

GE Consumer & Industrial
Electrical Distribution

AF-650 GP™ General Purpose Drive

Programming Guide



imagination at work



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1 Introduction

1

Programming Guide Software version: 4.9x

This Programming Guide can be used for all AF-650 GP frequency converters with software version 4.9x.
The software version number can be seen from par. ID-43 *Software Version*.

1.1.1 Approvals



1.1.2 Symbols

Symbols used in this guide.

NB!

Indicates something to be noted by the reader.



Indicates a general warning.



Indicates a high-voltage warning.

*

Indicates default setting



1.1.3 Abbreviations

Alternating current	AC
American wire gauge	AWG
Ampere/AMP	A
Current limit	I _{LIM}
Degrees Celsius	°C
Direct current	DC
Drive Control Tool PC Software	DCT 10
Drive Dependent	D-TYPE
Electro Magnetic Compatibility	EMC
Electronic Thermal Overload	Elec. OL
Gram	g
Hertz	Hz
Kilohertz	kHz
Meter	m
Millihenry Inductance	mH
Milliampere	mA
Millisecond	ms
Minute	min
Nanofarad	nF
Newton Meters	Nm
Nominal motor current	I _{M,N}
Nominal motor frequency	f _{M,N}
Nominal motor power	P _{M,N}
Nominal motor voltage	U _{M,N}
Parameter	par.
Protective Extra Low Voltage	PELV
Printed Circuit Board	PCB
Rated Inverter Output Current	I _{INV}
Revolutions Per Minute	RPM
Regenerative terminals	Regen
Second	s
Synchronous Motor Speed	n _s
Torque limit	T _{LIM}
Volts	V

1.1.4 Definitions

Frequency converter:

D-TYPE

Size and type of the connected frequency converter (dependencies).

I_{DRIVE MAX}

The maximum output current.

I_{DRIVEN}

The rated output current supplied by the frequency converter.

U_{DRIVE MAX}

The maximum output voltage.

Input:

Control command

You can start and stop the connected motor by means of Keypad and the digital inputs.

Functions are divided into two groups.

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

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.

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

 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).

 $M\text{-TYPE}$

Size and type of the connected motor (dependencies).

 $n_{M,N}$

The rated motor speed (nameplate data).

 n_s

Synchronous motor speed

$$n_s = \frac{2 \times \text{par. } F - 04 \times 60 \text{ s}}{\text{par. } P - 01}$$

 $P_{M,N}$

The rated motor power (nameplate data).

 $T_{M,N}$

The rated torque (motor).

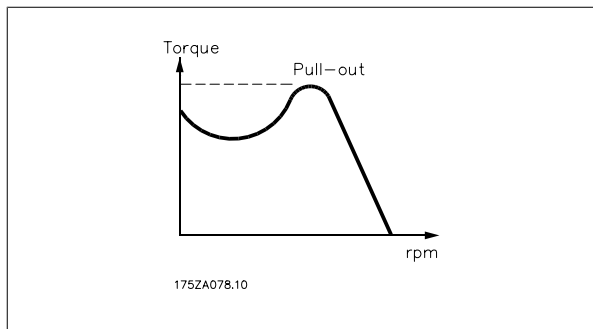
 U_M

The instantaneous motor voltage.

 $U_{M,N}$

The rated motor voltage (nameplate data).

Break-away torque

 η_{DRIVE}

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 this group.

Stop command

See Control commands.

**References:**Advanced Vector Control

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

Analog Reference

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

Binary Reference

A signal transmitted to the serial communication port.

Preset Reference

A defined preset reference to be set from -100% to +100% of the reference range. Selection of eight preset references via the digital terminals.

Pulse Reference

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

Ref_{MAX}

Determines the relationship between the reference input at 100% full scale value (typically 10 V, 20mA) and the resulting reference. The maximum reference value set in par. F-53 *Maximum Reference*.

Ref_{MIN}

Determines the relationship between the reference input at 0% value (typically 0V, 0mA, 4mA) and the resulting reference. The minimum reference value set in par. F-52 *Minimum Reference*.

Miscellaneous:Analog Inputs

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

There are two types of analog inputs:

Current input, 0-20 mA and 4-20 mA

Voltage input, 0-10 V DC

Voltage input, -10 - +10 V DC.

Analog Outputs

The analog outputs can supply a signal of 0-20 mA, 4-20 mA.

Auto Tuning

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

Brake Resistor

The brake resistor is a module capable of absorbing the brake power generated in regenerative braking. This regenerative braking power increases the intermediate circuit voltage and a brake chopper ensures that the power is transmitted to the brake resistor.

CT Characteristics

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

Digital Inputs

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

Digital Outputs

The frequency converter features two Solid State outputs that can supply a 24 V DC (max. 40 mA) signal.

DSP

Digital Signal Processor.

Electronic Thermal Overload

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

Hiperface®

Hiperface® is a registered trademark by Stegmann.

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.

Keypad

The Keypad makes up a complete interface for control and programming of the frequency converter. The Keypad is detachable and can be installed up to 10ft/ 3M from the frequency converter, i.e. in a front panel with the optional Remote Keypad Mounting Kit (RMKYPDAC)..

Logic Controller (LC)

The LC is a sequence of user defined actions executed when the associated user defined events are evaluated as true by the Logic Controller. (Parameter group LC-##).

lsb

Least significant bit.

msb

Most significant bit.

MCM

Short for Mille Circular Mil, an American measuring unit for cable cross-section. 1 MCM = 0.5067 mm².

On-line/Off-line Parameters

Changes to on-line parameters are activated immediately after the data value is changed. Changes to off-line parameters are not activated until you enter [OK] on the Keypad.

Process PID

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

Pulse Input/Incremental Encoder

An external, digital pulse transmitter used for feeding back information on motor speed. The encoder is used in applications where great accuracy in speed control is required.

RCD

Residual Current Device.

Set-up

You can save parameter settings in four Set-ups. Change between the four parameter Set-ups and edit one Set-up, while another Set-up is active.

SFAVM

Switching pattern called Stator Flux oriented Aynchronous Vector Modulation (par. F-37 *Adv. Switching Pattern*).

Slip Compensation

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

Drive Standard Bus

Includes RS 485 bus with Drive protocol or MC protocol. See par. O-30 *Protocol*.

Thermistor:

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

Trip

A state entered in fault situations, e.g. if the frequency converter is subject to an over-temperature or when the frequency converter is protecting the motor, process or mechanism. Restart is prevented until the cause of the fault has disappeared and the trip state is cancelled by activating reset or, in some cases, by being programmed to reset automatically. 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, e.g. if the frequency converter is subject to a short circuit on the output. A locked trip can only be cancelled by cutting off mains, removing the cause of the fault, and reconnecting the frequency converter. Restart is prevented until the trip state is cancelled by activating reset or, in some cases, by being programmed to reset automatically. Trip may not be used for personal safety.

VT Characteristics

Variable torque characteristics used for pumps and fans.

60° AVM

Switching pattern called 60° Aynchronous Vector Modulation (par. F-37 *Adv. Switching Pattern*).

Power Factor

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

$$Power\ factor = \frac{\sqrt{3} \times U \times I_1 \cos\varphi}{\sqrt{3} \times U \times I_{RMS}}$$

The power factor for 3-phase control:

$$= \frac{I_1 \times \cos\varphi_1}{I_{RMS}} = \frac{I_1}{I_{RMS}} \text{ since } \cos\varphi_1 = 1$$

The power factor indicates to which extent the frequency converter imposes a load on the mains supply.

$$I_{RMS} = \sqrt{I_1^2 + I_5^2 + I_7^2 + \dots + I_n^2}$$

The lower the power factor, the higher the I_{RMS} for the same kW performance.

In addition, a high power factor indicates that the different harmonic currents are low.

The frequency converters' built-in DC link reactor produce a high power factor, which minimizes the imposed load on the mains supply.

1.1.5 Safety Precautions



The voltage of the frequency converter is dangerous whenever connected to mains. Incorrect installation of the motor, frequency converter or network may cause damage to the equipment, serious personal injury or death. Consequently, the instructions in this manual, as well as national and local rules and safety regulations, must be complied with.

Safety Regulations

1. The mains supply to the frequency converter must be disconnected whenever repair work is to be carried out. Check that the mains supply has been disconnected and that the necessary time has elapsed before removing motor and mains supply plugs.
2. The [OFF] button on the Keypad of the frequency converter does not disconnect the mains supply and consequently it must not be used as a safety switch.
3. The equipment must be properly earthed, the user must be protected against supply voltage and the motor must be protected against overload in accordance with applicable national and local regulations.
4. The earth leakage current exceeds 3,5 mA.
5. Protection against motor overload is not included in the factory setting. If this function is desired, set par. F-10 *Electronic Overload* to data value Elec. OL trip 1 [4] or data value Elec. OL warning 1 [3].
6. Do not remove the plugs for the motor and mains supply while the frequency converter is connected to mains. Check that the mains supply has been disconnected and that the necessary time has elapsed before removing motor and mains plugs.
7. Please note that the frequency converter has more voltage sources than L1, L2 and L3, when load sharing (linking of DC intermediate circuit) or external 24 V DC are installed. Check that all voltage sources have been disconnected and that the necessary time has elapsed before commencing repair work.

Warning against unintended start

1. The motor can be brought to a stop by means of digital commands, bus commands, references or a local stop, while the frequency converter is connected to mains. If personal safety considerations (e.g. risk of personal injury caused by contact with moving machine parts following an unintentional start) make it necessary to ensure that no unintended start occurs, these stop functions are not sufficient. In such cases the mains supply must be disconnected or the *Safe Stop* function must be activated.
2. The motor may start while setting the parameters. If this means that personal safety may be compromised (e.g. personal injury caused by contact with moving machine parts), motor starting must be prevented, for instance by use of the *Safe Stop* function or secure disconnection of the motor connection.
3. A motor that has been stopped with the mains supply connected, may start if faults occur in the electronics of the frequency converter, through temporary overload or if a fault in the power supply grid or motor connection is remedied. If unintended start must be prevented for personal safety reasons (e.g. risk of injury caused by contact with moving machine parts), the normal stop functions of the frequency converter are not sufficient. In such cases the mains supply must be disconnected or the *Safe Stop* function must be activated.

NB!

When using the *Safe Stop* function, always follow the instructions in the *Safe Stop* section of the AF-650 GP Design Guide.

4. Control signals from, or internally within, the frequency converter may in rare cases be activated in error, be delayed or fail to occur entirely. When used in situations where safety is critical, e.g. when controlling the electromagnetic brake function of a hoist application, these control signals must not be relied on exclusively.



Touching the electrical parts may be fatal - even after the equipment has been disconnected from mains.

1

Also make sure that other voltage inputs have been disconnected, such as external 24 V DC, load sharing (linkage of DC intermediate circuit), as well as the motor connection for kinetic back up.

Systems where frequency converters are installed must, if necessary, be equipped with additional monitoring and protective devices according to the valid safety regulations, e.g. law on mechanical tools, regulations for the prevention of accidents etc. Modifications on the frequency converters by means of the operating software are allowed.

Hoisting applications:

The frequency converter functions for controlling mechanical brakes cannot be considered as a primary safety circuit. There must always be a redundancy for controlling external brakes.

Protection Mode

Once a hardware limit on motor current or dc-link voltage is exceeded the drive will enter "Protection mode". "Protection mode" means a change of the PWM modulation strategy and a low switching frequency to minimize losses. This continues 10 sec after the last fault and increases the reliability and the robustness of the drive while re-establishing full control of the motor.

In hoist applications "Protection mode" is not usable because the drive will usually not be able to leave this mode again and therefore it will extend the time before activating the brake – which is not recommendable.

The "Protection mode" can be disabled by setting par. *SP-26 Trip Delay at Drive Fault* to zero which means that the drive will trip immediately if one of the hardware limits is exceeded.

NB!

It is recommended to disable protection mode in hoisting applications (par. *SP-26 Trip Delay at Drive Fault* = 0)

Correlation of SIL and PFD

1

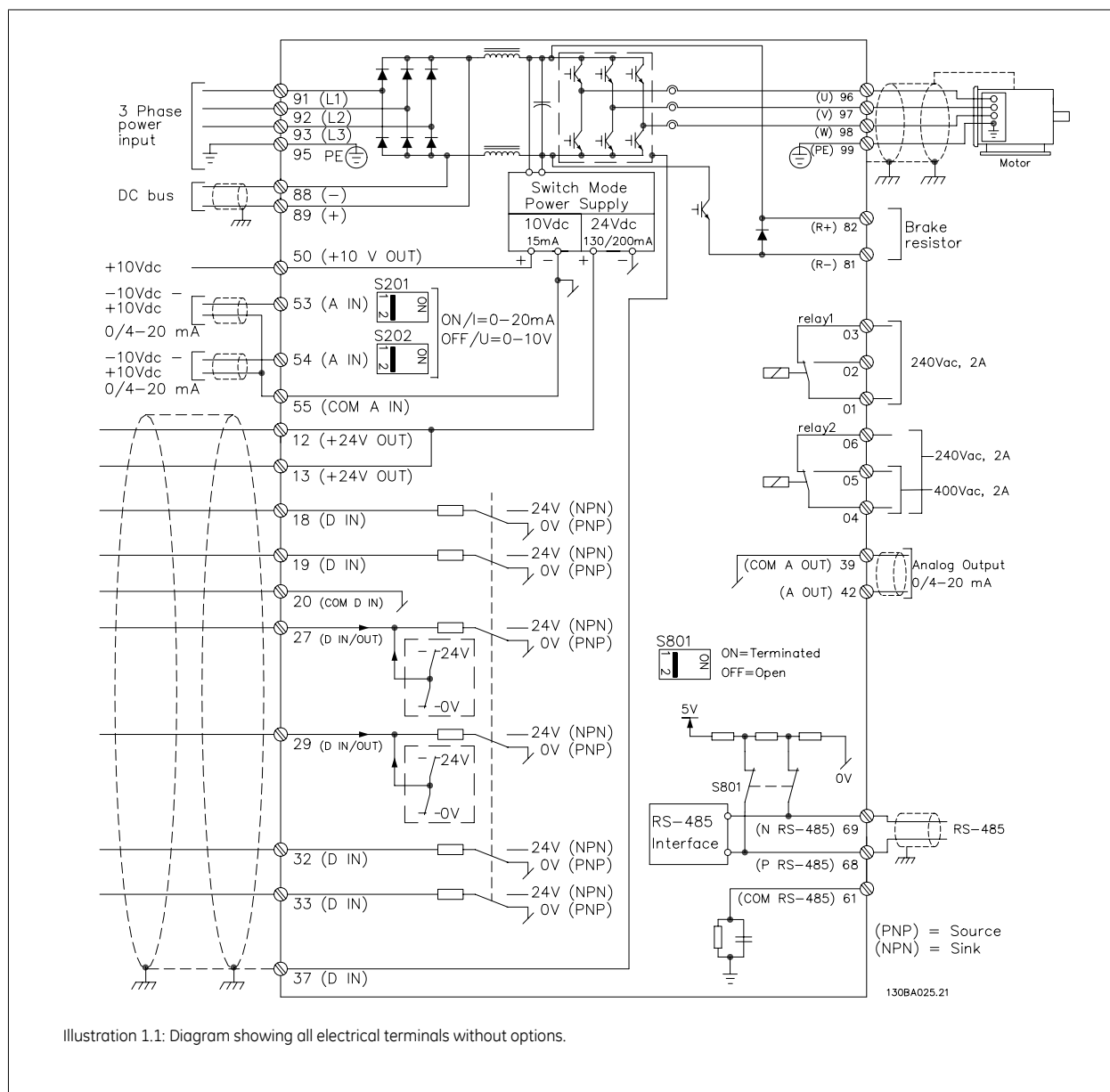
SIL	IEC 61508	ANSI S84.01	PFD	Availability Required	1/PFD
4	YES	NO	10^{-5} to 10^{-4}	> 99.99%	100,000 to 10,000
3	YES	YES	10^{-4} to 10^{-3}	99.90 to 99.99%	10,000 to 1,000
2	YES	YES	10^{-3} to 10^{-2}	99.90 to 99.99%	1,000 to 100
1	YES	YES	10^{-2} to 10^{-1}	99.90 to 99.99%	100 to 10

1.1 Safe stop

Certified to SIL2 by TÜV

PFH 7e-10 FIT = 7e-19/h

1.1.6 Electrical wiring - control cables



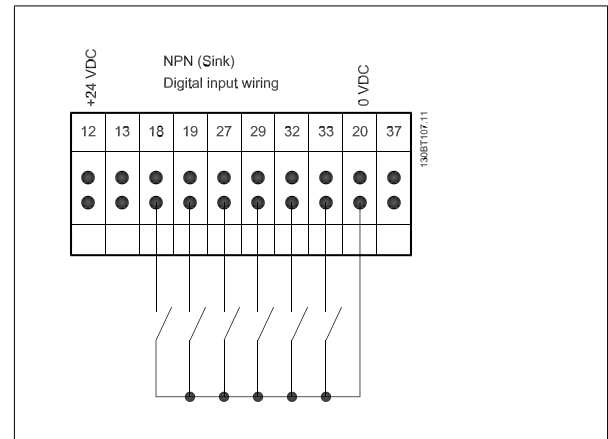
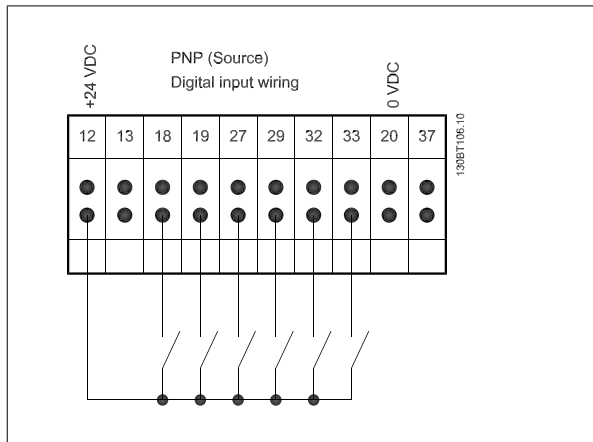


Very long control cables and analog signals may in rare cases and depending on installation result in 50/60 Hz earth loops due to noise from mains supply cables.

If this occurs, it may be necessary to break the screen or insert a 100 nF capacitor between screen and chassis.

The digital and analog inputs and outputs must be connected separately to the common inputs (terminal 20, 55, 39) of the frequency converter to avoid ground currents from both groups to affect other groups. For example, switching on the digital input may disturb the analog input signal.

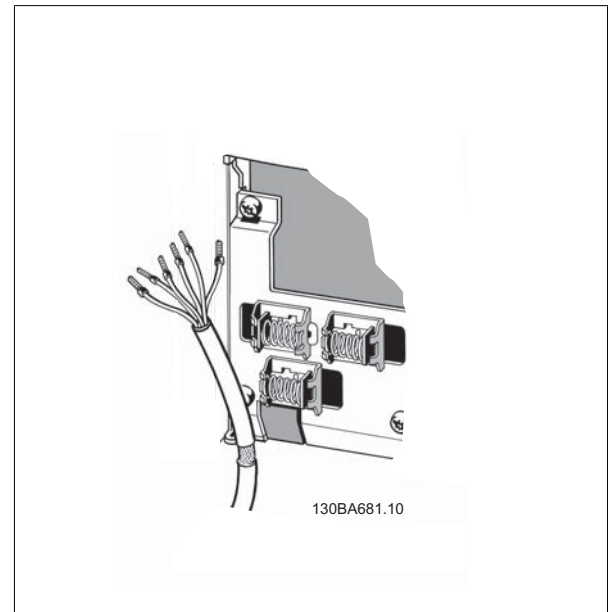
Input polarity of control terminals



NB!

Control cables must be screened/armoured.

See section entitled *Earthing of Screened/Armoured Control Cables* for the correct termination of control cables.







2 How to Program

2.1 The Graphical Keypad

The easiest programming of the frequency converter is performed by the Graphical Keypad.

2

2.1.1 How to Program on the Graphical Keypad

The following instructions are valid for the graphical Keypad:

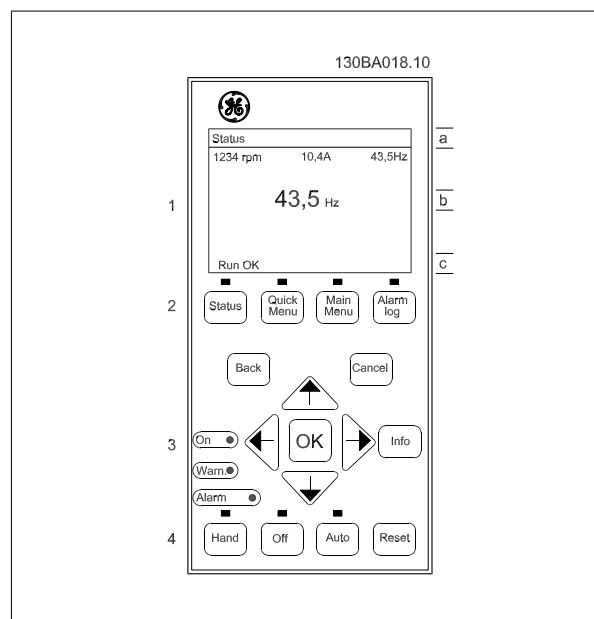
The keypad is divided into four functional groups:

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

All data is displayed in the display, which can show up to five items of operating data while displaying [Status].

Display lines:

- a. **Status line:** Status messages displaying icons and graphic.
- b. **Line 1-2:** Operator data lines displaying data defined or chosen by the user. By pressing the [Status] key, up to one extra line can be added.
- c. **Status line:** Status messages displaying text.





2.1.2 The LCD-Display

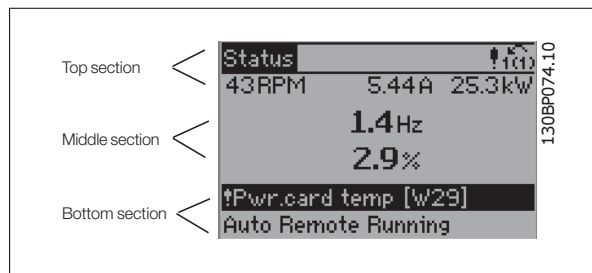
The LCD-display has back light and a total of 6 alpha-numeric lines. The display lines show the direction of rotation (arrow), the chosen Set-up as well as the programming Set-up. The display is divided into 3 sections:

2

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

The top line in the Middle section shows up to 5 measurements with related unit, regardless of status (except in the case of alarm/warning).

Bottom section always shows the state of the frequency converter in Status mode.



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

Display Contrast Adjustment

Press [status] and [▲] for darker display

Press [status] and [▼] for brighter display

Most parameter set-ups can be changed immediately via the control panel, unless a password has been created via par. K-60 *Main Menu Password* or via par. K-65 *Quick Menu Password*.

Indicator lights (LEDs):

If certain threshold values are exceeded, the alarm and/or warning LED lights up. A status and alarm text appear on the control panel.

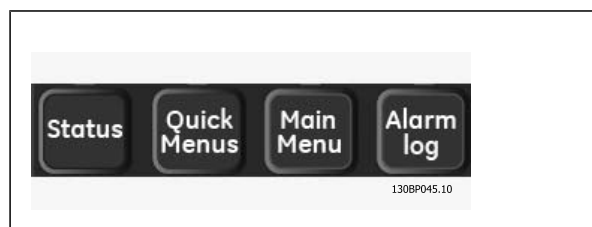
The ON LED is activated when the frequency converter receives mains voltage or via a DC bus terminal or 24V external supply option (OPC24VPS) supply. At the same time, the back light is on.

- Green LED/On: Control section is working.
- Yellow LED/Warn.: Indicates a warning.
- Flashing Red LED/Alarm: Indicates an alarm.



Keypad keys

The control keys are divided into functions. The keys below the display and indicator lamps are used for parameter Set-up, including choice of display indication during normal operation.



[Status] indicates the status of the frequency converter and/or the motor. You can choose between 3 different readouts by pressing the [Status] key: 5 line readouts, 4 line readouts or Logic Controller.

Use [Status] for selecting the mode of display or for changing back to Display mode from either the Quick Menu mode, the Main Menu mode or Alarm mode. Also use the [Status] key to toggle single or double read-out mode.



[Quick Menu] allows quick access to different Quick Menus such as:

- Quick Start
- Parameter Data Check
- Trending

Use [Quick Start] for programming the parameters belonging to the Quick Menu. It is possible to switch directly between Quick Menu mode and Main Menu mode.

[Main Menu] is used for programming all parameters.

It is possible to switch directly between Main Menu mode and Quick Menu mode.

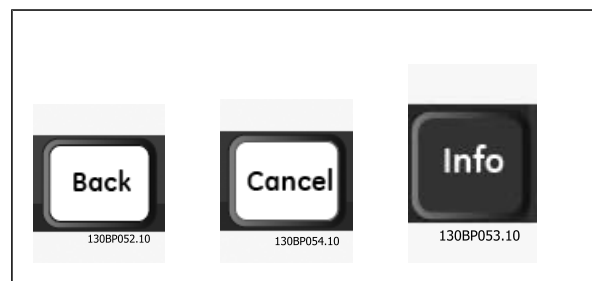
Parameter shortcut can be carried out by pressing down the [Main Menu] key for 3 seconds. The parameter shortcut allows direct access to any parameter.

[Alarm Log] displays an Alarm list of the five latest alarms (numbered A1-A5). To obtain additional details about an alarm, use the arrow keys to maneuver to the alarm number and press [OK]. You will now receive information about the condition of your frequency converter right before entering the alarm mode.

[Back] takes you to the previous step or layer in the navigation structure.

[Cancel] annuls your last change or command as long as the display has not been changed.

[Info] supplies information about a command, parameter, or function in any display window. [Info] provides detailed information whenever help is needed. Exit info mode by pressing either [Info], [Back], or [Cancel].

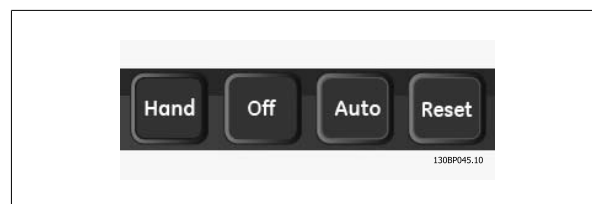


Navigation Keys

The four navigation arrows are used to navigate between the different choices available in [Quick Menu], [Main Menu] and [Alarm Log]. Use the keys to move the cursor.

[OK] is used for choosing a parameter marked by the cursor and for enabling the change of a parameter.

Local Control Key for local control are found at the bottom of the control panel.



[Hand] enables control of the frequency converter via the Keypad. [Hand] also starts the motor, and it is now possible to enter the motor speed data by means of the arrow keys. The key can be selected as Enable [1] or Disable [0] via par. K-40 [Hand] Button on Keypad

External stop signals activated by means of control signals or a serial bus will override a "start" command via the Keypad.

The following control signals will still be active when [Hand] is activated:

- [Hand] - [Off] - [Auto]
- Reset
- Coasting stop inverse
- Reversing
- Set-up select bit 0- Set-up select bit 1
- Stop command from serial communication
- Quick stop
- DC brake



[Off] stops the connected motor. The key can be selected as Enable [1] or Disable [0] via par. K-41 *[Off] Button on Keypad*. If no external stop function is selected and the [Off] key is inactive the motor can be stopped by disconnecting the voltage.

[Auto] enables the frequency converter to be controlled via the control terminals and/or serial communication. When a start signal is applied on the control terminals and/or the bus, the frequency converter will start. The key can be selected as Enable [1] or Disable [0] via par. K-42 *[Auto] Button on Keypad*.

NB!

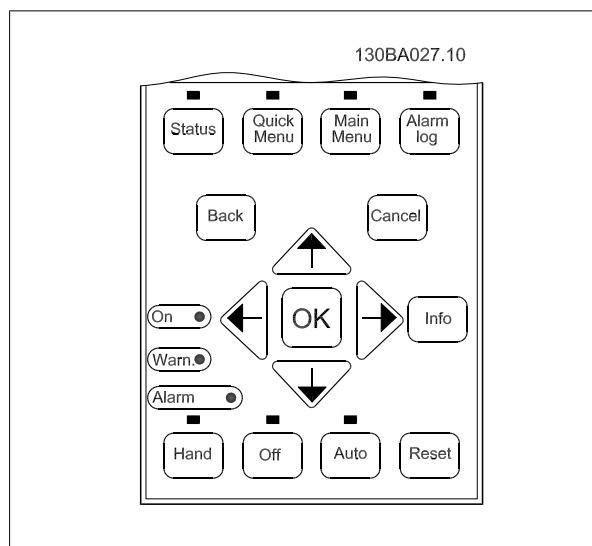
An active HAND-OFF-AUTO signal via the digital inputs has higher priority than the control keys [Hand] – [Auto].

[Reset] is used for resetting the frequency converter after an alarm (trip). It can be selected as *Enable [1] or Disable [0]* via par. K-43 *[Reset] Button on Keypad*.

The **parameter shortcut** can be carried out by holding down the [Main Menu] key for 3 seconds. The parameter shortcut allows direct access to any parameter.

2.1.3 Quick Transfer of Parameter Settings between Multiple Frequency Converters

Once the set-up of a frequency converter is complete, we recommend that you store the data in the Keypad or on a PC via Drive Control Tool Software DCT 10.

**Data storage in Keypad:**

1. Go to par. K-50 *Keypad Copy*
2. Press the [OK] key
3. Select "All to Keypad"
4. Press the [OK] key

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

NB!

Stop the motor before performing this operation.

You can now connect the Keypad to another frequency converter and copy the parameter settings to this frequency converter as well.

Data transfer from Keypad to frequency converter:

1. Go to par. K-50 *Keypad Copy*
2. Press the [OK] key
3. Select "All from Keypad"
4. Press the [OK] key

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

**NB!**

Stop the motor before performing this operation.

2.1.4 Display Mode

In normal operation, up to 5 different operating variables can be indicated continuously in the middle section: 1.1, 1.2, and 1.3 as well as 2 and 3.

2.1.5 Display Mode - Selection of Read-Outs

It is possible to toggle between three status read-out screens by pressing the [Status] key.

Operating variables with different formatting are shown in each status screen - see below.

The table shows the measurements you can link to each of the operating variables. Define the links via par. K-20 *Display Line 1.1 Small*, par. K-21 *Display Line 1.2 Small*, par. K-22 *Display Line 1.3 Small*, par. K-23 *Display Line 2 Large*, and par. K-24 *Display Line 3 Large*.

Each readout parameter selected in par. K-20 *Display Line 1.1 Small* to par. K-24 *Display Line 3 Large* has its own scale and digits after a possible decimal point. By larger numeric value of a parameter fewer digits are displayed after the decimal point.

Ex.: Current readout

5.25 A; 15.2 A 105 A.

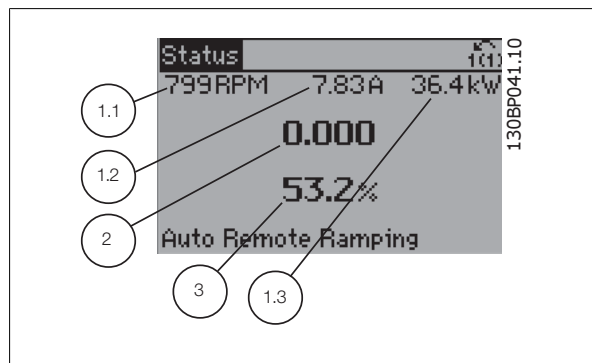
Operating variable:	Unit:
par. DR-00 Control Word	hex
par. DR-01 Reference [Unit]	[unit]
par. DR-02 Reference [%]	%
par. DR-03 Status Word	hex
par. DR-05 Main Actual Value [%]	%
par. DR-10 Power [kW]	[kW]
par. DR-11 Power [hp]	[HP]
par. DR-12 Motor Rated Voltage	[V]
par. DR-13 Frequency	[Hz]
par. DR-14 Motor Current	[A]
par. DR-16 Torque [Nm]	Nm
par. DR-17 Speed [RPM]	[RPM]
par. DR-18 Motor Thermal	%
par. DR-20 Motor Angle	
par. DR-30 DC Link Voltage	V
par. DR-32 Brake Energy /s	kW
par. DR-33 Brake Energy /2 min	kW
par. DR-34 Heatsink Temp.	C
par. DR-35 Drive Thermal	%
par. DR-36 Drive Nominal Current	A
par. DR-37 Drive Max. Current	A
par. DR-38 Logic Controller State	
par. DR-39 Control Card Temp.	C
par. DR-40 Trending Buffer Full	
par. DR-50 External Reference	
par. DR-51 Pulse Reference	
par. DR-52 Feedback [Unit]	[Unit]
par. DR-53 Digi Pot Reference	
par. DR-60 Digital Input	bin
par. DR-61 Terminal 53 Switch Setting	V
par. DR-62 Analog Input 53	
par. DR-63 Terminal 54 Switch Setting	V
par. DR-64 Analog Input 54	
par. DR-65 Analog Output 42 [mA]	[mA]
par. DR-66 Digital Output [bin]	[bin]
par. DR-67 Freq. Input #29 [Hz]	[Hz]
par. DR-68 Freq. Input #33 [Hz]	[Hz]
par. DR-69 Pulse Output #27 [Hz]	[Hz]
par. DR-70 Pulse Output #29 [Hz]	[Hz]
par. DR-71 Relay Output [bin]	
par. DR-72 Counter A	
par. DR-73 Counter B	
par. DR-80 Fieldbus CTW 1	hex
par. DR-82 Fieldbus REF 1	hex
par. DR-84 Comm. Option STW	hex
par. DR-85 Drive Port CTW 1	hex
par. DR-86 Drive Port REF 1	hex
par. DR-90 Alarm Word	
par. DR-92 Warning Word	
par. DR-94 Ext. Status Word	

**Status screen I:**

This read-out state is standard after start-up or initialization.

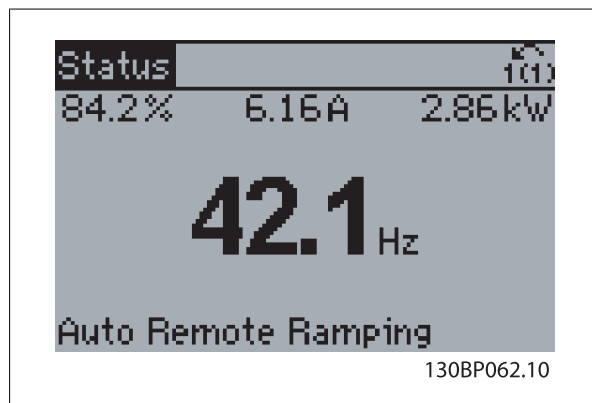
Use [INFO] to obtain information about the measurement links to the displayed operating variables (1.1, 1.2, 1.3, 2 and 3).

See the operating variables shown in the screen in this illustration.

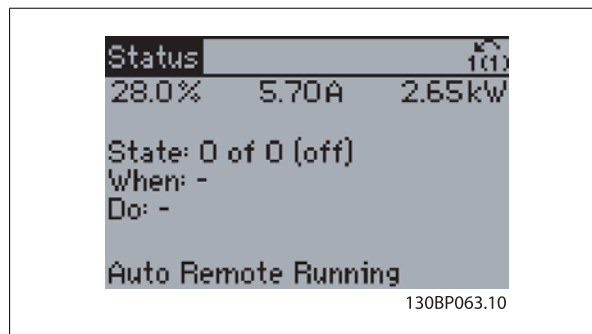
**Status screen II:**

See the operating variables (1.1, 1.2, 1.3 and 2) shown in the screen in this illustration.

In the example, Speed, Motor current, Motor power and Frequency are selected as variables in the first and second.

**Status screen III:**

This state displays the event and action of the Logic Controller. For further information, see section *Logic Controller*.



2.1.6 Parameter Set-Up

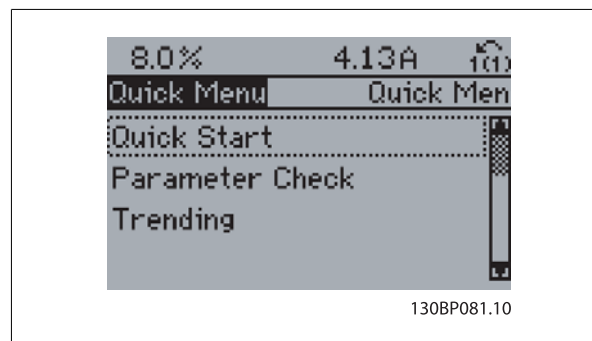
The frequency converter can be used for practically all assignments, which is why the number of parameters is quite large. The frequency converter offers a choice between two programming modes - a Main Menu and a Quick Menu mode.

The former provides access to all parameters. The latter takes the user through a few parameters making it possible to start operating the frequency converter. Regardless of the mode of programming, you can change a parameter both in the Main Menu mode and in the Quick Menu mode.



2.1.7 Quick Menu Key Functions

Pressing [Quick Menus] The list indicates the different areas contained in the Quick menu.



2

Select *Quickstart* to go through a limited amount of parameters to get the motor running almost optimally. The default setting for the other parameters considers the desired control functions and the configuration of signal inputs/outputs (control terminals).

The selection of parameter is effected by means of the arrow keys. The parameters in the following table are accessible.

Parameter	Setting
par. K-01 <i>Language</i>	
par. K-02 <i>Motor Speed Unit</i>	
par. P-02 <i>Motor Power [HP]</i>	
par. F-05 <i>Motor Rated Voltage</i>	[V]
par. P-03 <i>Motor Current</i>	[A]
par. F-04 <i>Base Frequency</i>	[Hz]
par. P-06 <i>Base Speed</i>	[rpm]
par. F-01 <i>Frequency Setting 1</i>	
par. F-02 <i>Operation Method</i>	
or	
par. P-07 <i>Motor Power [kW]</i>	[kW]
par. F-07 <i>Accel Time 1</i>	[sec]
par. F-08 <i>Decel Time 1</i>	[sec]
par. F-10 <i>Electronic Overload</i>	
par. F-17 <i>Motor Speed High Limit [RPM]</i>	
or	
par. F-15 <i>Motor Speed High Limit [Hz]</i>	
par. F-18 <i>Motor Speed Low Limit [RPM]</i>	
or	
par. F-16 <i>Motor Speed Low Limit [Hz]</i>	
par. H-08 <i>Reverse Lock</i>	
par. P-04 <i>Auto Tune</i>	[1] Enable complete Auto Tune

* If terminal 27 is set to "no function", no connection to +24 V on terminal 27 is necessary.

