR	Activate the set-up selection via the serial communication port OR via one of the digital inputs.

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

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

### 3.7.5 8-9\* Bus Feedback

### 3.7.4 8-8\* FC Port Diagnostics

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

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

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

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

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

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

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

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

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

### 3.8 Main Menu - Smart Logic - Group 13

#### 3.8.1 13-\*\* Prog. Features

Smart logic control (SLC) is a sequence of user-defined actions (see 13-52 *SL Controller Action* [x]) executed by the SLC when the associated user-defined event (see 13-51 *SL Controller Event* [x]) is evaluated as TRUE by the SLC. Events and actions are each numbered and linked in pairs. This means that when [0] event is fulfilled (attains the value TRUE), [0] action is executed. After this, the conditions of [1] event is evaluated and if evaluated TRUE, [1] action is executed and so on. Only one event is evaluated at any time. If an event is evaluated as FALSE, nothing happens (in the SLC) during the current scan interval and no other events are evaluated. This means that when the SLC starts, it evaluates [0] event (and only [0] event) each scan interval. Only when [0] event is evaluated TRUE, the SLC executes [0] action and start evaluating [1] event. It is possible to programme from 1 to 20 events and actions. When the last event/action have been executed, the sequence starts over again from [0] event/[0] action.

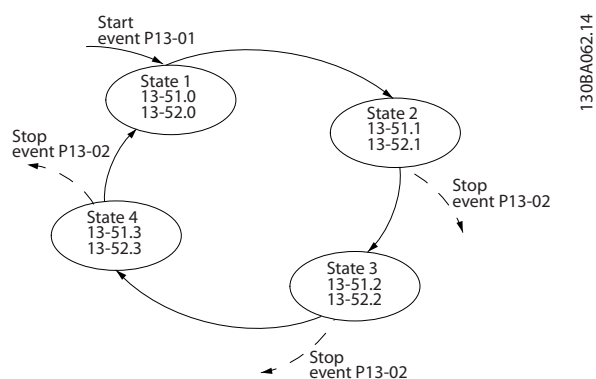


Illustration 3.11 Example with 3 Event/Actions

#### Starting and stopping the SLC

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

#### 3.8.2 13-0\* SLC Settings

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

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

13-01 Start Event		
Option:	Function:	
		Select the boolean (TRUE or FALSE) input to activate smart logic control.
[0]	False	Enters the fixed value of FALSE in the logic rule.
[1]	True	Enters the fixed value TRUE in the logic rule.
[2]	Running	The compressor is running.
[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 4-18 <i>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.



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

13-02 Stop Event		
Option:	Function:	
		Select the condition (TRUE or FALSE) which deactivates the smart logic controller.
[0]	False	Enters the fixed value of FALSE in the logic rule.
[1]	True	Enters the fixed value TRUE in the logic rule.
[2]	Running	See 13-01 Start Event for further description.
[3]	In range	See 13-01 Start Event for further description.
[4]	On reference	See 13-01 Start Event for further description.

13-02 Stop Event		
Option:	Function:	
[7]	Out of current range	See 13-01 Start Event for further description.
[8]	Below I low	See 13-01 Start Event for further description.
[9]	Above I high	See 13-01 Start Event for further description.
[16]	Thermal warning	See 13-01 Start Event for further description.
[17]	Mains out of range	See 13-01 Start Event for further description.
[18]	Reversing	See 13-01 Start Event for further description.
[19]	Warning	See 13-01 Start Event for further description.
[20]	Alarm (trip)	See 13-01 Start Event for further description.
[21]	Alarm (trip lock)	See 13-01 Start Event for further description.
[22]	Comparator 0	Use the result of comparator 0 in the logic rule.
[23]	Comparator 1	Use the result of comparator 1 in the logic rule.
[24]	Comparator 2	Use the result of comparator 2 in the logic rule.
[25]	Comparator 3	Use the result of comparator 3 in the logic rule.
[26]	Logic rule 0	Use the result of logic rule 0 in the logic rule.
[27]	Logic rule 1	Use the result of logic rule 1 in the logic rule.
[28]	Logic rule 2	Use the result of logic rule 2 in the logic rule.
[29]	Logic rule 3	Use the result of logic rule 3 in the logic rule.
[30]	SL Time-out 0	Use the result of timer 0 in the logic rule.
[31]	SL Time-out 1	Use the result of timer 1 in the logic rule.
[32]	SL Time-out 2	Use the result of timer 2 in the logic rule.
[33]	Digital input DI18	Use the value of DI18 in the logic rule (High=TRUE).
[34]	Digital input DI19	
[35]	Digital input DI27	Use the value of DI27 in the logic rule (High=TRUE).

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

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

### 3.8.3 13-1\* Comparators

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

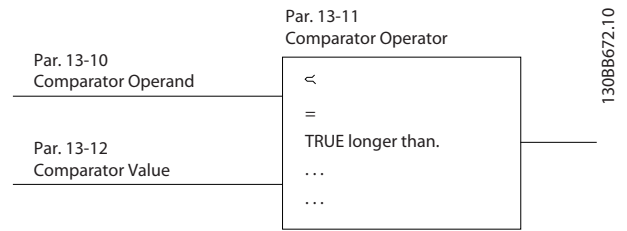


Illustration 3.12 Comparators

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

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

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

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

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

### 3.8.4 13-2\* Timers

Use the result (TRUE or FALSE) from *timers* directly to define an *event* (see 13-51 *SL Controller Event*), or as boolean input in a *logic rule* (see 13-40 *Logic Rule Boolean 1*, 13-42 *Logic Rule Boolean 2* or 13-44 *Logic Rule Boolean 3*). A timer is only FALSE when started by an action (i.e. [29] *Start timer 1*) until the timer value entered in this parameter is elapsed. Then it becomes TRUE again. All parameters in this parameter group are array parameters with index 0 to 2. Select index 0 to program timer 0, select index 1 to program timer 1, and so on.

13-20 SL Controller Timer		
Array [8]		
<b>Range:</b>		<b>Function:</b>
0 s*	[0 - 3600 s]	Enter the value to define the duration of the FALSE output from the programmed timer. A timer is only FALSE if it is started by an action (see 13-52 <i>SL Controller Action</i> [29-31] and 13-52 <i>SL Controller Action</i> [70-74] <i>Start timer X</i> ) and until the timer value has elapsed. Array parameter containing timers 0 to 7.

### 3.8.5 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 13-40 *Logic Rule Boolean 1*, 13-42 *Logic Rule Boolean 2* and 13-44 *Logic Rule Boolean 3*. Define the operators used to logically combine the selected inputs in *parameter 13-41 Logic Rule Operator 1* and *parameter 13-43 Logic Rule Operator 2*.