Select *Changes made* to get information about:

- the last 10 changes. Use the [▲] [▼] navigation keys to scroll between the last 10 changed parameters.
- the changes made since default setting.

Select *Trendings* to get information about the display line read-outs. The information is shown as graphs.

Only display parameters selected in par. K-20 *Display Line 1.1 Small* and par. K-24 *Display Line 3 Large* can be viewed. It is possible to store up to 120 samples in the memory for later reference.



2.1.8 Initial Commissioning

The easiest way of carrying out the initial commissioning is by using the Quick Menu button and follow the quick set-up procedure using Keypad (read table from left to right). The example applies to open loop applications:

2

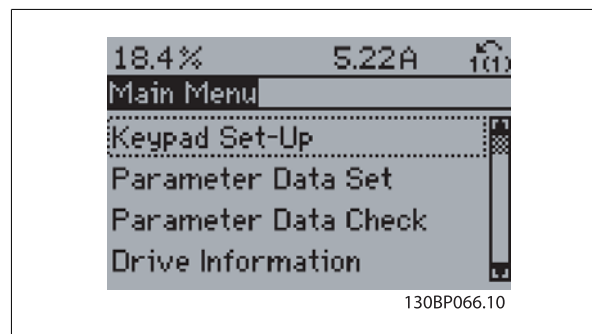
Press			
		Quick Start	
par. K-01 <i>Language</i>		Set language	
par. K-02 <i>Motor Speed Unit</i>		Set motor speed in Hz or RPM	
par. P-02 <i>Motor Power [HP]</i> or par. P-07 <i>Motor Power [kW]</i>		Set Motor nameplate power	
par. F-05 <i>Motor Rated Voltage</i>		Set Nameplate voltage	
par. F-04 <i>Base Frequency</i>		Set Nameplate frequency	
par. P-03 <i>Motor Current</i>		Set Nameplate current	
par. P-06 <i>Base Speed</i>		Set Nameplate speed in RPM	
par. F-01 <i>Frequency Setting 1</i>		Set reference source	
par. F-02 <i>Operation Method</i>		Select which reference site to activate	
par. F-07 <i>Accel Time 1</i>		Set the accel time with reference to synchronous motor speed, n_s	
par. F-08 <i>Decel Time 1</i>		Set the decel time time with reference to synchronous motor speed, n_s	
par. F-10 <i>Electronic Overload</i>		Set motor thermal protection	
par. F-15 <i>Motor Speed High Limit [Hz]</i> or par. F-17 <i>Motor Speed High Limit [RPM]</i>		Set motor speed high limit in Hz or RPM	
par. F-16 <i>Motor Speed Low Limit [Hz]</i> or par. F-18 <i>Motor Speed Low Limit [RPM]</i>		Set motor speed low limit in Hz or RPM	
par. H-08 <i>Reverse Lock</i>		Set allowed rotation direction	
par. P-04 <i>Auto Tune</i>		Set desired auto tune function. Enable complete auto tune is recommended	



2.1.9 Main Menu Mode

Start the Main Menu mode by pressing the [Main Menu] key. The read-out shown to the right appears on the display.

The middle and bottom sections on the display show a list of parameter groups which can be chosen by toggling the up and down buttons.



2

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

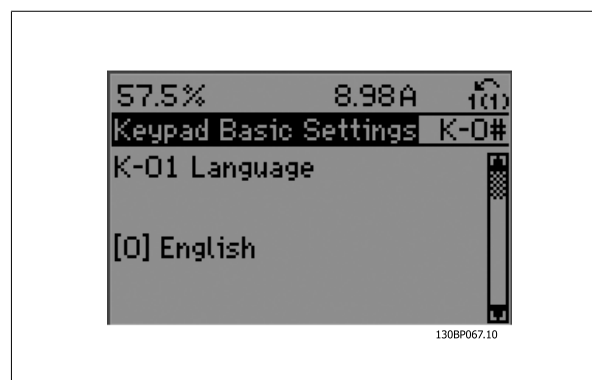
All parameters can be changed in the Main Menu. However, depending on the choice of configuration (par. H-40 *Configuration Mode*), some parameters can be "missing". E.g. open loop hides all the PID parameters, and other enabled options make more parameter groups visible.

2.1.10 Parameter Selection

In the Main menu mode, the parameters are divided into groups. You select a parameter group by means of the navigation keys.

After selecting a parameter group, choose a parameter by means of the navigation keys.

The middle section on the display shows the parameter number and name as well as the selected parameter value.



2.1.11 Changing Data

The procedure for changing data is the same whether you select a parameter in the Quick menu or the Main menu mode. Press [OK] to change the selected parameter.

The procedure for changing data depends on whether the selected parameter represents a numerical data value or a text value.

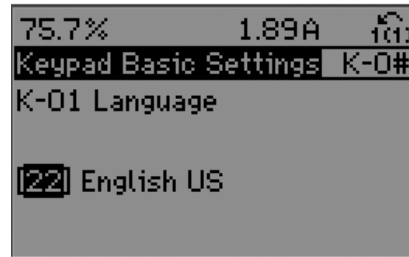


2.1.12 Changing a Text Value

If the selected parameter is a text value, change the text value by means of the [▲][▼] navigation keys.

The up key increases the value, and the down key decreases the value. Place the cursor on the value you want to save and press [OK].

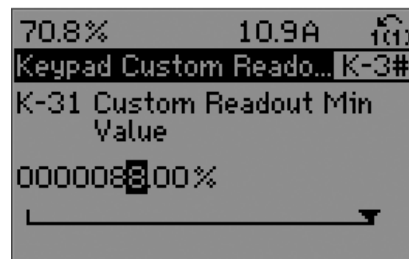
2



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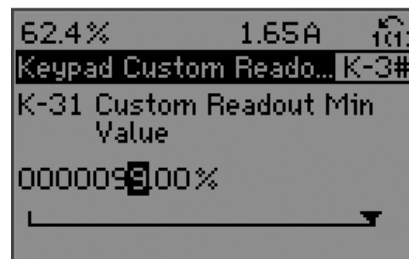
2.1.13 Changing a Group of Numeric Data Values

If the chosen parameter represents a numeric data value, change the chosen data value by means of the [◀] [▶] navigation keys as well as the [▲] [▼] navigation keys. Use the [◀] [▶] navigation keys to move the cursor horizontally.



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Use the [▲][▼] navigation keys to change the data value. The up key enlarges the data value, and the down key reduces the data value. Place the cursor on the value you want to save and press [OK].

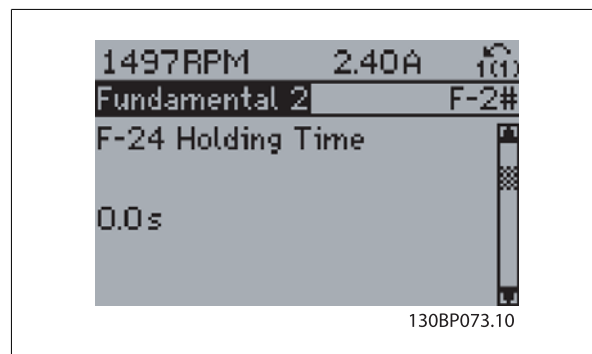


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2.1.14 Infinitely Variable Change of Numeric Data Value

If the chosen parameter represents a numeric data value, select a digit by means of the [◀] [▶] navigation keys.



2

Change the selected digit infinitely variably by means of the [▲] [▼] navigation keys.

The chosen digit is indicated by the cursor. Place the cursor on the digit you want to save and press [OK].

2.1.15 Changing a Data Value, Step-by-Step

Certain parameters can be changed step by step or infinitely varying. This applies to par. P-07 *Motor Power [kW]*, par. F-05 *Motor Rated Voltage* and par. F-04 *Base Frequency*.

The parameters are changed both as a group of numeric data values and as numeric data values infinitely varying.

2.1.16 Read-out and Programming of Indexed Parameters

Parameters are indexed when placed in a rolling stack.

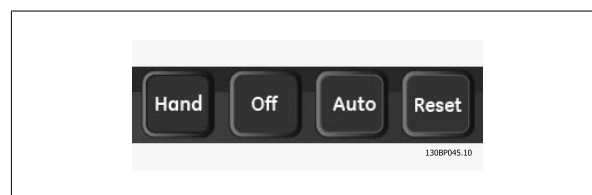
par. ID-30 *Fault Log: Error Code* to par. ID-32 *Alarm Log: Time* contain a fault log which can be read out. Choose a parameter, press [OK], and use the [▲] [▼] navigation keys to scroll through the value log.

Use par. C-05 *Multi-step Frequency 1 - 8* as another example:

Choose the parameter, press [OK], and use the [▲] [▼] navigation keys to scroll through the indexed values. To change the parameter value, select the indexed value and press [OK]. Change the value by using the [▲] [▼] keys. Press [OK] to accept the new setting. Press [CANCEL] to abort. Press [Back] to leave the parameter.

2.1.17 Keypad Keys

Keys for local control are found at the bottom of the Keypad.



[Hand] enables control of the frequency converter via the Keypad. [Hand] also starts the motor and it is now possible to enter the motor speed data by means of the arrow keys. The key can be selected as Enable [1] og Disable [0] via par. K-40 *[Hand] Button on Keypad*.

External stop signals activated by means of control signals or a serial bus will override a 'start' command via the Keypad.

The following control signals will still be active when [Hand] is activated:

- [Hand] - [Off] - [Auto]
- Reset
- Coasting stop inverse



- Reversing
- Set-up select lsb - Set-up select msb
- Stop command from serial communication
- Quick stop
- DC brake

[Off] stops the connected motor. The key can be selected as Enable [1] or Disable [0] via par. K-41 *[Off] Button on Keypad*.

If no external stop function is selected and the [Off] key is inactive the motor can be stopped by disconnecting the voltage.

[Auto] enables the frequency converter to be controlled via the control terminals and/or serial communication. When a start signal is applied on the control terminals and/or the bus, the frequency converter will start. The key can be selected as Enable [1] or Disable [0] via par. K-42 *[Auto] Button on Keypad*.

NB!

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

[Reset] is used for resetting the frequency converter after an alarm (trip). It can be selected as Enable [1] or Disable [0] via par. K-43 *[Reset] Button on Keypad*.

2.1.18 Restoring Drive to Factory Settings

The drive can be restored to factory settings in two ways:

Recommended

1. Select par. H-03 *Restore Factory Settings*
2. Press [OK]
3. Select [2] *Restore Factory Settings*
4. Press [OK]
5. Cut off the mains supply and wait until the display turns off.
6. Reconnect the mains supply - the frequency converter is now reset.

par. H-03 *Restore Factory Settings* restores all except:
 par. SP-50 *RFI Filter*
 par. O-30 *Protocol*
 par. O-31 *Address*
 par. O-32 *Drive Port Baud Rate*
 par. O-35 *Minimum Response Delay*
 par. O-36 *Max Response Delay*
 par. O-37 *Max Inter-Char Delay*
 par. ID-00 *Operating Hours* to par. ID-05 *Over Volt's*
 par. ID-20 *Historic Log: Event* to par. ID-22 *Historic Log: Time*
 par. ID-30 *Fault Log: Error Code* to par. ID-32 *Alarm Log: Time*

Manual Restore of Factory Settings

1. Disconnect from mains and wait until the display turns off
2. Press [Status] - [Main Menu] - [OK] at the same time while power up for Keypad
3. Release the keys after 5 s.
4. The frequency converter is now programmed according to default settings.

Manual restores all except:
 par. ID-00 *Operating Hours*
 par. ID-03 *Power Up's*
 par. ID-04 *Over Temp's*
 par. ID-05 *Over Volt's*

NB!

When you carry out manual restore, you also reset serial communication, RFI filter settings (par. SP-50 *RFI Filter*) and fault log settings.



3 Parameter Descriptions

3.1 Parameter Selection

3.1.1 Parameter Selection - AF-650 GP

Parameters for AF-650 GP are grouped into various parameter groups for easy selection of the correct parameters for optimized operation of the frequency converter.

Main Menu Item	Parameter Groups:
Keypad Set-up	K-##
Parameter Data Set	F-##, E-##, C-##, P-##, H-##, AN-##, SP-##, O-##, DN-##, PB-##, EN-##, EC-##, RS-##
Drive Information	ID-##
Data Readouts	DR-##
Advanced Parameter Data Set	LC-##, B-##, PI-##

Table 3.1: Parameter Groups in Main Menu Items

Group No	Parameter Groups:
K-##	Keypad Set-Up
F-##	Fundamental Parameters
E-##	Digital In/Out
C-##	Frequency Control Functions
P-##	Motor Data
H-##	High Perf Parameters
AN-##	Analog In/Out
SP-##	Special Functions
O-##	Options/Comms
DN-##	DeviceNet
PB-##	Profibus DP
EN-##	EtherNet/IP
EC-##	Feedback Option
RS-##	Resolver Interface
ID-##	Drive Information
DR-##	Data Readouts
LC-##	Logic Controller
B-##	Braking Functions
PI-##	PID Controls

Table 3.2: Parameter Groups



3.2 Keypad Set-Up

Parameter group related to the fundamental functions of the drive, keypad buttons, configuration of the keypad display, copy-cat features, and password protection.

3

3.2.1 K-0# Keypad Basic Settings

Parameters for configuring basic drives settings.

K-01 Language

Option:

Function:

Defines the language to be used in the display.

The frequency converter is delivered with 4 different languages.

[0] * English

Part of Language packages 1 - 4

K-02 Motor Speed Unit

Option:

Function:

This parameter cannot be adjusted while the motor is running.

The display showing depends on settings in par. K-02 *Motor Speed Unit* and par. K-03 *Regional Settings*.

The default setting of par. K-02 *Motor Speed Unit* and par. K-03 *Regional Settings* depends on which region of the world the frequency converter is supplied to, but can be re-programmed as required.

NB!

Changing the *Motor Speed Unit* will reset certain parameters to their initial value. It is recommended to select the motor speed unit first, before modifying other parameters.

[0] RPM

Selects display of motor speed variables and parameters (i.e. references, feedbacks and limits) in terms of motor speed (RPM).

[1] * Hz

Selects display of motor speed variables and parameters (i.e. references, feedbacks and limits) in terms of output frequency to the motor (Hz).

K-03 Regional Settings

Option:

Function:

[0] International

Sets par. P-07 *Motor Power [kW]* units to kW and the default value of par. F-04 *Base Frequency* to 50 Hz.

[1] * US

Sets par. P-09 *Slip Compensation* units to HP and the default value of par. F-04 *Base Frequency* to 60 Hz.

This parameter cannot be adjusted while the motor is running.

K-04 Operating State at Power-up

Option:

Function:

Selects the operating mode upon reconnection of the frequency converter to mains voltage after power down in Hand (local) operation mode.

[0] Resume

Restarts the frequency converter maintaining the same local reference and the same start/stop settings (applied by [START/STOP]) as before the frequency converter was powered down.

[1] * Forced stop, ref=old

Restarts the frequency converter with a saved local reference, after mains voltage reappears and after pressing [START].

[2] Forced stop, ref=0

Resets the local reference to 0 upon restarting the frequency converter.



3.2.2 K-1# Keypad Set-up Operations

Define and control the individual parameter setups.

The frequency converter has four parameter setups that can be programmed independently of each other. This makes the frequency converter very flexible and able to solve advanced control functionality problems, often saving the cost of external control equipment. For example these can be used to program the frequency converter to operate according to one control scheme in one setup (e.g. motor 1 for horizontal movement) and another control scheme in another setup (e.g. motor 2 for vertical movement). Alternatively they can be used by an OEM machine builder to identically program all their factory fitted frequency converters for different machine types within a range to have the same parameters and then during production/commissioning simply select a specific setup depending on which machine the frequency converter is installed on.

The active setup (i.e. the setup in which the frequency converter is currently operating) can be selected in par. K-10 *Active Set-up* and is displayed in the Keypad. Using Multi set-up it is possible to switch between setups with the frequency converter running or stopped, via digital input or serial communication commands. If it is necessary to change setups whilst running, ensure par. K-12 *This Set-up Linked to* is programmed as required. Using par. K-11 *Edit Set-up* it is possible to edit parameters within any of the setups whilst continuing the frequency converter operation in its Active Setup which can be a different setup to that being edited. Using par. K-51 *Set-up Copy* it is possible to copy parameter settings between the setups to enable quicker commissioning if similar parameter settings are required in different setups.

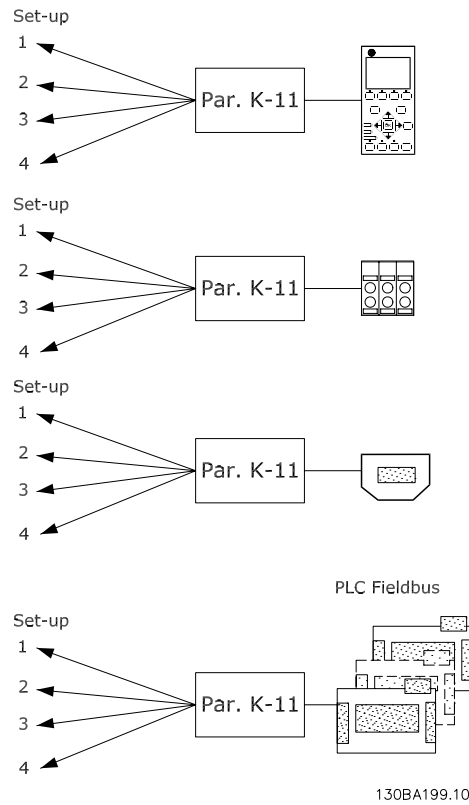
K-10 Active Set-up

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

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

K-11 Edit Set-up

Option:	Function:
	Select the set-up to be edited (i.e. programmed) during operation; either the active set-up or one of the inactive set-ups.
[0] Factory setup	Cannot be edited but it is useful as a data source to return the other set-ups to a known state.
[1] * Set-up 1	<i>Set-up 1 [1] to Set-up 4 [4]</i> can be edited freely during operation, independently of the active set-up.
[2] Set-up 2	
[3] Set-up 3	
[4] Set-up 4	
[9] Active Set-up	Can also be edited during operation. Edit the chosen set-up from a range of sources: Keypad, Drive RS485, Drive USB or up to five Network sites.



K-12 This Set-up Linked to

Option:

Function:

To enable conflict-free changes from one set-up to another during operation, link set-ups containing parameters which are not changeable during operation. The link will ensure synchronising of the 'not changeable during operation' parameter values when moving from one set-up to another during operation. 'Not changeable during operation' parameters can be identified by the label FALSE in the parameter lists in the section *Parameter Lists*.

par. K-12 *This Set-up Linked to* is used by Multi set-up in par. K-10 *Active Set-up*. Multi set-up is used to move from one set-up to another during operation (i.e. while the motor is running).

Example:

Use Multi set-up to shift from Set-up 1 to Set-up 2 whilst the motor is running. Program in Set-up 1 first, then ensure that Set-up 1 and Set-up 2 are synchronised (or 'linked'). Synchronisation can be performed in two ways:

1. Change the edit set-up to Set-up 2 [2] in par. K-11 *Edit Set-up* and set par. K-12 *This Set-up Linked to* to Set-up 1 [1]. This will start the linking (synchronising) process.



0.0% 0.00A

Keypad Set-Up Operat...K-1#

K-12 This Set-up Linked to

[1] Set-up 1

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OR

2. While still in Set-up 1, copy Set-up 1 to Set-up 2. Then set par. K-12 *This Set-up Linked to* to Set-up 2 [2]. This will start the linking process.

0.0% 0.00A

Keypad Set-Up Operat...K-1#

K-12 This Set-up Linked to

[2] Set-up 2

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After the link is complete, par. K-13 *Readout: Linked Set-ups* will read {1,2} to indicate that all 'not changeable during operation' parameters are now the same in Set-up 1 and Set-up 2. If there are changes to a 'not changeable during operation' parameter, e.g. par. P-30 *Stator Resistance (Rs)*, in Set-up 2, they will also be changed automatically in Set-up 1. A switch between Set-up 1 and Set-up 2 during operation is now possible.

[0] *	Not linked
[1]	Set-up 1
[2]	Set-up 2
[3]	Set-up 3
[4]	Set-up 4

**K-13 Readout: Linked Set-ups**

Array [5]

Range:

0* [0 - 255]

Function:

View a list of all the set-ups linked by means of par. K-12 *This Set-up Linked to*. The parameter has one index for each parameter set-up. The parameter value displayed for each index represents which setups are linked to that parameter setup.

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

Table 3.4: Example: Set-up 1 and Set-up 2 are linked

K-14 Readout: Edit Set-ups / Channel**Range:**

0* [-2147483648 - 2147483647]

Function:

View the setting of par. K-11 *Edit Set-up* for each of the four different communication channels. When the number is displayed in hex, as it is in the Keypad, each number represents one channel. Numbers 1-4 represent a set-up number; 'F' means factory setting; and 'A' means active set-up. The channels are, from right to left: Keypad, Drive bus, USB, HPFB1-5.

Example: The number AAAAAA21h means that the Drive bus selected Set-up 2 in par. K-11 *Edit Set-up*, the Keypad selected Set-up 1 and all others used the active set-up.

3.2.3 K-2# Keypad Display

Define the variables displayed in the keypad.

NB!

Please refer to par. K-37 *Display Text 1*, par. K-38 *Display Text 2* and par. K-39 *Display Text 3* for information on how to write display texts

K-20 Display Line 1.1 Small**Option:****Function:**

Select a variable for display in line 1, left position.

K-21 Display Line 1.2 Small**Option:****Function:**

Select a variable for display in line 1, middle position. The options are the same as listed for par. K-2#.

K-22 Display Line 1.3 Small**Option:****Function:**

Select a variable for display in line 1, right position. The options are the same as listed for par. K-2#.

K-23 Display Line 2 Large**Option:****Function:**

Select a variable for display in line 2. The options are the same as those listed for par. K-2#.

**K-24 Display Line 3 Large****Option:****Function:**

Select a variable for display in line 3.

The options are the same as those listed in par. K-20 *Display Line 1.1 Small*.**K-25 Quick Start**

Array [50]

Define up to 50 parameters to appear in the Quick Start Menu, accessible via the [Quick Menu] key on the Keypad. The parameters will be displayed in the Quick Start Menu in the order they are programmed into this array parameter. Delete parameters by setting the value to '0000'.

For example, this can be used to provide quick, simple access to just one or up to 50 parameters which require changing on a regular basis (e.g. for plant maintenance reasons) or by an OEM to enable simple commissioning of their equipment.

Range:**Function:**

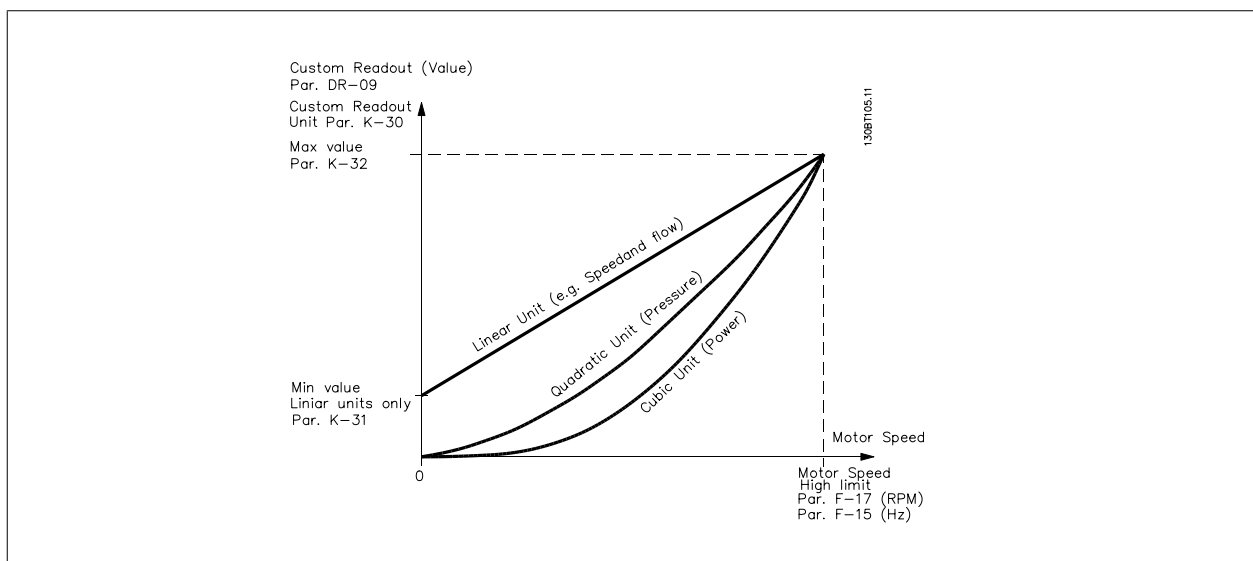
0* [0 - 9999]

3.2.4 K-3# Keypad Custom Readout

It is possible to customize the display elements for various purposes: *Custom Readout. Value proportional to speed (Linear, squared or cubed depending on unit selected in par. K-30 *Unit for Custom Readout*) *Display Text. Text string stored in a parameter.

Custom Readout

The calculated value to be displayed is based on settings in par. K-30 *Unit for Custom Readout*, par. K-31 *Min Value of Custom Readout* (linear only), par. K-32 *Max Value of Custom Readout*, par. F-17 *Motor Speed High Limit [RPM]*, par. F-15 *Motor Speed High Limit [Hz]* and actual speed.



The relation will depend on the type of unit selected in par. K-30 *Unit for Custom Readout*.



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

K-30 Unit for Custom Readout

Option:

Function:

It is possible to program a value to be shown in the display of the Keypad. The value will have a linear, squared or cubed relation to speed. This relation will depend on the unit selected (see table above). The actual calculated value can be read in par. DR-09 *Custom Readout*, and/or shown in the display by selecting Custom Readout [DR-09] in par. K-20 *Display Line 1.1 Small* to par. K-24 *Display Line 3 Large*.

[0] * None

[1] %

[5] PPM

[10] 1/min

[11] rpm

[12] Pulse/s

[20] l/s

[21] l/min

[22] l/h

[23] m³/s

[24] m³/min

[25] m³/h

[30] kg/s

[31] kg/min

[32] kg/h

[33] t/min

[34] t/h

[40] m/s

[41] m/min

[45] m

[60] °C

[70] mbar

[71] bar

[72] Pa

[73] kPa

[74] m WG

[80] kW

[120] GPM

[121] gal/s

[122] gal/min

[123] gal/h

[124] CFM



[125]	ft ³ /s
[126]	ft ³ /min
[127]	ft ³ /h
[130]	lb/s
[131]	lb/min
[132]	lb/h
[140]	ft/s
[141]	ft/min
[145]	ft
[160]	°F
[170]	psi
[171]	lb/in ²
[172]	in WG
[173]	ft WG
[180]	HP

K-31 Min Value of Custom Readout**Range:**

0.00Unit* [-999999.99 - par. F-32]

Function:

This parameter sets the min. value of the custom defined readout (occurs at zero speed). Only possible to set different from 0 is when selecting a linear unit in par. K-30 *Unit for Custom Readout*. For Quadratic and Cubic units the minimum value will be 0.

K-32 Max Value of Custom Readout**Range:**

100.00 Cus- [par. F-31 - 999999.99 CustomReadoutUnit*
tomReadoutUnit]

Function:

This parameter sets the max value to be shown when the speed of the motor has reached the set value for (par. F-17 *Motor Speed High Limit [RPM]* and par. F-15 *Motor Speed High Limit [Hz]*).

3.2.5 K-4# Keypad Buttons

Parameters for configuring the graphical Keypad Hand, Off, Auto, & Reset keys.

K-40 [Hand] Button on Keypad**Option:**

[0] Disabled

Function:

No function

[1] * Enabled

[Hand] Key enabled

[2] Password Protection

Avoid unauthorized start in Hand mode. If par. K-40 *[Hand] Button on Keypad* is included in the My Personal Menu, then define the password in par. K-65 *Quick Menu Password*0-65 Personal Menu Password. Otherwise define the password in par. K-60 *Main Menu Password*0-60 Main Menu Password.

K-41 [Off] Button on Keypad**Option:**

[0] Disabled

Function:

Avoids accidental stop of the frequency converter.

[1] * Enabled

[2] Password Protection

Avoids unauthorized stop. If par. K-41 *[Off] Button on Keypad* is included in the Quick Menu, then define the password in par. K-65 *Quick Menu Password*.

K-42 [Auto] Button on Keypad**Option:**

[0] Disabled

Function:

avoid accidental start of the frequency converter in Auto mode.



[1] * Enabled

[2] Password Protection Avoids unauthorised start in Auto mode. If par. K-42 *[Auto] Button on Keypad* is included in the Quick Menu, then define the password in par. K-65 *Quick Menu Password*.

K-43 [Reset] Button on Keypad

Option: **Function:**

[0] Disabled Avoids accidental alarm reset.

[1] * Enabled

[2] Password Protection Avoids unauthorised resetting. If par. K-43 *[Reset] Button on Keypad* is included in the Quick Menu, then define the password in par. K-65 *Quick Menu Password*.

3.2.6 K-5# Copy/Save

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

K-50 Keypad Copy

Option: **Function:**

[0] * No copy

[1] All to Keypad Copies all parameters in all set-ups from the frequency converter memory to the Keypad memory.

[2] All from Keypad Copies all parameters in all set-ups from the Keypad memory to the frequency converter memory.

[3] Size indep. from Keypad Copy only the parameters that are independent of the motor size. The latter selection can be used to programme several frequency converters with the same function without disturbing motor data.

This parameter cannot be adjusted while the motor is running.

K-51 Set-up Copy

Option: **Function:**

[0] * No copy No function

[1] Copy to set-up 1 Copies all parameters in the present Programming Set-up (defined in par. K-11 *Edit Set-up*) to Set-up 1.

[2] Copy to set-up 2 Copies all parameters in the present Programming Set-up (defined in par. K-11 *Edit Set-up*) to Set-up 2.

[3] Copy to set-up 3 Copies all parameters in the present Programming Set-up (defined in par. K-11 *Edit Set-up*) to Set-up 3.

[4] Copy to set-up 4 Copies all parameters in the present Programming Set-up (defined in par. K-11 *Edit Set-up*) to Set-up 4.

[9] Copy to all Copies the parameters in the present set-up over to each of the set-ups 1 to 4.

3.2.7 K-6# Password Protection

Parameters for setting the Password Protection for the drive parameters.

K-60 Main Menu Password

Range: **Function:**

100* [0 - 999] Define the password for access to the Main Menu via the [Main Menu] key. If par. K-61 *Access to Main Menu w/o Password* is set to *Full access* [0], this parameter will be ignored.

K-61 Access to Main Menu w/o Password

Option: **Function:**

[0] * Full access Disables password defined in par. K-60 *Main Menu Password*.

[1] Read only Prevent unauthorized editing of Main Menu parameters.

[2] No access Prevent unauthorized viewing and editing of Main Menu parameters.



If *Full access* [0] is selected then par. K-60 *Main Menu Password*, par. K-65 *Quick Menu Password* and par. K-66 *Access to Quick Menu w/o Password* will be ignored.

K-65 Quick Menu Password

Range:

200* [-9999 - 9999]

Function:

Define the password for access to the Quick Menu via the [Quick Menu] key. If par. K-66 *Access to Quick Menu w/o Password* is set to *Full access* [0], this parameter will be ignored.

K-66 Access to Quick Menu w/o Password

Option:

[0] * Full access

Function:

Disables the password defined in par. K-65 *Quick Menu Password*.

[1] Keypad: Read only

Prevents unauthorised editing of Quick Menu parameters.

[2] Keypad: No access

Prevents unauthorised viewing and editing of Quick Menu parameters.

[3] Bus: Read only

Read only functions for parameters on Network and/ or Drive standard bus.

[4] Bus: No access

No access to parameters is allowed via Network and/ or Drive standard bus.

[5] All: Read only

read only function for parameters on Keypad, Network or Drive standard bus.

[6] All: No access

No access from Keypad, Network or Drive standard bus is allowed.

If par. K-61 *Access to Main Menu w/o Password* is set to *Full access* [0] then this parameter will be ignored.

K-67 Bus Password Access

Range:

0* [0 - 9999]

Function:

Writing to this parameter enables users to unlock the frequency converter from network/ DCT10.



3.3 Parameter Data Set

Parameter group related to the fundamental functions of the drive.

3.3.1 F-0# Fundamental 0

Parameters to configure frequency command, base speed settings, Torque Boost, and accel/decel time.

3

F-01 Frequency Setting 1

Option:	Function:	
	Select the reference input to be used for the first reference signal. par. F-01 <i>Frequency Setting 1</i> , par. C-30 <i>Frequency Command 2</i> and par. C-34 <i>Frequency Command 3</i> define up to three different reference signals. The sum of these reference signals defines the actual reference.	
[0]	No function	
[1] *	Analog Input 53	
[2]	Analog Input 54	
[7]	Frequency input 29	
[8]	Frequency input 33	
[11]	Local bus reference	
[20]	Digital Potentio-Meter	
[21]	Analog input X30-11	(OPCGPIO - General Purpose I/O Option Module)
[22]	Analog input X30-12	(OPCGPIO - General Purpose I/O Option Module)

F-02 Operation Method

Option:	Function:	
	Select which reference site to activate.	
[0] *	Linked to Hand / Auto	Use local reference when in Hand mode; or remote reference when in Auto mode.
[1]	Remote	Use remote reference in both Hand mode and Auto mode.
[2]	Local	Use local reference in both Hand mode and Auto mode.

NB!
When set to Local [2], the frequency converter will start with this setting again following a 'power down'.

F-03 Max Output Frequency 1

Range:	Function:
132.0 Hz* [1.0 - 1000.0 Hz]	Provides a final limit on the output frequency for improved safety in applications where you want to avoid accidental over-speeding. This limit is final in all configurations (independent of the setting in par. H-40 <i>Configuration Mode</i>).

NB!

Max. output frequency cannot exceed 10% of the inverter switching frequency (par. F-26 *Motor Noise (Carrier Freq)*).

par. F-03 *Max Output Frequency 1* cannot be adjusted while the motor is running.

F-04 Base Frequency

Range:	Function:
50. Hz* [20 - 1000 Hz]	Min - Max motor frequency: 20 - 1000 Hz.



Select the motor frequency value from the motor nameplate data. If a value different from 50 Hz or 60 Hz is selected, it is necessary to adapt the load independent settings in par. H-50 *Motor Magnetisation at Zero Speed* to par. H-53 *Model Shift Frequency*. For 87 Hz operation with 230/400 V motors, set the nameplate data for 230 V/50 Hz. Adapt par. F-17 *Motor Speed High Limit [RPM]* and par. F-53 *Maximum Reference* to the 87 Hz application.

F-05 Motor Rated Voltage

Range:

500. V* [10. - 1000. V]

Function:

Enter the nominal motor voltage according to the motor nameplate data. The default value corresponds to the nominal rated output of the unit.

F-07 Accel Time 1

Range:

3.00 s* [0.01 - 3600.00 s]

Function:

Enter the accel time, i.e. the acceleration time from 0 RPM to the synchronous motor speed n_s . Choose a accel time such that the output current does not exceed the current limit in par. F-43 *Current Limit* during ramping. The value 0.00 corresponds to 0.01 sec. in speed mode. See decel time in par. F-08 *Decel Time 1*.

$$Par. F - 07 = \frac{t_{acc}[s] \times n_s [RPM]}{ref[RPM]}$$

F-08 Decel Time 1

Range:

3.00 s* [0.01 - 3600.00 s]

Function:

Enter the decel time, i.e. the deceleration time from the synchronous motor speed n_s to 0 RPM. Choose a decel time such that no over-voltage 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 par. F-43 *Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See accel time in par. F-07 *Accel Time 1*.

$$Par. F - 08 = \frac{t_{dec}[s] \times n_s [RPM]}{ref[RPM]}$$

F-09 Torque Boost

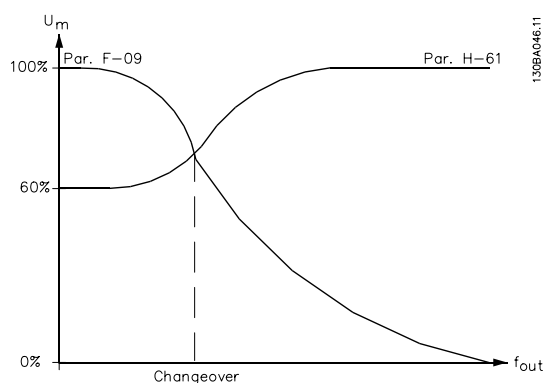
Range:

100 %* [0 - 300 %]

Function:

Enter the % value to compensate voltage in relation to load when the motor is running at low speed and obtain the optimum U/f characteristic. The motor size determines the frequency range within which this parameter is active.

Motor size	Change over
0.25 kW - 7.5 kW	< 10 Hz





3.3.2 F-1# Fundamental 1

Parameters to configure drive electronic overload and high/low speed limits.

F-10 Electronic Overload

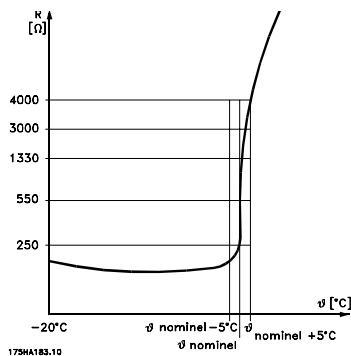
Option:

Function:

The frequency converter determines the motor temperature for motor protection in two different ways:

- Via a thermistor sensor connected to one of the analog or digital inputs (par. F-12 *Motor Thermistor Input*).
- Via calculation of the thermal load, based on the actual load and time. The calculated thermal load is compared with the rated motor current $I_{M,N}$ and the rated motor frequency $f_{M,N}$. The calculations estimate the need for a lower load at lower speed due to less cooling from the fan incorporated in the motor.

[0] *	No protection	Continuously overloaded motor, when no warning or trip of the frequency converter is required.
[1]	Thermistor warning	Activates a warning when the connected thermistor or KTY-sensor in the motor reacts in the event of motor over-temperature.
[2]	Thermistor trip	Stops (trips) frequency converter when connected thermistor in motor reacts in the event of motor over-temperature. The thermistor cut-out value must be $> 3 \text{ k}\Omega$. Integrate a thermistor (PTC sensor) in the motor for winding protection.
[3]	Electronic Overload Warning 1	
[4]	Electronic Overload Trip 1	
[5]	Electronic Overload Warning 2	
[6]	Electronic Overload Trip 2	
[7]	Electronic Overload Warning 3	
[8]	Electronic Overload Trip 3	
[9]	Electronic Overload Warning 4	
[10]	Electronic Overload Trip 4	



Motor protection can be implemented using a range of techniques: PTC or KTY sensor (see also section *KTY Sensor Connection*) in motor windings; mechanical thermal switch (Klixon type); or Electronic Thermal Overload.

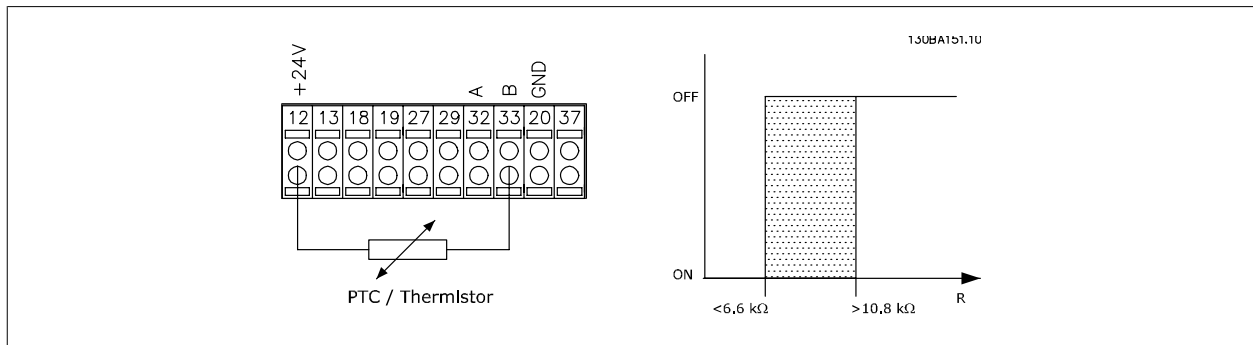
Using a digital input and 24 V as power supply:

Example: The frequency converter trips when the motor temperature is too high

Parameter set-up:

Set par. F-10 *Electronic Overload to Thermistor Trip* [2]

Set par. F-12 *Motor Thermistor Input to Digital Input* [6]



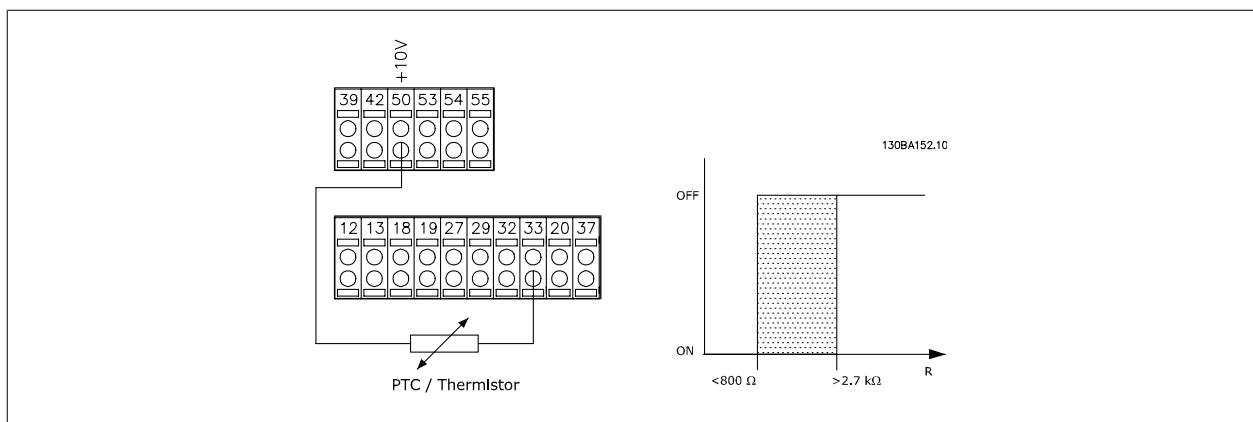
Using a digital input and 10 V as power supply:

Example: The frequency converter trips when the motor temperature is too high.

Parameter set-up:

Set par. F-10 *Electronic Overload to Thermistor Trip* [2]

Set par. F-12 *Motor Thermistor Input to Digital Input* [6]



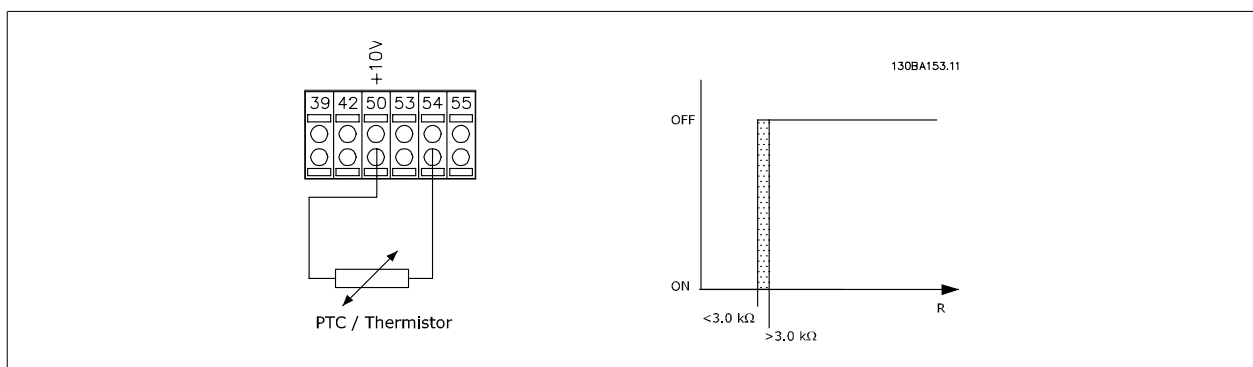
Using an analog input and 10 V as power supply:

Example: The frequency converter trips when the motor temperature is too high.

Parameter set-up:

Set par. F-10 *Electronic Overload to Thermistor Trip* [2]

Set par. F-12 *Motor Thermistor Input to Analog Input* 54 [2]



Input	Supply Voltage	Threshold
Digital/analog	Volt	Cut-out Values
Digital	24 V	< 6.6 kΩ - > 10.8 kΩ
Digital	10 V	< 800Ω - > 2.7 kΩ
Analog	10 V	< 3.0 kΩ - > 3.0 kΩ

**NB!**

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

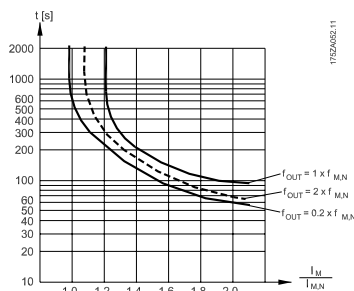
Select *Electronic Overload Warning* 1-4, to activate a warning on the display when the motor is overloaded.

Select *Electronic Overload Trip* 1-4 to trip the frequency converter when the motor is overloaded.

Program a warning signal via one of the digital outputs. The signal appears in the event of a warning and if the frequency converter trips (thermal warning).

Electronic Overload functions 1-4 will calculate the load when the set-up where they were selected is active. For example Electronic Overload 3 starts calculating when setup 3 is selected. For the North American market: The Electronic Overload functions provide class 20 motor overload protection in accordance with NEC.

3

**F-11 Motor External Fan****Option:**

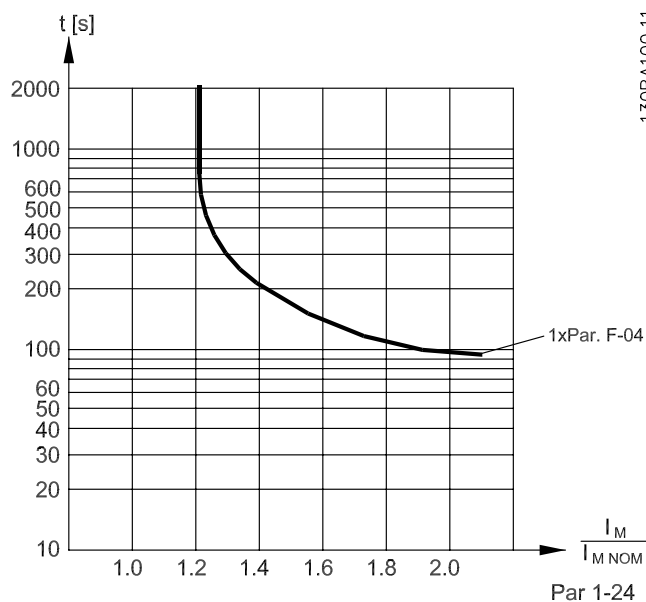
[0] * No

Function:

No external fan on motor, i.e. the motor is derated at low speed.

[1] Yes

Applies an external motor fan (external ventilation), so no derating of the motor is required at low speed. The graph below is followed if the motor current is lower than nominal motor current (see par. P-03 *Motor Current*). If the motor current exceeds nominal current, the operation time still decreases as if no fan were installed.



**F-12 Motor Thermistor Input****Option:****Function:**

Select the input to which the thermistor (PTC sensor) should be connected. An analog input option [1] or [2] cannot be selected if the analog input is already in use as a reference source (selected in par. F-01 *Frequency Setting 1*, par. C-30 *Frequency Command 2* or par. C-34 *Frequency Command 3*).

[0] *	None
[1]	Analog input 53
[2]	Analog input 54
[3]	Digital input 18
[4]	Digital input 19
[5]	Digital input 32
[6]	Digital input 33

NB!

This parameter cannot be adjusted while the motor is running.

NB!

Digital inputs should be set to "No operation" - see par. E-##.

F-15 Motor Speed High Limit [Hz]**Range:**

50/60.0 Hz* [par. H-12 - par. H-19 Hz]

Function:

Enter the maximum limit for motor speed. The Motor Speed High Limit can be set to correspond to the manufacturer's recommended maximum of the motor shaft. The Motor Speed High Limit must exceed the in par. F-16 *Motor Speed Low Limit [Hz]*. Only par. F-18 *Motor Speed Low Limit [RPM]* or par. F-16 *Motor Speed Low Limit [Hz]* will be displayed depending on other parameters in the Main Menu and depending on default settings dependant on global location.

NB!

Max. output frequency cannot exceed 10% of the inverter switching frequency (par. F-26 *Motor Noise (Carrier Freq)*).

F-16 Motor Speed Low Limit [Hz]**Range:**

0 Hz* [0.0 - par. H-14 Hz]

Function:

Enter the minimum limit for motor speed. The Motor Speed Low Limit can be set to correspond to the minimum output frequency of the motor shaft. The Motor Speed Low Limit must not exceed the setting in par. F-15 *Motor Speed High Limit [Hz]*.

F-17 Motor Speed High Limit [RPM]**Range:**

3600. RPM* [par. H-11 - 60000. RPM]

Function:

Enter the maximum limit for motor speed. The Motor Speed High Limit can be set to correspond to the manufacturer's maximum rated motor speed. The Motor Speed High Limit must exceed the setting in par. F-18 *Motor Speed Low Limit [RPM]*.

NB!

Max. output frequency cannot exceed 10% of the inverter switching frequency (par. F-26 *Motor Noise (Carrier Freq)*).

F-18 Motor Speed Low Limit [RPM]**Range:**

0 RPM* [0 - par. H-13 RPM]

Function:

Enter the minimum limit for motor speed. The Motor Speed Low Limit can be set to correspond to the manufacturer's recommended minimum motor speed. The Motor Speed Low Limit must not exceed the setting in par. F-17 *Motor Speed High Limit [RPM]*.



3.3.3 F-2# Fundamental 2

Parameters to configure drive Start Speed, Start Current, Holding Time and Motor Noise (Carrier Frequency).

F-22 Start Speed [RPM]

Range:	Function:
0 RPM* [0 - 600 RPM]	Set a motor start speed. After the start signal, the output speed leaps to set value. Set the start function in par. F-25 <i>Start Function</i> to [3], [4] or [5], and set a start delay time in par. F-24 <i>Holding Time</i> .

F-23 Start Speed [Hz]

Range:	Function:
0 Hz* [0.0 - 500.0 Hz]	Set a motor start speed. After the start signal, the output speed leaps to set value. Set the start function in par. F-25 <i>Start Function</i> to [3], [4] or [5], and set a start delay time in par. F-24 <i>Holding Time</i> .

F-24 Holding Time

Range:	Function:
0.0 s* [0.0 - 10.0 s]	This parameter refers to the start function selected in par. F-25 <i>Start Function</i> . Enter the time delay required before commencing acceleration.

F-25 Start Function

Option:	Function:
	Select the start function during start delay. This parameter is linked to par. F-24 <i>Holding Time</i> .
[0] DC Hold/delay time	Energizes motor with a DC holding current (par. B-00 <i>DC Hold Current</i>) during the start delay time.
[1] DC Brake/delay time	Energizes motor with a DC braking current (par. B-01 <i>DC Brake Current</i>) during the start delay time.
[2] * Coast/delay time	Releases shaft coasted converter during the start delay time (inverter off).
[3] Start speed cw	Only possible with . Connect the function described in par. F-22 <i>Start Speed [RPM]</i> and par. F-29 <i>Start Current</i> in the start delay time. Regardless of the value applied by the reference signal, the output speed applies the setting of the start speed in par. F-22 <i>Start Speed [RPM]</i> or par. F-23 <i>Start Speed [Hz]</i> and the output current corresponds to the setting of the start current in par. F-29 <i>Start Current</i> . This function is typically used in hoisting applications without counterweight and especially in applications with a Cone-motor, where the start is clockwise, followed by rotation in the reference direction.
[4] Horizontal operation	Only possible with . For obtaining the function described in par. F-22 <i>Start Speed [RPM]</i> and par. F-29 <i>Start Current</i> during the start delay time. The motor rotates in the reference direction. If the reference signal equals zero (0), par. F-22 <i>Start Speed [RPM]</i> is ignored and the output speed equals zero (0). The output current corresponds to the setting of the start current in par. F-29 <i>Start Current</i> .
[5] Adv. Vector Control/Flux Clockwise	for the function described in par. F-22 <i>Start Speed [RPM]</i> only. The start current is calculated automatically. This function uses the start speed in the start delay time only. Regardless of the value set by the reference signal, the output speed equals the setting of the start speed in par. F-22 <i>Start Speed [RPM]</i> . <i>Start speed/current clockwise</i> [3] and <i>Advanced Vector Control/Flux clockwise</i> [5] are typically used in hoisting applications. <i>Start speed/current in reference direction</i> [4] is particularly used in applications with counterweight and horizontal movement.
[6] Hoist Mech. Brake Rel	For utilizing mechanical brake control functions, par. B-24 <i>Stop Delay</i> to par. B-28 <i>Gain Boost Factor</i> . This parameter is only active when par. H-41 <i>Motor Control Principle</i> is set to [3] <i>Flux w/ motor feedback</i> .

F-26 Motor Noise (Carrier Freq)

Select the inverter switching frequency. Changing the switching frequency can help to reduce acoustic noise from the motor. Default depend on power size.

Option:	Function:
[0] 1.0 kHz	



[1]	1.5 kHz
[2]	2.0 kHz
[3]	2.5 kHz
[4]	3.0 kHz
[5]	3.5 kHz
[6]	4.0 kHz
[7] *	5.0 kHz
[8]	6.0 kHz
[9]	7.0 kHz
[10]	8.0 kHz
[11]	10.0 kHz
[12]	12.0 kHz
[13]	14.0 kHz
[14]	16.0 kHz

NB!

The output frequency value of the frequency converter must never exceed 1/10 of the switching frequency. When the motor is running, adjust the switching frequency until the motor is as noiseless as possible. See also par. F-37 *Adv. Switching Pattern* and the section *Special conditions* in the AF-650 GP Design Guide.

NB!

Switching frequencies higher than 5.0 kHz lead to automatic derating of the maximum output of the frequency converter.

F-27 Motor Tone Random**Option:****Function:**

[0] * Off

No change of the acoustic motor switching noise.

[1] On

Transforms the acoustic motor switching noise from a clear ringing tone to a less noticeable 'white' noise. This is achieved by slightly and randomly altering the synchronism of the pulse width modulated output phases.

F-29 Start Current**Range:****Function:**

0.00 A* [0.00 - par. E-24 A]

Some motors, e.g. cone rotor motors, need extra current/starting speed to disengage the rotor. To obtain this boost, set the required current in par. F-29 *Start Current*. Set par. F-22 *Start Speed [RPM]*. Set par. F-25 *Start Function* to [3] or [4], and set a start delay time in par. F-24 *Holding Time*.

This parameter can be used for hoist applications (cone rotor).

3.3.4 F-3# Fundamental 3

Parameters to configure drive Advanced Switching Pattern and Overmodulation.

F-37 Adv. Switching Pattern**Option:****Function:**

[0] 60 AVM

Select the switching pattern: 60° AVM or SFAVM.

[1] * SFAVM

NB!

The output frequency value of the frequency converter must never exceed 1/10 of the switching frequency. When the motor is running, adjust the switching frequency until the motor is as noiseless as possible. See also par. F-37 *Adv. Switching Pattern* and the section *Special conditions* in the AF-650 GP Design Guide.

**NB!**

Switching frequencies higher than 5.0 kHz lead to automatic derating of the maximum output of the frequency converter.

F-38 Overmodulation**Option:**

[0] Off

Function:

Select *On* [1] to connect the overmodulation function for the output voltage, to obtain an output voltage up to 15% greater than the mains voltage.

Select *Off* [0] for no overmodulation of the output voltage, in order to avoid torque ripple on the motor shaft. This feature may be useful for applications such as grinding machines.

[1] * On

3

3.3.5 F-4# Fundamental 4

Parameters to configure drive torque and current limits.

F-40 Torque Limiter (Driving)**Range:**

160.0 %* [0.0 - 1000.0 %]

Function:

This is a true torque limit function that can run into the oversynchronous range above nominal motor speed.

Motor magnetisation drop is automatically compensated by a current increase.



Changing par. *F-40 Torque Limiter (Driving)* when par. *H-40 Configuration Mode* is set to *Speed open loop* [0], par. *H-66 Min. Current at Low Speed* is automatically readjusted.

F-41 Torque Limiter (Braking)**Range:**

100.0 %* [0.0 - 1000.0 %]

Function:

This is a true torque limit function that can run into the oversynchronous range above nominal motor speed.

Motor magnetisation drop is automatically compensated by a current increase.

F-43 Current Limit**Range:**

160.0 %* [1.0 - 1000.0 %]

Function:

This is a true current limit function that continues in the oversynchronous range, however due to field weakening the motor torque at current limit will drop accordingly when the voltage increase stops above the synchronised speed of the motor.

3.3.6 F-5# Extended References

Parameters to configure drive min/max reference and reference function.

F-50 Reference Range**Option:**

Select the range of the reference signal and the feedback signal. Signal values can be positive only, or positive and negative. The minimum limit may have a negative value, unless *Speed closed loop* [1] control or *Process* [3] is selected in par. *H-40 Configuration Mode*.

[0] Min - Max

Select the range of the reference signal and the feedback signal. Signal values can be positive only, or positive and negative. The minimum limit may have a negative value, unless *Speed closed loop* [1] control or *Process* [3] is selected in par. *H-40 Configuration Mode*.

[1] * -Max - +Max

For both positive and negative values (both directions, relative to par. *H-08 Reverse Lock*).

**F-51 Reference/Feedback Unit****Option:****Function:**

Select the unit to be used in Process PID Control references and feedbacks.

[0] * None

[1] %

[2] RPM

[3] Hz

[4] Nm

[5] PPM

[10] 1/min

[12] Pulse/s

[20] l/s

[21] l/min

[22] l/h

[23] m³/s[24] m³/min[25] m³/h

[30] kg/s

[31] kg/min

[32] kg/h

[33] t/min

[34] t/h

[40] m/s

[41] m/min

[45] m

[60] °C

[70] mbar

[71] bar

[72] Pa

[73] kPa

[74] m WG

[80] kW

[120] GPM

[121] gal/s

[122] gal/min

[123] gal/h

[124] CFM

[125] ft³/s[126] ft³/min[127] ft³/h

[130] lb/s

[131] lb/min

[132] lb/h

[140] ft/s

[141] ft/min

[145] ft

[150] lb ft



[160] °F

[170] psi

[171] lb/in²

[172] in WG

[173] ft WG

[180] HP

F-52 Minimum Reference**Range:**

0 Unit* [-999999.999 - par. P-03]

Function:

Enter the Minimum Reference. The Minimum Reference is the lowest value obtainable by summing all references.

Minimum Reference is active only when par. F-50 *Reference Range* is set to *Min.- Max.* [0].

The Minimum Reference unit matches:

- The choice of configuration in par. H-40 *Configuration Mode Configuration Mode*: for *Speed closed loop* [1], RPM; for *Torque* [2], Nm.
- The unit selected in par. F-51 *Reference/Feedback Unit*.

F-53 Maximum Reference**Range:**

1500.000 [par. P-02 - 999999.999]

Unit*

Function:

Enter the Maximum Reference. The Maximum Reference is the highest value obtainable by summing all references.

The Maximum Reference unit matches:

- The choice of configuration in par. H-40 *Configuration Mode*: for *Speed closed loop* [1], RPM; for *Torque* [2], Nm.
- The unit selected in par. F-50 *Reference Range*.

F-54 Reference Function**Option:**

[0] * Sum

Function:

Sums both external and preset reference sources.

[1] External/Preset

Use either the preset or the external reference source.

Shift between external and preset via a command on a digital input.

3.3.7 F-6# References

Parameters to configure drive to add or subtract a fixed value to an input reference.

F-62 Catch up/slow Down Value**Range:**

0.00 %* [0.00 - 100.00 %]

Function:

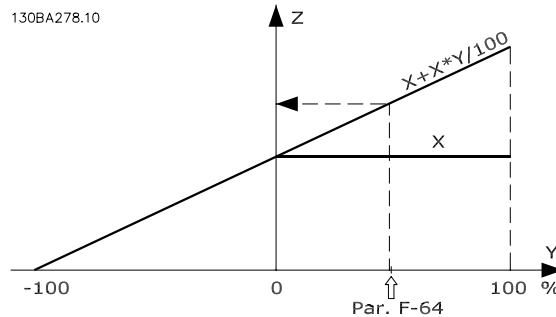
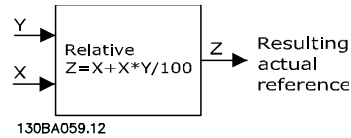
Enter a percentage (relative) value to be either added to or deducted from the actual reference for Catch up or Slow down respectively. If *Catch up* is selected via one of the digital inputs (par. E-01 *Terminal 18 Digital Input* to par. E-06 *Terminal 33 Digital Input*), the percentage (relative) value is added to the total reference. If *Slow down* is selected via one of the digital inputs (par. E-01 *Terminal 18 Digital Input* to par. E-06 *Terminal 33 Digital Input*), the percentage (relative) value is deducted from the total reference. Obtain extended functionality with the DigiPot function. See parameter group F-9# *Digital Pot-Meter*.

F-64 Preset Relative Reference**Range:**

0.00 %* [-100.00 - 100.00 %]

Function:

The actual reference, X, is increased or decreased with the percentage Y, set in par. F-64 *Preset Relative Reference*. This results in the actual reference Z. Actual reference (X) is the sum of the inputs selected in par. F-01 *Frequency Setting 1*, par. C-30 *Frequency Command 2*, par. C-34 *Frequency Command 3* and par. O-02 *Control Word Source*.

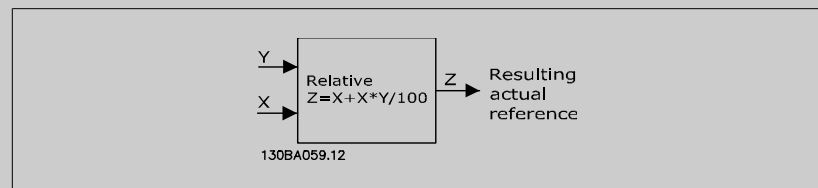


F-68 Relative Scaling Reference Resource

Option:

Function:

Select a variable value to be added to the fixed value (defined in par. F-64 *Preset Relative Reference*). The sum of the fixed and variable values (labelled Y in the illustration below) is multiplied with the actual reference (labelled X in the illustration below). This product is then added to the actual reference ($X + X*Y/100$) to give the resultant actual reference.



This parameter cannot be adjusted while the motor is running.

[0] *	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[7]	Frequency input 29	
[8]	Frequency input 33	
[11]	Local bus reference	
[20]	Digital Potentiometer	
[21]	Analog input X30-11	(OPCGPIO)
[22]	Analog input X30-12	(OPCGPIO)

3.3.8 F-9# Digital Potentiometer

Parameters to configure drive digital pot-meter function.

**F-90 Step Size****Range:**

0.10 %* [0.01 - 200.00 %]

Function:

Enter the increment size required for INCREASE/DECREASE, as a percentage of the synchronous motor speed, n_s . If INCREASE/ DECREASE is activated the resulting reference will be increased / decreased by the amount set in this parameter.

F-91 Accel/Decel Time**Range:**

1.00 s* [0.00 - 3600.00 s]

Function:

Enter the ramp time, i.e. the time for adjustment of the reference from 0% to 100% of the specified digital potentiometer function (Increase, Decrease or Clear).

If Increase/ Decrease is activated for longer than the ramp delay period specified in par. F-95 *Accel/Decel Ramp Delay* the actual reference will be ramped up / down according to this ramp time. The ramp time is defined as the time used to adjust the reference by the step size specified in par. F-90 *Step Size*.

F-92 Power Restore**Option:**

[0] * Off

Function:

Resets the Digital Pot-Meter reference to 0% after power up.

[1] On

Restores the most recent Digital Pot-Meter reference at power up.

F-93 Maximum Limit**Range:**

100 %* [-200 - 200 %]

Function:

Set the maximum permissible value for the resultant reference. This is advisable if the Digital Pot-Meter is used for fine tuning of the resulting reference.

F-94 Minimum Limit**Range:**

-100 %* [-200 - 200 %]

Function:

Set the minimum permissible value for the resultant reference. This is advisable if the Digital Pot-Meter is used for fine tuning of the resulting reference.

F-95 Accel/Decel Ramp Delay**Range:**

0* [0 - 0]

Function:

Enter the delay required from activation of the digital pot-meter function until the frequency converter starts to ramp the reference. With a delay of 0 ms, the reference starts to ramp as soon as INCREASE/ DECREASE is activated. See also par. F-91 *Accel/Decel Time*.



3.4 E-## Digital In/Out

Parameter group related to the Digital Inputs/Outputs, additional accel/decel ramps, pulse inputs/outputs, and encoder input.

3.4.1 E-0# Digital Inputs

Parameters to configure the Digital Inputs/Outputs and Safe Stop functions.

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	Select	Terminal
No operation	[0]	All *term 32, 33
Reset	[1]	All
Coast inverse	[2]	All *term 27
Coast and reset inverse	[3]	All
Quick stop inverse	[4]	All
DC-brake inverse	[5]	All
Stop inverse	[6]	All
Start	[8]	All *term 18
Latched start	[9]	All
Reversing	[10]	All *term 19
Start reversing	[11]	All
Enable start forward	[12]	All
Enable start reverse	[13]	All
Jog	[14]	All *term 29
Preset reference on	[15]	All
Preset ref bit 0	[16]	All
Preset ref bit 1	[17]	All
Preset ref bit 2	[18]	All
Freeze reference	[19]	All
Freeze output	[20]	All
Speed up	[21]	All
Speed down	[22]	All
Set-up select bit 0	[23]	All
Set-up select bit 1	[24]	All
Precise stop inverse	[26]	18, 19
Precises start, stop	[27]	18, 19
Catch up	[28]	All
Slow down	[29]	All
Counter input	[30]	29, 33
Pulse input	[32]	29, 33
Ramp bit 0	[34]	All
Ramp bit 1	[35]	All
Mains failure inverse	[36]	All
Latched precise start	[40]	18, 19
Latched precise stop inverse	[41]	18, 19
DigiPot Increase	[55]	All
DigiPot Decrease	[56]	All
DigiPot Clear	[57]	All
Counter A (up)	[60]	29, 33
Counter A (down)	[61]	29, 33
Reset Counter A	[62]	All
Counter B (up)	[63]	29, 33
Counter B (down)	[64]	29, 33
Reset Counter B	[65]	All
Mech. Brake Feedb.	[70]	All
Mech. Brake Feedb. Inv.	[71]	All
PTC Card 1	[80]	All

AF-650 GP standard terminals are 18, 19, 27, 29, 32 and 33. OPCGPIO General Purpose I/O Option Module terminals are X30/2, X30/3 and X30/4.

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



All digital inputs can be programmed to these functions:

[0]	No operation	No reaction to signals transmitted to the terminal.
[1]	Reset	Resets frequency converter after a TRIP/ALARM. Not all alarms can be reset.
[2]	Coast inverse	(Default Digital input 27): Coasting stop, inverted input (NC). The frequency converter leaves the motor in free mode. Logic '0' => coasting stop.
[3]	Coast and reset inverse	Reset and coasting stop Inverted input (NC). Leaves motor in free mode and resets frequency converter. Logic '0' => coasting stop and reset.
[4]	Quick stop inverse	Inverted input (NC). Generates a stop in accordance with quick-stop ramp time set in par. C-23 <i>Quick Stop Decel Time</i> . When motor stops, the shaft is in free mode. Logic '0' => Quick-stop.
[5]	DC-brake inverse	Inverted input for DC braking (NC). Stops motor by energizing it with a DC current for a certain time period. See par. B-01 <i>DC Brake Current</i> to par. B-03 <i>DC Brake Cut In Speed [RPM]</i> . The function is only active when the value in par. B-02 <i>DC Braking Time</i> is different from 0. Logic '0' => DC braking.
[6]	Stop inverse	Stop Inverted function. Generates a stop function when the selected terminal goes from logical level '1' to '0'. The stop is performed according to the selected ramp time (par. F-08 <i>Decel Time 1</i> , par. E-11 <i>Decel Time 2</i> , par. E-13 <i>Decel Time 3</i> , par. E-15 <i>Decel Time 4</i>). NB! When the frequency converter is at the torque limit and has received a stop command, it may not stop by itself. To ensure that the frequency converter stops, configure a digital output to <i>Torque limit & stop</i> [27] and connect this digital output to a digital input that is configured as coast.
[8]	Start	(Default Digital input 18): Select start for a start/stop command. Logic '1' = start, logic '0' = stop.
[9]	Latched start	The motor starts, if a pulse is applied for min. 2 ms. The motor stops when Stop inverse is activated.
[10]	Reversing	(Default Digital input 19). Change the direction of motor shaft rotation. Select Logic '1' to reverse. The reversing signal only changes the direction of rotation. It does not activate the start function. Select both directions in par. H-08 <i>Reverse Lock</i> . The function is not active in process closed loop.
[11]	Start reversing	Used for start/stop and for reversing on the same wire. Signals on start are not allowed at the same time.
[12]	Enable start forward	Disengages the counterclockwise movement and allows for the clockwise direction.
[13]	Enable start reverse	Disengages the clockwise movement and allows for the counterclockwise direction.
[14]	Jog	(Default Digital input 29): Use to activate jog speed. See par. C-20 <i>Jog Speed [Hz]</i> .
[15]	Preset reference on	Shifts between external reference and preset reference. It is assumed that <i>External/preset</i> [1] has been selected in par. F-54 <i>Reference Function</i> . Logic '0' = external reference active; logic '1' = one of the eight preset references is active.
[16]	Preset ref bit 0	Preset ref. bit 0,1, and 2 enables a choice between one of the eight preset references according to the table below.
[17]	Preset ref bit 1	Same as Preset ref bit 0 [16].
[18]	Preset ref bit 2	Same as Preset ref bit 0 [16].

Preset ref. bit	2	1	0
Preset ref. 0	0	0	0
Preset ref. 1	0	0	1
Preset ref. 2	0	1	0
Preset ref. 3	0	1	1
Preset ref. 4	1	0	0
Preset ref. 5	1	0	1
Preset ref. 6	1	1	0
Preset ref. 7	1	1	1



[19] Freeze ref Freezes the actual reference, which is now the point of enable/condition for Speed up and Speed down to be used. If Speed up/down is used, the speed change always follows ramp 2 (par. E-10 *Accel Time 2* and par. E-11 *Decel Time 2*) in the range 0 - par. F-53 *Maximum Reference*.

[20] Freeze output Freezes the actual motor frequency (Hz), which is now the point of enable/condition for Speed up and Speed down to be used. If Speed up/down is used, the speed change always follows ramp 2 (par. E-10 *Accel Time 2* and par. E-11 *Decel Time 2*) in the range 0 - par. F-04 *Base Frequency*.

NB!

When Freeze output is active, the frequency converter cannot be stopped via a low 'start [8]' signal. Stop the frequency converter via a terminal programmed for Coasting inverse [2] or Coast and reset, inverse.

[21] Speed up Select Speed up and Speed down if digital control of the up/down speed is desired (motor potentiometer). Activate this function by selecting either Freeze reference or Freeze output. When Speed up/ down is activated for less than 400 msec. the resulting reference will be increased/ decreased by 0.1 %. If Speed up/ down is activated for more than 400 msec. the resulting reference will follow the setting in accel/ decel parameters.

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

[22] Speed down Same as Speed up [21].

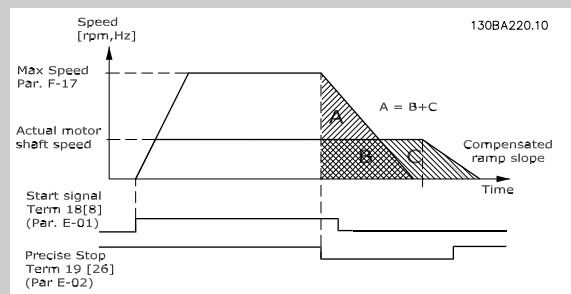
[23] Set-up select bit 0 Select Set-up select bit 0 or Select Set-up select bit 1 to select one of the four set-ups. Set par. K-10 *Active Set-up* to Multi Set-up.

[24] Set-up select bit 1 (Default Digital input 32): Same as Set-up select bit 0 [23].

[26] Precise stop inv. Prolongs stop signal to give a precise stop independent of speed. Sends an inverted stop signal when the precise stop function is activated in par. H-83 *Precise Stop Function*.

Precise stop inverse function is available for terminals 18 or 19.

[27] Precise start, stop Use when Precise ramp stop [0] is selected in par 1-83.



[28] Catch up Increases reference value by percentage (relative) set in par. F-62 *Catch up/slow Down Value*.

[29] Slow down Reduces reference value by percentage (relative) set in par. F-62 *Catch up/slow Down Value*.

[30] Counter input Precise stop function in par. H-83 *Precise Stop Function* acts as Counter stop or speed compensated counter stop with or without reset. The counter value must be set in par. H-84 *Precise Stop Counter Value*.

[32] Pulse input Use pulse sequence as either reference or feedback. Scaling is done in par. group E-6#.

[34] Ramp bit 0 Enables a choice between one of the 4 ramps available, according to the table below.

[35] Ramp bit 1 Same as Ramp bit 0.



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

[36]	Mains failure inverse	Activates par. SP-10 <i>Line failure</i> . Mains failure inverse is active in the Logic .0. situation.
[41]	Latched Precise Stop inverse	Sends a latched stop signal when the precise stop function is activated in par. H-83 <i>Precise Stop Function</i> . The Latched Precise stop inverse function is available for terminals 18 or 19.
[55]	DigiPot Increase	INCREASE signal to the Digital Potentiometer function described in parameter group F-9#
[56]	DigiPot Decrease	DECREASE signal to the Digital Potentiometer function described in parameter group F-9#
[57]	DigiPot Clear	Clears the Digital Potentiometer reference described in parameter group F-9#
[60]	Counter A	(Terminal 29 or 33 only) Input for increment counting in the LC counter.
[61]	Counter A	(Terminal 29 or 33 only) Input for decrement counting in the LC counter.
[62]	Reset Counter A	Input for reset of counter A.
[63]	Counter B	(Terminal 29 or 33 only) Input for increment counting in the LC counter.
[64]	Counter B	(Terminal 29 or 33 only) Input for decrement counting in the LC counter.
[65]	Reset Counter B	Input for reset of counter B.
[70]	Mech. Brake Feedback	Brake feedback for hoisting applications
[71]	Mech. Brake Feedback inv.	Inverted brake feedback for hoisting applications
[80]	PTC Card 1	All Digital Inputs can be set to PTC Card 1 [80]. However, only one Digital Input must be set to this choice.

E-00 Digital I/O Mode

Option:

Function:

Digital inputs and programmed digital outputs are pre-programmable for operation either in PNP or NPN systems.

[0] *	PNP	Action on positive directional pulses (↑). PNP systems are pulled down to GND.
[1]	NPN	Action on negative directional pulses (↓). NPN systems are pulled up to + 24 V, internally in the frequency converter.

NB!

Once this parameter has been changed, it must be activated by performing a power cycle.

This parameter cannot be adjusted while the motor is running.

E-01 Terminal 18 Digital Input

Option:

Function:

[0]	No operation	
[1]	Reset	
[2]	Coast inverse	
[3]	Coast and reset inv	
[4]	Quick stop inverse	
[5]	DC-brake inverse	
[6]	Stop inverse	
[8] *	Start	Select the function from the available digital input range.
[9]	Latched start	
[10]	Reversing	
[11]	Start reversing	
[12]	Enable start forward	
[13]	Enable start reverse	
[14]	Jog	



[15]	Preset reference on
[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
[24]	Set-up select bit 1
[26]	Precise stop inverse
[27]	Precise start, stop
[28]	Catch up
[29]	Slow down
[34]	Ramp bit 0
[35]	Ramp bit 1
[40]	Latched precise start
[41]	Latch prec stop inv
[55]	DigiPot increase
[56]	DigiPot decrease
[57]	DigiPot clear
[58]	DigiPot Hoist
[62]	Reset Counter A
[65]	Reset Counter B
[70]	Mech. Brake Feedb.
[71]	Mech. Brake Feedb. Inv.
[80]	PTC Card 1

E-02 Terminal 19 Digital Input**Option:****Function:**

[0]	No operation	
[1]	Reset	
[2]	Coast inverse	
[3]	Coast and reset inv	
[4]	Quick stop inverse	
[5]	DC-brake inverse	
[6]	Stop inverse	
[8]	Start	
[9]	Latched start	
[10] *	Reversing	Select the function from the available digital input range.
[11]	Start reversing	
[12]	Enable start forward	
[13]	Enable start reverse	
[14]	Jog	
[15]	Preset reference on	
[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
[24]	Set-up select bit 1
[26]	Precise stop inverse
[27]	Precise start, stop
[28]	Catch up
[29]	Slow down
[34]	Ramp bit 0
[35]	Ramp bit 1
[40]	Latched precise start
[41]	Latch prec stop inv
[55]	DigiPot increase
[56]	DigiPot decrease
[57]	DigiPot clear
[58]	DigiPot Hoist
[62]	Reset Counter A
[65]	Reset Counter B
[70]	Mech. Brake Feedb.
[71]	Mech. Brake Feedb. Inv.
[80]	PTC Card 1

E-03 Terminal 27 Digital Input

Option:

Function:

[0]	No operation	
[1]	Reset	
[2] *	Coast inverse	Select the function from the available digital input range.
[3]	Coast and reset inv	
[4]	Quick stop inverse	
[5]	DC-brake inverse	
[6]	Stop inverse	
[8]	Start	
[9]	Latched start	
[10]	Reversing	
[11]	Start reversing	
[12]	Enable start forward	
[13]	Enable start reverse	
[14]	Jog	
[15]	Preset reference on	
[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
[24]	Set-up select bit 1
[28]	Catch up
[29]	Slow down
[34]	Ramp bit 0
[35]	Ramp bit 1
[55]	DigiPot increase
[56]	DigiPot decrease
[57]	DigiPot clear
[58]	DigiPot Hoist
[62]	Reset Counter A
[65]	Reset Counter B
[70]	Mech. Brake Feedb.
[71]	Mech. Brake Feedb. Inv.
[80]	PTC Card 1

E-04 Terminal 29 Digital Input**Option:****Function:**

Select the function from the available digital input range and the additional options [60], [61], [63] and [64]. Counters are used in Logic Controller functions. .