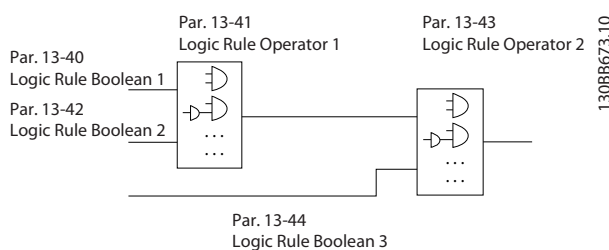


Illustration 3.13 Logic Rules

#### Priority of calculation

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

13-40 Logic Rule Boolean 1		
Array [6]		
<b>Option:</b>		<b>Function:</b>
[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 13-01 <i>Start Event</i> for further description.
[3]	In range	See 13-01 <i>Start Event</i> for further description.
[4]	On reference	See 13-01 <i>Start Event</i> for further description.
[7]	Out of current range	See 13-01 <i>Start Event</i> for further description.
[8]	Below l low	See 13-01 <i>Start Event</i> for further description.
[9]	Above l high	See 13-01 <i>Start Event</i> for further description.
[16]	Thermal warning	See 13-01 <i>Start Event</i> for further description.
[17]	Mains out of range	See 13-01 <i>Start Event</i> for further description.
[18]	Reversing	See 13-01 <i>Start Event</i> for further description.
[19]	Warning	See 13-01 <i>Start Event</i> for further description.
[20]	Alarm (trip)	See 13-01 <i>Start Event</i> for further description.
[21]	Alarm (trip lock)	See 13-01 <i>Start Event</i> for further description.

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

13-40 Logic Rule Boolean 1		
Array [6]		
Option:	Function:	
[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		
Option:	Function:	
[0]	Disabled	
[1]	AND	
[2]	OR	
[3]	AND NOT	
[4]	OR NOT	
[5]	NOT AND	
[6]	NOT OR	
[7]	NOT AND NOT	
[8]	NOT OR NOT	

13-42 Logic Rule Boolean 2		
Array [6]		
Option:	Function:	
		Select the second boolean (TRUE or FALSE) input for the selected logic rule.  See 13-40 Logic Rule Boolean 1 for further descriptions of options and their functions.
[0] *	False	
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	

13-42 Logic Rule Boolean 2		
Array [6]		
Option:	Function:	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL Time-out 0	
[31]	SL Time-out 1	
[32]	SL Time-out 2	
[33]	Digital input DI18	
[34]	Digital input DI19	
[35]	Digital input DI27	
[36]	Digital input DI29	
[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]		
Option:	Function:	
	Select the second logical operator to be used on the boolean input calculated in <i>13-40 Logic Rule Boolean 1</i> , <i>parameter 13-41 Logic Rule Operator 1</i> , and <i>13-42 Logic Rule Boolean 2</i> , and the boolean input coming from <i>13-42 Logic Rule Boolean 2</i> . [13-44] signifies the boolean input of <i>13-44 Logic Rule Boolean 3</i> . [13-40/13-42] signifies the boolean input calculated in <i>13-40 Logic Rule Boolean 1</i> , <i>parameter 13-41 Logic Rule Operator 1</i> , and <i>13-42 Logic Rule Boolean 2</i> . [0] Disabled (factory setting). select this option to ignore <i>13-44 Logic Rule Boolean 3</i> .	
[0]	Disabled	
[1]	AND	
[2]	OR	
[3]	AND NOT	

13-43 Logic Rule Operator 2		
Array [6]		
Option:	Function:	
[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]		
Option:	Function:	
	Select the third boolean (TRUE or FALSE) input for the selected logic rule.  See <i>13-40 Logic Rule Boolean 1</i> for further descriptions of options and their functions.	
[0] *	False	
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL Time-out 0	
[31]	SL Time-out 1	
[32]	SL Time-out 2	
[33]	Digital input DI18	
[34]	Digital input DI19	
[35]	Digital input DI27	
[36]	Digital input DI29	
[39]	Start command	
[40]	Drive stopped	
[42]	Auto Reset Trip	
[50]	Comparator 4	
[51]	Comparator 5	
[60]	Logic rule 4	

13-44 Logic Rule Boolean 3		
Array [6]		
Option:	Function:	
[61]	Logic rule 5	
[70]	SL Time-out 3	
[71]	SL Time-out 4	
[72]	SL Time-out 5	
[73]	SL Time-out 6	
[74]	SL Time-out 7	

### 3.8.6 13-5\* States

13-51 SL Controller Event		
Array [20]		
Option:	Function:	
		Select the boolean input (TRUE or FALSE) to define the smart logic controller event.  See 13-02 Stop Event for further descriptions of options and their functions.
[0] *	False	
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[16]	Thermal warning	
[17]	Mains out of range	
[18]	Reversing	
[19]	Warning	
[20]	Alarm (trip)	
[21]	Alarm (trip lock)	
[22]	Comparator 0	
[23]	Comparator 1	
[24]	Comparator 2	
[25]	Comparator 3	
[26]	Logic rule 0	
[27]	Logic rule 1	
[28]	Logic rule 2	
[29]	Logic rule 3	
[30]	SL Time-out 0	
[31]	SL Time-out 1	
[32]	SL Time-out 2	
[33]	Digital input DI18	
[34]	Digital input DI19	
[35]	Digital input DI27	
[36]	Digital input DI29	
[39]	Start command	
[40]	Drive stopped	
[42]	Auto Reset Trip	

13-51 SL Controller Event		
Array [20]		
Option:	Function:	
[50]	Comparator 4	
[51]	Comparator 5	
[60]	Logic rule 4	
[61]	Logic rule 5	
[70]	SL Time-out 3	
[71]	SL Time-out 4	
[72]	SL Time-out 5	
[73]	SL Time-out 6	
[74]	SL Time-out 7	

13-52 SL Controller Action		
Array [20]		
Option:	Function:	
		Select the action corresponding to the SLC event. Actions are executed when the corresponding event (defined in 13-51 SL Controller Event) is evaluated as true. The following actions are available for selection:
[0] *	Disabled	
[1]	No action	
[2]	Select set-up 1	Changes the active set-up (parameter 0-10 Active Set-up) to 1.
[3]	Select set-up 2	Changes the active set-up (parameter 0-10 Active Set-up) to 2.
[10]	Select preset ref 0	Selects preset reference 0.
[11]	Select preset ref 1	Selects preset reference 1.
[12]	Select preset ref 2	Selects preset reference 2.
[13]	Select preset ref 3	Selects preset reference 3.
[14]	Select preset ref 4	Selects preset reference 4.
[15]	Select preset ref 5	Selects preset reference 5.
[16]	Select preset ref 6	Selects preset reference 6.
[17]	Select preset ref 7	Selects preset reference 7. If the active preset reference is changed, it merges with other preset reference commands coming from either the digital inputs or via a fieldbus.
[18]	Select ramp 1	Selects ramp 1.
[19]	Select ramp 2	Selects ramp 2.
[22]	Run	Issues a start command to the frequency converter.