[0]	No operation
[1]	Reset
[2]	Coast inverse
[3]	Coast and reset inv
[4]	Quick stop inverse
[5]	DC-brake inverse
[6]	Stop inverse
[8]	Start
[9]	Latched start
[10]	Reversing
[11]	Start reversing
[12]	Enable start forward
[13]	Enable start reverse
[14] *	Jog
[15]	Preset reference on
[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
[24]	Set-up select bit 1
[28]	Catch up



[29]	Slow down
[30]	Counter input
[32]	Pulse Input
[34]	Ramp bit 0
[35]	Ramp bit 1
[55]	DigiPot increase
[56]	DigiPot decrease
[57]	DigiPot clear
[58]	DigiPot Hoist
[60]	Counter A (up)
[61]	Counter A (down)
[62]	Reset Counter A
[63]	Counter B (up)
[64]	Counter B (down)
[65]	Reset Counter B
[70]	Mech. Brake Feedb.
[71]	Mech. Brake Feedb. Inv.
[80]	PTC Card 1

E-05 Terminal 32 Digital Input

Option:	Function:
[0] *	No operation Select the function from the available digital input range.
[1]	Reset
[2]	Coast inverse
[3]	Coast and reset inv
[4]	Quick stop inverse
[5]	DC-brake inverse
[6]	Stop inverse
[8]	Start
[9]	Latched start
[10]	Reversing
[11]	Start reversing
[12]	Enable start forward
[13]	Enable start reverse
[14]	Jog
[15]	Preset reference on
[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
[24]	Set-up select bit 1
[28]	Catch up
[29]	Slow down



[34]	Ramp bit 0
[35]	Ramp bit 1
[55]	DigiPot increase
[56]	DigiPot decrease
[57]	DigiPot clear
[58]	DigiPot Hoist
[62]	Reset Counter A
[65]	Reset Counter B
[70]	Mech. Brake Feedb.
[71]	Mech. Brake Feedb. Inv.
[80]	PTC Card 1

E-06 Terminal 33 Digital Input**Option:****Function:**

Select the function from the available digital input range and the additional options [60], [61], [63] and [64]. Counters are used in Logic Controller functions.

[0] *	No operation
[1]	Reset
[2]	Coast inverse
[3]	Coast and reset inv
[4]	Quick stop inverse
[5]	DC-brake inverse
[6]	Stop inverse
[8]	Start
[9]	Latched start
[10]	Reversing
[11]	Start reversing
[12]	Enable start forward
[13]	Enable start reverse
[14]	Jog
[15]	Preset reference on
[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
[24]	Set-up select bit 1
[28]	Catch up
[29]	Slow down
[30]	Counter input
[32]	Pulse Input
[34]	Ramp bit 0
[35]	Ramp bit 1
[55]	DigiPot increase



[56]	DigiPot decrease
[57]	DigiPot clear
[58]	DigiPot Hoist
[60]	Counter A (up)
[61]	Counter A (down)
[62]	Reset Counter A
[63]	Counter B (up)
[64]	Counter B (down)
[65]	Reset Counter B
[70]	Mech. Brake Feedb.
[71]	Mech. Brake Feedb. Inv.
[80]	PTC Card 1

E-07 Terminal 37 Safe Stop

Option:

Function:

[1] *	Safe Stop Alarm	Coasts frequency converter when safe stop is activated. Manual reset from Keypad, digital input or Network.
[3]	Safe Stop Warning	Coasts frequency converter when safe stop is activated (term 37 off). When safe stop circuit is reestablished, the frequency converter will continue without manual reset.

NB!

When Auto Reset/ Warning is selected the frequency converter opens up for automatic restart.

Overview of functions, alarms and warnings

Function	No.	PTC	Relay
No Function	[0]	-	-
Safe Stop Alarm	[1]*	-	Safe Stop [A68]
Safe Stop Warning	[3]	-	Safe Stop [W68]

W means warning and A means alarm. For further information, see Alarms and Warnings in section *Troubleshooting* in the Design Guide or the Operating Instructions

A dangerous failure related to Safe Stop will give Alarm: Dangerous Failure [A72].

3.4.2 E-1# Additional Accel/Decel Ramps

Parameters to configure the Accel/Decel Ramps 2, 3, and 4.

E-10 Accel Time 2

Range:

3.00 s* [0.01 - 3600.00 s]

Function:

Enter the accel time from 0 RPM to the rated motor speed n_s . Choose a accel time such that the output current does not exceed the current limit in par. F-43 *Current Limit* during ramping. The value 0.00 corresponds to 0.01 sec. in speed mode. See decel time in par. E-11 *Decel Time 2*.

$$Par. E - 10 = \frac{t_{acc} [s] \times n_s [RPM]}{ref [RPM]}$$

E-11 Decel Time 2

Range:

3.00 s* [0.01 - 3600.00 s]

Function:

Enter the decel time from the rated motor speed n_s to 0 RPM. Choose a decel time such that no over-voltage 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 par. F-43 *Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See accel time in par. E-10 *Accel Time 2*.



$$Par. E - 11 = \frac{t_{dec}[s] \times n_s[RPM]}{ref[RPM]}$$

E-12 Accel Time 3**Range:**

3.00 s* [0.01 - 3600.00 s]

Function:

Enter the accel time from 0 RPM to the rated motor speed n_s . Choose a accel time such that the output current does not exceed the current limit in par. F-43 *Current Limit* during ramping. The value 0.00 corresponds to 0.01 sec. in speed mode. See decel time in par. E-13 *Decel Time 3*.

E-13 Decel Time 3**Range:**

3.00 s* [0.01 - 3600.00 s]

Function:

Enter the decel time from the rated motor speed n_s to 0 RPM. Choose a decel time such that no over-voltage 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 par. F-43 *Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See accel time in par. E-12 *Accel Time 3*.

$$Par. E - 13 = \frac{t_{dec}[s] \times n_s[RPM]}{ref[RPM]}$$

E-14 Accel Time 4**Range:**

3.00 s* [0.01 - 3600.00 s]

Function:

Enter the accel time from 0 RPM to the rated motor speed n_s . Choose a accel time such that the output current does not exceed the current limit in par. F-43 *Current Limit* during ramping. The value 0.00 corresponds to 0.01 sec. in speed mode. See decel time in par. E-15 *Decel Time 4*.

$$Par. E - 14 = \frac{t_{acc}[s] \times n_s[RPM]}{ref[RPM]}$$

E-15 Decel Time 4**Range:**

3.00 s* [0.01 - 3600.00 s]

Function:

Enter the decel time from the rated motor speed n_s to 0 RPM. Choose a decel time such that no over-voltage 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 par. F-43 *Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See accel time in par. E-14 *Accel Time 4*.

$$Par. E - 15 = \frac{t_{dec}[s] \times n_s[RPM]}{ref[RPM]}$$

3.4.3 E-2# Digital Output

Parameters to configure terminal 27 and 29 digital outputs controlled by serial communications and to configure Relay 1 and Relay 2.

Parameters for configuring the output functions for the output terminals. The 2 solid-state digital outputs are common for terminals 27 and 29. Set the I/O function for terminal 27 in par. E-51 *Terminal 27 Mode*, and set the I/O function for terminal 29 in par. E-52 *Terminal 29 Mode*. These parameters cannot be adjusted while the motor is running.

[0]	No operation	Default for all digital outputs and relay outputs
[1]	Control ready	The control 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 and is in Auto mode.
[4]	Enable / no warning	Ready for operation. No start or stop command is been given (start/disable). There are no warnings.
[5]	Running	Motor is running.
[6]	Running / no warning	Output speed is higher than the speed set in par. H-81 <i>Min Speed for Function at Stop [RPM]</i> . The motor is running and there are no warnings.
[7]	Run in range / no warning	Motor is running within the programmed current and speed ranges set in par. H-70 <i>Warning Current Low</i> to par. H-73 <i>Warning Speed High</i> . There are no warnings.



[8]	Run on reference / no warning	Motor runs at reference speed.
[9]	Alarm	An alarm activates the output. There are no warnings.
[10]	Alarm or warning	An alarm or a warning activates the output.
[11]	At torque limit	The torque limit set in par. F-40 <i>Torque Limiter (Driving)</i> or par. 4-17F-41 has been exceeded.
[12]	Out of current range	The motor current is outside the range set in par. F-43 <i>Current Limit</i> .
[13]	Below current, low	Motor current is lower than set in par. H-70 <i>Warning Current Low</i> .
[14]	Above current, high	Motor current is higher than set in par. H-71 <i>Warning Current High</i> .
[15]	Out of range	Output frequency is outside the frequency range set in par. H-70 <i>Warning Current Low</i> and par. H-71 <i>Warning Current High</i> .
[16]	Below speed, low	Output speed is lower than the setting in par. H-72 <i>Warning Speed Low</i> .
[17]	Above speed, high	Output speed is higher than the setting in par. H-73 <i>Warning Speed High</i> .
[18]	Out of feedback range	Feedback is outside the range set in par. H-76 <i>Warning Feedback Low</i> and par. H-77 <i>Warning Feedback High</i> .
[19]	Below feedback low	Feedback is below the limit set in par. H-76 <i>Warning Feedback Low</i> .
[20]	Above feedback high	Feedback is above the limit set in par. H-77 <i>Warning Feedback High</i> .
[21]	Thermal warning	The thermal warning turns on when the temperature exceeds the limit in the motor, the frequency converter, the brake resistor, or the thermistor.
[22]	Ready, no thermal warning	Frequency converter is ready for operation and there is no over-temperature warning.
[23]	Remote, ready, no thermal warning	Frequency converter is ready for operation and is in Auto mode. There is no over-temperature warning.
[24]	Ready, no over-/ under voltage	Frequency converter is ready for operation and the mains voltage is within the specified voltage range (see <i>General Specifications</i> section).
[25]	Reverse	<i>Reversing</i> . Logic '1' when CW rotation of the motor. Logic '0' when CCW rotation of the motor. If the motor is not rotating the output will follow the reference.
[26]	Bus OK	Active communication (no time-out) via the serial communication port.
[27]	Torque limit and stop	Use in performing a coasting stop and in torque limit condition. If the frequency converter has received a stop signal and is at the torque limit, the signal is Logic '0'.
[28]	Brake, no brake warning	Brake is active and there are no warnings.
[29]	Brake ready, no fault	Brake is ready for operation and there are no faults.
[30]	Brake fault (IGBT)	Output is Logic '1' when the brake IGBT is short-circuited. Use this function to protect the frequency converter if there is a fault on the brake modules. Use the output/relay to cut out the main voltage from the frequency converter.
[31]	Relay 123	Relay is activated when Control Word [0] is selected in parameter group O-##.
[32]	Mechanical brake control	Enables control of an external mechanical brake, see description in the section <i>Control of Mechanical Brake</i> , and par. group B-2#.
[40]	Out of ref range	
[41]	Below reference low	
[42]	Above reference high	
[45]	Bus Ctrl	Controls output via bus. The state of the output is set in par. E-90 <i>Digital & Relay Bus Control</i> . The output state is retained in the event of bus time-out.
[46]	Bus Ctrl On at timeout	Controls output via bus. The state of the output is set in par. E-90 <i>Digital & Relay Bus Control</i> . In the event of bus time-out the output state is set high (On).
[47]	Bus Ctrl Off at timeout	Controls output via bus. The state of the output is set in par. E-90 <i>Digital & Relay Bus Control</i> . In the event of bus time-out the output state is set low (Off).
[55]	Pulse output	
[60]	Comparator 0	See par. group LC-1#. If Comparator 0 is TRUE, the output will go high. Otherwise, it will be low.
[61]	Comparator 1	See par. group LC-1#. If Comparator 1 is TRUE, the output will go high. Otherwise, it will be low.



[62]	Comparator 2	See par. group LC-1#. If Comparator 2 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[63]	Comparator 3	See par. group LC-1#. If Comparator 3 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[64]	Comparator 4	See par. group LC-1#. If Comparator 4 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[65]	Comparator 5	See par. group LC-1#. If Comparator 5 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[70]	Logic Rule 0	See par. group LC-4#. If Logic Rule 0 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[71]	Logic Rule 1	See par. group LC-4#. If Logic Rule 1 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[72]	Logic Rule 2	See par. group LC-4#. If Logic Rule 2 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[73]	Logic Rule 3	See par. group LC-4#. If Logic Rule 3 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[74]	Logic Rule 4	See par. group LC-4#. If Logic Rule 4 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[75]	Logic Rule 5	See par. group LC-4#. If Logic Rule 5 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[80]	SL Digital Output A	See par. LC-52 <i>Logic Controller Action</i> . The output will go high whenever the Logic Controller Action [38] <i>Set dig. out. A high</i> is executed. The output will go low whenever the Logic Controller Action [32] <i>Set dig. out. A low</i> is executed.
[81]	SL Digital Output B	See par. LC-52 <i>Logic Controller Action</i> . The input will go high whenever the Logic Controller Action [39] <i>Set dig. out. A high</i> is executed. The input will go low whenever the Logic Controller Action [33] <i>Set dig. out. A low</i> is executed.
[82]	SL Digital Output C	See par. LC-52 <i>Logic Controller Action</i> . The input will go high whenever the Logic Controller Action [40] <i>Set dig. out. A high</i> is executed. The input will go low whenever the Logic Controller Action [34] <i>Set dig. out. A low</i> is executed.
[83]	SL Digital Output D	See par. LC-52 <i>Logic Controller Action</i> . The input will go high whenever the Logic Controller Action [41] <i>Set dig. out. A high</i> is executed. The input will go low whenever the Logic Controller Action [35] <i>Set dig. out. A low</i> is executed.
[84]	SL Digital Output E	See par. LC-52 <i>Logic Controller Action</i> . The input will go high whenever the Logic Controller Action [42] <i>Set dig. out. A high</i> is executed. The input will go low whenever the Logic Controller Action [36] <i>Set dig. out. A low</i> is executed.
[85]	SL Digital Output F	See par. LC-52 <i>Logic Controller Action</i> . The input will go high whenever the Logic Controller Action [43] <i>Set dig. out. A high</i> is executed. The input will go low whenever the Logic Controller Action [37] <i>Set dig. out. A low</i> is executed.
[120]	Local reference active	Output is high when par. F-02 <i>Operation Method</i> = [2] Local or when par. F-02 <i>Operation Method</i> = [0] <i>Linked to hand auto</i> at the same time as the Keypad is in Hand mode.
[121]	Remote reference active	Output is high when par. F-02 <i>Operation Method</i> = Remote [1] or <i>Linked to hand/auto</i> [0] while the Keypad is in [Auto] mode.
[122]	No alarm	Output is high when no alarm is present.
[123]	Start command active	Output is high when there is an active Start command (i.e. via digital input bus connection or [Hand] or [Auto]), and no Stop or Start command is active.
[124]	Running reverse	Output is high when the frequency converter is running counter clockwise (the logical product of the status bits 'running' AND 'reverse').
[125]	Drive in hand mode	Output is high when the frequency converter is in [Handmode] (as indicated by the LED light above [Hand]).
[126]	Drive in auto mode	Output is high when the frequency converter is in [Hand] mode (as indicated by the LED light above [Auto]).

**E-20 Terminal 27 Digital Output****Option:****Function:**

[0] * No operation

[1] Control ready

[2] Drive ready

[3] Drive rdy/rem ctrl

[4] Enable / no warning

[5] Drive running

[6] Running / no warning

[7] Run in range/no warn

[8] Run on ref/no warn

[9] Alarm

[10] Alarm or warning

[11] At torque limit

[12] Out of current range

[13] Below current, low

[14] Above current, high

[15] Out of speed range

[16] Below speed, low

[17] Above speed, high

[18] Out of feedb. range

[19] Below feedback, low

[20] Above feedback, high

[21] Thermal warning

[22] Ready,no thermal W

[23] Remote,ready,no TW

[24] Ready, Voltage OK

[25] Reverse

[26] Bus OK

[27] Torque limit & stop

[28] Brake, no brake war

[29] Brake ready, no fault

[30] Brake fault (IGBT)

[31] Relay 123

[32] Mech brake ctrl

[33] Safe stop active

[40] Out of ref range

[41] Below reference, low

[42] Above ref, high

[45] Bus ctrl.

[46] Bus ctrl, 1 if timeout

[47] Bus ctrl, 0 if timeout

[55] Pulse output

[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]	Logic Controller digital output A
[81]	Logic Controller digital output B
[82]	Logic Controller digital output C
[83]	Logic Controller digital output D
[84]	Logic Controller digital output E
[85]	Logic Controller digital output F
[120]	Local ref active
[121]	Remote ref active
[122]	No alarm
[123]	Start command activ
[124]	Running reverse
[125]	Drive in hand mode
[126]	Drive in auto mode

E-21 Terminal 29 Digital Output

Option: **Function:**

[0] *	No operation
[1]	Control ready
[2]	Drive ready
[3]	Drive rdy/rem ctrl
[4]	Enable / no warning
[5]	Drive running
[6]	Running / no warning
[7]	Run in range/no warn
[8]	Run on ref/no warn
[9]	Alarm
[10]	Alarm or warning
[11]	At torque limit
[12]	Out of current range
[13]	Below current, low
[14]	Above current, high
[15]	Out of speed range
[16]	Below speed, low
[17]	Above speed, high
[18]	Out of feedb. range
[19]	Below feedback, low
[20]	Above feedback, high
[21]	Thermal warning
[22]	Ready,no thermal W
[23]	Remote,ready,no TW



[24]	Ready, Voltage OK
[25]	Reverse
[26]	Bus OK
[27]	Torque limit & stop
[28]	Brake, no brake war
[29]	Brake ready, no fault
[30]	Brake fault (IGBT)
[31]	Relay 123
[32]	Mech brake ctrl
[33]	Safe stop active
[40]	Out of ref range
[41]	Below reference, low
[42]	Above ref, high
[45]	Bus ctrl.
[46]	Bus ctrl, 1 if timeout
[47]	Bus ctrl, 0 if timeout
[55]	Pulse output
[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]	Logic Controller digital output A
[81]	Logic Controller digital output B
[82]	Logic Controller digital output C
[83]	Logic Controller digital output D
[84]	Logic Controller digital output E
[85]	Logic Controller digital output F
[120]	Local ref active
[121]	Remote ref active
[122]	No alarm
[123]	Start command activ
[124]	Running reverse
[125]	Drive in hand mode
[126]	Drive in auto mode

E-24 Function 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])

Option:

Function:

[0] * No operation



[1] Control ready

[2] Drive ready

[3] Drive rdy/rem ctrl

[4] Enable / no warning

[5] Drive running

[6] Running / no warning

[7] Run in range/no warn

[8] Run on ref/no warn

[9] Alarm

[10] Alarm or warning

[11] At torque limit

[12] Out of current range

[13] Below current, low

[14] Above current, high

[15] Out of speed range

[16] Below speed, low

[17] Above speed, high

[18] Out of feedb. range

[19] Below feedback, low

[20] Above feedback, high

[21] Thermal warning

[22] Ready,no thermal W

[23] Remote,ready,no TW

[24] Ready, Voltage OK

[25] Reverse

[26] Bus OK

[27] Torque limit & stop

[28] Brake, no brake war

[29] Brake ready, no fault

[30] Brake fault (IGBT)

[31] Relay 123

[32] Mech brake ctrl

[33] Safe stop active

[36] Control word bit 11

[37] Control word bit 12

[40] Out of ref range

[41] Below reference, low

[42] Above ref, high

[45] Bus ctrl.

[46] Bus ctrl, 1 if timeout

[47] Bus ctrl, 0 if timeout

[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]	Logic Controller digital output A
[81]	Logic Controller digital output B
[82]	Logic Controller digital output C
[83]	Logic Controller digital output D
[84]	Logic Controller digital output E
[85]	Logic Controller digital output F
[120]	Local ref active
[121]	Remote ref active
[122]	No alarm
[123]	Start command activ
[124]	Running reverse
[125]	Drive in hand mode
[126]	Drive in auto mode

E-26 On Delay, Relay

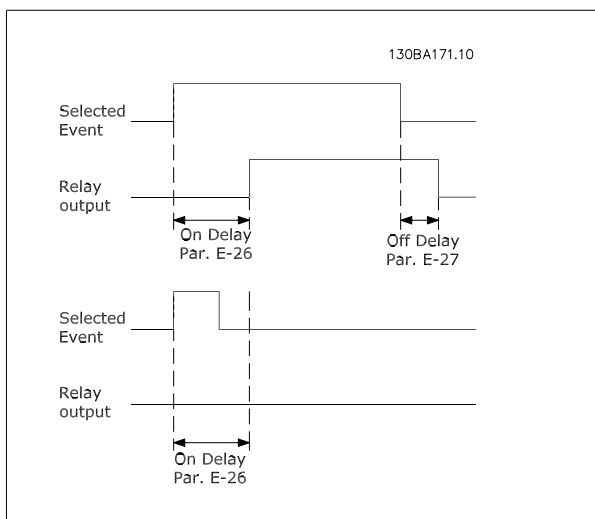
Array [8](Relay 1 [0], Relay 2 [1], Relay 3 [2], Relay 4 [3], Relay 5 [4], Relay 6 [5], Relay 7 [6], Relay 8 [7], Relay 9 [8])

Range:

0.01 s* [0.01 - 600.00 s]

Function:

Enter the delay of the relay cut-in time. Select one of available mechanical relays and OPCRLY Relay Option Module in an array function. See par. E-24 *Function Relay*.

**E-27 Off Delay, Relay**

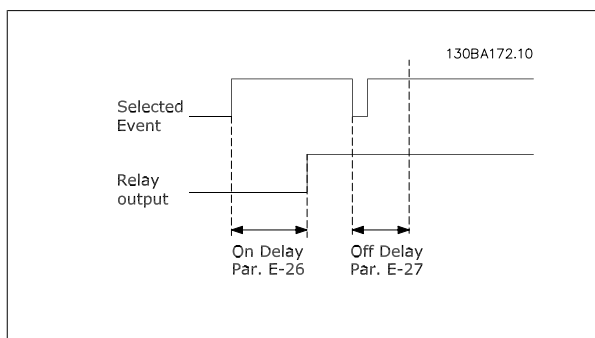
Array [8] (Relay 1 [0], Relay 2 [1], Relay 3 [2], Relay 4 [3], Relay 5 [4], Relay 6 [5], Relay 7 [6], Relay 8 [7], Relay 9 [8])

Range:

0.01 s* [0.01 - 600.00 s]

Function:

Enter the delay of the relay cut-out time. Select one of available mechanical relays and OPCRLY Relay Option Module in an array function. See par. E-24 *Function Relay*.



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

3.4.4 E-5# I/O Mode / Add On I/O

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	Select	Terminal
No operation	[0]	All *term 32, 33
Reset	[1]	All
Coast inverse	[2]	All *term 27
Coast and reset inverse	[3]	All
Quick stop inverse	[4]	All
DC-brake inverse	[5]	All
Stop inverse	[6]	All
Start	[8]	All *term 18
Latched start	[9]	All
Reversing	[10]	All *term 19
Start reversing	[11]	All
Enable start forward	[12]	All
Enable start reverse	[13]	All
Jog	[14]	All *term 29
Preset reference on	[15]	All
Preset ref bit 0	[16]	All
Preset ref bit 1	[17]	All
Preset ref bit 2	[18]	All
Freeze reference	[19]	All
Freeze output	[20]	All
Speed up	[21]	All
Speed down	[22]	All
Set-up select bit 0	[23]	All
Set-up select bit 1	[24]	All
Precise stop inverse	[26]	18, 19
Precises start, stop	[27]	18, 19
Catch up	[28]	All
Slow down	[29]	All
Counter input	[30]	29, 33
Pulse input	[32]	29, 33
Ramp bit 0	[34]	All
Ramp bit 1	[35]	All
Mains failure inverse	[36]	All
Latched precise start	[40]	18, 19
Latched precise stop inverse	[41]	18, 19
DigiPot Increase	[55]	All
DigiPot Decrease	[56]	All
DigiPot Clear	[57]	All
Counter A (up)	[60]	29, 33
Counter A (down)	[61]	29, 33
Reset Counter A	[62]	All
Counter B (up)	[63]	29, 33
Counter B (down)	[64]	29, 33
Reset Counter B	[65]	All
Mech. Brake Feedb.	[70]	All
Mech. Brake Feedb. Inv.	[71]	All
PTC Card 1	[80]	All

AF-650 GP standard terminals are 18, 19, 27, 29, 32 and 33. OPGPIO General Purpose I/O Option Module terminals are X30/2, X30/3 and X30/4.

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



All digital inputs can be programmed to these functions:

[0]	No operation	No reaction to signals transmitted to the terminal.
[1]	Reset	Resets frequency converter after a TRIP/ALARM. Not all alarms can be reset.
[2]	Coast inverse	(Default Digital input 27): Coasting stop, inverted input (NC). The frequency converter leaves the motor in free mode. Logic '0' => coasting stop.
[3]	Coast and reset inverse	Reset and coasting stop Inverted input (NC). Leaves motor in free mode and resets frequency converter. Logic '0' => coasting stop and reset.
[4]	Quick stop inverse	Inverted input (NC). Generates a stop in accordance with quick-stop ramp time set in par. C-23 <i>Quick Stop Decel Time</i> . When motor stops, the shaft is in free mode. Logic '0' => Quick-stop.
[5]	DC-brake inverse	Inverted input for DC braking (NC). Stops motor by energizing it with a DC current for a certain time period. See par. B-01 <i>DC Brake Current</i> to par. B-03 <i>DC Brake Cut In Speed [RPM]</i> . The function is only active when the value in par. B-02 <i>DC Braking Time</i> is different from 0. Logic '0' => DC braking.
[6]	Stop inverse	Stop Inverted function. Generates a stop function when the selected terminal goes from logical level '1' to '0'. The stop is performed according to the selected ramp time (par. F-08 <i>Decel Time 1</i> , par. E-11 <i>Decel Time 2</i> , par. E-13 <i>Decel Time 3</i> , par. E-15 <i>Decel Time 4</i>). NB! When the frequency converter is at the torque limit and has received a stop command, it may not stop by itself. To ensure that the frequency converter stops, configure a digital output to <i>Torque limit & stop</i> [27] and connect this digital output to a digital input that is configured as coast.
[8]	Start	(Default Digital input 18): Select start for a start/stop command. Logic '1' = start, logic '0' = stop.
[9]	Latched start	The motor starts, if a pulse is applied for min. 2 ms. The motor stops when Stop inverse is activated.
[10]	Reversing	(Default Digital input 19). Change the direction of motor shaft rotation. Select Logic '1' to reverse. The reversing signal only changes the direction of rotation. It does not activate the start function. Select both directions in par. H-08 <i>Reverse Lock</i> . The function is not active in process closed loop.
[11]	Start reversing	Used for start/stop and for reversing on the same wire. Signals on start are not allowed at the same time.
[12]	Enable start forward	Disengages the counterclockwise movement and allows for the clockwise direction.
[13]	Enable start reverse	Disengages the clockwise movement and allows for the counterclockwise direction.
[14]	Jog	(Default Digital input 29): Use to activate jog speed. See par. C-20 <i>Jog Speed [Hz]</i> .
[15]	Preset reference on	Shifts between external reference and preset reference. It is assumed that <i>External/preset</i> [1] has been selected in par. F-54 <i>Reference Function</i> . Logic '0' = external reference active; logic '1' = one of the eight preset references is active.
[16]	Preset ref bit 0	Preset ref. bit 0,1, and 2 enables a choice between one of the eight preset references according to the table below.
[17]	Preset ref bit 1	Same as Preset ref bit 0 [16].
[18]	Preset ref bit 2	Same as Preset ref bit 0 [16].

Preset ref. bit	2	1	0
Preset ref. 0	0	0	0
Preset ref. 1	0	0	1
Preset ref. 2	0	1	0
Preset ref. 3	0	1	1
Preset ref. 4	1	0	0
Preset ref. 5	1	0	1
Preset ref. 6	1	1	0
Preset ref. 7	1	1	1



[19] Freeze ref Freezes the actual reference, which is now the point of enable/condition for Speed up and Speed down to be used. If Speed up/down is used, the speed change always follows ramp 2 (par. E-10 *Accel Time 2* and par. E-11 *Decel Time 2*) in the range 0 - par. F-53 *Maximum Reference*.

[20] Freeze output Freezes the actual motor frequency (Hz), which is now the point of enable/condition for Speed up and Speed down to be used. If Speed up/down is used, the speed change always follows ramp 2 (par. E-10 *Accel Time 2* and par. E-11 *Decel Time 2*) in the range 0 - par. F-04 *Base Frequency*.

NB!

When Freeze output is active, the frequency converter cannot be stopped via a low 'start [8]' signal. Stop the frequency converter via a terminal programmed for Coasting inverse [2] or Coast and reset, inverse.

[21] Speed up Select Speed up and Speed down if digital control of the up/down speed is desired (motor potentiometer). Activate this function by selecting either Freeze reference or Freeze output. When Speed up/ down is activated for less than 400 msec. the resulting reference will be increased/ decreased by 0.1 %. If Speed up/ down is activated for more than 400 msec. the resulting reference will follow the setting in accel/ decel parameters.

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

[22] Speed down Same as Speed up [21].

[23] Set-up select bit 0 Select Set-up select bit 0 or Select Set-up select bit 1 to select one of the four set-ups. Set par. K-10 *Active Set-up* to Multi Set-up.

[24] Set-up select bit 1 (Default Digital input 32): Same as Set-up select bit 0 [23].

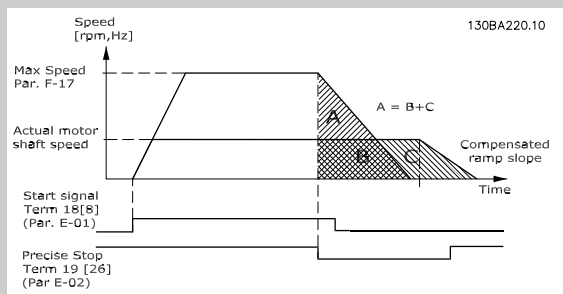
[26] Precise stop inv.

Prolongs stop signal to give a precise stop independent of speed.
Sends an inverted stop signal when the precise stop function is activated in par. H-83 *Precise Stop Function*.

Precise stop inverse function is available for terminals 18 or 19.

[27] Precise start, stop

Use when Precise ramp stop [0] is selected in par. H-83 *Precise Stop Function*.



[28] Catch up Increases reference value by percentage (relative) set in par. F-62 *Catch up/slow Down Value*.

[29] Slow down Reduces reference value by percentage (relative) set in par. F-62 *Catch up/slow Down Value*.

[30] Counter input Precise stop function in par. H-83 *Precise Stop Function* acts as Counter stop or speed compensated counter stop with or without reset. The counter value must be set in par. H-84 *Precise Stop Counter Value*.

[32] Pulse input Use pulse sequence as either reference or feedback. Scaling is done in parameter group E-6#.

[34] Ramp bit 0 Enables a choice between one of the 4 ramps available, according to the table below.

[35] Ramp bit 1 Same as Ramp bit 0.



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

[36]	Mains failure inverse	Activates par. SP-10 <i>Line failure</i> . Mains failure inverse is active in the Logic .0. situation.
[41]	Latched Precise Stop inverse	Sends a latched stop signal when the precise stop function is activated in par. H-83 <i>Precise Stop Function</i> . The Latched Precise stop inverse function is available for terminals 18 or 19.
[55]	DigiPot Increase	INCREASE signal to the Digital Potentiometer function described in parameter group F-9#
[56]	DigiPot Decrease	DECREASE signal to the Digital Potentiometer function described in parameter group F-9#
[57]	DigiPot Clear	Clears the Digital Potentiometer reference described in parameter group F-9#
[60]	Counter A	(Terminal 29 or 33 only) Input for increment counting in the LC counter.
[61]	Counter A	(Terminal 29 or 33 only) Input for decrement counting in the LC counter.
[62]	Reset Counter A	Input for reset of counter A.
[63]	Counter B	(Terminal 29 or 33 only) Input for increment counting in the LC counter.
[64]	Counter B	(Terminal 29 or 33 only) Input for decrement counting in the LC counter.
[65]	Reset Counter B	Input for reset of counter B.
[70]	Mech. Brake Feedback	Brake feedback for hoisting applications
[71]	Mech. Brake Feedback inv.	Inverted brake feedback for hoisting applications
[80]	PTC Card 1	All Digital Inputs can be set to PTC Card 1 [80]. However, only one Digital Input must be set to this choice.

E-51 Terminal 27 Mode

Option:

Function:

[0] *	Input	Defines terminal 27 as a digital input.
[1]	Output	Defines terminal 27 as a digital output.

Please note that this parameter cannot be adjusted while the motor is running.

E-52 Terminal 29 Mode

Option:

Function:

[0] *	Input	Defines terminal 29 as a digital input.
[1]	Output	Defines terminal 29 as a digital output.

This parameter cannot be adjusted while the motor is running.

E-53 Terminal X30/2 Digital Input

Option:

Function:

[0] *	No operation	This parameter is active when option module OPCGPIO General Purpose I/O Option Module is installed in the frequency converter.
[1]	Reset	
[2]	Coast inverse	
[3]	Coast and reset inv	
[4]	Quick stop inverse	
[5]	DC-brake inverse	
[6]	Stop inverse	
[8]	Start	
[9]	Latched start	
[10]	Reversing	
[11]	Start reversing	
[12]	Enable start forward	
[13]	Enable start reverse	



[14]	Jog
[15]	Preset reference on
[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
[24]	Set-up select bit 1
[28]	Catch up
[29]	Slow down
[34]	Ramp bit 0
[35]	Ramp bit 1
[55]	DigiPot increase
[56]	DigiPot decrease
[57]	DigiPot clear
[58]	DigiPot Hoist
[62]	Reset Counter A
[65]	Reset Counter B
[70]	Mech. Brake Feedb.
[71]	Mech. Brake Feedb. Inv.

E-54 Terminal X30/3 Digital Input

Option:	Function:
[0] *	No operation This parameter is active when option module OPCGPIO General Purpose I/O Option Module is installed in the frequency converter.
[1]	Reset
[2]	Coast inverse
[3]	Coast and reset inv
[4]	Quick stop inverse
[5]	DC-brake inverse
[6]	Stop inverse
[8]	Start
[9]	Latched start
[10]	Reversing
[11]	Start reversing
[12]	Enable start forward
[13]	Enable start reverse
[14]	Jog
[15]	Preset reference on
[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
[24]	Set-up select bit 1
[28]	Catch up
[29]	Slow down
[34]	Ramp bit 0
[35]	Ramp bit 1
[55]	DigiPot increase
[56]	DigiPot decrease
[57]	DigiPot clear
[58]	DigiPot Hoist
[62]	Reset Counter A
[65]	Reset Counter B
[70]	Mech. Brake Feedb.
[71]	Mech. Brake Feedb. Inv.

E-55 Terminal X30/4 Digital Input

Option:	Function:
[0] * No operation	This parameter is active when option module OPCGPIO General Purpose I/O Option Module is installed in the frequency converter.
[1]	Reset
[2]	Coast inverse
[3]	Coast and reset inv
[4]	Quick stop inverse
[5]	DC-brake inverse
[6]	Stop inverse
[8]	Start
[9]	Latched start
[10]	Reversing
[11]	Start reversing
[12]	Enable start forward
[13]	Enable start reverse
[14]	Jog
[15]	Preset reference on
[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
[24]	Set-up select bit 1
[28]	Catch up
[29]	Slow down
[34]	Ramp bit 0



[35]	Ramp bit 1
[55]	DigiPot increase
[56]	DigiPot decrease
[57]	DigiPot clear
[58]	DigiPot Hoist
[62]	Reset Counter A
[65]	Reset Counter B
[70]	Mech. Brake Feedb.
[71]	Mech. Brake Feedb. Inv.