13-52 SL Controller Action		
Array [20]		
Option:	Function:	
[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).
[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.

13-52 SL Controller Action		
Array [20]		
Option:	Function:	
[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]	Reset/Alarm	

### 3.9 Main Menu - Special Functions - Group 14

#### 3.9.1 14-0\* Inverter Switching

14-01 Switching Frequency		
Option:	Function:	
		Select the inverter switching frequency. Changing the switching frequency can help to reduce acoustic noise from the compressor.
		<b>NOTICE</b> 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 14-01 Switching Frequency until the compressor is as noiseless as possible.
		<b>NOTICE</b> High switching frequencies heat the frequency converter and may reduce its lifetime.
		<b>NOTICE</b> Not all choices are available in all power sizes.
[0]	Ran3	3 kHz true random PWM (white noise modulation)
[1]	Ran5	5 kHz true random PWM (white noise modulation)
[2]	2.0 kHz	
[3]	3.0 kHz	
[4]	4.0 kHz	
[5] *	5.0 kHz	
[6]	6.0 kHz	
[7]	8.0 kHz	
[8]	10.0 kHz	
[9]	12.0 kHz	
[10]	16.0 kHz	

14-03 Overmodulation		
Option:	Function:	
[0]	Off	Selects no overmodulation of the output voltage to avoid torque ripple on the 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 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).

#### 3.9.2 14-1\* Mains On/Off

Parameters for configuring mains failure monitoring and handling.

14-10 Mains Failure		
Option:	Function:	
[0] *	No function	
[3]	Coasting	

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

14-12 Function at Mains Imbalance		
Option:	Function:	
		Operation under severe mains imbalance conditions reduces the lifetime of the compressor. Conditions are considered severe if the compressor is operated continuously near nominal load. When a severe mains imbalance is detected, select one of the available functions.
[0]	Trip	Trips the frequency converter.
[1]	Warning	Issues a warning.
[2]	Disabled	No action. <b>CAUTION</b> May cause reduced life time.
[3] *	Derate	Derates the load by mains imbalance.

#### 3.9.3 14-2\* Trip Reset

14-20 Reset Mode		
Option:	Function:	
		<b>NOTICE</b> Automatic reset is also active for resetting the STO function.  Select the reset function after tripping. Once reset, the frequency converter can be restarted.
[0]	Manual reset	Select [0] Manual reset, to perform a reset via [Reset] or via the digital inputs.



14-20 Reset Mode		
Option:	Function:	
[1]	Automatic reset x 1	Select [1]-[12] <i>Automatic reset x 1... x20</i> to perform between 1 and 20 automatic resets after tripping.
[2]	Automatic reset x 2	
[3]	Automatic reset x 3	
[4]	Automatic reset x 4	
[5]	Automatic reset x 5	
[6]	Automatic reset x 6	
[7]	Automatic reset x 7	
[8]	Automatic reset x 8	
[9]	Automatic reset x 9	
[10] *	Automatic reset x 10	
[11]	Automatic reset x 15	
[12]	Automatic reset x 20	
[13]	Infinite auto reset	Select [13] <i>Infinite Automatic Reset</i> for continuous resetting after tripping.

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

14-22 Operation Mode		
Option:	Function:	
		Select [2] <i>Initialisation</i> to reset all parameter values to default.
[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	Select [2] <i>Initialisation</i> to reset all parameter values to default settings, 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> .

14-90 Fault Level		
Use this parameter to customise fault levels. Use [0] <i>Off</i> 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	

### 3.10 Main Menu - Drive Information - Group 15

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

#### 3.10.1 15-0\* Operating Data

15-00 Operating hours		
Range:	Function:	
0 h* [0 - 2147483647 h]	View how many hours the frequency converter has run. The value is saved when the frequency converter is turned off.	

15-01 Running Hours		
Range:	Function:	
0 h* [0 - 2147483647 h]	View how many hours the compressor has run. Reset the counter in <i>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 which have occurred.	

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

15-06 Reset kWh Counter		
Option:	Function:	
	<b>NOTICE</b> Pres [OK] to reset.	
[0]	Do not reset	
[1]	Reset counter	Select [1] <i>Reset</i> and press [OK] to reset the kWh counter to zero (see <i>15-02 kWh Counter</i> ).

15-07 Reset Running Hours Counter		
Option:	Function:	
[0] *	Do not reset	
[1]	Reset counter	Select [1] <i>Reset counter</i> and press [OK] to reset the running hours counter

15-07 Reset Running Hours Counter		
Option:	Function:	
		( <i>15-01 Running Hours</i> ) to zero (see also <i>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>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.	

#### 3.10.2 15-3\* Alarm Log

Parameters in this group are array parameters, where up to 10 fault logs can be viewed. [0] is the most recent logged data, and [9] the oldest. Error codes, values, and time stamp can be viewed for all logged data.

15-30 Alarm Log: Error Code		
Range:	Function:	
0 * [0 - 255 ]	View the error code and look up its meaning in <i>chapter 4 Troubleshooting</i> .	

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

#### 3.10.3 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 read-out is identical to the frequency converter series power field of the type code definition, characters 11-12.

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

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

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

Range:	Function:	
0*	[0 - 0 ]	View the power card ordering number.

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 ]	

### 3.11 Main Menu - Data Readouts - Group 16

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

Table 3.5 Control Word

16-01 Reference [Unit]		
Range:	Function:	
0 ReferenceFeed-backUnit*	[-4999 - 4999 ReferenceFeed-backUnit]	View the present reference value applied on impulse or analog basis in the unit resulting from the configuration selected in 1-00 Configuration Mode (Hz).

16-02 Reference [%]		
Range:	Function:	
0 %*	[-200 - 200 %]	View the total reference. The total reference is the sum of digital, analog, preset, bus, and freeze references.

16-03 Status Word		
Range:	Function:	
0 *	[0 - 65535 ]	View the status word sent from the frequency converter via the serial communication port in hex code.

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

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

#### 3.11.2 16-1\* Motor Status

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

16-11 Power [hp]		
Range:	Function:	
0 hp* [0 - 1000 hp]	View the the actual compressor power in hp. The value shown is calculated on the basis of 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 dampening.	

16-14 Motor current		
Range:	Function:	
0 A* [0 - 655.35 A]	View the compressor current measured as a mean value, I <sub>RMS</sub> .	

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

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

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 1-90 Motor Thermal Protection. The basis for the calculation is the ETR function selected in 1-90 Motor Thermal Protection.	

16-22 Torque [%]		
Range:	Function:	
0 %* [-200 - 200 %]	This is a read-out 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 1-20 Motor Power or 1-21 Motor Power [HP] and 1-25 Motor Nominal Speed. This is the value monitored by the Broken Belt Function set in parameter group 22-6*.	

### 3.11.3 16-3\* Drive Status

16-30 DC Link Voltage		
Range:	Function:	
0 V* [0 - 65535 V]	Display 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 are used for compressor protection, etc.	

16-37 Inv. Max. Current		
Range:	Function:	
0 A* [0 - 655.35 A]	View the inverter maximum current. The data are used for calculation of frequency converter protection, etc.	

16-38 SL Controller State		
Range:	Function:	
0 * [0 - 20 ]	View the actual state of the smart logic controller (SLC).	

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

16-54 Feedback 1 [Unit]		
Range:		Function:
0 ProcessCtrlUnit*	[-999999.999 - 999999.999 ProcessCtrlUnit]	View value of Feedback 1, see parameter group 20-0* <i>Feedback</i> .

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

### 3.11.5 16-6\* Inputs and Outputs

16-60 Digital Input																
Range:		Function:														
0 *	[0 - 65535 ]	View actual state of the digital inputs 18, 19, 27 and 29.														
		<table border="1"> <tr><td>Bit 0</td><td>Unused</td></tr> <tr><td>Bit 1</td><td>Unused</td></tr> <tr><td>Bit 2</td><td>Digital input term. 29</td></tr> <tr><td>Bit 3</td><td>Digital input term. 27</td></tr> <tr><td>Bit 4</td><td>Digital input term. 19</td></tr> <tr><td>Bit 5</td><td>Digital input term. 18</td></tr> <tr><td>Bit 6~15</td><td>Unused</td></tr> </table>	Bit 0	Unused	Bit 1	Unused	Bit 2	Digital input term. 29	Bit 3	Digital input term. 27	Bit 4	Digital input term. 19	Bit 5	Digital input term. 18	Bit 6~15	Unused
Bit 0	Unused															
Bit 1	Unused															
Bit 2	Digital input term. 29															
Bit 3	Digital input term. 27															
Bit 4	Digital input term. 19															
Bit 5	Digital input term. 18															
Bit 6~15	Unused															
<b>Table 3.7 Bits Definition</b>																

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

16-62 Analog Input AI53		
Range:		Function:
1 *	[0 - 20 ]	View the actual value at input 53.

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

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

16-65 Analog Output AO42 [mA]		
Range:		Function:
0 mA*	[0 - 20 mA]	View the actual value at output 42 in mA. The value shown reflects the selection in 6-90 <i>Terminal 42 Mode</i> and 6-91 <i>Terminal 42 Analog Output</i> .

16-66 Digital Output																				
Range:		Function:																		
0 *	[0 - 15 ]	View the binary value of all digital outputs.  <b>Definition:</b> X: Not used 0: Low 1: High																		
		<table border="1"> <tr><th>XX</th><th>None used</th></tr> <tr><td>X0</td><td>Terminal 42 not used, terminal 45 low</td></tr> <tr><td>X1</td><td>Terminal 42 not used, terminal 45 high</td></tr> <tr><td>0X</td><td>Terminal 42 low, terminal 45 not used</td></tr> <tr><td>0</td><td>Terminal 42 low, terminal 45 low</td></tr> <tr><td>1</td><td>Terminal 42 low, terminal 45 high</td></tr> <tr><td>1X</td><td>Terminal 42 high, terminal 45 not used</td></tr> <tr><td>10</td><td>Terminal 42 high, terminal 45 low</td></tr> <tr><td>11</td><td>Terminal 42 high, terminal 45 high</td></tr> </table>	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
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																			
<b>Table 3.8 Binary Value of Digital Outputs</b>																				

16-67 Pulse Input #29 [Hz]		
Range:		Function:
0*	[0 - 130000 ]	View the actual frequency rate on terminal 29.

16-71 Relay Output [bin]										
Range:	Function:									
0 *	[0 - 65535 ]	View the setting of the relay. Bits definition:								
		<table border="1"> <tr> <td>Bit 0~2</td> <td>Unused</td> </tr> <tr> <td>Bit 3</td> <td>Relay 02</td> </tr> <tr> <td>Bit 4</td> <td>Relay 01</td> </tr> <tr> <td>Bit 5~15</td> <td>Unused</td> </tr> </table>	Bit 0~2	Unused	Bit 3	Relay 02	Bit 4	Relay 01	Bit 5~15	Unused
Bit 0~2	Unused									
Bit 3	Relay 02									
Bit 4	Relay 01									
Bit 5~15	Unused									
Table 3.9 Relay Setting										

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

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

16-79 Analog Output AO45		
Range:	Function:	
0 mA*	[0 - 20 mA]	

### 3.11.6 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.

### 3.11.7 16-9\* Diagnosis Read-Outs

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

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

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

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

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

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

### 3.12 Main Menu - Drive Closed Loop - Group 20

#### 3.12.1 20-0\* Feedback

20-00 Feedback 1 Source		
Option:	Function:	
	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.	
[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 a 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		
Option:	Function:	
[0] *	Linear	
[1]	Square root	

20-03 Feedback 2 Source		
Option:	Function:	
[0] *	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[3]	Pulse input 29	
[100]	Bus Feedback 1	
[101]	Bus Feedback 2	

20-04 Feedback 2 Conversion		
Option:	Function:	
[0] *	Linear	
[1]	Square root	

#### 3.12.2 20-2\* Feedback/Setpoint

20-20 Feedback Function		
Option:	Function:	
[0]	Sum	
[1]	Difference	
[2]	Average	
[3] *	Minimum	
[4]	Maximum	

#### 3.12.3 20-8\* PI Basic Settings

20-81 PI Normal/ Inverse Control		
Option:	Function:	
[0] *	Normal	
[1]	Inverse	

20-83 PI Start Speed [Hz]		
Range:	Function:	
0 Hz*	[ 0 - 200.0 Hz]	

20-84 On Reference Bandwidth		
Range:	Function:	
5 %*	[ 0 - 200 %]	

#### 3.12.4 20-9\* PI Controller

20-91 PI Anti Windup		
Option:	Function:	
[0]	Off	
[1] *	On	

20-93 PI Proportional Gain		
Range:	Function:	
0.50*	[ 0 - 10 ]	

20-94 PI Integral Time		
Range:	Function:	
20 s*	[ 0.10 - 9999 s]	

20-97 PI Feed Forward Factor		
Range:	Function:	
0 %*	[ 0 - 400 %]	



### 3.13 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.

28-02 Minimum Run Time		
Range:	Function:	
60 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.