E-56 Term X30/6 Digi Out (OPCGPIO)**Option:****Function:**

[0] *	No operation	This parameter is active when option module OPCGPIO General Purpose I/O Option Module is mounted in the frequency converter.
[1]	Control ready	
[2]	Drive ready	
[3]	Drive rdy/rem ctrl	
[4]	Enable / no warning	
[5]	Drive running	
[6]	Running / no warning	
[7]	Run in range/no warn	
[8]	Run on ref/no warn	
[9]	Alarm	
[10]	Alarm or warning	
[11]	At torque limit	
[12]	Out of current range	
[13]	Below current, low	
[14]	Above current, high	
[15]	Out of speed range	
[16]	Below speed, low	
[17]	Above speed, high	
[18]	Out of feedb. range	
[19]	Below feedback, low	
[20]	Above feedback, high	
[21]	Thermal warning	
[22]	Ready,no thermal W	
[23]	Remote,ready,no TW	
[24]	Ready, Voltage OK	
[25]	Reverse	
[26]	Bus OK	
[27]	Torque limit & stop	
[28]	Brake, no brake war	
[29]	Brake ready, no fault	
[30]	Brake fault (IGBT)	
[31]	Relay 123	
[32]	Mech brake ctrl	
[33]	Safe stop active	



[40]	Out of ref range
[41]	Below reference, low
[42]	Above ref, high
[45]	Bus ctrl.
[46]	Bus ctrl, 1 if timeout
[47]	Bus ctrl, 0 if timeout
[55]	Pulse output
[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]	Logic Controller digital output A
[81]	Logic Controller digital output B
[82]	Logic Controller digital output C
[83]	Logic Controller digital output D
[84]	Logic Controller digital output E
[85]	Logic Controller digital output F
[120]	Local ref active
[121]	Remote ref active
[122]	No alarm
[123]	Start command activ
[124]	Running reverse
[125]	Drive in hand mode
[126]	Drive in auto mode

E-57 Term X30/7 Digi Out (OPCGPIO)**Option:****Function:**

[0] *	No operation	This parameter is active when option module OPCGPIO General Purpose I/O Option Module is mounted in the frequency converter.
[1]	Control ready	
[2]	Drive ready	
[3]	Drive rdy/rem ctrl	
[4]	Enable / no warning	
[5]	Drive running	
[6]	Running / no warning	
[7]	Run in range/no warn	
[8]	Run on ref/no warn	
[9]	Alarm	
[10]	Alarm or warning	



[11]	At torque limit
[12]	Out of current range
[13]	Below current, low
[14]	Above current, high
[15]	Out of speed range
[16]	Below speed, low
[17]	Above speed, high
[18]	Out of feedb. range
[19]	Below feedback, low
[20]	Above feedback, high
[21]	Thermal warning
[22]	Ready,no thermal W
[23]	Remote,ready,no TW
[24]	Ready, Voltage OK
[25]	Reverse
[26]	Bus OK
[27]	Torque limit & stop
[28]	Brake, no brake war
[29]	Brake ready, no fault
[30]	Brake fault (IGBT)
[31]	Relay 123
[32]	Mech brake ctrl
[33]	Safe stop active
[40]	Out of ref range
[41]	Below reference, low
[42]	Above ref, high
[45]	Bus ctrl.
[46]	Bus ctrl, 1 if timeout
[47]	Bus ctrl, 0 if timeout
[55]	Pulse output
[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]	Logic Controller digital output A
[81]	Logic Controller digital output B
[82]	Logic Controller digital output C
[83]	Logic Controller digital output D
[84]	Logic Controller digital output E



[85]	Logic Controller digital output F
[120]	Local ref active
[121]	Remote ref active
[122]	No alarm
[123]	Start command activ
[124]	Running reverse
[125]	Drive in hand mode
[126]	Drive in auto mode

3.4.5 E-6# Pulse Input

Parameters to configure terminal 29 and 33 as Pulse Train inputs.

E-60 Term. 29 Low Frequency

Range:	Function:
100 Hz* [0 - 110000 Hz]	Enter the low frequency limit corresponding to the low motor shaft speed (i.e. low reference value) in par. E-62 <i>Term. 29 Low Ref./Feedb. Value</i> . Refer to the diagram in this section.

E-61 Term. 29 High Frequency

Range:	Function:
100 Hz* [0 - 110000 Hz]	Enter the high frequency limit corresponding to the high motor shaft speed (i.e. high reference value) in par. E-63 <i>Term. 29 High Ref./Feedb. Value</i> .

E-62 Term. 29 Low Ref./Feedb. Value

Range:	Function:
0.000 Unit* [-999999.999 - 999999.999]	Enter the low reference value limit for the motor shaft speed [RPM]. This is also the lowest feedback value, see also par. E-67 <i>Term. 33 Low Ref./Feedb. Value</i> . Set terminal 29 to digital input (par. E-52 <i>Terminal 29 Mode =input</i> [0] (default) and par. E-04 <i>Terminal 29 Digital Input</i> = applicable value).

E-63 Term. 29 High Ref./Feedb. Value

Range:	Function:
1500.000 Unit* [-999999.999 - 999999.999]	Enter the high reference value [RPM] for the motor shaft speed and the high feedback value, see also par. E-68 <i>Term. 33 High Ref./Feedb. Value</i> . Select terminal 29 as a digital input (par. E-52 <i>Terminal 29 Mode =input</i> [0] (default) and par. E-04 <i>Terminal 29 Digital Input</i> = applicable value).

E-64 Pulse Filter Time Constant #29

Range:	Function:
100 ms* [1 - 1000 ms]	Enter the pulse filter time constant. The pulse filter dampens oscillations of the feedback signal, which is an advantage if there is a lot of noise in the system. A high time constant value results in better dampening but also increases the time delay through the filter. This parameter cannot be adjusted while the motor is running.

E-65 Term. 33 Low Frequency

Range:	Function:
100 Hz* [0 - 110000 Hz]	Enter the low frequency corresponding to the low motor shaft speed (i.e. low reference value) in par. E-67 <i>Term. 33 Low Ref./Feedb. Value</i> .

E-66 Term. 33 High Frequency

Range:	Function:
100 Hz* [0 - 110000 Hz]	Enter the high frequency corresponding to the high motor shaft speed (i.e. high reference value) in par. E-68 <i>Term. 33 High Ref./Feedb. Value</i> .

**E-67 Term. 33 Low Ref./Feedb. Value****Range:**

0.000* [-999999.999 - 999999.999]

Function:

Enter the low reference value [RPM] for the motor shaft speed. This is also the low feedback value, see also par. E-62 *Term. 29 Low Ref./Feedb. Value*.

E-68 Term. 33 High Ref./Feedb. Value**Range:**1500.000 [-999999.999 - 999999.999]
Unit***Function:**

Enter the high reference value [RPM] for the motor shaft speed. See also par. E-63 *Term. 29 High Ref./Feedb. Value*.

E-69 Pulse Filter Time Constant #33**Range:**

100 ms* [1 - 1000 ms]

Function:

Enter the pulse filter time constant. The low-pass filter reduces the influence on and dampens oscillations on the feedback signal from the control.

This is an advantage, e.g. if there is a great amount on noise in the system. This parameter cannot be adjusted while the motor is running.

3.4.6 E-7# Pulse Output

Parameters to configure terminal 27 and 29 as Pulse Train Outputs and to configure Encoder input terminals 32 and 33.

E-70 Terminal 27 Pulse Output Variable**Option:**

[0] * No operation

Function:

Select the desired display output for terminal 27.
This parameter cannot be adjusted while the motor is running.

[45] Bus ctrl.

[48] Bus ctrl., timeout

[100] Output frequency

[101] Reference

[102] Feedback

[103] Motor Current

[104] Torque rel to limit

[105] Torq relate to rated

[106] Power

[107] Speed

[108] Torque

[109] Max Out Freq

[119] Torque % lim

E-72 Pulse Output Max Freq #27**Range:**

5000. Hz* [0 - 32000 Hz]

Function:

Set the maximum frequency for terminal 27, corresponding to the output variable selected in par. E-70 *Terminal 27 Pulse Output Variable*.
This parameter cannot be adjusted while the motor is running.

E-73 Terminal 29 Pulse Output Variable**Option:**

[0] * No operation

Function:

Select the desired display output for terminal 29.
This parameter cannot be adjusted while the motor is running.

[45] Bus ctrl.



[48]	Bus ctrl., timeout
[100]	Output frequency
[101]	Reference
[102]	Feedback
[103]	Motor Current
[104]	Torque rel to limit
[105]	Torq relate to rated
[106]	Power
[107]	Speed
[108]	Torque
[109]	Max Out Freq
[119]	Torque % lim

E-75 Terminal X30/6 Pulse Output Variable

Option:	Function:
[0] * No operation	Select the variable for read-out on terminal X30/6. This parameter cannot be adjusted while the motor is running. This parameter is active when the General Purpose I/O Option Module (OPCGPIO) is installed in the frequency converter.
[45]	Bus ctrl.
[48]	Bus ctrl., timeout
[100]	Output frequency
[101]	Reference
[102]	Feedback
[103]	Motor Current
[104]	Torque rel to limit
[105]	Torq relate to rated
[106]	Power
[107]	Speed
[113]	Ext. Closed Loop 1
[114]	Ext. Closed Loop 2
[115]	Ext. Closed Loop 3

E-78 Pulse Output Max Freq #X30/6

Range:	Function:
5000. Hz* [0 - 32000 Hz]	Select the maximum frequency on terminal X30/6 referring to the output variable in par. E-75 <i>Terminal X30/6 Pulse Output Variable</i> . This parameter cannot be adjusted while the motor is running. This parameter is active when the General Purpose I/O Option Module (OPCGPIO) is mounted in the frequency converter.

3.4.7 E-8# 24V Encoder Input

Parameters to configure the Encoder outputs.

E-80 Term 32/33 Pulses Per Revolution

Range:	Function:
1024 PPR* [128 - 4096 PPR]	Set the encoder pulses per revolution on the motor shaft. Read the correct value from the encoder. This parameter cannot be adjusted while the motor is running.

**E-81 Term 32/33 Encoder Direction****Option:****Function:**

Change the detected encoder rotation direction without changing the wiring to the encoder.

[0] * Clockwise

Sets channel A 90° (electrical degrees) behind channel B upon clockwise rotation of the encoder shaft.

[1] Counter clockwise

Sets channel A 90° (electrical degrees) ahead of channel B upon clockwise rotation of the encoder shaft.

This parameter cannot be adjusted while the motor is running.

3

3.4.8 E-9# Bus Controlled

Parameters to configure digital, relay and pulse train outputs to be controlled by the serial communications.

E-90 Digital & Relay Bus Control**Range:****Function:**

0* [0 - FFFFFFFF]

This parameter holds the state of the digital outputs and relays that is controlled by bus.

A logical '1' indicates that the output is high or active.

A logical '0' indicates that the output is low or inactive.

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

E-93 Pulse Out #27 Bus Control**Range:****Function:**

0.00 %* [0.00 - 100.00 %]

Set the output frequency transferred to the output terminal 27 when the terminal is configured as 'Bus Controlled' in par. E-70 *Terminal 27 Pulse Output Variable* [45].**E-94 Pulse Out #27 Timeout Preset****Range:****Function:**

0.00 %* [0.00 - 100.00 %]

Set the output frequency transferred to the output terminal 27 when the terminal is configured as 'Bus Ctrl Timeout' in par. E-70 *Terminal 27 Pulse Output Variable* [48]. And a time-out is detected.**E-95 Pulse Out #29 Bus Control****Range:****Function:**

0.00 %* [0.00 - 100.00 %]

Set the output frequency transferred to the output terminal 29 when the terminal is configured as 'Bus Controlled' in par. E-70 *Terminal 27 Pulse Output Variable* [45].**E-96 Pulse Out #29 Timeout Preset****Range:****Function:**

0.00 %* [0.00 - 100.00 %]

Set the output frequency transferred to the output terminal 29 when the terminal is configured as 'Bus Ctrl Timeout' in par. E-70 *Terminal 27 Pulse Output Variable* [48]. And a time-out is detected.



3.5 C-## Frequency Control Functions

Parameter group related to the Jump Frequencies, Multi-step Frequencies, Job set-up, and Frequency Settings 2 and 3.

3.5.1 C-0# Frequency Control Functions

Parameters to configure Jump Frequencies 1, 2, 3, and 4, and Multi-step Frequencies 1 through 8.

C-01 Jump Frequency From [Hz]

Array [4]

Range:

0 Hz* [0.0 - par. H-14 Hz]

Function:

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.

C-02 Jump Speed From [RPM]

Array [4]

Range:

0 RPM* [0 - par. H-13 RPM]

Function:

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.

C-03 Jump Speed To [RPM]

Array [4]

Range:

0 RPM* [0 - par. H-13 RPM]

Function:

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.

C-04 Jump Frequency To [Hz]

Array [4]

Range:

0 Hz* [0.0 - par. H-14 Hz]

Function:

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.

C-05 Multi-step Frequency 1 - 8

Array [8]

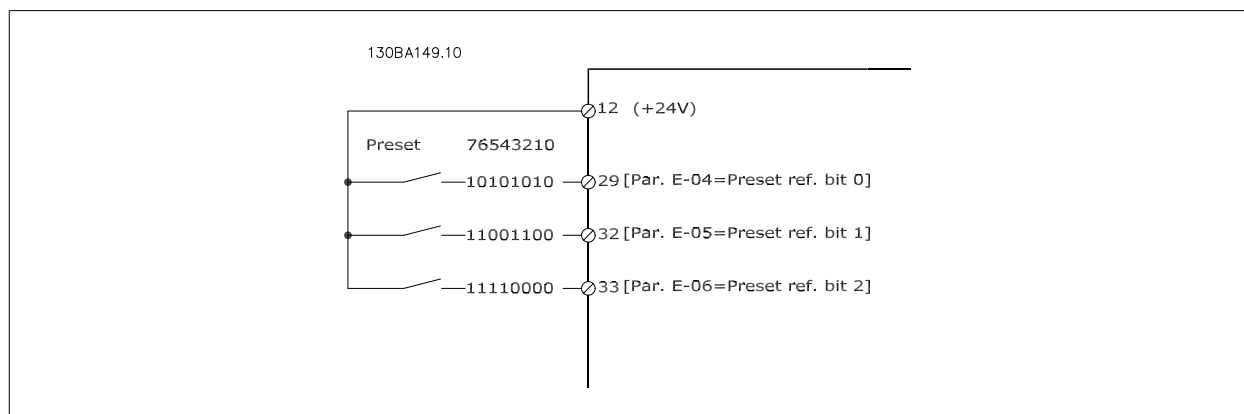
Range: 0-7

Range:

0.00 %* [-100.00 - 100.00 %]

Function:

Enter up to eight different preset references (0-7) in this parameter, using array programming. The preset reference is stated as a percentage of the value Ref_{MAX} (par. F-53 *Maximum Reference*). If a Ref_{MIN} different from 0 (par. F-52 *Minimum Reference*) is programmed, the preset reference is calculated as a percentage of the full reference range, i.e. on the basis of the difference between Ref_{MAX} and Ref_{MIN}. Afterwards, the value is added to Ref_{MIN}. When using preset references, select Preset ref. bit 0 / 1 / 2 [16], [17] or [18] for the corresponding digital inputs in parameter group E-##.



Preset ref. bit	2	1	0
Preset ref. 0	0	0	0
Preset ref. 1	0	0	1
Preset ref. 2	0	1	0
Preset ref. 3	0	1	1
Preset ref. 4	1	0	0
Preset ref. 5	1	0	1
Preset ref. 6	1	1	0
Preset ref. 7	1	1	1

3.5.2 C-2# Jog Set-Up

Parameters to configure Jog Speed, Jog Accel/Decel Time and Quick Stop Decel Time.

C-20 Jog Speed [Hz]

Range:

0 Hz* [0.0 - par. H-14 Hz]

Function:

The jog speed is a fixed output speed at which the frequency converter is running when the jog function is activated.

See also par. C-22 Jog Accel/Decel Time.

C-21 Jog Speed [RPM]

Range:

150. RPM* [0 - par. H-13 RPM]

Function:

Enter a value for the jog speed n_{JOG} , which is a fixed output speed. The frequency converter runs at this speed when the jog function is activated. The maximum limit is defined in par. F-17 Motor Speed High Limit [RPM].

See also par. C-22 Jog Accel/Decel Time.

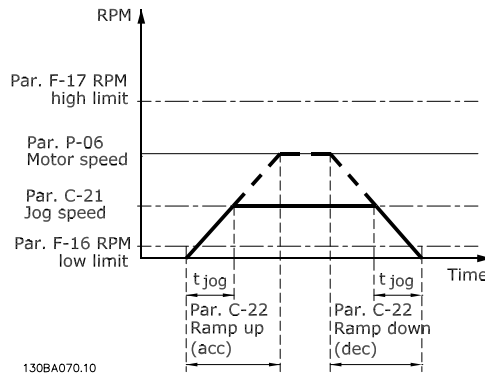
C-22 Jog Accel/Decel Time

Range:

3.00 s* [0.01 - 3600.00 s]

Function:

Enter the jog ramp time, i.e. the acceleration/deceleration time between 0 RPM and the rated motor frequency n_s . Ensure that the resultant output current required for the given jog ramp time does not exceed the current limit in par. F-43 Current Limit. The jog ramp time starts upon activation of a jog signal via the control panel, a selected digital input, or the serial communication port.



$$Par. C - 22 = \frac{t_{jog} [s] \times n_s [RPM]}{\Delta \log speed (par. C - 21) [RPM]}$$

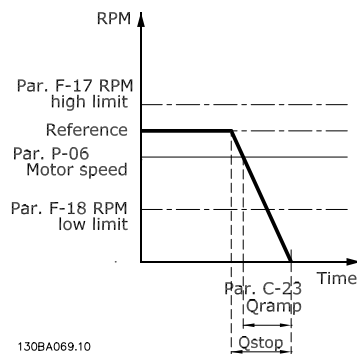
C-23 Quick Stop Decel Time

Range:

3.00 s* [0.01 - 3600.00 s]

Function:

Enter the quick-stop decel time from the synchronous motor speed to 0 RPM. Ensure that no resultant over-voltage will arise in the inverter due to regenerative operation of the motor required to achieve the given decel time. Ensure also that the generated current required to achieve the given decel time does not exceed the current limit (set in par. F-43 *Current Limit*). Quick-stop is activated by means of a signal on a selected digital input, or via the serial communication port.



$$Par. C - 23 = \frac{t_{Qstop} [s] \times n_s [RPM]}{\Delta jog ref (par. C - 21) [RPM]}$$

3.5.3 C-3# Frequency Setting 2 and 3

Parameters to configure Frequency Settings 2 and 3.

C-30 Frequency Command 2

Option:

Function:

Select the reference input to be used for the second reference signal. par. F-01 *Frequency Setting 1*, par. C-30 *Frequency Command 2* and par. C-34 *Frequency Command 3* define up to three different reference signals. The sum of these reference signals defines the actual reference.

- [0] No function
- [1] Analog Input 53
- [2] Analog Input 54
- [7] Frequency input 29



[8]	Frequency input 33	
[11]	Local bus reference	
[20] *	Digital Pot-Meter	
[21]	Analog input X30-11	(OPCGPIO)
[22]	Analog input X30-12	(OPCGPIO)

C-34 Frequency Command 3**Option:****Function:**

Select the reference input to be used for the third reference signal. par. F-01 *Frequency Setting 1*, par. C-30 *Frequency Command 2* and par. C-34 *Frequency Command 3* define up to three different reference signals. The sum of these reference signals defines the actual reference.

[0]	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[7]	Frequency input 29	
[8]	Frequency input 33	
[11] *	Local bus reference	
[20]	Digital Pot-Meter	
[21]	Analog input X30-11	(OPCGPIO)
[22]	Analog input X30-12	(OPCGPIO)



3.6 P-## Motor Data

Parameter group related to setting motor data in the drive.

3.6.1 P-0# Motor Data

Parameters to configure Motor, Auto Tuning and Slip Compensation.

P-01 Motor Poles

Range:

Function:

4.* [2 - 100]

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

The table shows the number of poles for normal speed ranges of various motor types. Define motors designed for other frequencies separately. The motor pole value is always an even number, because it refers to the total number of poles, not pairs of poles. The frequency converter creates the initial setting of par. P-01 *Motor Poles* based on par. F-04 *Base Frequency* and par. P-06 *Base Speed*.

P-02 Motor Power [HP]

Range:

Function:

4.00 hp* [0.09 - 3000.00 hp]

Enter the nominal motor power in HP according to the motor nameplate data. The default value corresponds to the nominal rated output of the unit. This parameter is visible in Keypad if par. K-03 *Regional Settings* is US [1]

P-03 Motor Current

Range:

Function:

7.20 A* [0.10 - 10000.00 A]

Enter the nominal motor current value from the motor nameplate data. The data are used for calculating torque, motor protection etc.

P-04 Auto Tune

Option:

Function:

The Auto Tune function optimises dynamic motor performance by automatically optimising the advanced motor parameters (par. P-30 *Stator Resistance (Rs)* to par. P-35 *Main Reactance (Xh)*) at motor standstill.

Activate the Auto Tune function by pressing [Hand] after selecting [1] or [2]. See also the section *Auto Tuning* in the AF-650 GP Design Guide. After a normal sequence, the display will read: "Press [OK] to finish Auto Tune". After pressing the [OK] key the frequency converter is ready for operation.

This parameter cannot be adjusted while the motor is running.

[0] * Off

[1] Enable complete Auto Tune

Performs Auto Tune of the stator resistance R_s , the rotor resistance R_r , the stator leakage reactance X_1 , the rotor leakage reactance X_2 and the main reactance X_m . Do *not* select this option if an LC filter is used between the frequency converter and the motor.

[2] Enable reduced Auto Tune

Performs a reduced Auto Tune of the stator resistance R_s in the system only.

Note:

- For the best results run Auto Tune on a cold motor.
- Auto Tune cannot be performed while the motor is running.
- Auto Tune cannot be performed on permanent magnet motors.

**NB!**

It is important to set motor par. F-04, F-05, and P-02 to P-08 correctly, since these form part of the Auto Tune algorithm. An Auto Tune should be performed to achieve optimum dynamic motor performance. It may take up to 10 min, depending on the power rating of the motor.

NB!

Avoid generating external torque during Auto Tune.

NB!

If one of the settings in par. F-04, F-05, or P-02 to P-08 is changed, par. P-30 *Stator Resistance (Rs)* to par. P-01 *Motor Poles*, the advanced motor parameters, will return to default setting.

NB!

Auto Tune will work problem-free on 1 motor size down, typically work on 2 motor sizes down, rarely work on 3 sizes down and never work on 4 sizes down. Please keep in mind that the accuracy of the measured motor data will be poorer when you operate on motors smaller than nominal drive size.

P-05 Motor Cont. Rated Torque**Range:**

0 Nm* [0.1 - 10000.0 Nm]

Function:

Enter the value from the motor nameplate data. The default value corresponds to the nominal rated output. This parameter is available when par. P-20 *Motor Construction* is set to *PM, non salient SPM* [1], i.e. the parameter is valid for PM and non-salient SPM motors only.

P-06 Base Speed**Range:**

1420. RPM* [10 - 60000 RPM]

Function:

Enter the nominal motor speed value from the motor nameplate data. The data are used for calculating motor compensations.

P-07 Motor Power [kW]**Range:**

4.00 kW* [0.09 - 3000.00 kW]

Function:

Enter the nominal motor power in kW according to the motor nameplate data. The default value corresponds to the nominal rated output of the unit.
This parameter cannot be adjusted while the motor is running. This parameter is visible in Keypad if par. K-03 *Regional Settings* is *International* [0].

P-09 Slip Compensation**Range:**

100. %* [-500 - 500 %]

Function:

Enter the % value for slip compensation, to compensate for tolerances in the value of $n_{M,N}$. Slip compensation is calculated automatically, i.e. on the basis of the rated motor speed $n_{M,N}$.
This function is not active when par. H-40 *Configuration Mode* is set to *Speed closed loop* [1] or *Torque* [2] Torque control with speed feedback or when par. H-41 *Motor Control Principle* is set to *U/f* [0] special motor mode.

P-10 Slip Compensation Time Constant**Range:**

0.10 s* [0.05 - 5.00 s]

Function:

Enter the slip compensation reaction speed. A high value results in slow reaction, and a low value results in quick reaction. If low-frequency resonance problems arise, use a longer time setting.



3.6.2 P-2# Motor Selection

Parameters to configure the drive to work with Asynchronous AC Motor or Permanent Magnet Motor

P-20 Motor Construction

Option:	Function:
	Select the motor construction type.
[0] * Asynchron	For asynchronous motors.
[1] PM, non salient SPM	

Motor construction can either be asynchronous or permanent magnet (PM) motor.

3.6.3 P-3# Adv. Motor Data

Parameters to configure advanced motor data to the drive.

P-30 Stator Resistance (Rs)

Range:	Function:
1.4000 [0.0140 - 140.0000 Ohm] Ohm*	Set the stator resistance value. Enter the value from a motor data sheet or perform an Auto Tune on a cold motor.

P-31 Rotor Resistance (Rr)

Range:	Function:
1.0000 [0.0100 - 100.0000 Ohm] Ohm*	Fine-tuning R_r will improve shaft performance. Set the rotor resistance value using one of these methods: 1. Run an Auto Tune on a cold motor. The frequency converter will measure the value from the motor. All compensations are reset to 100%. 2. Enter the R_r value manually. Obtain the value from the motor supplier. 3. Use the R_r default setting. The frequency converter establishes the setting on the basis of the motor nameplate data.

P-33 Stator Leakage Reactance (X1)

Range:	Function:
4.0000 [0.0400 - 400.0000 Ohm] Ohm*	Set the stator leakage reactance of the motor using one of these methods: 1. Run an Auto Tune on a cold motor. The frequency converter will measure the value from the motor. 2. Enter the X₁ value manually. Obtain the value from the motor supplier. 3. Use the X₁ default setting. The frequency converter establishes the setting on the basis of the motor name plate data.

P-34 Rotor Leakage Reactance (X2)

Range:	Function:
4.0000 [0.0400 - 400.0000 Ohm] Ohm*	Set the rotor leakage reactance of the motor using one of these methods: 1. Run an Auto Tune on a cold motor. The frequency converter will measure the value from the motor. 2. Enter the X₂ value manually. Obtain the value from the motor supplier. 3. Use the X₂ default setting. The frequency converter establishes the setting on the basis of the motor name plate data.

**P-35 Main Reactance (Xh)****Range:**

100.0000 [1.0000 - 10000.0000 Ohm]
Ohm*

Function:

Set the main reactance of the motor using one of these methods:

1. Run an Auto Tune on a cold motor. The frequency converter will measure the value from the motor.
2. Enter the X_h value manually. Obtain the value from the motor supplier.
3. Use the X_h default setting. The frequency converter establishes the setting on the basis of the motor name plate data.

P-36 Iron Loss Resistance (Rfe)**Range:**

10000.000 [0 - 10000.000 Ohm]
Ohm*

Function:

Enter the equivalent iron loss resistance (R_{Fe}) value to compensate for iron loss in the motor.

The R_{Fe} value cannot be found by performing an Auto Tune.

The R_{Fe} value is especially important in torque control applications. If R_{Fe} is unknown, leave par. P-36 *Iron Loss Resistance (Rfe)* on default setting.

P-37 d-axis Inductance (Ld)**Range:**

0 mH* [0 - 0.000 mH]

Function:

Enter the value of the d-axis inductance. Obtain the value from the permanent magnet motor data sheet.

The d-axis inductance cannot be found by performing an Auto Tune.



3.7 H-## High Perf Parameters

Parameter group related to high performance functions in the drive.

3.7.1 H-0# High Perf Operations

Parameters to restore factory setting, configure auto reset, fan operation, reverse lock and start mode (catch a spinning load).

H-03 Restore Factory Settings

Option:	Function:
	Use this parameter to specify normal operation, to perform tests or to initialise all parameters except par. ID-03 <i>Power Up's</i> , par. ID-04 <i>Over Temp's</i> and par. ID-05 <i>Over Volt's</i> . This function is active only when the power is cycled (power off-power on) to the frequency converter.
[0] * Normal operation	Select <i>Normal operation</i> [0] for normal operation of the frequency converter with the motor in the selected application.
[2] Restore Factory Settings	Select <i>Initialization</i> [2] to reset all parameter values to default settings, except for par. ID-03 <i>Power Up's</i> , par. ID-04 <i>Over Temp's</i> and par. ID-05 <i>Over Volt's</i> . The frequency converter will reset during the next power-up. par. H-03 <i>Restore Factory Settings</i> will also revert to the default setting <i>Normal operation</i> [0].
[3] Boot mode	

H-04 Auto-Reset (Times)

Option:	Function:
	Select the reset function after tripping. Once reset, the frequency converter can be restarted.
[0] * Manual reset	Select <i>Manual reset</i> [0], to perform a reset via [RESET] or via the digital inputs.
[1] Automatic reset x 1	Select <i>Automatic reset x 1...x20</i> [1]-[12] to perform between one and twenty 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 <i>Infinite Automatic Reset</i> [13] for continuous resetting after tripping.

NB!

The motor may start without warning. If the specified number of AUTOMATIC RESETs is reached within 10 minutes, the frequency converter enters Manual reset [0] mode. After the Manual reset is performed, the setting of par. H-04 *Auto-Reset (Times)* reverts to the original selection. If the number of automatic resets is not reached within 10 minutes, or when a Manual reset is performed, the internal AUTOMATIC RESET counter returns to zero.

NB!

Automatic reset will also be active for resetting safe stop function in firmware version < 4.3x.

**H-05 Auto-Reset (Reset Interval)****Range:**

10 s* [0 - 600 s]

Function:

Enter the time interval from trip to start of the automatic reset function. This parameter is active when par. H-04 *Auto-Reset (Times)* is set to *Automatic reset* [1] - [13].

H-07 Accel/Decel Time 1 Type**Option:****Function:**

Select the ramp type, depending on requirements for acceleration/deceleration. A linear ramp will give constant acceleration during ramping. An S-ramp will give non-linear acceleration, compensating for jerk in the application.

[0] * Linear

[1] S-ramp Const Jerk

Acceleration with lowest possible jerk.

[2] S-ramp Const Time

S-ramp based on the values set in par. F-07 *Accel Time 1* and par. F-08 *Decel Time 1*.**NB!**

If S-ramp [1] is selected and the reference during ramping is changed the ramp time may be prolonged in order to realize a jerk free movement which may result in a longer start or stop time.

Additional adjustment of the S-ramp ratios or switching initiators may be necessary.

H-08 Reverse Lock**Option:****Function:**

Select the motor speed direction(s) required. Use this parameter to prevent unwanted reversing. When par. H-40 *Configuration Mode* is set to *Process* [3], par. H-08 *Reverse Lock* is set to *Clockwise* [0] as default. The setting in par. H-08 *Reverse Lock* does not limit options for setting par. F-15 *Motor Speed High Limit [Hz]* or par. F-17 *Motor Speed High Limit [RPM]*.

This parameter cannot be adjusted while the motor is running.

[0] * Clockwise

[1] Counter clockwise

[2] Both directions

H-09 Start Mode**Option:****Function:**

This function makes it possible to catch a motor which is spinning freely due to a mains drop-out.

[0] * Disabled

No function

[1] Enabled

This parameter cannot be adjusted while motor is running.

NB!

This function is not recommended for hoisting applications.

3.7.2 H-2# Motor Feedback Monitoring

Parameters to configure Motor Feedback Monitoring.

H-20 Motor Feedback Loss Function**Option:****Function:**

Select which reaction the frequency converter should take if a feedback fault is detected. The selected action is to take place when the feedback signal differs from the output speed where its range is specified



in par. H-21 *Motor Feedback Speed Error* during its time frame set in par. H-22 *Motor Feedback Loss Timeout*.

[0]	Disabled
[1]	Warning
[2] *	Trip
[3]	Jog
[4]	Freeze Output
[5]	Max Speed
[6]	Switch to Open Loop
[7]	Select Setup 1
[8]	Select Setup 2
[9]	Select Setup 3
[10]	Select Setup 4
[11]	stop & trip

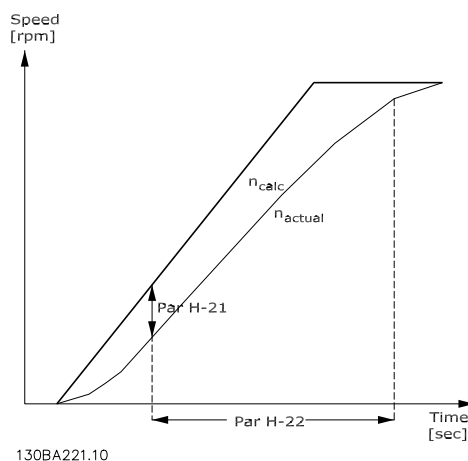
H-21 Motor Feedback Speed Error

Range:

300 RPM* [1 - 600 RPM]

Function:

Select the max allowed tracking error in speed from the calculated and the actual mechanical shaft output speed.



H-22 Motor Feedback Loss Timeout

Range:

0.05 s* [0.00 - 60.00 s]

Function:

Set the timeout value allowing the speed error set in par. H-21 *Motor Feedback Speed Error* to be exceeded.

3.7.3 H-4# Advanced Settings

Parameters to configure advanced controls for Open/Closed Loop, control principles: V/Hz, Adv. Vector, Sensorless Vector, and Closed Loop Vector, Constant or Variable Torque, and Overload Mode.

H-40 Configuration Mode

Option:**Function:**

Select the application control principle to be used when a Remote Reference (i.e. via analog input or Network) is active. A Remote Reference can only be active when par. F-02 *Operation Method* is set to [0] or [1].



[0] *	Speed open loop	Enables speed control (without feedback signal from motor) with automatic slip compensation for almost constant speed at varying loads.
[1]	Speed closed loop	Enables encoder feedback from motor. Obtain full holding torque at 0 RPM. For increased speed accuracy, provide a feedback signal and set the speed PID control.
[2]	Torque	Connects the encoder speed feedback signal to the encoder input. Only possible with "Flux with motor feedback" option, par. H-41 <i>Motor Control Principle</i> .
[3]	Process	Enables the use of process control in the frequency converter. The process control parameters are set in par. groups PI-2# and PI-3#.
[4]	Torque open loop	Enables the use of torque open loop in Adv. Vector Control mode (par. H-41 <i>Motor Control Principle</i>). The torque PID parameters are set in par. group PI-1#.

H-41 Motor Control Principle

Option:	Function:
	Select which motor control principle to employ.
[0] * U/f	special motor mode, for parallel connected motors in special motor applications. When U/f is selected the characteristic of the control principle can be edited in par. H-55 <i>U/f Characteristic - U</i> and par. H-56 <i>U/f Characteristic - F</i> .
[1] Advanced Vector Control	Voltage Vector Control principle suitable for most applications. The main benefit of Advanced Vector Control operation is that it uses a robust motor model.
[2] Flux sensorless	Flux Vector control without encoder feedback, for simple installation and robustness against sudden load changes.
[3] Flux w/ motor feedb	very high accuracy speed and torque control, suitable for the most demanding applications.

The best shaft performance is normally achieved using either of the two Flux Vector control modes *Flux sensorless* [2] and *Flux with encoder feedback* [3].

This parameter cannot be adjusted while the motor is running.

H-42 Flux Motor Feedback Source

Option:	Function:
	Select the interface at which to receive feedback from the motor.
[0] Motor feedback par. H-42	
[1] * 24V encoder	A and B channel encoder, which can be connected to the digital input terminals 32/33 only. Terminals 32/33 must be programmed to <i>No operation</i> .
[2] Encoder Option Module OPCENC	
[3] Resolver Option Module OPCRES	

This parameter cannot be adjusted while the motor is running.

H-43 Torque Characteristics

Option:	Function:
	Select the torque characteristic required. VT and Automatic Energy Savings are both energy saving operations.
[0] * Constant torque	Motor shaft output provides constant torque under variable speed control.
[1] Variable torque	Motor shaft output provides variable torque under variable speed control. Set the variable torque level in par. SP-40 <i>VT Level</i> .
[2] Energy Savings CT	Automatically optimises energy consumption by minimising magnetisation and frequency via par. SP-41 <i>Energy Savings Min. Magnetization</i> and par. SP-42 <i>Energy Savings Min. Frequency</i> .

This parameter cannot be adjusted while the motor is running.

**H-44 Constant or Variable Torque OL****Option:****Function:**

[0] *	High torque	Allows up to 160% over torque.
[1]	Normal torque	For oversized motor - allows up to 110% over torque.

This parameter cannot be adjusted while the motor is running.

H-45 Local Mode Configuration**Option:****Function:**

Select which application configuration mode (par. H-40 *Configuration Mode*), i.e. application control principle, to use when a Local (Keypad) Reference is active. A Local Reference can be active only when par. F-02 *Operation Method* is set to [0] or [2]. By default the local reference is active in Hand Mode only.

[0]	Speed open loop
[1]	Speed closed loop
[2] *	As mode par H-40

H-46 Back EMF at 1000 RPM**Range:****Function:**

500. V* [10. - 9000 V]

Set the nominal back EMF for the motor when running at 1000 RPM. This parameter is only active when par. P-20 *Motor Construction* is set to *PM motor* [1] (Permanent Magnet Motor).

NB!

When using PM motors, it is recommended to use brake resistors.

H-47 Motor Angle Offset**Range:****Function:**

0* [-32768 - 32767]

Enter the correct offset angle between the PM motor and the index position (single-turn) of the attached encoder or resolver. The value range of 0 - 32768 corresponds to 0 - 2 * pi (radians). To obtain the offset angle value: After frequency converter start-up apply DC-hold and enter the value of par. DR-20 *Motor Angle* into this parameter.

This parameter is only active when par. P-20 *Motor Construction* is set to *PM, non-salient SPM* [1] (Permanent Magnet Motor).

3.7.4 H-5# Load Indep. Settings

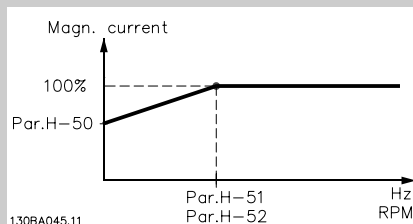
Parameters to configure the load-independent motor settings.

H-50 Motor Magnetisation at Zero Speed**Range:****Function:**

100 %* [0 - 300 %]

Use this par. along with par. H-51 *Min Speed Normal Magnetising [RPM]* to obtain a different thermal load on the motor when running at low speed.

Enter a value which is a percentage of the rated magnetizing current. If the setting is too low, the torque on the motor shaft may be reduced.



H-51 Min Speed Normal Magnetising [RPM]

Range:

15. RPM* [10 - 300 RPM]

Function:

Set the required speed for normal magnetising current. If the speed is set lower than the motor slip speed, par. H-50 *Motor Magnetisation at Zero Speed* and par. H-51 *Min Speed Normal Magnetising [RPM]* are of no significance.

Use this par. along with par. H-50 *Motor Magnetisation at Zero Speed*. See drawing for par. H-50 *Motor Magnetisation at Zero Speed*.

H-52 Min Speed Normal Magnetising [Hz]

Range:

12.5 Hz* [0 - 250.0 Hz]

Function:

Set the required frequency for normal magnetising current. If the frequency is set lower than the motor slip frequency, par. H-50 *Motor Magnetisation at Zero Speed* is inactive.

Use this parameter along with par. H-50 *Motor Magnetisation at Zero Speed*. See drawing for par. H-50 *Motor Magnetisation at Zero Speed*.

H-53 Model Shift Frequency

Range:

0 Hz* [4.0 - 0 Hz]

Function:

Flux Model shift

Enter the frequency value for shift between two models for determining motor speed. Choose the value based on settings in par. H-40 *Configuration Mode* and par. H-41 *Motor Control Principle*. There are two options: shift between Flux model 1 and Flux model 2; or shift between Variable Current mode and Flux model 2.