#### 3.13.1 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, these 2 oil return mechanisms. With oil return management enabled, the frequency converter performs oil return by boosting the compressor speed for a selectable duration. Programme 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 (as programmed in *parameter 28-11 Low Speed Running Time*). A text message on the LCP indicates oil return boosts.

#### NOTICE

If 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		
Range:	Function:	
20 min*	[ 1 - 1440 min]	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.

28-13 Boost Duration		
Range:	Function:	
60 s*	[10 - 3600 s]	This parameter controls the duration of oil return boosts.

#### 3.13.2 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. In case of 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		
Option:	Function:	
[0]	Disabled	Activate a DC-brake current when the compressor is stopped.
[1] *	Enabled	

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

3

## 4 Troubleshooting

### 4.1 Alarms and Warnings

A warning or an alarm is signalled 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 *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 additional 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 *14-20 Reset Mode* (Warning: automatic wake-up is possible!)

*Table 4.1* specifies whether a warning occurs before an alarm, or whether to display a warning or an alarm for a given fault.

This is possible, for instance, in *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>14-12 Function at Mains Imbalance</i> .
7	11	DC over volt	X	X		Intermediate circuit voltage exceeds limit.
8	10	DC under volt	X	X		Intermediate circuit 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 over	X	X		The motor is too hot due to more than 100% load for too long. See <i>1-90 Motor Thermal Protection</i> .
11	7	Motor th over	X	X		The thermistor or the thermistor connection is disconnected. See <i>1-90 Motor Thermal Protection</i> .
13	5	Over Current	X	X	X	Inverter peak current limit is exceeded.
14	2	Earth Fault		X	X	Discharge from output phases to ground.
16	12	Short Circuit		X	X	Short-circuit in the compressor or on the compressor terminals.

Fault number	Alarm/Warning bit number	Fault text	Warning	Alarm	Trip locked	Cause of problem
17	4	Ctrl. word TO	X	X		No communication to the frequency converter. See parameter group 8-0* <i>General Settings</i> .
18	10 (parameter 1 6-91 Alarm Word 2)	Start failed		X		The speed has not been able to exceed 1-78 <i>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 parameter 4-58 <i>Missing Motor Phase Function</i> .
31	20	V phase loss		X	X	Motor phase V is missing. Check the phase. See parameter 4-58 <i>Missing Motor Phase Function</i> .
32	21	W phase loss		X	X	Motor phase W is missing. Check the phase. See parameter 4-58 <i>Missing Motor Phase Function</i> .
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 15-31 <i>Alarm Log Value</i> if possible.
47	23	Control Voltage Fault	X	X	X	24 V DC may be overloaded.
48	25	VDD1 supply low		X	X	Control voltage low. Contact the local Danfoss supplier
49	11 (parameter 1 6-91 Alarm Word 2)			X		The speed is below the specified limit in 1-87 <i>Compressor Min. Speed for Trip [Hz]</i> .
58		AMA internal	X	X		Contact the local Danfoss supplier.
59	25	Current limit	X			The current is higher than the value in 4-18 <i>Current Limit</i> .
60	44	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.
79		Illegal power section configuration	X	X		Internal fault. Contact the local Danfoss supplier.
80	29	Drive initialised		X		All parameter settings are initialised to default settings.
87	47	Auto DC Braking	X			The frequency converter is auto DC braking.
126		Motor Rotating		X		High back-emf voltage. Stop the rotor of the PM motor.
250		New sparepart		X	X	The power or switch mode power supply has been exchanged. (Only on 400 V 30-90 kW units). Contact the local Danfoss supplier
251		New Typecode		X	X	The frequency converter has a new type code (Only on 400 V 30-90 kW units). Contact the local Danfoss supplier.

**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 16-90 *Alarm Word*, 16-92 *Warning Word* and 16-94 *Ext. Status Word*.

### 4.2 Alarm Words

Bit	Hex	Dec	16-90 Alarm Word	16-91 Alarm Word 2
0	1	1	0	0
1	2	2	Pwr.Card Temp	0
2	4	4	Earth Fault	ServiceTrip, Typecode
3	8	8	0	Sparepart
4	10	16	Ctrl. Word TO	0
5	20	32	Over Current	0
6	40	64	0	0
7	80	128	Motor Th. Over	0
8	100	256	Motor ETR Over	Broken Belt
9	200	512	Inverter Overld.	0
10	400	1024	DC under Volt	0
11	800	2048	DC over Volt.	0
12	1000	4096	Short Circuit	External Interlock
13	2000	8192	0	0
14	4000	16384	Mains ph. loss	0
15	8000	32768	AMA Not OK	0
16	10000	65536	Live Zero Error	0
17	20000	131072	Internal Fault	0
18	40000	262144	0	Fans error
19	80000	524288	U phase Loss	0
20	100000	1048576	V phase Loss	0
21	200000	2097152	W phase Loss	0
22	400000	4194304	0	0
23	800000	8388608	Control Voltage Fault	0
24	1000000	16777216	0	0
25	2000000	33554432	VDD1 Supply Low	0
26	4000000	67108864	0	0
27	8000000	134217728	0	0
28	10000000	268435456	Earth fault	0
29	20000000	536870912	Drive Initialized	0
30	40000000	1073741824	0	0
31	80000000	2147483648	0	0

### 4.3 Warning Words

Bit	Hex	Dec	16-92 Warning Word	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	#Clock Failure
3	8	8	Ctrl. Card Temp	Reserved
4	10	16	Ctrl. Word TO	Reserved
5	20	32	Over Current	#No Flow
6	40	64	Torque Limit	Dry Pump
7	80	128	Motor Th. Over	End of Curve
8	100	256	Motor ETR Over	Broken Belt
9	200	512	Inverter Overld.	Not used
10	400	1024	DC under Volt	Reserved
11	800	2048	DC over Volt.	Reserved
12	1000	4096	#DC Voltage Low	Reserved
13	2000	8192	#DC Voltage High	Reserved
14	4000	16384	Mains ph. loss	Reserved
15	8000	32768	No Motor	Auto DC Braking
16	10000	65536	Live Zero Error	Reserved
17	20000	131072	#10 V Low	Not used
18	40000	262144	Brake Resistor Power Limit	Fans Warning
19	80000	524288	Brake Resistor Short Circuit	#ECB WARNING
20	100000	1048576	Brake IGBT	Overload T27
21	200000	2097152	#Speed Limit	Overload T29
22	400000	4194304	Fieldbus Fault	Memory Module
23	800000	8388608	24 V Supply Low	Reserved
24	1000000	16777216	Mains Failure	Reserved
25	2000000	33554432	Current Limit	Reserved
26	4000000	67108864	Low temp.	Reserved
27	8000000	134217728	#Voltage Limit	Reserved
28	10000000	268435456	Encoder Loss	Feedback Fault
29	20000000	536870912	#Output Freq. Limit	Back EMF too High
30	40000000	1073741824	Safe Stop	Reserved
31	80000000	2147483648	Not used	Reserved

### 4.4 Extended Status Words

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

#### Troubleshooting

- Check the supply voltage and supply currents to the frequency converter.

#### WARNING/ALARM 7, DC overvoltage

If the intermediate circuit voltage exceeds the limit, the frequency converter trips after a time.

#### Troubleshooting

- Extend the ramp time
- Activate functions in *2-10 Brake Function*

#### WARNING/ALARM 8, DC under voltage

If the intermediate circuit 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.

- Display 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 *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 *1-24 Motor Current* is set correctly.
- Check that compressor data in parameters 1-20 through 1-25 are set correctly.
- Run *AMA* in *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 *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 earth 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 *8-04 Control Timeout Function* is NOT set to OFF.

If *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 *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 *1-79 Compressor Start Max Time to Trip*). This may be caused by a blocked motor.

**WARNING 24, Fan fault**

The fan warning function is an extra protection function that checks if the fan is running/mounted. The fan warning can be disabled in *14-53 Fan Monitor ([0] Disabled)*.

**Troubleshooting**

- Check fan resistance.

**ALARM 30, Motor phase U missing**

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

Turn off the frequency converter and check motor phase U.

**ALARM 31, Motor phase V missing**

Motor phase V between the frequency converter and the motor is missing.

Turn off the frequency converter and check motor phase V.

**ALARM 32, Motor phase W missing**

Motor phase W between the frequency converter and the motor is missing.

Turn off the frequency converter and check motor phase W.

**ALARM 38, Internal fault**

It 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.

**WARNING 47, Control Voltage Fault**

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

**WARNING 48, VDD1 Supply Low**

The VDD1 supply on the control card is outside of allowable limits.

**ALARM 49**

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 *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]).

**WARNING 66, Heatsink temperature low**

This warning is based on the temperature sensor in the IGBT module.

**ALARM 80, Drive initialised to default value**

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

**ALARM 126, Motor Rotating**

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

**ALARM 250, New Spare Part**

The power or switch mode power supply has been exchanged.

**ALARM 251, New Type Code**

The frequency converter has a new type code.



## 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 and FALSE means that the frequency converter must be stopped before a change can be made.

##### 2-Set-up

All set-up: The parameter can be set individually in each of the 2 set-ups, i.e. one 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 by means of a frequency converter.

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

Data type	Description	Type
2	Integer 8	Int8
3	Integer 16	Int16
4	Integer 32	Int32
5	Unsigned 8	UInt8
6	Unsigned 16	UInt16
7	Unsigned 32	UInt32
9	Visible String	VisStr
33	Normalised value 2 bytes	N2
35	Bit sequence of 16 boolean variables	V2

Table 5.1 Data Type

## 5.1.2 0-\*\* Operation/Display

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
<b>0-0* Basic Settings</b>						
0-01	Language	[0] English	1 set-up	TRUE	-	UInt8
0-03	Regional Settings	[0] International	1 set-up	FALSE	-	UInt8
0-04	Operating State at Power-up	[0] Resume	All set-ups	TRUE	-	UInt8
0-06	GridType	ExpressionLimit	1 set-up	FALSE	-	UInt8
0-07	Auto DC Braking	[1] On	1 set-up	FALSE	-	UInt8
<b>0-1* Set-up Operations</b>						
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
<b>0-3* LCP Custom Readout</b>						
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
<b>0-4* LCP Keypad</b>						
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
<b>0-5* Copy/Save</b>						
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
<b>0-6* Password</b>						
0-60	Main Menu Password	0 N/A	1 set-up	TRUE	0	UInt16

## 5.1.3 1-\*\* Load and Motor

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
<b>1-0* General Settings</b>						
1-00	Configuration Mode	[0] Open Loop	All set-ups	TRUE	-	UInt8
1-01	Motor Control Principle	[1] VVC+	All set-ups	FALSE	-	UInt8
1-03	Torque Characteristics	[1] Variable Torque	All set-ups	FALSE	-	UInt8
1-06	Clockwise Direction	[0] Normal	1 set-up	FALSE	-	UInt8
1-08	Motor Control Bandwidth	ExpressionLimit	All set-ups	FALSE	-	UInt8
<b>1-1* Motor Selection</b>						
1-10	Motor Construction	[3] PM, salient IPM, Sat	All set-ups	FALSE	-	UInt8
1-13	Compressor Selection	ExpressionLimit	2 set-ups	TRUE	-	UInt8
1-14	Damping Gain	120 %	All set-ups	TRUE	0	Int16
1-15	Low Speed Filter Time Const.	ExpressionLimit	All set-ups	TRUE	-2	UInt16
1-16	High Speed Filter Time Const.	ExpressionLimit	All set-ups	TRUE	-2	UInt16
1-17	Voltage filter time const.	ExpressionLimit	All set-ups	TRUE	-3	UInt16
<b>1-2* Motor Data</b>						
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