This parameter cannot be adjusted while the motor is running.

Flux Model 1 – Flux model 2

This model is used when par. H-40 *Configuration Mode* is set to *Speed closed loop* [1] or *Torque* [2] and par. H-41 *Motor Control Principle* is set to *Flux w/motor feedback* [3]. With this parameter it is possible to make an adjustment of the shifting point where AF-650 GP changes between Flux model 1 and Flux model 2, which is useful in some sensitive speed and torque control applications.

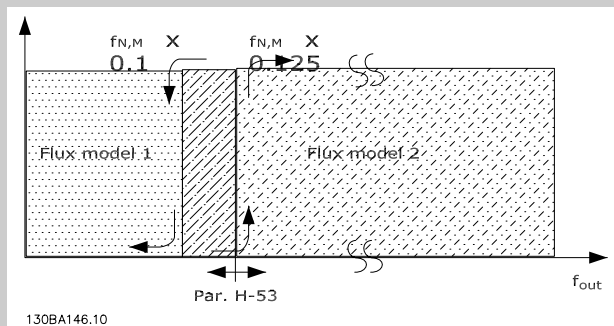


Illustration 3.3: H-40 = [1] Speed closed loop or [2] Torque and H-41 = [3] Flux w/motor feedback

Variable Current - Flux model - Sensorless

This model is used when H-40 is set to *Speed open loop* [0] and H-41 is set to *Flux sensorless* [2].

In speed open loop in flux mode, the speed is determined from the current measurement.

Below $f_{norm} \times 0.1$, the drive runs on a Variable Current model. Above $f_{norm} \times 0.125$ the frequency converter runs on a Flux model.

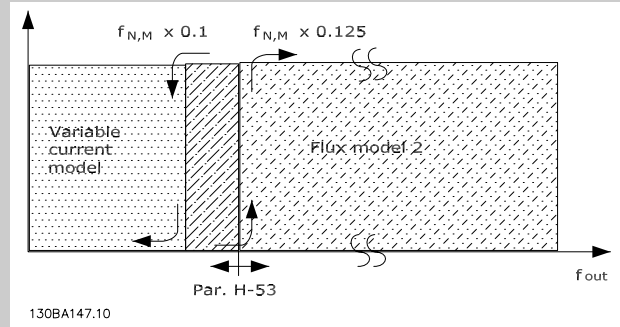


Illustration 3.4: H-40 = [0] Speed open loop, H-41 = [2] Flux sensorless

H-55 U/f Characteristic - U

Range:

0 V* [0.0 - 1000.0 V]

Function:

Enter the voltage at each frequency point to manually form a U/f characteristic matching the motor. The frequency points are defined in par. H-56 U/f Characteristic - F. This parameter is an array parameter [0-5] and is only accessible when par. H-41 Motor Control Principle is set to U/f [0].

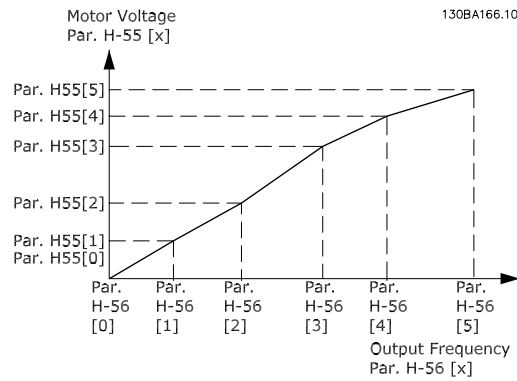
H-56 U/f Characteristic - F

Range:

0 Hz* [0 - 1000.0 Hz]

Function:

Enter the frequency points to manually form a U/f-characteristic matching the motor. The voltage at each point is defined in par. H-55 U/f Characteristic - U. This parameter is an array parameter [0-5] and is only accessible when par. H-41 Motor Control Principle is set to U/f [0].



3.7.5 H-6# Load Depen. Settings

Parameters to configure the load-dependent motor settings.

H-61 High Speed Load Compensation

Range:

100 %* [0 - 300 %]

Function:

Enter the % value to compensate voltage in relation to load when the motor is running at high speed and obtain the optimum U/f characteristic. The motor size determines the frequency range within which this parameter is active.



Motor size	Change-over
0.25 kW - 7.5 kW	> 10 Hz

H-64 Resonance Dampening**Range:**

100 %* [0 - 500 %]

Function:

Enter the resonance dampening value. Set par. H-64 *Resonance Dampening* and par. H-65 *Resonance Dampening Time Constant* to help eliminate high-frequency resonance problems. To reduce resonance oscillation, increase the value of par. H-64 *Resonance Dampening*.

H-65 Resonance Dampening Time Constant**Range:**

5 ms* [5 - 50 ms]

Function:

Set par. H-64 *Resonance Dampening* and par. H-65 *Resonance Dampening Time Constant* to help eliminate high-frequency resonance problems. Enter the time constant that provides the best dampening.

H-66 Min. Current at Low Speed**Range:**

100 %* [1. - 200. %]

Function:

Enter the minimum motor current at low speed, see par. H-53 *Model Shift Frequency*. Increasing this current improves motor torque at low speed.

par. H-66 *Min. Current at Low Speed* is enabled when par. H-40 *Configuration Mode* = *Speed open loop* [0] only. The frequency converter runs with constant current through motor for speeds below 10 Hz.

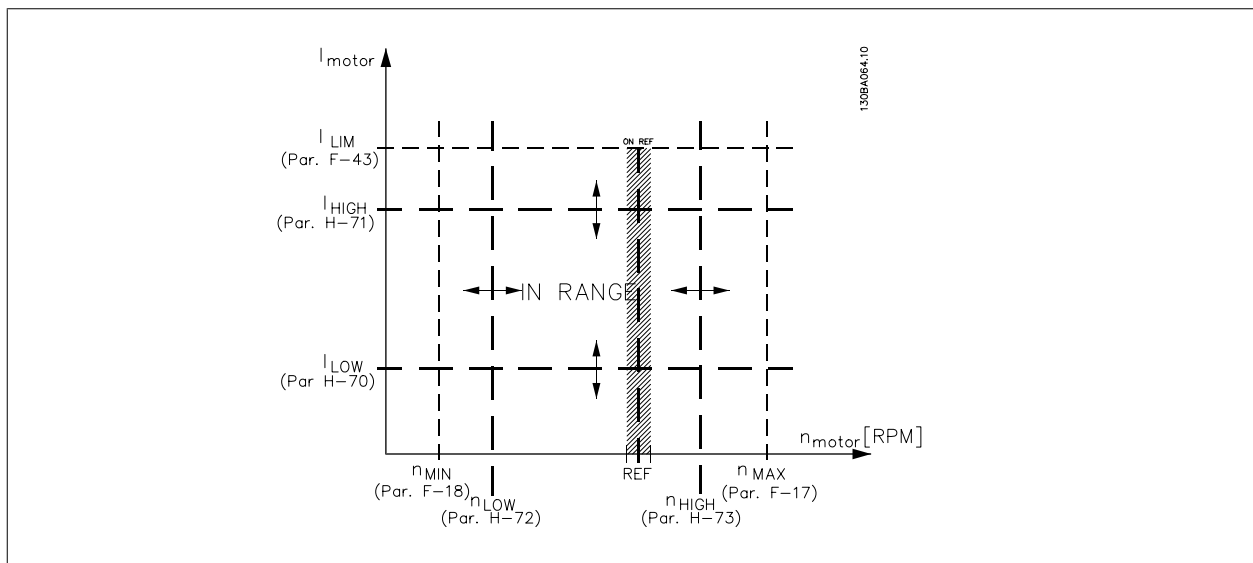
For speeds above 10 Hz, the motor flux model in the frequency converter controls the motor. par. F-40 *Torque Limiter (Driving)* and / or par. F-41 *Torque Limiter (Braking)* automatically adjust par. H-66 *Min. Current at Low Speed*. The parameter with the highest value adjusts par. H-66 *Min. Current at Low Speed*. The current setting in par. H-66 *Min. Current at Low Speed* is composed of the torque generating current and the magnetizing current.

Example: Set par. F-40 *Torque Limiter (Driving)* to 100% and set par. F-41 *Torque Limiter (Braking)* to 60%. par. H-66 *Min. Current at Low Speed* automatically adjusts to about 127%, depending on the motor size.

3.7.6 H-7# Adjustable Warnings

Parameters to configure the warnings limits for current, speed, reference, and feedback.

Warnings are shown on display, programmed output or serial bus.



**H-70 Warning Current Low****Range:**

0.00 A* [0.00 - par. H-51 A]

Function:

Enter the I_{LOW} value. When the motor current falls below this limit, the display reads *Current Low*. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02. Refer to the drawing in this section.

H-71 Warning Current High**Range:**

par. AP-37 [par. H-50 - par. AP-37 A]

Function:

Enter the I_{HIGH} value. When the motor current exceeds this limit, the display reads *Current High*. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02. Refer to the drawing in this section.

H-72 Warning Speed Low**Range:**

0 RPM* [0 - par. H-53 RPM]

Function:

Enter the n_{LOW} value. When the motor speed exceeds this limit, the display reads *Speed Low*. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02.

H-73 Warning Speed High**Range:**

par. H-13 [par. H-52 - par. H-13 RPM]

Function:

Enter the n_{HIGH} value. When the motor speed exceeds this limit, the display reads *Speed High*. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02. Programme the upper signal limit of the motor speed, n_{HIGH} , within the normal working range of the frequency converter. Refer to the drawing in this section.

H-74 Warning Reference Low**Range:**

-999999.99 [-999999.999 - par. H-75]

Function:

Enter the lower reference limit. When the actual reference falls below this limit, the display indicates *Ref Low*. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02.

H-75 Warning Reference High**Range:**

999999.999 [par. H-74 - 999999.999]

Function:

Enter the upper reference limit. When the actual reference exceeds this limit, the display reads *Ref High*. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02.

H-76 Warning Feedback Low**Range:**

-999999.99 [-999999.999 - par. H-77]

Function:

Enter the lower feedback limit. When the feedback falls below this limit, the display reads *Feedb Low*. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02.

H-77 Warning Feedback High**Range:**

999999.999 [par. H-76 - 999999.999]

Function:

Enter the upper feedback limit. When the feedback exceeds this limit, the display reads *Feedb High*. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02.

**H-78 Missing Motor Phase Function****Option:****Function:**

Displays an alarm in the event of a missing motor phase.

Select 100 ms to have a short detection time and alarm in the event of a missing motor phase. 100 ms is recommended for hoisting applications.

[0] Disabled

[2] * Trip 1000 ms

NB!

This parameter cannot be adjusted while the motor is running.

3.7.7 H-8# Stop Adjustments

Parameters to configure the special stop features for the motor and Load Type and Min/Max Inertia.

H-80 Function at Stop**Option:****Function:**

Select the frequency converter function after a stop command or after the speed is ramped down to the settings in par. H-81 *Min Speed for Function at Stop [RPM]*.

[0] * Coast Leaves motor in free mode. The motor is disconnected from the from the frequency converter.

[1] DC hold Energizes motor with a DC holding current (see par. B-00 *DC Hold Current*).

[2] Motor check Checks if a motor has been connected.

[3] Pre-magnetizing Builds up a magnetic field while the motor is stopped. The motor can now produce a quick torque build-up at start. Asynchronous motors only.

H-81 Min Speed for Function at Stop [RPM]**Range:****Function:**

3. RPM* [0 - 600 RPM] Set the speed at which to activate par. H-80 *Function at Stop*.

H-82 Min Speed for Function at Stop [Hz]**Range:****Function:**

0.1 Hz* [0.0 - 20.0 Hz] Set the output frequency at which to activate par. H-80 *Function at Stop*.

H-83 Precise Stop Function**Option:****Function:**

[0] * Precise ramp stop Achieves high repetitive precision at the stopping point.

[1] Cnt stop with reset Runs the frequency converter from receipt of a pulse start signal until the number of pulses programmed by the user in par. H-84 *Precise Stop Counter Value* has been received at input terminal 29 or input terminal 33.
An internal stop signal will activate the normal ramp down time (par. F-08 *Decel Time 1*, par. E-11 *Decel Time 2*, par. E-13 *Decel Time 3* or par. E-15 *Decel Time 4*). The counter function is activated (starts timing) at the edge of the start signal (when it changes from stop to start). After each precise stop the number of pulses counted during ramp down 0 rpm is reset.

[2] Cnt stop w/o reset Same as [1] but the number of pulses counted during ramp down to 0 rpm is deducted from the counter value in par. H-84 *Precise Stop Counter Value*.

[3] Speed comp stop Stops at precisely the same point, regardless of the present speed, the stop signal is delayed internally when the present speed is lower than the maximum speed (set in par. F-03 *Max Output Frequency 1*).

[4] Com cnt stop w/rst Same as [3] but after each precise stop the number of pulses counted during ramp down 0 rpm is reset.



- [5] Comp cnt stop w/o r Same as [3] but the number of pulses counted during ramp down to 0 rpm is deducted from the counter value in par. H-84 *Precise Stop Counter Value*.

This parameter cannot be adjusted while the motor is running.

H-84 Precise Stop Counter Value

Range:	Function:
100000* [0 - 999999999]	Enter the counter value to be used in the integrated precise stop function, par. H-83 <i>Precise Stop Function</i> . The maximum permissible frequency at terminal 29 or 33 is 110 kHz.

H-85 Precise Stop Speed Compensation Delay

Range:	Function:
10 ms* [0 - 100 ms]	Enter the delay time for sensors, PLCs, etc. for use in par. H-83 <i>Precise Stop Function</i> . In speed compensated stop mode, the delay time at different frequencies has a major influence on the stop function.

H-87 Load Type

Option:	Function:
[0] * Passive load	For conveyers, fan and pump applications.
[1] Active load	For hoisting applications. When <i>Active Load</i> [1] is selected, set par. H-66 <i>Min. Current at Low Speed</i> to a level which corresponds to maximum torque.

H-88 Minimum Inertia

Range:	Function:
0.0048 [0.0001 - par. E-69 kgm ²] kgm ² *	Enter the minimum moment of inertia of the mechanical system. par. H-88 <i>Minimum Inertia</i> and par. H-89 <i>Maximum Inertia</i> are used for pre-adjustment of the Proportional Gain in the speed control, see par. PI-02 <i>Speed PID Proportional Gain</i> .

This parameter cannot be adjusted while motor is running.

H-89 Maximum Inertia

Range:	Function:
0.0048 [par. E-68 - 0.4800 kgm ²] kgm ² *	Enter the maximum moment of inertia of the mechanical system. par. H-88 <i>Minimum Inertia</i> and par. H-89 <i>Maximum Inertia</i> are used for pre-adjustment of the Proportional Gain in the speed control, see par. .

This parameter cannot be adjusted while motor is running.

3.7.8 H-9# Motor Temperature

Parameters to configure the special KTY sensor when used as a thermistor source and when Parameter F-12 Thermistor Source is enabled.

H-95 KTY Sensor Type

Option:	Function:
	Select the used type of KTY sensor:
	KTY Sensor type 1: 1Kohm at 100 degrees C KTY Sensor type 2: 1Kohm at 25 degrees C KTY Sensor type 3: 2Kohm at 25 degrees C
[0] * KTY Sensor 1	
[1] KTY Sensor 2	
[2] KTY Sensor 3	

**H-96 KTY Thermistor Input****Option:****Function:**

Selecting analog input terminal 54 to be used as KTY sensor input. Terminal 54 cannot be selected as KTY source if otherwise used as reference (see par. F-01 *Frequency Setting 1* to par. C-34 *Frequency Command 3*).

NB!

Connection of KTY-sensor between term. 54 and 55 (GND). See picture in section *KTY Sensor Connection*.

[0] * None

[2] Analog Input 54

H-97 KTY Threshold level**Range:****Function:**

80 °C* [-40 - 140 °C]

Select the KTY sensor threshold level for motor thermal protection.



3.8 AN-## Analog In/Out

Parameter group related to the Analog Inputs and Outputs.

3.8.1 AN-0# Analog I/O Mode

Parameters to configure the Analog Inputs and Output time out period for lost signals.

AN-00 Live Zero Timeout Time

Range:

10 s* [1 - 99 s]

Function:

Enter the Live Zero Time-out time period. Live Zero Time-out Time is active for analog inputs, i.e. terminal 53 or terminal 54, used as reference or feedback sources. If the reference signal value associated with the selected current input falls below 50% of the value set in par. AN-10 *Terminal 53 Low Voltage*, par. AN-12 *Terminal 53 Low Current*, par. AN-20 *Terminal 54 Low Voltage* or par. AN-22 *Terminal 54 Low Current* for a time period longer than the time set in par. AN-00 *Live Zero Timeout Time*, the function selected in par. AN-01 *Live Zero Timeout Function* will be activated.

AN-01 Live Zero Timeout Function

Option:

Function:

Select the time-out function. The function set in par. AN-01 *Live Zero Timeout Function* will be activated if the input signal on terminal 53 or 54 is below 50% of the value in par. AN-10 *Terminal 53 Low Voltage*, par. AN-12 *Terminal 53 Low Current*, par. AN-20 *Terminal 54 Low Voltage* or par. AN-22 *Terminal 54 Low Current* for a time period defined in par. AN-00 *Live Zero Timeout Time*. If several time-outs occur simultaneously, the frequency converter prioritises the time-out functions as follows:

1. par. AN-01 *Live Zero Timeout Function*
2. par. O-04 *Control Word Timeout Function*

[0] * Off

[1] Freeze output

Frozen at the present value

[2] Stop

Overruled to stop

[3] Jogging

Overruled to jog speed

[4] Max. speed

Overruled to max. speed

[5] Stop and trip

Overruled to stop with subsequent trip

[20] Coast

Coast: Overruled to Coast

[21] Coast and trip

Coast and trip: Overruled to Coast with subsequent trip.

3.8.2 AN-1# Analog Input 53

Parameters to configure the scaling and limits for Analog Input 1 (terminal 53)

AN-10 Terminal 53 Low Voltage

Range:

0.07 V* [-10.00 - par. AN-11 V]

Function:

Enter the low voltage value. This analog input scaling value should correspond to the minimum reference value, set in par. AN-14 *Terminal 53 Low Ref./Feedb. Value*. See also the section *Reference Handling*.

AN-11 Terminal 53 High Voltage

Range:

10.00 V* [par. AN-10 - 10.00 V]

Function:

Enter the high voltage value. This analog input scaling value should correspond to the high reference/feedback value set in par. AN-15 *Terminal 53 High Ref./Feedb. Value*.

**AN-12 Terminal 53 Low Current****Range:**

0.14 mA* [0.00 - par. AN-13 mA]

Function:

Enter the low current value. This reference signal should correspond to the minimum reference value, set in par. F-52 *Minimum Reference*. The value must be set at >2 mA in order to activate the Live Zero Timeout Function in par. AN-01 *Live Zero Timeout Function*.

AN-13 Terminal 53 High Current**Range:**

20.00 mA* [par. AN-12 - 20.00 mA]

Function:

Enter the high current value corresponding to the high reference/feedback set in par. AN-15 *Terminal 53 High Ref./Feedb. Value*.

AN-14 Terminal 53 Low Ref./Feedb. Value**Range:**

0.000 Unit* [-1000000.000 to par. AN-15]

Function:**AN-15 Terminal 53 High Ref./Feedb. Value****Range:**1500.000 [par. AN-45 to -1000000.000]
Unit***Function:**

Enter the analog input scaling value that corresponds to the maximum reference feedback value set in par. AN-11 *Terminal 53 High Voltage* and par. AN-13 *Terminal 53 High Current*.

AN-16 Terminal 53 Filter Time Constant**Range:**

0.001 s* [0.001 - 10.000 s]

Function:

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.

This parameter cannot be adjusted while the motor is running.

3.8.3 AN-2# Analog Input 54

Parameters to configure the scaling and limits for Analog Input 2 (terminal 54)

AN-20 Terminal 54 Low Voltage**Range:**

0.07 V* [-10.00 - par. AN-21 V]

Function:

Enter the low voltage value. This analog input scaling value should correspond to the minimum reference value, set in par. F-52 *Minimum Reference*. See also the section *Reference Handling*.

AN-21 Terminal 54 High Voltage**Range:**

10.00 V* [par. AN-20 - 10.00 V]

Function:

Enter the high voltage value. This analog input scaling value should correspond to the high reference/feedback value set in par. AN-25 *Terminal 54 High Ref./Feedb. Value*.

AN-22 Terminal 54 Low Current**Range:**

0.14 mA* [0.00 - par. AN-23 mA]

Function:

Enter the low current value. This reference signal should correspond to the minimum reference value, set in par. F-52 *Minimum Reference*. The value must be set at >2 mA in order to activate the Live Zero Timeout Function in par. AN-01 *Live Zero Timeout Function*.

AN-23 Terminal 54 High Current**Range:**

20.00 mA* [par. AN-22 - 20.00 mA]

Function:

Enter the high current value corresponding to the high reference/feedback value set in par. AN-25 *Terminal 54 High Ref./Feedb. Value*.

**AN-24 Terminal 54 Low Ref./Feedb. Value****Range:**

0 Unit* [-1000000.000 to par. AN-25]

Function:Enter the analog input scaling value that corresponds to the minimum reference feedback value set in par. F-52 *Minimum Reference*.**AN-25 Terminal 54 High Ref./Feedb. Value****Range:**

1500.000 Unit* [Par. AN-24 to 1000000.000]

Function:Enter the analog input scaling value that corresponds to the maximum reference feedback value set in par. F-53 *Maximum Reference*.**AN-26 Terminal 54 Filter Time Constant****Range:**

0.001 s* [0.001 - 10.000 s]

Function:

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.

This parameter cannot be adjusted while the motor is running.

3.8.4 AN-3# Analog Input X30/11

Parameters to configure the scaling and limits for Analog Input 1 associated with OPCGPIO General Purpose Field Installed Option Module.

AN-30 Terminal X30/11 Low Voltage**Range:**

0.07 V* [0.00 - par. AN-31 V]

Function:Sets the analog input scaling value to correspond to the low reference/feedback value (set in par. AN-34 *Term. X30/11 Low Ref./Feedb. Value*).**AN-31 Terminal X30/11 High Voltage****Range:**

10.00 V* [par. AN-30 - 10.00 V]

Function:Sets the analog input scaling value to correspond to the high reference/feedback value (set in par. AN-35 *Term. X30/11 High Ref./Feedb. Value*).**AN-34 Term. X30/11 Low Ref./Feedb. Value****Range:**

0.000 Unit* [-1000000.000 to par. AN-35]

Function:Sets the analog input scaling value to correspond to the low voltage value (set in par. AN-30 *Terminal X30/11 Low Voltage*).**AN-35 Term. X30/11 High Ref./Feedb. Value****Range:**

1500.000* [Par. AN-34 to 1000000.000]

Function:Sets the analog input scaling value to correspond to the high voltage value (set in par. AN-31 *Terminal X30/11 High Voltage*).**AN-36 Term. X30/11 Filter Time Constant****Range:**

0.001 s* [0.001 - 10.000 s]

Function:

A 1st order digital low pass filter time constant for suppressing electrical noise on terminal X30/11.

par. AN-36 *Term. X30/11 Filter Time Constant* cannot be changed while the motor is running.

3.8.5 AN-4# Analog Input X30/12

Parameters to configure the scaling and limits for Analog Input 2 associated with OPCGPIO General Purpose Field Installed Option Module.

**AN-40 Terminal X30/12 Low Voltage****Range:**

0.07 V* [0.00 - par. AN-41 V]

Function:Sets the analog input scaling value to correspond to the low reference/feedback value set in par. AN-44 *Term. X30/12 Low Ref./Feedb. Value*.**AN-41 Terminal X30/12 High Voltage****Range:**

10.00 V* [par. AN-40 - 10.00 V]

Function:Sets the analog input scaling value to correspond to the high reference/feedback value set in par. AN-45 *Term. X30/12 High Ref./Feedb. Value*.**AN-44 Term. X30/12 Low Ref./Feedb. Value****Range:**

0.000 Unit* [-1000000.000 to par. AN-45]

Function:Sets the analog output scaling value to correspond to the low voltage value set in par. AN-40 *Terminal X30/12 Low Voltage*.**AN-45 Term. X30/12 High Ref./Feedb. Value****Range:**

1500.000* [Par. AN-44 to 100000.000]

Function:Sets the analog input scaling value to correspond to the high voltage value set in par. AN-41 *Terminal X30/12 High Voltage*.**AN-46 Term. X30/12 Filter Time Constant****Range:**

0.001 s* [0.001 - 10.000 s]

Function:A 1st order digital low pass filter time constant for suppressing electrical noise on terminal X30/12. par. AN-46 *Term. X30/12 Filter Time Constant* cannot be changed while the motor is running.**3.8.6 AN-5# Analog Output 42**

Parameters to configure the scaling and limits for Analog Output 1 (terminal 42)

AN-50 Terminal 42 Output**Option:****Function:**Select the function of Terminal 42 as an analog current output. Depending on the selection the output is either a 0-20 mA or 4-20 mA output. The current value can be read out in Keypad in par. DR-65 *Analog Output 42 [mA]*.

[0] * No operation

When no signal on the analog output.

[100] Output frequency

0 Hz = 0 mA; 100 Hz = 20 mA.

[101] Reference

par. F-50 *Reference Range* [Min - Max] 0% = 0 mA; 100% = 20 mA
par. F-50 *Reference Range* [-Max - Max] -100% = 0 mA; 0% = 10 mA; +100% = 20 mA

[102] Feedback

par. F-50 *Reference Range* [Min - Max] 0% = 0 mA; 100% = 20 mA
par. F-50 *Reference Range* [-Max - Max] -100% = 0 mA; 0% = 10 mA; +100% = 20 mA

[103] Motor Current

Motor current 0 - 20 mA; Value is taken from par. DR-37 *Drive Max. Current*. Inverter max. current (160% current) is equal to 20 mA.

[104] Torque rel to limit

The torque setting is related to setting in par. F-40 *Torque Limiter (Driving)*

[105] Torq relate to rated

The torque is related to the motor torque setting.

[106] Power

Taken from par. P-07 *Motor Power [kW]*.

[107] Speed

Taken from par. F-53 *Maximum Reference*. 20 mA = value in par. F-53 *Maximum Reference*

[108] Torque

Torque reference related to 160% torque.

[109] Max Out Freq

In relation to par. F-03 *Max Output Frequency 1*.



[119]	Torque % lim	Torque % lim: Torque reference. par. F-50 <i>Reference Range</i> [Min - Max] 0% = 0 mA; 100% = 20 mA par. F-50 <i>Reference Range</i> [-Max - Max] -100% = 0 mA; 0% = 10 mA; +100% = 20 mA
[130]	Output freq. 4-20mA	0 Hz = 4 mA, 100 Hz = 20 mA
[131]	Reference 4-20mA	par. F-50 <i>Reference Range</i> [Min-Max] 0% = 4 mA; 100% = 20 mA par. F-50 <i>Reference Range</i> [-Max-Max] -100% = 4mA; 0% = 12 mA; +100% = 20 mA
[132]	Feedback 4-20mA	Feedback 4-20mA: par. F-50 <i>Reference Range</i> [Min-Max] 0% = 4 mA; 100% = 20 mA par. F-50 <i>Reference Range</i> [-Max-Max] -100% = 4mA; 0% = 12 mA; +100% = 20 mA
[133]	Motor cur. 4-20mA	Value is taken from par. DR-37 <i>Drive Max. Current</i> . Inverter max. current (160% current) is equal to 20 mA.
[134]	Torq.% lim 4-20 mA	The torque setting is related to setting in par. F-40 <i>Torque Limiter (Driving)</i> .
[135]	Torq.% nom 4-20 mA	The torque setting is related to the motor torque setting.
[136]	Power 4-20mA	Taken from par. P-07 <i>Motor Power [kW]</i>
[137]	Speed 4-20mA	Taken from par. F-53 <i>Maximum Reference</i> . 20 mA = Value in par. F-53 <i>Maximum Reference</i> .
[138]	Torque 4-20mA	Torque reference related to 160% torque.
[139]	Bus ctrl. 0-20 mA	An output value set from Network process data. The output will work independently of internal functions in the frequency converter.
[140]	Bus ctrl. 4-20 mA	An output value set from Network process data. The output will work independently of internal functions in the frequency converter.
[141]	Bus ctrl 0-20mA t.o.	par. H-74 <i>Warning Reference Low</i> defines the behaviour of the analog output in case of bus time-out.
[142]	Bus ctrl 4-20mA t.o.	par. H-74 <i>Warning Reference Low</i> defines the behaviour of the analog output in case of bus time-out.
[149]	Torque % lim 4-20mA	Torque % Lim 4-20mA: Torque reference. par. F-50 <i>Reference Range</i> [Min-Max] 0% = 4 mA; 100% = 20mA par. F-50 <i>Reference Range</i> [-Max - Max] -100% = 4 mA; 0% = 12mA; +100% = 20mA
[150]	Max Out Fr 4-20mA	In relation to par. F-03 <i>Max Output Frequency 1</i> .

AN-51 Terminal 42 Output Min Scale

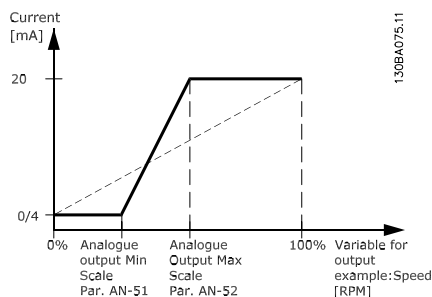
Range:	Function:
0.00 %* [0.00 - 200.00 %]	Scale for the minimum output (0 or 4 mA) of the analogue signal at terminal 42. Set the value to be the percentage of the full range of the variable selected in par. AN-50 <i>Terminal 42 Output</i> .

AN-52 Terminal 42 Output Max Scale

Range:	Function:
100.00 %* [0.00 - 200.00 %]	Scale the maximum output of the selected analog signal at terminal 42. Set the value to the maximum value of the current signal output. Scale the output to give a current lower than 20 mA at full scale; or 20 mA at an output below 100% of the maximum signal value. If 20 mA is the desired output current at a value between 0 - 100% of the full-scale output, programme the percentage value in the parameter, i.e. 50% = 20 mA. If a current between 4 and 20 mA is desired at maximum output (100%), calculate the percentage value as follows:

20 mA / *desired maximum current* x 100 %

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

**AN-53 Terminal 42 Output Bus Control****Range:**

0.00 %* [0.00 - 100.00 %]

Function:

Holds the level of Output 42 if controlled by bus.

AN-54 Terminal 42 Output Timeout Preset**Range:**

0.00 %* [0.00 - 100.00 %]

Function:

Holds the preset level of Output 42.

In case of a bus timeout and a timeout function is selected in par. AN-50 *Terminal 42 Output* the output will preset to this level.**3.8.7 AN-6# Analog Output X30/8**

Parameters to configure the scaling and limits for Analog Output 1 associated with OPCGPIO General Purpose Field Installed Option Module.

AN-60 Terminal X30/8 Output**Option:****Function:**Select the function of Terminal X30/8 as an analog current output. Depending on the selection the output is either a 0-20 mA or 4-20 mA output. The current value can be read out in Keypad in par. DR-65 *Analog Output 42 [mA]*.

[0] * No operation

When no signal on the analog output.

[100] Output frequency

0 Hz = 0 mA; 100 Hz = 20 mA.

[101] Reference

par. F-50 *Reference Range* [Min - Max] 0% = 0 mA; 100% = 20 mA
par. F-50 *Reference Range* [-Max - Max] -100% = 0 mA; 0% = 10 mA; +100% = 20 mA

[102] Feedback

par. F-50 *Reference Range* [Min - Max] 0% = 0 mA; 100% = 20 mA
par. F-50 *Reference Range* [-Max - Max] -100% = 0 mA; 0% = 10 mA; +100% = 20 mA

[103] Motor Current

Motor current 0 - 20 mA; Value is taken from par. DR-37 *Drive Max. Current*. Inverter max. current (160% current) is equal to 20 mA.

[104] Torque rel to limit

The torque setting is related to setting in par. F-40 *Torque Limiter (Driving)*.

[105] Torq relate to rated

The torque is related to the motor torque setting.

[106] Power

Taken from par. P-07 *Motor Power [kW]*.

[107] Speed

Taken from par. F-53 *Maximum Reference*. 20 mA = value in par. F-53 *Maximum Reference*

[108] Torque

Torque reference related to 160% torque.

[109] Max Out Freq

In relation to par. F-03 *Max Output Frequency 1*.

[119] Torque % lim

Torque % lim: Torque reference. par. F-50 *Reference Range* [Min - Max] 0% = 0 mA; 100% = 20 mA
par. F-50 *Reference Range* [-Max - Max] -100% = 0 mA; 0% = 10 mA; +100% = 20 mA

[130] Output freq. 4-20mA

0 Hz = 4 mA, 100 Hz = 20 mA



[131]	Reference 4-20mA	par. F-50 <i>Reference Range</i> [Min-Max] 0% = 4 mA; 100% = 20 mA par. F-50 <i>Reference Range</i> [-Max-Max] -100% = 4mA; 0% = 12 mA; +100% = 20 mA
[132]	Feedback 4-20mA	Feedback 4-20mA: par. F-50 <i>Reference Range</i> [Min-Max] 0% = 4 mA; 100% = 20 mA par. F-50 <i>Reference Range</i> [-Max-Max] -100% = 4mA; 0% = 12 mA; +100% = 20 mA
[133]	Motor cur. 4-20mA	Value is taken from par. DR-37 <i>Drive Max. Current</i> . Inverter max. current (160% current) is equal to 20 mA.
[134]	Torq.% lim 4-20 mA	The torque setting is related to setting in par. F-40 <i>Torque Limiter (Driving)</i> .
[135]	Torq.% nom 4-20 mA	The torque setting is related to the motor torque setting.
[136]	Power 4-20mA	Taken from par. P-07 <i>Motor Power [kW]</i>
[137]	Speed 4-20mA	Taken from par. F-53 <i>Maximum Reference</i> . 20 mA = Value in par. F-53 <i>Maximum Reference</i> .
[138]	Torque 4-20mA	Torque reference related to 160% torque.
[139]	Bus ctrl. 0-20 mA	An output value set from Network process data. The output will work independently of internal functions in the frequency converter.
[140]	Bus ctrl. 4-20 mA	An output value set from Network process data. The output will work independently of internal functions in the frequency converter.
[141]	Bus ctrl 0-20mA t.o.	par. H-74 <i>Warning Reference Low</i> defines the behaviour of the analog output in case of bus time-out.
[142]	Bus ctrl 4-20mA t.o.	par. H-74 <i>Warning Reference Low</i> defines the behaviour of the analog output in case of bus time-out.
[149]	Torque % lim 4-20mA	Torque % Lim 4-20mA: Torque reference. par. F-50 <i>Reference Range</i> [Min-Max] 0% = 4 mA; 100% = 20mA par. F-50 <i>Reference Range</i> [-Max - Max] -100% = 4 mA; 0% = 12mA; +100% = 20mA
[150]	Max Out Fr 4-20mA	In relation to par. F-03 <i>Max Output Frequency 1</i> .

AN-61 Terminal X30/8 Min. Scale

Range:	Function:
0.00 %* [0.00 - 200.00 %]	Scales the minimum output of the selected analog signal on terminal X30/8. Scale the minimum value as a percentage of the maximum signal value, i.e. 0 mA (or 0 Hz) is desired at 25% of the maximum output value and 25% is programmed. The value can never be higher than the corresponding setting in par. AN-62 <i>Terminal X30/8 Max. Scale</i> if value is below 100%. This parameter is active when option module OPCGPIO General Purpose I/O Option Module is mounted in the frequency converter.

AN-62 Terminal X30/8 Max. Scale

Range:	Function:
100.00 %* [0.00 - 200.00 %]	Scales the maximum output of the selected analog signal on terminal X30/8. Scale the value to the desired maximum value of the current signal output. Scale the output to give a lower current than 20 mA at full scale or 20 mA at an output below 100% of the maximum signal value. If 20 mA is the desired output current at a value between 0 - 100% of the full-scale output, program the percentage value in the parameter, i.e. 50% = 20 mA. If a current between 4 and 20 mA is desired at maximum output (100%), calculate the percentage value as follows:

20 mA / *desired maximum current* x 100 %

i.e. 10 mA : $\frac{20 - 4}{10} \times 100 = 160 \%$



3.9 SP-## Special Functions

Parameter group related to special functions with regards to Line Voltage, Reset Functions, Current Limit, Energy Savings, Derating, and Accel/Decel Ramp Types.

3.9.1 SP-1# Line On/Off

Parameters to configure actions taken for Line Failures, Input Fault, and Imbalance.

SP-10 Line failure

Option:

Function:

Function: Select the function to which the frequency converter must act when the threshold in par. SP-11 *Line Voltage at Input Fault* has been reached.

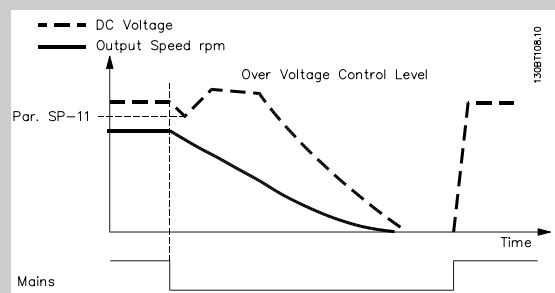
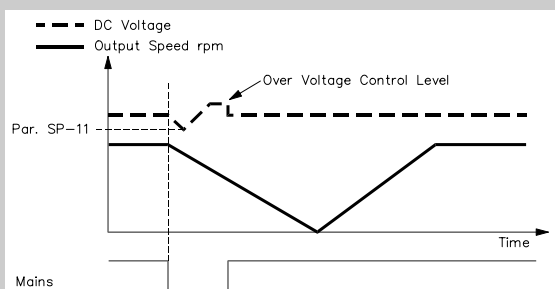
par. SP-10 *Line failure* cannot be changed while motor is running.

Controlled ramp down:

The frequency converter will perform a controlled ramp down. If par. B-10 *Brake Function* is Off [0] or AC brake [2], the ramp will follow the Over Voltage Ramping. If par. B-10 *Brake Function* is [1] *Resistor Brake* the ramp will follow the setting in par. C-23 *Quick Stop Decel Time*.

Controlled ramp-down [1]:

After power-up the frequency converter is ready for start. Controlled ramp-down and trip [2]: After power-up the frequency converter needs a reset for starting.



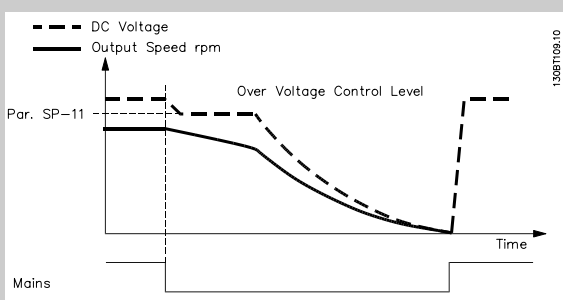
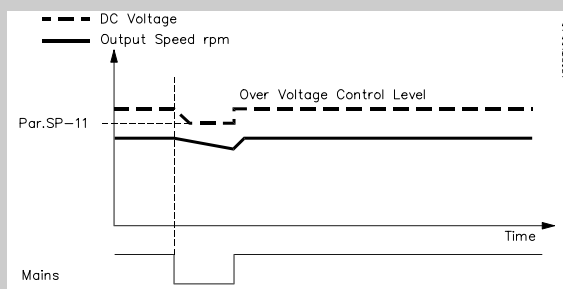
1. The power is back before the energy from DC /moment of inertia from load is too low. The frequency converter will perform a controlled ramp down when par. SP-11 *Line Voltage at Input Fault* level has been reached.
2. The frequency converter will perform a controlled ramp down as long as energy in the DC link is present. After this point the motor will be coasted.

Kinetic back-up:

The frequency converter will perform a Kinetic back-up. If par. B-10 *Brake Function* is Off [0] or AC brake [2], the ramp will follow the Over Voltage Ramping. If par. B-10 *Brake Function* is [1] *Resistor Brake* the ramp will follow the setting in par. C-23 *Quick Stop Decel Time*.

Kinetic Back-up [4]: The frequency converter will keep on running as long as there is energy in the system due to the moment of inertia produced by the load.

Kinetic Back-up [5]: The frequency converter will ride through on speed as long as the energy is present from moment of inertia from the load. If the DC voltage goes below par. SP-11 *Line Voltage at Input Fault* the frequency converter will perform a trip.



[0] * No function

[1] Ctrl. Decel

[2] Ctrl. Decel, trip

[3] Coasting

[4] Kinetic back-up

[5] Kinetic back-up, trip

[6] Alarm

SP-11 Line Voltage at Input Fault

Range:

342. V* [180 - 600 V]

Function:

This parameter defines the threshold voltage at which the selected function in par. SP-10 *Line failure* should be activated.

SP-12 Function at Line Imbalance

Operation under severe main imbalance conditions reduces the lifetime of the motor. Conditions are considered severe if the motor is operated continuously near nominal load (e.g. a pump or fan running near full speed).

Option:

[0] * Trip

Function:

Trips the frequency converter

[1] Warning

Issues a warning

[2] Disabled

No action



3.9.2 SP-2# Reset Functions

Parameters to configure the trip delay do to Torque Limit or Drive Fault.

SP-24 Trip Delay at Current Limit

Range:

60 s* [0 - 60 s]

Function:

Enter the current limit trip delay in seconds. When the output current reaches the current limit (par. F-43 *Current Limit*), a warning is triggered. When the current limit warning has been continuously present for the period specified in this parameter, the frequency converter trips. Disable the trip delay by setting the parameter to 60 s = OFF. Thermal monitoring of the frequency converter will still remain active.

SP-25 Trip Delay at Torque Limit

Range:

60 s* [0 - 60 s]

Function:

Enter the torque limit trip delay in seconds. When the output torque reaches the torque limits (par. F-40 *Torque Limiter (Driving)* and par. F-41 *Torque Limiter (Braking)*), a warning is triggered. When the torque limit warning has been continuously present for the period specified in this parameter, the frequency converter trips. Disable the trip delay by setting the parameter to 60 s = OFF. Thermal monitoring of the frequency converter will still remain active.

SP-26 Trip Delay at Drive Fault

Range:

0. s* [0 - 35 s]

Function:

When the frequency converter detects an over-voltage in the set time trip will be effected after the set time.

If value = 0, *protection mode* is disabled

NB!

It is recommended to disable *protection mode* in hoisting applications.

SP-29 Service Code

Range:

000000* [000000 Hex - FFFFFF]

Function:

For internal service only.

3.9.3 SP-3# Current Limit Ctrl.

Parameters to configure the Current Limit Control which is activated when the motor current, and thus the torque, is higher than the torque limits set in par. F-40 Torque Limiter Driving and F-41 Torque Limiter Braking.

SP-30 Current Lim Ctrl, Proportional Gain

Range:

100 %* [0 - 500 %]

Function:

Enter the proportional gain value for the current limit controller. Selection of a high value makes the controller react faster. Too high a setting leads to controller instability.

SP-31 Current Lim Ctrl, Integration Time

Range:

0.020 s* [0.002 - 2.000 s]

Function:

Controls the current limit control integration time. Setting it to a lower value makes it react faster. A setting too low leads to control instability.



3.9.4 SP-4# Energy Savings

Parameters to configure the energy optimization level in both the Variable Torque and Energy Savings modes.

SP-40 VT Level

Range:

66 %* [40 - 90 %]

Function:

Enter the level of motor magnetisation at low speed. Selection of a low value reduces energy loss in the motor, but also reduces load capability.
This parameter cannot be adjusted while the motor is running.

SP-41 Energy Savings Min. Magnetization

Range:

40. %* [40 - 75 %]

Function:

Enter the minimum allowable magnetisation for Automatic Energy Savings. Selection of a low value reduces energy loss in the motor, but can also reduce resistance to sudden load changes.

SP-42 Energy Savings Min. Frequency

Range:

10 Hz* [5 - 40 Hz]

Function:

Enter the minimum frequency at which the Automatic Energy Savings is to be active.

SP-43 Motor Cosphi

Range:

0.66* [0.40 - 0.95]

Function:

The Cos(phi) setpoint is automatically set for optimum Automatic Energy Savings performance. This parameter should normally not be altered. However in some situations it may be necessary to enter a new value to fine-tune.

3.9.5 SP-5# Environment

Parameters to enable/disable the optional factory installed A1/B1 RFI Filter, and Fan Monitor and to configure an output filter if installed.

SP-50 RFI Filter

Option:

[0] Off

Function:

Select *Off* [0] only if the frequency converter is fed by an isolated mains source, i.e. from a special IT mains source.
In this mode, the internal RFI filter capacitors between chassis and the mains RFI filter circuit are cut-out to avoid damage of the intermediate circuit and to reduce the ground capacity currents according to IEC 61800-3.

[1] * On

Select *On* [1] to ensure that the frequency converter complies with EMC standards.

SP-52 Fan Operation

Select minimum speed of the main fan.

Select *Auto* [0] to run fan only when internal temperature in frequency converter is in range 35° C to approx. 55° C.

Fan runs at low speed below 35° C, and at full speed at approx. 55° C.

Option:

[0] * Auto

Function:

[1] On 50%

[2] On 75%

[3] On 100%

**SP-53 Fan Monitor****Option:****Function:**

Select which reaction the frequency converter should take in case a fan fault is detected.

[0] Disabled

[1] * Warning

[2] Trip

SP-55 Output Filter**Option:****Function:**

Select if a Sine-Wave output filter connected. This parameter cannot be adjusted while motor is running.

[0] * No Filter

[1] Sine-Wave Filter

SP-56 Capacitance Output Filter**Range:****Function:**

2.0 uF* [0.1 - 6500.0 uF]

Set the capacitance of the output filter. The value can be found on the filter label.

NB!

This is required for correct compensation in Flux mode (par. H-41 *Motor Control Principle*)

SP-57 Inductance Output Filter**Range:****Function:**

7.000 mH* [0.001 - 65.000 mH]

Set the inductance of the output filter. The value can be found on the filter label.

NB!

This is required for correct compensation in Flux mode (par. H-41 *Motor Control Principle*)

SP-59 Actual Number of Inverter Units**Range:****Function:**

1.* [1 -]

Set the actual number of power units.

SP-63 Option Supplied by External 24VDC**Option:****Function:**

[0] No

Select No [0] to use the drive's 24 V DC supply.

[1] * Yes

Select Yes [1] if an external 24 V DC supply will be used to power the option. I/O will be galvanically isolated from the drive when operated from an external supply.

3.9.6 SP-7# Additional ADD/DEC Settings

Parameters to configure the jerk compensations for S-Ramps settings on Accel/Decel Ramps 1 through 4.

SP-71 Accel Time 1 S-ramp Ratio at Accel. Start**Range:****Function:**

50 %* [1 - 99. %]

Enter the proportion of the total accel time (par. F-07 *Accel Time 1*) in which the acceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks occurring in the application.

**SP-72 Accel Time 1 S-ramp Ratio at Accel. End****Range:**

50 %* [1 - 99. %]

Function:

Enter the proportion of the total accel time (par. F-07 *Accel Time 1*) in which the acceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

SP-73 Decel Time 1 S-ramp Ratio at Decel. Start**Range:**

50 %* [1 - 99. %]

Function:

Enter the proportion of the total decel time (par. F-08 *Decel Time 1*) where the deceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

SP-74 Decel Time 1 S-ramp Ratio at Decel. End**Range:**

50 %* [1 - 99. %]

Function:

Enter the proportion of the total decel time (par. F-08 *Decel Time 1*) where the deceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

SP-76 Accel/Decel Time 2 Type**Option:**

[0] * Linear

[1] S-ramp Const Jerk

[2] S-ramp Const Time

Function:

Select the ramp type, depending on requirements for acceleration/deceleration. A linear ramp will give constant acceleration during ramping. An S-ramp will give non-linear acceleration, compensating for jerk in the application.

Acceleration with lowest possible jerk

S-ramp based on the values set in par. E-10 *Accel Time 2* and par. E-11 *Decel Time 2***NB!**

If S-ramp [1] is selected and the reference during ramping is changed the ramp time may be prolonged in order to realize a jerk free movement which may result in a longer start or stop time.

Additional adjustment of the S-ramp ratios or switching initiators may be necessary.

SP-79 Accel Time 2 S-ramp Ratio at Accel. Start**Range:**

50 %* [1 - 99. %]

Function:

Enter the proportion of the total accel time (par. E-10 *Accel Time 2*) in which the acceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

SP-80 Accel Time 2 S-ramp Ratio at Accel. End**Range:**

50 %* [1 - 99. %]

Function:

Enter the proportion of the total accel time (par. E-10 *Accel Time 2*) in which the acceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

SP-81 Decel Time 2 S-ramp Ratio at Decel. Start**Range:**

50 %* [1 - 99. %]

Function:

Enter the proportion of the total decel time (par. E-11 *Decel Time 2*) where the deceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

**SP-82 Decel Time 2 S-ramp Ratio at Decel. End****Range:**

50 %* [1 - 99. %]

Function:

Enter the proportion of the total decel time (par. E-11 *Decel Time 2*) where the deceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

SP-84 Accel/Decel Ramp 3 Type**Option:****Function:**

Select the ramp type, depending on requirements for acceleration and deceleration. A linear ramp will give constant acceleration during ramping. An S-ramp will give non-linear acceleration, compensating for jerk in the application.

[0] * Linear

[1] S-ramp Const Jerk

Accelerates with lowest possible jerk.

[2] S-ramp Const Time

S-ramp based on the values set in par. E-12 *Accel Time 3* and par. E-13 *Decel Time 3***NB!**

If S-ramp [1] is selected and the reference during ramping is changed the ramp time may be prolonged in order to realize a jerk free movement which may result in a longer start or stop time.

Additional adjustment of the S-ramp ratios or switching initiators may be necessary.

SP-87 Accel Time 3 S-ramp Ratio at Accel. Start**Range:**

50 %* [1 - 99. %]

Function:

Enter the proportion of the total accel time (par. E-12 *Accel Time 3*) in which the acceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

SP-88 Accel Time 3 S-ramp Ratio at Accel. End**Range:**

50 %* [1 - 99. %]

Function:

Enter the proportion of the total accel time (par. E-12 *Accel Time 3*) in which the acceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

SP-89 Decel Time 3 S-ramp Ratio at Decel. Start**Range:**

50 %* [1 - 99. %]

Function:

Enter the proportion of the total decel time (par. E-13 *Decel Time 3*) where the deceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

SP-90 Decel Time 3 S-ramp Ratio at Decel. End**Range:**

50 %* [1 - 99. %]

Function:

Enter the proportion of the total decel time (par. E-13 *Decel Time 3*) where the deceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

**SP-92 Accel/Decel Ramp 4 Type****Option:****Function:**

Select the ramp type, depending on requirements for acceleration and deceleration. A linear ramp will give constant acceleration during ramping. An S-ramp will give non-linear acceleration, compensating for jerk in the application

[0] * Linear

[1] S-ramp Const Jerk

Accelerates with lowest possible jerk.

[2] S-ramp Const Time

S-ramp based on the values set in par. E-14 *Accel Time 4* and par. E-15 *Decel Time 4*.

NB!

If S-ramp [1] is selected and the reference during ramping is changed the ramp time may be prolonged in order to realize a jerk free movement which may result in a longer start or stop time.

Additional adjustment of the S-ramp ratios or switching initiators may be necessary.

SP-95 Accel Time 4 S-ramp Ratio at Accel. Start**Range:****Function:**

50 %* [1 - 99. %]

Enter the proportion of the total accell time (par. E-14 *Accel Time 4*) in which the acceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

SP-96 Accel Time 4 S-ramp Ratio at Accel. End**Range:****Function:**

50 %* [1 - 99. %]

Enter the proportion of the total accell time (par. E-14 *Accel Time 4*) in which the acceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

SP-97 Decel Time 4 S-ramp Ratio at Decel. Start**Range:****Function:**

50 %* [1 - 99. %]

Enter the proportion of the total decel time (par. E-15 *Decel Time 4*) where the deceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

SP-98 Decel Time 4 S-ramp Ratio at Decel. End**Range:****Function:**

50 %* [1 - 99. %]

Enter the proportion of the total decel time (par. E-15 *Decel Time 4*) where the deceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.



3.10 O-## Options/Comms

Parameter group related to communications and options.

3.10.1 O-0# General Settings

Parameters to configure the general settings for communications and options.

3

O-01 Control Site

Option:

Function:

The setting in this parameter overrides the settings in par. O-50 *Coasting Select* to par. O-56 *Preset Reference Select*.

[0] *	Digital and ctrl.word	Control by using both digital input and control word.
[1]	Digital only	Control by using digital inputs only.
[2]	Controlword only	Control by using control word only.

O-02 Control Word Source

Select the source of the control word: one of two serial interfaces or four installed options. During initial power-up, the frequency converter automatically sets this parameter to *Option A* [3] if it detects a valid network option module installed in slot A. If the option is removed, the frequency converter detects a change in the configuration, sets par. O-02 *Control Word Source* back to default setting *Drive RS485*, and the frequency converter then trips. If an option is installed after initial power-up, the setting of par. O-02 *Control Word Source* will not change but the frequency converter will trip and display: *Alarm 67 Option Changed*.

This parameter cannot be adjusted while the motor is running.

Option:

Function:

[0]	None
[1]	Drive RS485
[2]	Drive USB
[3] *	Option A
[4]	Option B
[5]	Option C0
[6]	Option C1
[30]	External Can

O-03 Control Word Timeout Time

Range:

Function:

1.0 s*	[0.1 - 18000.0 s]	Enter the maximum time expected to pass between the reception of two consecutive messages. If this time is exceeded, it indicates that the serial communication has stopped. The function selected in par. O-04 <i>Control Word Timeout Function</i> will then be carried out. The time-out counter is triggered by a valid control word.
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O-04 Control Word Timeout Function

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

Option:

Function:

[0] *	Off	Resumes control via serial bus (Network or standard) using the most recent control word.
[1]	Freeze output	Freezes output frequency until communication resumes.
[2]	Stop	Stops with auto restart when communication resumes.
[3]	Jogging	Runs the motor at JOG frequency until communication resumes.



[4]	Max. speed	Runs the motor at maximum frequency until communication resumes.
[5]	Stop and trip	Stops the motor, then resets the frequency converter in order to restart: via the network, via the reset button on the Keypad or via a digital input.
[7]	Select setup 1	Changes the set-up upon reestablishment of communication following a control word time-out. If communication resumes causing the time-out situation to disappear, par. O-05 <i>End-of-Timeout Function</i> defines whether to resume the set-up used before the time-out or to retain the set-up endorsed by the time-out function.
[8]	Select setup 2	See [7] <i>Select setup 1</i>
[9]	Select setup 3	See [7] <i>Select setup 1</i>
[10]	Select setup 4	See [7] <i>Select setup 1</i>

NB!

The following configuration is required in order to change the set-up after a time-out:

Set par. K-10 *Active Set-up* to [9] *Multi set-up* and select the relevant link in par. K-12 *This Set-up Linked to*.

O-05 End-of-Timeout Function**Option:****Function:**

		Select the action after receiving a valid control word following a time-out. This parameter is active only when par. O-04 <i>Control Word Timeout Function</i> is set to [Set-up 1-4].
[0]	Hold set-up	Retains the set-up selected in par. O-04 <i>Control Word Timeout Function</i> and displays a warning, until par. O-06 <i>Reset Control Word Timeout</i> toggles. Then the frequency converter resumes its original set-up.
[1] *	Resume set-up	Resumes the set-up active prior to the time-out.

O-06 Reset Control Word Timeout

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

Option:**Function:**

[0] *	Do not reset	Retains the set-up specified in par. O-04 <i>Control Word Timeout Function</i> , following a control word time-out.
[1]	Do reset	Returns the frequency converter to the original set-up following a control word time-out. The frequency converter performs the reset and then immediately reverts to the <i>Do not reset</i> [0] setting

O-07 Diagnosis Trigger**Option:****Function:**

This parameter enables and controls the frequency converter diagnosis function and permits expansion of the diagnosis data to 24 byte.

NB!

This is only valid for Profibus.

- *Disable* [0]: Do not send extended diagnosis data even if they appear in the frequency converter.
- *Trigger on alarms* [1]: Send extended diagnosis data when one or more alarms appear in alarm par. DR-90 *Alarm Word* or par. PB-53 *Profibus Warning Word*.
- *Trigger alarms/warn.* [2]: Send extended diagnosis data if one or more alarms or warnings appear in alarm par. DR-90 *Alarm Word*, par. PB-53 *Profibus Warning Word*, or warning par. DR-92 *Warning Word*.



The content of the extended diagnosis frame is as follows:

Byte	Content	Description
0 - 5	Standard DP Diagnose Data	Standard DP Diagnose Data
6	PDU length xx	Header of extended diagnostic data
7	Status type = 0x81	Header of extended diagnostic data
8	Slot = 0	Header of extended diagnostic data
9	Status info = 0	Header of extended diagnostic data
10 - 13	par. DR-92 <i>Warning Word</i>	warning word
14 - 17	par. DR-03 <i>Status Word</i>	status word
18 - 21	par. DR-90 <i>Alarm Word</i>	alarm word
22 - 23	par. PB-53 <i>Profibus Warning Word</i>	Communication warning word (Profibus)

Enabling diagnosis may cause increased bus traffic. Diagnosis functions are not supported by all network types.

- [0] * Disable
- [1] Trigger on alarms
- [2] Trigger alarm/warn.

3.10.2 O-1# Control Settings

Parameters to configure the option control word profile.

O-10 Control Word Profile

Select the interpretation of the control and status words corresponding to the installed network. Only the selections valid for the network installed in slot A will be visible in the Keypad display.

For guidelines in selection of *GE Drive profile* [0] and *PROFIdrive profile* [1] please refer to the *Serial communication via RS 485 Interface* section.

For additional guidelines in the selection of *PROFIdrive profile* [1], *ODVA* [5] and *CANopen DSP 402* [7], please refer to the Operating Instructions for the installed network.

Option:

Function:

- [0] * Drive Profile
- [1] PROFIdrive profile
- [5] ODVA
- [7] CANopen DSP 402

O-13 Configurable Status Word STW

Option:

Function:

This parameter enables configuration of bits 12 – 15 in the status word.

- [0] No function
- [1] * Profile Default Function corresponds to the profile default selected in par. O-10 *Control Word Profile*.
- [2] Alarm 68 Only Only set in case of an Alarm 68.
- [3] Trip excl Alarm 68 Set in case of a trip, except if the trip is executed by an Alarm 68.
- [16] T37 DI status The bit indicates the status of terminal 37.
"0" indicates T37 is low (safe stop)
"1" indicates T37 is high (normal)

O-14 Configurable Control Word CTW

Option:

Function:

Selection of control word bit 10 if it is active low or active high

- [0] None
- [1] * Profile default
- [2] CTW Valid, active low



3.10.3 O-3# Drive Port Settings

Parameters to configure the GE drive port.

O-30 Protocol

Option:**Function:**

[0] *	Drive	
[1]	Drive MC	Select the protocol for the drive (standard) port.
[2]	Modbus RTU	

O-31 Address

Range:**Function:**

1.*	[1. - 126.]	Enter the address for the Drive (standard) port. Valid range: 1 - 126.
-----	-------------	---

O-32 Drive Port Baud Rate

Option:**Function:**

[0]	2400 Baud	Baud rate selection for the Drive (standard) port.
[1]	4800 Baud	
[2] *	9600 Baud	
[3]	19200 Baud	
[4]	38400 Baud	
[5]	57600 Baud	
[6]	76800 Baud	
[7]	115200 Baud	

O-33 Drive Port Parity

Option:**Function:**

Parity and Stop Bits for the protocol par. O-30 *Protocol* using the Drive Port. For some of the protocols, not all options will be visible. Default depends on the protocol selected.

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

O-35 Minimum Response Delay

Range:**Function:**

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

O-36 Max Response Delay

Range:**Function:**

10001. ms*	[11. - 10001 ms]	Specify the maximum permissible delay time between transmitting a request and receiving a response. Exceeding this delay time will cause control word time-out.
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O-37 Max Inter-Char Delay

Range:**Function:**

25.00 ms*	[0.00 - 35.00 ms]	Specify the maximum permissible time interval between receipt of two bytes. This parameter activates time-out if transmission is interrupted. This parameter is active only when par. O-30 <i>Protocol</i> is set to <i>Drive MC</i> [1] protocol.
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3.10.4 O-4# Drive MC Port Settings

Parameters to configure the standard telegram or custom telegram for the GE drive port.

O-40 Telegram Selection

Option:**Function:**

[1] *	Standard telegram 1	
[101]	PPO 1	Enables use of freely configurable messages or standard messages for the Drive port.
[102]	PPO 2	
[103]	PPO 3	
[104]	PPO 4	
[105]	PPO 5	
[106]	PPO 6	
[107]	PPO 7	
[108]	PPO 8	
[200]	Custom telegram 1	

3

3.10.5 O-5# Digital/Bus

Parameters to configure the control word Digital/Bus merging.

O-50 Coasting Select

Option:**Function:**

		Select control of the coasting function via the terminals (digital input) and/or via the network.
[0]	Digit Input	Activates Start command via a digital input.
[1]	Bus	Activates Start command via the serial communication port or network option module.
[2]	Logic AND	Activates Start command via the network/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activates Start command via the network/serial communication port OR via one of the digital inputs.

NB!

This parameter is active only when par. O-01 *Control Site* is set to [0] *Digital and control word*.

O-51 Quick Stop Select

Select control of the Quick Stop function via the terminals (digital input) and/or via the network.

Option:**Function:**

[0]	Digital Input
[1]	Bus
[2]	Logic AND
[3] *	Logic OR

NB!

This parameter is active only when par. O-01 *Control Site* is set to [0] *Digital and control word*.

**O-52 DC Brake Select****Option:****Function:**

		Select control of the DC brake via the terminals (digital input) and/or via the network.
[0]	Digit Input	Activates Start command via a digital input.
[1]	Bus	Activates Start command via the serial communication port or network option module.
[2]	Logic AND	Activates Start command via the network/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activates Start command via the network/serial communication port OR via one of the digital inputs.

NB!

This parameter is active only when par. O-01 *Control Site* is set to [0] *Digital and control word*.

O-53 Start Select**Option:****Function:**

		Select control of the frequency converter start function via the terminals (digital input) and/or via the network.
[0]	Digit Input	Activates Start command via a digital input.
[1]	Bus	Activates Start command via the serial communication port or network option module.
[2]	Logic AND	Activates Start command via the network/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activates Start command via the network/serial communication port OR via one of the digital inputs.

NB!

This parameter is active only when par. O-01 *Control Site* is set to [0] *Digital and control word*.

O-54 Reversing Select**Option:****Function:**

[0]	Digital Input	Select control of the frequency converter reverse function via the terminals (digital input) and/or via the network.
[1]	Bus	Activates the Reverse command via the serial communication port or network option module.
[2]	Logic AND	Activates the Reverse command via the network/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activates the Reverse command via the network/serial communication port OR via one of the digital inputs.

NB!

This parameter is only active when par. O-01 *Control Site* is set to [0] *Digital and control word*.

**O-55 Set-up Select****Option:****Function:**

Select control of the frequency converter set-up selection via the terminals (digital input) and/or via the network.

[0]	Digit Input	Activates the set-up selection via a digital input.
[1]	Bus	Activates the set-up selection via the serial communication port or network option module.
[2]	Logic AND	Activates the set-up selection via the network/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activate the set-up selection via the network/serial communication port OR via one of the digital inputs.

NB!

This parameter is active only when par. O-01 *Control Site* is set to [0] *Digital and control word*.

O-56 Preset Reference Select**Option:****Function:**

Select control of the frequency converter Preset Reference selection via the terminals (digital input) and/or via the network.

[0]	Digit Input	Activates Preset Reference selection via a digital input.
[1]	Bus	Activates Preset Reference selection via the serial communication port or network option module.
[2]	Logic AND	Activates Preset Reference selection via the network/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activates the Preset Reference selection via the network/serial communication port OR via one of the digital inputs.

NB!

This parameter is active only when par. O-01 *Control Site* is set to [0] *Digital and control word*.

3.10.6 O-8# Drive Port Diagnostics**O-80 Bus Message Count****Range:****Function:**

0* [0 - 4294967296]

This parameter shows the number of valid messages detected on the network.

O-81 Bus Error Count**Range:****Function:**

0* [0 - 4294967296]

This parameter shows the number of messages with faults (e.g. CRC fault), detected on the network.

O-82 Slave Messages Rcvd**Range:****Function:**

0* [0 - 4294967296]

This parameter shows the number of valid messages addressed to the slave, sent by the frequency converter.

O-83 Slave Error Count**Range:****Function:**

0* [0 - 4294967296]

This parameter shows the number of error messages, which could not be executed by the frequency converter.



3.10.7 O-9# Bus Jog Feedback

Parameters to configure the Jog Speed when drive is in Bus Control.

O-90 Bus Jog 1 Speed

Range:

100 RPM* [0 - par. H-13 RPM]

Function:

Enter the jog speed. This is a fixed jog speed activated via the serial port or network option.

O-91 Bus Jog 2 Speed

Range:

200 RPM* [0 - par. H-13 RPM]

Function:

Enter the jog speed. This is a fixed jog speed activated via the serial port or network option.



3.11 DN-## CAN Fieldbus

Parameter group related to Field Installed DeviceNet Network Communications Option Module.

3.11.1 DN-0# Common Settings

Parameters to configure the common settings for DeviceNet.

DN-00 DeviceNet Protocol

Option:**Function:**

[0] CANopen

[1] * DeviceNet

View the active CAN protocol.

NB!

The options depend on installed option.

DN-01 Baud Rate Select

Select the network transmission speed. The selection must correspond to the transmission speed of the master and the other network nodes.

Option:**Function:**

[16] 10 Kbps

[17] 20 Kbps

[18] 50 Kbps

[19] 100 Kbps

[20] * 125 Kbps

[21] 250 Kbps

[22] 500 Kbps

DN-02 MAC ID

Range:**Function:**

63.* [0 - 63.]

Selection of station address. Every station connected to the same network must have an unambiguous address.

DN-05 Readout Transmit Error Counter

Range:**Function:**

0* [0 - 4294967296]

View the number of CAN control transmission errors since the last power-up.

DN-06 Readout Receive Error Counter

Range:**Function:**

0* [0 - 4294967296]

View the number of CAN control receipt errors since the last power-up.

DN-07 Readout Bus Off Counter

Range:**Function:**

0* [0 - 255]

View the number of Bus Off events since the last power-up.



3.11.2 DN-1# DeviceNet

Parameters to configure the Process Data Type, Config Write, Config Read, Warnings, and keypad control of DeviceNet.

DN-10 Process Data Type Selection

Option:**Function:**

Select the Instance (message) for data transmission. The Instances available are dependent upon the setting of par. O-10 *Control Word Profile*.

When par. O-10 *Control Word Profile* is set to [0] *Drive protocol*, par. DN-10 *Process Data Type Selection* options [0] and [1] are available.

When par. O-10 *Control Word Profile* is set to [5] *ODVA*, par. DN-10 *Process Data Type Selection* options [2] and [3] are available.

Instances 100/150 and 101/151 are GE-specific. Instances 20/70 and 21/71 are ODVA-specific AC Drive profiles.

For guidelines in message selection, please refer to the DeviceNet Operating Instructions.

Note that a change to this parameter will be executed immediately.

[0] * INSTANCE 100/150

[1] INSTANCE 101/151

[2] INSTANCE 20/70

[3] INSTANCE 21/71

DN-11 Process Data Config Write

Select the process write data for I/O Assembly Instances 101/151. Elements [2] and [3] of this array can be selected. Elements [0] and [1] of the array are fixed.

Option:**Function:**

Select the process write data for I/O Assembly Instances 101/151. Elements [2] and [3] of this array can be selected. Elements [0] and [1] of the array are fixed.

DN-12 Process Data Config Read

Select the process read data for I/O Assembly Instances 101/151. Elements [2] and [3] of this array can be selected. Elements [0] and [1] of the array are fixed.

Option:**Function:**

DN-13 Warning Parameter

Range:

0* [0 - FFFFF]

Function:

View a DeviceNet-specific Warning word. One bit is assigned to every warning. Please refer to the DeviceNet Operating Instructions for further information.

Bit:	Meaning:
0	not active
1	Explicit connection timeout
2	I/O connection
3	Retry limit reached
4	Actual is not updated
5	CAN bus off
6	I/O send error
7	Initialization error
8	No bus supply
9	Bus off
10	Error passive
11	Error warning
12	Duplicate MAC ID Error
13	RX queue overrun
14	TX queue overrun
15	CAN overrun

**DN-14 Net Reference**

Read only from Keypad

Option:**Function:**

Select the reference source in Instance 21/71 and 20/70.

[0] * Off

Enables reference via analog/digital inputs.

[1] On

Enables reference via the network.

DN-15 Net Control

Read only from Keypad

Option:**Function:**

Select the control source in Instance 21/71 and 20-70.

[0] * Off

Enables control via analog/digital inputs.

[1] On

Enable control via the network.

3.11.3 DN-2# COS Filters

Parameters to configure the filtering of Change of State data.

DN-20 COS Filter 1**Range:****Function:**

0* [0 - FFFFF]

Enter the value for COS Filter 1 to set up the filter mask for the Status Word. When operating in COS (Change-Of-State), this function filters out bits in the Status Word that should not be sent if they change.

DN-21 COS Filter 2**Range:****Function:**

0* [0 - FFFFF]

Enter the value for COS Filter 2, to set up the filter mask for the Main Actual Value. When operating in COS (Change-Of-State), this function filters out bits in the Main Actual Value that should not be sent if they change.

DN-22 COS Filter 3**Range:****Function:**

0* [0 - FFFFF]

Enter the value for COS Filter 3, to set up the filter mask for PCD 3. When operating in COS (Change-Of-State), this function filters out bits in PCD 3 that should not be sent if they change.

DN-23 COS Filter 4**Range:****Function:**

0* [0 - FFFFF]

Enter the value for COS Filter 4 to set up the filter mask for PCD 4. When operating in COS (Change-Of-State), this function filters out bits in PCD 4 that should not be sent if they change.

3.11.4 DN-3# Parameter Access

Parameters to configure the access to indexed parameters and defining programming set-up.

DN-30 Array Index**Range:****Function:**

0* [0 - 255]

View array parameters. This parameter is valid only when a DeviceNet fieldbus is installed.

**DN-31 Store Data Values****Option:****Function:**

Parameter values changed via DeviceNet are not automatically stored in non-volatile memory. Use this parameter to activate a function that stores parameter values in the EEPROM non-volatile memory, so changed parameter values will be retained at power-down.

[0] * Off

Deactivates the non-volatile storage function.

[1] Store all setups

Stores all parameter values from the active set-up in the non-volatile memory. The selection returns to Off [0] when all values have been stored.

[2] Store all setups

Stores all parameter values for all set-ups in the non-volatile memory. The selection returns to Off [0] when all parameter values have been stored.

DN-32 Devicenet Revision**Range:****Function:**

0* []

View the DeviceNet revision number. This parameter is used for EDS file creation.

DN-33 Store Always**Option:****Function:**

[0] * Off

Deactivates non-volatile storage of data.

[1] On

Stores parameter data received via DeviceNet in EEPROM non-volatile memory as default.

DN-39 Devicenet F Parameters

Array [1000]

No Keypad access

Range:**Function:**

0* []

This parameter is used to configure the frequency converter via DeviceNet and build the EDS-file.



3.12 PB-## Profibus

Parameter group related to Field Installed Profibus DP Network Communications Option Module.

PB-00 Setpoint

Range:

0* [0 - 65535]

Function:

This parameter receives cyclical reference from a Master Class 2. If the control priority is set to Master Class 2, the reference for the frequency converter is taken from this parameter, whereas the cyclical reference will be ignored.

PB-07 Actual Value

Range:

0* [0 - 65535]

Function:

This parameter delivers the MAV for a Master Class 2. The parameter is valid if the control priority is set to Master Class 2.

PB-15 PCD Write Configuration

Array [10]

Option:
Function:

Select the parameters to be assigned to PCD 3 to 10 of the messages. The number of available PCDs depends on the message type. The values in PCD 3 to 10 will then be written to the selected parameters as data values. Alternatively, specify a standard Profibus message in par. PB-22 *Telegram Selection*.

PB-16 PCD Read Configuration

Array [10]

Option:
Function:

Select the parameters to be assigned to PCD 3 to 10 of the messages. The number of available PCDs depends on the message type. PCDs 3 to 10 contain the actual data values of the selected parameters. For standard Profibus messages, see par. PB-22 *Telegram Selection*.

PB-18 Node Address

Range:

126* [0 - 126.]

Function:

Enter the station address in this parameter or alternatively in the hardware switch. In order to adjust the station address in par. PB-18 *Node Address*, the hardware switch must be set to 126 or 127 (i.e. all switches set to 'on'). Otherwise this parameter will display the actual setting of the switch.

PB-22 Telegram Selection

Displays the Profibus message configuration.

Option:
Function:

[1] Standard telegram 1

[101] PPO 1

[102] PPO 2

[103] PPO 3

[104] PPO 4

[105] PPO 5

[106] PPO 6

[107] PPO 7

[108] * PPO 8

Read only.

[200] Custom telegram 1

**PB-23 Parameters for Signals**

Array [1000]

Read only

Option:**Function:**

This parameter contains a list of signals available for selection in par. PB-15 *PCD Write Configuration* and par. PB-16 *PCD Read Configuration*.

PB-27 Parameter Edit**Option:****Function:**

Parameters can be edited via Profibus, the standard RS485 interface, or the Keypad.

[0] Disabled

Disables editing via Profibus.

[1] * Enabled

Enables editing via Profibus.

PB-28 Process Control**Option:****Function:**

Process control (setting of Control Word, speed reference, and process data) is possible via either Profibus or standard Network but not both simultaneously. Local control is always possible via the Keypad. Control via process control is possible via either terminals or Network depending on the settings in par. O-50 *Coasting Select* to par. O-56 *Preset Reference Select*.

[0] Disable

Disables process control via Profibus, and enables process control via standard Network or Profibus Master class 2.

[1] * Enable cyclic master

Enables process control via Profibus Master Class 1, and disables process control via standard Network or Profibus Master class 2.

PB-44 Fault Message Counter**Range:****Function:**

0* [0 - 65535]

This parameter displays the number of error events stored in par. PB-45 *Fault Code* and par. PB-47 *Fault Number*. The maximum buffer capacity is eight error events. The buffer and counter are set to 0 upon reset or power-up.

PB-45 Fault Code**Range:****Function:**

0* []

This buffer contains the alarm word for all alarms and warnings that have occurred since last reset or power-up. The maximum buffer capacity is eight error events.

PB-47 Fault Number**Range:****Function:**

0* []

This buffer contains the alarm number (e.g. 2 for live zero error, 4 for mains phase loss) for all alarms and warnings that have occurred since last reset or power-up. The maximum buffer capacity is eight error events.

PB-52 Fault Situation Counter**Range:****Function:**

0* [0 - 1000]

This parameter displays the number of error events which have occurred since last reset of power-up.

PB-53 Profibus Warning Word**Range:****Function:**

0* []

Read only



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

PB-63 Actual Baud Rate**Option:****Function:**

This parameter displays the actual Profibus baud rate. The Profibus Master automatically sets the baud rate.

[0]	9,6 kbit/s
[1]	19,2 kbit/s
[2]	93,75 kbit/s
[3]	187,5 kbit/s
[4]	500 kbit/s
[6]	1500 kbit/s
[7]	3000 kbit/s
[8]	6000 kbit/s
[9]	12000 kbit/s
[10]	31,25 kbit/s
[11]	45,45 kbit/s
[255] *	No baudrate found

PB-64 Device Identification**Range:****Function:**

0* []

This parameter displays the device identification. Please refer to the *Operating Instructions for Profibus*, for further explanation.

PB-65 Profile Number**Range:****Function:**

0* []

This parameter contains the profile identification. Byte 1 contains the profile number and byte 2 the version number of the profile.

NB!

This parameter is not visible via Keypad.

PB-67 Control Word 1**Range:****Function:**

0* [0 - 65535]

This parameter accepts the Control Word from a Master Class 2 in the same format as PCD 1.

PB-68 Status Word 1**Range:****Function:**

0* [0 - 65535]

This parameter delivers the Status Word for a Master Class 2 in the same format as PCD 2.

**PB-71 Profibus Save Data Values****Option:****Function:**

Parameter values changed via Profibus are not automatically stored in non-volatile memory. Use this parameter to activate a function that stores parameter values in the EEPROM non-volatile memory, so changed parameter values will be retained at power-down.

[0] * Off

Deactivates the non-volatile storage function.