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
1-29	Automatic Motor Adaption (AMA)	[0] Off	All set-ups	FALSE	-	Uint8
<b>1-3* Adv. Motor Data</b>						
1-30	Stator Resistance (Rs)	ExpressionLimit	All set-ups	FALSE	-3	Uint32
1-33	Stator Leakage Reactance (X1)	ExpressionLimit	All set-ups	FALSE	-3	Uint32
1-35	Main Reactance (Xh)	ExpressionLimit	All set-ups	FALSE	-2	Uint32
1-37	d-axis Inductance (Ld)	ExpressionLimit	All set-ups	FALSE	-6	Int32
1-38	q-axis Inductance (Lq)	ExpressionLimit	All set-ups	FALSE	-6	Int32
1-39	Motor Poles	ExpressionLimit	All set-ups	FALSE	0	Uint8
<b>1-4* Adv. Motor Data II</b>						
1-40	Back EMF at 1000 RPM	ExpressionLimit	All set-ups	FALSE	0	Uint16
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
<b>1-5* Load Indep. Setting</b>						
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
<b>1-6* Load Depen. Setting</b>						
1-62	Slip Compensation	0 %	All set-ups	TRUE	0	Int16
1-63	Slip Compensation Time Constant	0.1 s	All set-ups	TRUE	-2	Uint16
1-64	Resonance Dampening	100 %	All set-ups	TRUE	0	Uint16
1-65	Resonance Dampening Time Constant	0.005 s	All set-ups	TRUE	-3	Uint16
1-66	Min. Current at Low Speed	50 %	All set-ups	TRUE	0	Uint32
<b>1-7* Start Adjustments</b>						
1-70	PM Start Mode	[1] Parking	All set-ups	TRUE	-	Uint8
1-71	Start Delay	60 s	All set-ups	TRUE	-1	Uint16
1-72	Start Function	[2] Coast/delay time	All set-ups	TRUE	-	Uint8
1-73	Flying Start	[0] Disabled	All set-ups	FALSE	-	Uint8
1-75	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
<b>1-8* Stop Adjustments</b>						
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
<b>1-9* Motor Temperature</b>						
1-90	Motor Thermal Protection	ExpressionLimit	All set-ups	TRUE	-	Uint8
1-93	Thermistor Source	[0] None	All set-ups	FALSE	-	Uint8

## 5.1.4 3-\*\* Reference/Ramps

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
<b>3-0* Reference Limits</b>						
3-02	Minimum Reference	0 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Int32
3-03	Maximum Reference	200 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Int32
<b>3-1* References</b>						
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 in 53	All set-ups	TRUE	-	UInt8
3-16	Reference 2 Source	[2] Analog in 54	All set-ups	TRUE	-	UInt8
3-17	Reference 3 Source	[11] Local bus reference	All set-ups	TRUE	-	UInt8
<b>3-4* Ramp 1</b>						
3-41	Ramp 1 Ramp Up Time	ExpressionLimit	All set-ups	TRUE	-2	UInt32
3-42	Ramp 1 Ramp Down Time	ExpressionLimit	All set-ups	TRUE	-2	UInt32
<b>3-5* Ramp 2</b>						
3-51	Ramp 2 Ramp Up Time	ExpressionLimit	All set-ups	TRUE	-2	UInt32
3-52	Ramp 2 Ramp Down Time	ExpressionLimit	All set-ups	TRUE	-2	UInt32
<b>3-8* Other Ramps</b>						
3-80	Jog Ramp Time	ExpressionLimit	All set-ups	TRUE	-2	UInt32
3-81	Quick Stop Ramp Time	ExpressionLimit	1 set-up	TRUE	-2	UInt32
3-82	Starting Ramp Up Time	6.00 s	2 set-ups	TRUE	-2	UInt32
3-83	Stopping Ramp Down Time	6 s	All set-ups	TRUE	-2	UInt32

## 5.1.5 4-\*\* Limits/Warnings

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
<b>4-1* Motor Limits</b>						
4-10	Motor Speed Direction	[0] Clockwise	All set-ups	FALSE	-	UInt8
4-12	Motor Speed Low Limit [Hz]	30 Hz	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	ExpressionLimit	All set-ups	FALSE	-1	UInt16
<b>4-4* Adj. Warnings 2</b>						
4-40	Warning Freq. Low	ExpressionLimit	All set-ups	TRUE	-1	uint16
4-41	Warning Freq. High	ExpressionLimit	All set-ups	TRUE	-1	uint16
<b>4-5* Adj. Warnings</b>						
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
<b>4-6* Speed Bypass</b>						
4-61	Bypass Speed From [Hz]	0 Hz	All set-ups	TRUE	-1	UInt16
4-63	Bypass Speed To [Hz]	0 Hz	All set-ups	TRUE	-1	UInt16
4-64	Semi-Auto Bypass Set-up	[0] Off	All set-ups	TRUE	-	UInt8

## 5.1.6 5-\*\* Digital In/Out

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
<b>5-0* Digital I/O mode</b>						
5-00	Digital Input Mode	[0] PNP	1 set-up	FALSE	-	Uint8
<b>5-1* Digital Inputs</b>						
5-10	Terminal 18 Digital Input	[8] Start	All set-ups	TRUE	-	Uint8
5-11	Terminal 19 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
5-12	Terminal 27 Digital Input	ExpressionLimit	All set-ups	TRUE	-	Uint8
5-13	Terminal 29 Digital Input	[1] Reset	All set-ups	TRUE	-	Uint8
<b>5-4* Relays</b>						
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
<b>5-5* Pulse Input</b>						
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	ExpressionLimit	All set-ups	TRUE	-3	Int32
<b>5-9* Bus Controlled</b>						
5-90	Digital & Relay Bus Control	0 N/A	All set-ups	TRUE	0	Uint32

## 5.1.7 6-\*\* Analog In/Out

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
<b>6-0* Analog I/O Mode</b>						
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
<b>6-1* Analog Input 53</b>						
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	30 N/A	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
<b>6-2* Analog Input 54</b>						
6-20	Terminal 54 Low Voltage	0.07 V	All set-ups	TRUE	-2	Uint16
6-21	Terminal 54 High Voltage	10 V	All set-ups	TRUE	-2	Uint16
6-22	Terminal 54 Low Current	4 mA	All set-ups	TRUE	-5	Uint16
6-23	Terminal 54 High Current	20 mA	All set-ups	TRUE	-5	Uint16
6-24	Terminal 54 Low Ref./Feedb. Value	0 N/A	All set-ups	TRUE	-3	Int32
6-25	Terminal 54 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
6-26	Terminal 54 Filter Time Constant	0.01 s	All set-ups	TRUE	-2	Uint16
6-29	Terminal 54 mode	[0] Current mode	1 set-up	TRUE	-	Uint8
<b>6-7* Analog/Digital Output 45</b>						
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

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
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
<b>6-9* Analog/Digital Output 42</b>						
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

### 5.1.8 8-\*\* Comm. and Options

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
<b>8-0* General Settings</b>						
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
<b>8-3* FC Port Settings</b>						
8-30	Protocol	[0] FC	1 set-up	TRUE	-	Uint8
8-31	Address	1 N/A	1 set-up	TRUE	0	Uint8
8-32	Baud Rate	ExpressionLimit	1 set-up	TRUE	-	Uint8
8-33	Parity / Stop Bits	ExpressionLimit	1 set-up	TRUE	-	Uint8
8-35	Minimum Response Delay	0.01 s	1 set-up	TRUE	-3	Uint16
8-36	Maximum Response Delay	ExpressionLimit	1 set-up	TRUE	-3	Uint16
8-37	Maximum Inter-char delay	0.025 s	1 set-up	TRUE	-3	Uint16
<b>8-4* FC MC protocol set</b>						
8-42	PCD Write Configuration	ExpressionLimit	2 set-ups	TRUE	-	Uint8
8-43	PCD Read Configuration	ExpressionLimit	1 set-up	TRUE	-	Uint8
<b>8-5* Digital/Bus</b>						
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
<b>8-8* FC Port Diagnostics</b>						
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
<b>8-9* Bus Jog / Feedback</b>						
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

## 5.1.9 13-\*\* Smart Logic

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
<b>13-0* SLC Settings</b>						
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
<b>13-1* Comparators</b>						
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
<b>13-2* Timers</b>						
13-20	SL Controller Timer	0 s	1 set-up	TRUE	-2	Uint32
<b>13-4* Logic Rules</b>						
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
<b>13-5* States</b>						
13-51	SL Controller Event	[0] False	1 set-up	TRUE	-	Uint8
13-52	SL Controller Action	[0] Disabled	1 set-up	TRUE	-	Uint8

## 5.1.10 14-\*\* Special Functions

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
<b>14-0* Inverter Switching</b>						
14-01	Switching Frequency	ExpressionLimit	All set-ups	TRUE	-	Uint8
14-03	Overmodulation	[1] On	All set-ups	FALSE	-	Uint8
14-07	Dead Time Compensation Level	ExpressionLimit	All set-ups	FALSE	0	Uint8
14-08	Damping Gain Factor	ExpressionLimit	All set-ups	TRUE	0	Uint8
14-09	Dead Time Bias Current Level	ExpressionLimit	All set-ups	FALSE	0	Uint8
<b>14-1* Mains On/Off</b>						
14-10	Mains Failure	[0] No function	All set-ups	FALSE	-	Uint8
14-11	Mains Voltage at Mains Fault	342 V	All set-ups	TRUE	0	Uint16
14-12	Function at Mains Imbalance	[3] Derate	1 set-up	TRUE	-	Uint8
<b>14-2* Reset Functions</b>						
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
14-27	Action At Inverter Fault	[1] Warning	All set-ups	TRUE	-	Uint8
14-28	Production Settings	[0] No action	1 set-up	FALSE	-	Uint8
14-29	Service Code	0 N/A	1 set-up	TRUE	0	Uint32
<b>14-4* Energy Optimising</b>						
14-40	VT Level	90 %	All set-ups	FALSE	0	Uint8
14-41	AEO Minimum Magnetisation	66 %	All set-ups	FALSE	0	Uint8
<b>14-5* Environment</b>						
14-50	RFI Filter	[1] On	1 set-up	FALSE	-	Uint8

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
14-51	DC-Link Voltage Compensation	[1] On	All set-ups	FALSE	-	Uint8
14-52	Fan Control	[0] Auto	1 set-up	TRUE	-	Uint8
14-53	Fan Monitor	[1] Warning	1 set-up	TRUE	-	Uint8
14-55	Output Filter	[0] No Filter	1 set-up	FALSE	-	Uint8
<b>14-6* Auto Derate</b>						
14-63	Min Switch Frequency	[2] 2.0 kHz	1 set-up	FALSE	-	Uint8
14-64	Dead Time Compensation Zero Current Level	[0] Disabled	All set-ups	FALSE	-	Uint8
14-65	Speed Derate Dead Time Compensation	ExpressionLimit	All set-ups	FALSE	0	Uint16
<b>14-9* Fault Settings</b>						
14-90	Fault Level	[4] Trip w. delayed reset	All set-ups	FALSE	-	Uint8



### 5.1.11 15-\*\* Drive Information

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
<b>15-0* Operating Data</b>						
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
<b>15-3* Alarm Log</b>						
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
<b>15-4* Drive Identification</b>						
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]
<b>15-9* Parameter Info</b>						
15-92	Defined Parameters	0 N/A	1 set-up	TRUE	0	Uint16
15-97	Application Type	0 N/A	1 set-up	TRUE	0	Uint32
15-98	Drive Identification	0 N/A	1 set-up	FALSE	0	VisStr[56]

### 5.1.12 16-\*\* Data Readouts

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
<b>16-0* General Status</b>						
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
<b>16-1* Motor Status</b>						
16-10	Power [kW]	0 kW	1 set-up	TRUE	-3	Uint32
16-11	Power [hp]	0 hp	1 set-up	TRUE	-3	Uint32
16-12	Motor Voltage	0 V	1 set-up	TRUE	-1	Uint32
16-13	Frequency	0 Hz	1 set-up	TRUE	-1	Uint32

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
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
<b>16-3* Drive Status</b>						
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
<b>16-5* Ref. &amp; Feedb.</b>						
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
<b>16-6* Inputs &amp; Outputs</b>						
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
<b>16-8* Fieldbus &amp; FC Port</b>						
16-86	FC Port REF 1	0 N/A	1 set-up	TRUE	0	Int16
<b>16-9* Diagnosis Readouts</b>						
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

## 5.1.13 20-\*\* Drive Closed Loop

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
<b>20-0* Feedback</b>						
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
<b>20-2* Feedback/Setpoint</b>						
20-20	Feedback Function	[3] Minimum	All set-ups	TRUE	-	Uint8
<b>20-8* PI Basic Settings</b>						
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
<b>20-9* PI Controller</b>						
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

## 5.1.14 28-\*\* Compressor Functions

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
<b>28-0* Short Cycle Protection</b>						
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	60 s	All set-ups	TRUE	0	Uint16
<b>28-1* Oil Return Management</b>						
28-10	Oil Return Management	[1] On	All set-ups	FALSE	-	Uint8
28-11	Low Speed Running Time	20 min	All set-ups	TRUE	70	Uint16
28-13	Boost Duration	60 s	All set-ups	FALSE	0	Uint16
<b>28-4* Anti-reverse Protection at Stop</b>						
28-40	Reverse Protection Control	[1] Enabled	All set-ups	TRUE	-	Uint8
<b>28-6* Compressor Readouts</b>						
28-60	RPS	0 /s	All set-ups	FALSE	-1	uint16

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