[1] Store all setups

Stores all parameter values for all set-ups in the non-volatile memory. The selection returns to *Off* [0] when all parameter values have been stored.

[2] Store all setups

Stores all parameter values for all set-ups in the non-volatile memory. The selection returns to *Off* [0] when all parameter values have been stored.

PB-72 ProfibusDriveReset**Option:****Function:**

[0] * No action

[1] Power-on reset

Resets frequency converter upon power-up, as for power-cycle.

[3] Comm option reset

Resets the Profibus option only, useful after changing certain settings in parameter group PB-##, e.g. par. PB-18 *Node Address*.
When reset, the frequency converter disappears from the Network, which may cause a communication error from the master.

PB-80 Defined Parameters (1)

Array [116]

No Keypad access

Read only

Range:**Function:**

0* [0 - 115]

This parameter displays a list of all the defined frequency converter parameters available for Profibus.

PB-81 Defined Parameters (2)

Array [116]

No Keypad access

Read only

Range:**Function:**

0* [0 - 115]

This parameter displays a list of all the defined frequency converter parameters available for Profibus.

PB-82 Defined Parameters (3)

Array [116]

No Keypad access

Read only

Range:**Function:**

0* [0 - 115]

This parameter displays a list of all the defined frequency converter parameters available for Profibus.

PB-83 Defined Parameters (4)

Array [116]

No Keypad access

Read only

Range:**Function:**

0* [0 - 115]

This parameter displays a list of all the defined frequency converter parameters available for Profibus.

PB-84 Defined Parameters (5)**Range:****Function:**

0* [0 - 115]

This parameter displays a list of all the defined frequency converter parameters available for Profibus.

**PB-90 Changed Parameters (1)**

Array [116]

No Keypad access

Read only

Range:

0* [0 - 115]

Function:

This parameter displays a list of all the frequency converter parameters deviating from default setting.

PB-91 Changed Parameters (2)

Array [116]

No Keypad access

Read only

Range:

0* [0 - 115]

Function:

This parameter displays a list of all the frequency converter parameters deviating from default setting.

PB-92 Changed Parameters (3)

Array [116]

No Keypad access

Read only

Range:

0* [0 - 115]

Function:

This parameter displays a list of all the frequency converter parameters deviating from default setting.

PB-94 Changed Parameters (5)

Array [116]

No Keypad Address

Read only

Range:

0* [0 - 115]

Function:

This parameter displays a list of all the frequency converter parameters deviating from default setting.



3.13 EC-## Feedback Option

3.13.1 EC-1# Inc. Enc. Interface

EC-10 Signal Type

Select the incremental type (A/B channel) of the encoder in use. Find the information on the encoder data sheet.

Select *None* [0] if the feedback sensor is an absolute encoder only.

This parameter cannot be adjusted while the motor is running.

Option:

Function:

[0]	None
[1] *	RS422 (5V TTL)
[2]	Sinusoidal 1Vpp

EC-11 Resolution (PPR)

Range:

Function:

1024*	[10 - 10000]	Enter the resolution of the incremental track, i.e. the number of pulses or periods per revolution. This parameter cannot be adjusted while the motor is running.
-------	--------------	--

3.13.2 EC-2# Abs. Enc. Interface

EC-20 Protocol Selection

Select *HIPERFACE* [1] if the encoder is absolute only.

Select *None* [0] if the feedback sensor is an incremental encoder only.

This parameter cannot be adjusted while the motor is running.

Option:

Function:

[0] *	None
[1]	HIPERFACE
[2]	EnDat
[4]	SSI

EC-21 Resolution (Positions/Rev)

Select the resolution of the absolute encoder, i.e. the number of counts per revolution.

This parameter cannot be adjusted while the motor is running. The value depends on setting in par. EC-20 *Protocol Selection*.

Range:

Function:

8192.*	[4. - 131072.]
--------	----------------

EC-24 SSI Data Length

Range:

Function:

13*	[13 - 25]	Set the number of bits for the SSI telegram. Choose 13 bits for single-turn encoders and 25 bits for multi-turn encoder.
-----	-----------	--

EC-25 Clock Rate

Range:

Function:

0 kHz*	[100 - 0 kHz]	Set the SSI clock rate. With long encoder cables the clock rate must be reduced.
--------	---------------	--

EC-26 SSI Data Format

Option:

Function:

[0] *	Gray code	
[1]	Binary code	Set the data format of the SSI data. Choose between Gray or Binary format.

**EC-34 HIPERFACE Baudrate**

Select the baud rate of the attached encoder.

This parameter cannot be adjusted while the motor is running. The parameter is only accessible when par. EC-20 *Protocol Selection* is set to HIPERFACE [1].

Option: **Function:**

[0]	600
[1]	1200
[2]	2400
[3]	4800
[4] *	9600
[5]	19200
[6]	38400

3

3.13.3 EC-6# Monitoring and App.**EC-60 Feedback Direction**

Change the detected encoder rotation direction without changing the wiring to the encoder.

This parameter cannot be adjusted while the motor is running.

Option: **Function:**

[0] *	Clockwise
[1]	Counter clockwise

EC-61 Feedback Signal Monitoring

Select which reaction the frequency converter should take in case a faulty encoder signal is detected.

The encoder function in par. EC-61 *Feedback Signal Monitoring* is an electrical check of the hardware circuit in the encoder system.

Option: **Function:**

[0]	Disabled
[1] *	Warning
[2]	Trip
[3]	Jog
[4]	Freeze Output
[5]	Max Speed
[6]	Switch to Open Loop
[7]	Select Setup 1
[8]	Select Setup 2
[9]	Select Setup 3
[10]	Select Setup 4
[11]	stop & trip



3.14 RS-## Resolver Interface

RS-50 Poles

Range:

2* [2 - 2]

Function:

Set the number of poles on the resolver.
The value is stated in the data sheet for resolvers.

RS-51 Input Voltage

Range:

7.0 V* [2.0 - 8.0 V]

Function:

Set the input voltage to the resolver. The voltage is stated as RMS value.
The value is stated in the data sheet for resolvers

RS-52 Input Frequency

Range:

10.0 kHz* [2.0 - 15.0 kHz]

Function:

Set the input frequency to the resolver.
The value is stated in the data sheet for resolvers.

RS-53 Transformation Ratio

Range:

0.5* [0.1 - 1.1]

Function:

Set the transformation ratio for the resolver.
The transformation ration is:

$$T_{ratio} = \frac{V_{Out}}{V_{In}}$$

The value is stated in the data sheet for resolvers.

RS-59 Resolver Interface

Activate the OPCRES resolver option when the resolver parameters are selected.

To avoid damage to resolvers par. RS-50 Poles – par. RS-53 Transformation Ratio must be adjusted before activating this parameter.

Option:

[0] * Disabled
[1] Enabled

Function:



3.15 Parameter Data Check

3.15.1 Last 10 Changes

Displays a list of the 10 last changes made to the parameters in the present parameter setup. This allows for any corrections of the last 10 changes.

3.15.2 Since Factory Settings

Displays a list of all the parameter changes since the factory settings of the drive or since the last factory restore of parameters.

3.16 ID-## Drive Information

Parameter group related to drive information such as operating data, hardware configuration and software version.

3.16.1 ID-0# Operating Data

Parameters to view operating hours, kWh counters, power ups, etc.

ID-00 Operating Hours

Range:

0 h* [0 - 2147483647 h]

Function:

View how many hours the frequency converter has run. The value is saved when the frequency converter is turned off.

ID-01 Running Hours

Range:

0 h* [0 - 2147483647 h]

Function:

View how many hours the motor has run. Reset the counter in par. ID-07 *Reset Running Hours Counter*. The value is saved when the frequency converter is turned off.

ID-02 kWh Counter

Range:

0 kWh* [0 - 2147483647 kWh]

Function:

Registering the power consumption of the motor as a mean value over one hour. Reset the counter in par. ID-06 *Reset kWh Counter*.

ID-03 Power Up's

Range:

0* [0 - 2147483647]

Function:

View the number of times the frequency converter has been powered up.

ID-04 Over Temp's

Range:

0* [0 - 65535]

Function:

View the number of frequency converter temperature faults which have occurred.

ID-05 Over Volt's

Range:

0* [0 - 65535]

Function:

View the number of frequency converter overvoltages which have occurred.

ID-06 Reset kWh Counter

Option:

[0] * Do not reset

Function:

Select *Do not reset* [0] if no reset of the kWh counter is desired.

[1] Reset counter

Select *Reset* [1] and press [OK] to reset the kWh counter to zero (see par. ID-02 *kWh Counter*).

**NB!**

The reset is carried out by pressing [OK].

ID-07 Reset Running Hours Counter**Option:****Function:**

[0] * Do not reset

[1] Reset counter

Select *Reset* [1] and press [OK] to reset the Running Hours counter to zero (see par. ID-01 *Running Hours*). This parameter cannot be selected via the serial port, RS 485.
Select *Do not reset* [0] if no reset of the Running Hours counter is desired.

ID-08 Number of Starts**Range:****Function:**

0* [0 - 2147483647]

This is a read out parameter only. The counter shows the numbers of starts and stops caused by a normal Start/Stop command and/or when entering/leaving sleep mode.

NB!

This parameter will be reset when resetting par. ID-07 *Reset Running Hours Counter*.

3.16.2 ID-1# Data Trending Settings

Data Log Settings enables continuous logging of up to 4 data sources (par. ID-10) at individual rates (par. ID-11). A trigger event (Par. ID-12) and window (par. ID-14) are used to start and stop the logging conditionally.

ID-10 Trending Source

Array [4]

Option:**Function:**

Select which variables are to be logged.

ID-11 Trending Interval**Range:****Function:**

1 ms* [1 - 86400000 ms]

Enter the interval in milliseconds between each sampling of the variables to be logged.

ID-12 Trigger Event

Select the trigger event. When the trigger event occurs, a window is applied to freeze the log. The log will then retain a specified percentage of samples before the occurrence of the trigger event (par. ID-14 *Samples Before Trigger*).

Choices are described under E-## Digital Output.

Option:**Function:**

[0] * False

[1] True

[2] Running

[3] In range

[4] On reference

[5] Torque limit

[6] Current Limit

[7] Out of current range

[8] Below I low

[9] Above I high

[10] Out of speed range

[11] Below speed low

[12] Above speed high



[13]	Out of feedb. range
[14]	Below feedb. low
[15]	Above feedb. high
[16]	Thermal warning
[17]	Line voltage out of range
[18]	Reversing
[19]	Warning
[20]	Alarm (trip)
[21]	Alarm (trip lock)
[22]	Comparator 0
[23]	Comparator 1
[24]	Comparator 2
[25]	Comparator 3
[26]	Logic rule 0
[27]	Logic rule 1
[28]	Logic rule 2
[29]	Logic rule 3
[33]	Digital input DI18
[34]	Digital input DI19
[35]	Digital input DI27
[36]	Digital input DI29
[37]	Digital input DI32
[38]	Digital input DI33
[50]	Comparator 4
[51]	Comparator 5
[60]	Logic rule 4
[61]	Logic rule 5

ID-13 Trending Mode**Option:****Function:**

[0] *	Trend always	Select <i>Log always</i> [0] for continuous logging.
[1]	Trend once on trigger	Select <i>Log once on trigger</i> [1] to conditionally start and stop logging using par. ID-12 <i>Trigger Event</i> and par. ID-14 <i>Samples Before Trigger</i> .

ID-14 Samples Before Trigger**Range:****Function:**

50*	[0 - 100]	Enter the percentage of all samples prior to a trigger event which are to be retained in the log. See also par. ID-12 <i>Trigger Event</i> and par. ID-13 <i>Trending Mode</i> .
-----	-----------	--

3.16.3 ID-2# Historic Log

View up to 50 data items logged up to the last reported trip. The data is stored in array parameters, where [0] is the most recent data and [49] is the oldest data.

ID-20 Historic Log: Event

Array [50]

Range:**Function:**

0*	[0 - 255]	View the event type of the logged events.
----	-----------	---

**ID-21 Historic Log: Value**

Array [50]

Range:

0* [0 - 2147483647]

Function:

View the value of the logged event. Interpret the event values according to this table:

Digital input	Decimal value. See par. DR-60 <i>Digital Input</i> for description after converting to binary value.
Digital output (not monitored in this SW release)	Decimal value. See par. DR-66 <i>Digital Output [bin]</i> for description after converting to binary value.
Warning word	Decimal value. See par. DR-92 <i>Warning Word</i> for description.
Alarm word	Decimal value. See par. DR-90 <i>Alarm Word</i> for description.
Status word	Decimal value. See par. DR-03 <i>Status Word</i> for description after converting to binary value.
Control word	Decimal value. See par. DR-00 <i>Control Word</i> for description.
Extended status word	Decimal value. See par. DR-94 <i>Ext. Status Word</i> for description.

ID-22 Historic Log: Time

Array [50]

Range:

0 ms* [0 - 2147483647 ms]

Function:

View the time at which the logged event occurred. Time is measured in ms since frequency converter start. The max. value corresponds to approx. 24 days which means that the count will restart at zero after this time period.

3.16.4 ID-3# Alarm Log

View up to 10 alarm logs. The data is stored in array parameters, where [0] is the most recent and [9] is the oldest data. Error codes, values, and time stamp can be viewed for all logged data.

ID-30 Fault Log: Error Code

Array [10]

Range:

0* [0 - 255]

Function:View the error code and look up its meaning in the *Troubleshooting* chapter of the AF-650 GP Design Guide.**ID-31 Alarm Log: Value**

Array [10]

Range:

0* [-32767 - 32767]

Function:

View an extra description of the error. This parameter is mostly used in combination with alarm 38 'internal fault'.

ID-32 Alarm Log: Time

Array [10]

Range:

0 s* [0 - 2147483647 s]

Function:

View the time when the logged event occurred. Time is measured in seconds from frequency converter start-up.

3.16.5 ID-4# Drive Identification

Parameters to view the information about the hardware and software configuration of the drive.

ID-40 Drive Type**Range:**

0* []

Function:

View the Drive type.

**ID-41 Power Section****Range:**

0*

[]

Function:

View the Drive type.

ID-42 Voltage**Range:**

0*

[]

Function:

View the Drive type.

ID-43 Software Version**Range:**

0*

[]

Function:

View the combined SW version consisting of power SW and control SW.

ID-46 GE Product No.**Range:**

0*

[]

Function:

View the 8-digit ordering number used for re-ordering the frequency converter in its original configuration.

ID-47 GE Power Card Model No**Range:**

0*

[]

Function:

View the power card ordering number.

ID-48 Keypad ID Number**Range:**

0*

[]

Function:

View the Keypad ID number.

ID-49 SW ID Control Card**Range:**

0*

[]

Function:

View the control card software version number.

ID-50 SW ID Power Card**Range:**

0*

[]

Function:

View the power card software version number.

ID-51 Drive Serial Number**Range:**

0*

[]

Function:

View the frequency converter serial number.

ID-53 Power Card Serial Number**Range:**

0*

[]

Function:

View the power card serial number.

3.16.6 ID-6# Option Ident

Parameters to view the information about the hardware and software configuration of the field installed I/O and network option modules.

ID-60 Option Mounted**Range:**

0*

[]

Function:

View the installed option type.

ID-61 Option SW Version**Range:**

0*

[]

Function:

View the installed option software version.

**ID-62 Option Ordering No****Range:**

0* []

Function:

Shows the ordering number for the installed options.

ID-63 Option Serial No**Range:**

0* []

Function:

View the installed option serial number.

3.16.7 ID-9# Parameter Info

Parameters to view defined parameters and modified parameters.

ID-92 Defined Parameters

Array [1000]

Range:

0* [0 - 9999]

Function:

View a list of all defined parameters in the frequency converter. The list ends with 0.

ID-93 Modified Parameters

Array [1000]

Range:

0* [0 - 9999]

Function:

View a list of the parameters that have been changed from their default setting. The list ends with 0. Changes may not be visible until up to 30 seconds after implementation.

ID-99 Parameter Metadata

Array [30]

Range:

0* [0 - 9999]

Function:

This parameter contains data used by the DCT10 software tool.



3.17 DR-## Data Read-outs

Parameter group related to data readouts in the drive for references, voltages, control, alarms, warnings, and status words.

3.17.1 DR-0# General Status

Parameters to view the calculated references, the active control word, and status word.

DR-00 Control Word		
Range:		Function:
0*	[0 - FFFFF]	View the Control word sent from the frequency converter via the serial communication port in hex code.
DR-01 Reference [Unit]		
Range:		Function:
0.000*	[-999999.000 - 999999.000]	View the present reference value applied on impulse or analog basis in the unit resulting from the configuration selected in par. H-40 <i>Configuration Mode</i> (Hz, Nm or RPM).
DR-02 Reference [%]		
Range:		Function:
0.0 %*	[-200.0 - 200.0 %]	View the total reference. The total reference is the sum of digital, analog, preset, bus, and freeze references, plus catch-up and slow-down.
DR-03 Status Word		
Range:		Function:
0*	[0 - FFFFF]	View the Status word sent from the frequency converter via the serial communication port in hex code.
DR-05 Main Actual Value [%]		
Range:		Function:
0.00 %*	[-100.00 - 100.00 %]	View the two-byte word sent with the Status word to the bus Master reporting the Main Actual Value.
DR-09 Custom Readout		
Range:		Function:
0.00 Unit*	[x.ss - x.xx Unit]	View the value of custom readout from par. K-30 <i>Unit for Custom Readout</i> to par. K-32 <i>Max Value of Custom Readout</i>

3.17.2 DR-1# Motor Status

Parameters to view the motor status values.

DR-10 Power [kW]		
Range:		Function:
0.00 kW*	[0.00 - 10000.00 kW]	View the motor power in kW. The value shown is calculated on the basis of the actual motor voltage and motor current. The value is filtered, and therefore approx. 30 ms may pass from when an input value changes to when the data read-out values change.

DR-11 Power [hp]		
Range:		Function:
0.00 hp*	[0.00 - 10000.00 hp]	View the motor power in HP. The value shown is calculated on the basis of the actual motor voltage and motor current. The value is filtered, and therefore approximately 30 ms may pass from when an input value changes to when the data read-out values change.



DR-12 Motor Rated Voltage		
Range:		Function:
0.0 V*	[0.0 - 6000.0 V]	View the motor voltage, a calculated value used for controlling the motor.
DR-13 Frequency		
Range:		Function:
0.0 Hz*	[0.0 - 6500.0 Hz]	View the motor frequency, without resonance dampening.
DR-14 Motor Current		
Range:		Function:
0.00 A*	[0.00 - 10000.00 A]	View the motor current measured as a mean value, IRMS. The value is filtered, and thus approximately 30 ms may pass from when an input value changes to when the data read-out values change.
DR-15 Frequency [%]		
Range:		Function:
0.00 %*	[-100.00 - 100.00 %]	View a two-byte word reporting the actual motor frequency (without resonance dampening) as a percentage (scale 0000-4000 Hex) of par. F-03 <i>Max Output Frequency 1</i> . Set par. PB-16 <i>PCD Read Configuration</i> index 1 to send it with the Status Word instead of the MAV.
DR-16 Torque [Nm]		
Range:		Function:
0.0 Nm*	[-3000.0 - 3000.0 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 will 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 read-out values change.
DR-17 Speed [RPM]		
Range:		Function:
0 RPM*	[-30000 - 30000 RPM]	View the actual motor RPM. In open loop or closed loop process control the motor RPM is estimated. In speed closed loop modes the motor RPM is measured.
DR-18 Motor Thermal		
Range:		Function:
0 %*	[0 - 100 %]	View the calculated thermal load on the motor. The cut-out limit is 100%. The basis for calculation is the Electronic Thermal Overload function selected in par. F-10 <i>Electronic Overload</i> .
DR-19 KTY sensor temperature		
Range:		Function:
0 °C*	[0 - 0 °C]	Returning the actual temperature on KTY sensor built into the motor. See par. F-1#.
DR-20 Motor Angle		
Range:		Function:
0*	[0 - 65535]	View the current encoder/resolver angle offset relative to the index position. The value range of 0-65535 corresponds to 0-2*pi (radians).
DR-22 Torque [%]		
Range:		Function:
0 %*	[-200 - 200 %]	Value shown is the torque in percent of nominal torque, with sign, applied to the motor shaft.

**DR-25 Torque [Nm] High****Range:**

0.0 Nm* [-200000000.0 - 200000000.0 Nm]

Function:

View the torque value with sign, applied to the motor shaft. Some motors supply more than 160% torque. Consequently, the min. value and the max. value will depend on the max. motor current as well as the motor used. This specific readout has been adapted to be able to show higher values than the standard readout in par. DR-16 *Torque [Nm]*.

3.17.3 DR-3# Drive Status

Parameters to view the drive status values.

DR-30 DC Link Voltage**Range:**

0 V* [0 - 10000 V]

Function:

View a measured value. The value is filtered with an 30 ms time constant.

DR-32 Brake Energy /s**Range:**

0.000 kW* [0.000 - 10000.000 kW]

Function:

View the brake power transmitted to an external brake resistor, stated as an instantaneous value.

DR-33 Brake Energy /2 min**Range:**

0.000 kW* [0.000 - 10000.000 kW]

Function:

View the brake power transmitted to an external brake resistor. The mean power is calculated on an average basis for the most recent 120 seconds.

DR-34 Heatsink Temp.**Range:**

0 °C* [0 - 255 °C]

Function:

View the frequency converter heatsink temperature. The cut-out limit is 90 ± 5 °C, and the motor cuts back in at 60 ± 5 °C.

DR-35 Drive Thermal**Range:**

0 %* [0 - 100 %]

Function:

View the percentage load on the inverter.

DR-36 Drive Nominal Current**Range:**

10.00 A* [0.01 - 10000.00 A]

Function:

View the inverter nominal current, which should match the nameplate data on the connected motor. The data are used for calculation of torque, motor protection, etc.

DR-37 Drive Max. Current**Range:**

16.00 A* [0.01 - 10000.00 A]

Function:

View the inverter maximum current, which should match the nameplate data on the connected motor. The data are used for calculation of torque, motor protection, etc.

DR-38 Logic Controller State**Range:**

0* [0 - 100]

Function:

View the state of the event under execution by the SL controller.

DR-39 Control Card Temp.**Range:**

0 °C* [0 - 100 °C]

Function:

View the temperature on the control card, stated in °C.

**DR-40 Trending Buffer Full****Option:****Function:**

View whether the logging buffer is full (see par. ID-1#). The logging buffer will never be full when par. ID-13 *Trending Mode* is set to *Log always* [0].

[0] * No

[1] Yes

3

3.17.4 DR-5# Ref. & Feedb.

Parameters to view the reference and feedback status values.

DR-50 External Reference**Range:****Function:**

0.0* [-200.0 - 200.0]

View the total reference, the sum of digital, analog, preset, bus and freeze references, plus catch-up and slow-down.

DR-51 Pulse Reference**Range:****Function:**

0.0* [-200.0 - 200.0]

View the reference value from programmed digital input(s). The read-out can also reflect the impulses from an incremental encoder.

DR-52 Feedback [Unit]**Range:****Function:**

0.0* [-999999.999 - 999999.999]

View the feedback unit resulting from the selection of unit and scaling in par. F-50 *Reference Range*, par. F-51 *Reference/Feedback Unit*, par. F-52 *Minimum Reference* and par. F-53 *Maximum Reference*.

DR-53 Digi Pot Reference**Range:****Function:**

0.0* [-200.00 - 200.00]

View the contribution of the Digital Potentiometer to the actual reference.



3

Parameters to view the digital and analog I/O status values.

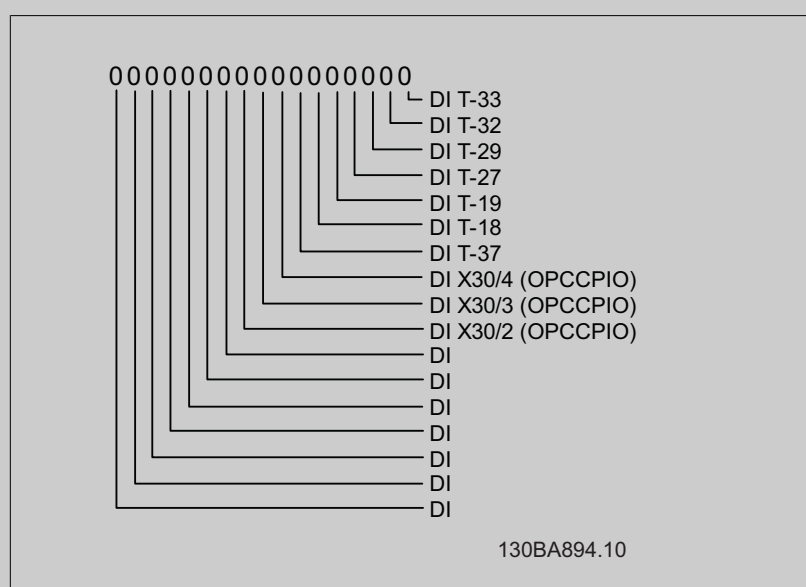
Range:

0*	[0 - 1023]
----	------------

Function:

View the signal states from the active digital inputs. Example: Input 18 corresponds to bit no. 5, '0' = no signal, '1' = connected signal. Bit 6 works in the opposite way, on = '0', off = '1' (safe stop input).

Bit 0	Digital input term. 33
Bit 1	Digital input term. 32
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	Digital input term. 37
Bit 7	Digital input GP I/O term. X30/4 (OPCGPIO)
Bit 8	Digital input GP I/O term. X30/3 (OPCGPIO)
Bit 9	Digital input GP I/O term. X30/2 (OPCGPIO)
Bit 10-63	Reserved for future terminals



Option:

Function:

View the setting of input terminal 53. Current = 0; Voltage = 1.

[0] *	Current
[1]	Voltage
[2]	Pt 1000 [°C]
[3]	Pt 1000 [°F]
[4]	Ni 1000 [°C]
[5]	Ni 1000 [°F]

Range:

Function:

0.000* [-20.000 - 20.000]

View the actual value at input 53.

**DR-63 Terminal 54 Switch Setting****Option:****Function:**

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

[0] * Current

[1] Voltage

[2] Pt 1000 [°C]

[3] Pt 1000 [°F]

[4] Ni 1000 [°C]

[5] Ni 1000 [°F]

DR-64 Analog Input 54**Range:****Function:**

0.000* [-20.000 - 20.000]

View the actual value at input 54.

DR-65 Analog Output 42 [mA]**Range:****Function:**

0.000* [0.000 - 30.000]

View the actual value at output 42 in mA. The value shown reflects the selection in par. AN-50 *Terminal 42 Output*.**DR-66 Digital Output [bin]****Range:****Function:**

0* [0 - 15]

View the binary value of all digital outputs.

DR-67 Freq. Input #29 [Hz]**Range:****Function:**

0* [0 - 130000]

View the actual frequency rate on terminal 29.

DR-68 Freq. Input #33 [Hz]**Range:****Function:**

0* [0 - 130000]

View the actual value of the frequency applied at terminal 33 as an impulse input.

DR-69 Pulse Output #27 [Hz]**Range:****Function:**

0* [0 - 40000]

View the actual value of pulses applied to terminal 27 in digital output mode.

DR-70 Pulse Output #29 [Hz]**Range:****Function:**

0* [0 - 40000]

View the actual value of pulses at terminal 29 in digital output mode.

DR-71 Relay Output [bin]**Range:****Function:**

0* [0 - 511]

View the settings of all relays.

Readout choice [Par. DR-71]:

Relay output [bin]:

00000 bin

OptionB card relay 09

OptionB card relay 08

OptionB card relay 07

Power card relay 02

Power card relay 01

130BA195.10

**DR-72 Counter A****Range:**

0* [-2147483648 - 2147483647]

Function:

View the present value of Counter A. Counters are useful as comparator operands, see par. LC-10 *Comparator Operand*.

The value can be reset or changed either via digital inputs (parameter group E-##) or by using an LC action (par. LC-52 *Logic Controller Action*).

DR-73 Counter B**Range:**

0* [-2147483648 - 2147483647]

Function:

View the present value of Counter B. Counters are useful as comparator operands (par. LC-10 *Comparator Operand*).

The value can be reset or changed either via digital inputs (parameter group E-0#) or by using an Logic Controller action (par. LC-52 *Logic Controller Action*).

DR-74 Prec. Stop Counter**Range:**

0* [0 - 2147483647]

Function:

Returns the actual counter value of precise counter (par. H-84 *Precise Stop Counter Value*).

DR-75 Analog In X30/11**Range:**

0.000* [-20.000 - 20.000]

Function:

View the actual value at input X30/11 of OPCGPIO General Purpose I/O Option Module.

DR-76 Analog In X30/12**Range:**

0.000* [-20.000 - 20.000]

Function:

View the actual value at input X30/12 of OPCGPIO General Purpose I/O Option Module.

DR-77 Analog Out X30/8 [mA]**Range:**

0.000* [0.000 - 30.000]

Function:

View the actual value at input X30/8.

DR-78 Analog Out X45/1 [mA]**Range:**

0.000* [0.000 - 30.000]

Function:

View the actual value at output X45/1. The value shown reflects the selection in par. AN-70 *Terminal X45/1 Output*.

DR-79 Analog Out X45/3 [mA]**Range:**

0.000* [0.000 - 30.000]

Function:

View the actual value at output X45/3. The value shown reflects the selection in par. AN-80 *Terminal X45/3 Output*.

3.17.6 DR-8# Fieldbus & Drive Port

Parameters to view the bus references and control words.

DR-80 Fieldbus CTW 1**Range:**

0* [0 - 65535]

Function:

View the two-byte Control word (CTW) received from the Bus-Master. Interpretation of the Control word depends on the network option installed and the Control word profile selected in par. O-10 *Control Word Profile*.

For more information please refer to the relevant network manual.



DR-82 Fieldbus REF 1		
Range:		Function:
0*	[-200 - 200]	View the two-byte word sent with the control word form the Bus-Master to set the reference value. For more information please refer to the relevant network manual.
DR-84 Comm. Option STW		
Range:		Function:
0*	[0 - 65535]	View the extended Network comm. option status word.
DR-85 Drive Port CTW 1		
Range:		Function:
0*	[0 - 65535]	View the two-byte Control word (CTW) received from the Bus-Master. Interpretation of the control word depends on the network option installed and the Control word profile selected in par. O-10 <i>Control Word Profile</i> .
DR-86 Drive Port REF 1		
Range:		Function:
0*	[-200 - 200]	View the two-byte Status word (STW) sent to the Bus-Master. Interpretation of the Status word depends on the network option installed and the Control word profile selected in par. O-10 <i>Control Word Profile</i> .

3.17.7 DR-9# Diagnosis Readout

Parameters to view the alarms, warnings, and extended status words.

DR-90 Alarm Word		
Range:		Function:
0*	[0 - 4294967295]	View the alarm word sent via the serial communication port in hex code.
DR-91 Alarm Word 2		
Range:		Function:
0*	[0 - 4294967295]	View the alarm word sent via the serial communication port in hex code.
DR-92 Warning Word		
Range:		Function:
0*	[0 - 4294967295]	View the warning word sent via the serial communication port in hex code.
DR-93 Warning Word 2		
Range:		Function:
0*	[0 - 4294967295]	View the warning word sent via the serial communication port in hex code.
DR-94 Ext. Status Word		
Range:		Function:
0*	[0 - 4294967295]	Returns the extended warning word sent via the serial communication port in hex code.



3.18 Adv Parameter Data Set

3.19 LC-## Logic Controller

Parameter group related to programming the drive's built-in Logic Controller. The Logic Controller consists of a series of user defined actions (see par. LC-53) that are executed when the corresponding user-defined events are met.

3.19.1 LC-0# LC Settings

Parameters to configure the activation, deactivations and reset of the Logic Controller (LC).

LC-00 Logic Controller Mode		
Option:		Function:
[0] *	Off	Disables the Logic Controller.
[1]	On	Enables the Logic Controller.

LC-01 Start Event		
Option:		Function:
[0] *	False	Select the boolean (TRUE or FALSE) input to activate Logic Controller. <i>False</i> [0] enters the fixed value - FALSE
[1]	True	<i>True</i> [1] enters the fixed value - TRUE.
[2]	Running	<i>Running</i> [2] The motor is running.
[3]	In range	<i>In range</i> [3] The motor is running within the programmed current and speed ranges set in par. H-70 <i>Warning Current Low</i> to par. H-73 <i>Warning Speed High</i> .
[4]	On reference	<i>On reference</i> [4] The motor is running on reference.
[5]	Torque limit	<i>Torque limit</i> [5] The torque limit, set in par. F-40 <i>Torque Limiter (Driving)</i> or par. F-41 <i>Torque Limiter (Braking)</i> , has been exceeded.
[6]	Current Limit	<i>Current limit</i> [6] The motor current limit, set in par. F-43 <i>Current Limit</i> , has been exceeded.
[7]	Out of current range	<i>Out of current range</i> [7] The motor current is outside the range set in par. F-43 <i>Current Limit</i> .
[8]	Below I low	<i>Below I low</i> [8] The motor current is lower than set in par. H-70 <i>Warning Current Low</i> .
[9]	Above I high	<i>Above I high</i> [9] The motor current is higher than set in par. H-71 <i>Warning Current High</i> .
[10]	Out of speed range	<i>Out of speed range</i> [10] The speed is outside the range set in par. H-72 <i>Warning Speed Low</i> and par. H-73 <i>Warning Speed High</i> .
[11]	Below speed low	<i>Below speed low</i> [11] The output speed is lower than the setting in par. H-72 <i>Warning Speed Low</i> .
[12]	Above speed high	<i>Above speed high</i> [12] The output speed is higher than the setting in par. H-73 <i>Warning Speed High</i> .
[13]	Out of feedb. range	<i>Out of feedb. Range</i> [13] The feedback is outside the range set in par. H-76 <i>Warning Feedback Low</i> and par. H-77 <i>Warning Feedback High</i> .
[14]	Below feedb. low	<i>Below feedb. Low</i> [14] The feedback is below the limit set in par. H-76 <i>Warning Feedback Low</i> .
[15]	Above feedb. high	<i>Above feedb. High</i> [15] The feedback is above the limit set in par. H-77 <i>Warning Feedback High</i> .
[16]	Thermal warning	<i>Thermal warning</i> [16] The thermal warning turns on when the temperature exceeds the limit in the motor, the frequency converter, the brake resistor or the thermistor.
[17]	Line voltage out of range	<i>Mains out of range</i> [17] The mains voltage is outside the specified voltage range.
[18]	Reversing	<i>Reversing</i> [18] The output is high when the frequency converter is running counter clockwise (the logical product of the status bits "running" AND "reverse").



[19]	Warning	<i>Warning</i> [19] A warning is active.
[20]	Alarm (trip)	<i>Alarm (trip)</i> [20] A (trip) alarm is active.
[21]	Alarm (trip lock)	<i>Alarm (trip lock)</i> [21] A (Trip lock) alarm is active.
[22]	Comparator 0	<i>Comparator 0</i> [22] Use the result of comparator 0.
[23]	Comparator 1	<i>Comparator 1</i> [23] Use the result of comparator 1.
[24]	Comparator 2	<i>Comparator 2</i> [24] Use the result of comparator 2.
[25]	Comparator 3	<i>Comparator 3</i> [25] Use the result of comparator 3.
[26]	Logic rule 0	<i>Logic rule 0</i> [26] Use the result of logic rule 0.
[27]	Logic rule 1	<i>Logic rule 1</i> [27] Use the result of logic rule 1.
[28]	Logic rule 2	<i>Logic rule 2</i> [28] Use the result of logic rule 2.
[29]	Logic rule 3	<i>Logic rule 3</i> [29] Use the result of logic rule 3.
[33]	Digital input DI18	<i>Digital input DI18</i> [33] Use the result of digital input 18.
[34]	Digital input DI19	<i>Digital input DI19</i> [34] Use the result of digital input 19.
[35]	Digital input DI27	<i>Digital input DI27</i> [35] Use the result of digital input 27.
[36]	Digital input DI29	<i>Digital input DI27</i> [35] Use the result of digital input 29.
[37]	Digital input DI32	<i>Digital input DI32</i> [37] Use the result of digital input 32.
[38]	Digital input DI33	<i>Digital input DI33</i> [38] Use the result of digital input 33.
[39]	Start command	<i>Start command</i> [39] A start command is issued.
[40]	Drive stopped	<i>Drive stopped</i> [40] A stop command (Jog, Stop, Qstop, Coast) is issued – and not from the Logic Controller itself.
[41]	Reset Trip	<i>Reset Trip</i> [41] A reset is issued
[42]	Auto-reset Trip	<i>Auto-reset Trip</i> [42] An Auto reset is performed.
[43]	Ok key	<i>OK key</i> [43] The Ok key is pressed.
[44]	Reset key	<i>Reset key</i> [44] The reset key is pressed.
[45]	Left key	<i>Left key</i> [45] The left key is pressed.
[46]	Right key	<i>Right key</i> [46] The right key is pressed.
[47]	Up key	<i>Up key</i> [47] The up key is pressed.
[48]	Down key	<i>Down key</i> [48] The down key is pressed.
[50]	Comparator 4	<i>Comparator 4</i> [50] Use the result of comparator 4.
[51]	Comparator 5	<i>Comparator 5</i> [51] Use the result of comparator 5.
[60]	Logic rule 4	<i>Logic rule 4</i> [60] Use the result of logic rule 4.
[61]	Logic rule 5	<i>Logic rule 5</i> [61] Use the result of logic rule 5.

LC-02 Stop Event

Select the boolean (TRUE or FALSE) input to activate Logic Controller.

Option:

Function:

[0] *	False	For descriptions [0] - [61], see par. LC-01 <i>Start Event Start Event</i>
[1]	True	
[2]	Running	
[3]	In range	



[4]	On reference
[5]	Torque limit
[6]	Current Limit
[7]	Out of current range
[8]	Below I low
[9]	Above I high
[10]	Out of speed range
[11]	Below speed low
[12]	Above speed high
[13]	Out of feedb. range
[14]	Below feedb. low
[15]	Above feedb. high
[16]	Thermal warning
[17]	Line voltage 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]	Logic Controller Time-out 0
[31]	Logic Controller Time-out 1
[32]	Logic Controller Time-out 2
[33]	Digital input DI18
[34]	Digital input DI19
[35]	Digital input DI27
[36]	Digital input DI29
[37]	Digital input DI32
[38]	Digital input DI33
[39]	Start command
[40]	Drive stopped
[41]	Reset Trip
[42]	Auto-reset Trip
[43]	Ok key
[44]	Reset key
[45]	Left key
[46]	Right key
[47]	Up key
[48]	Down key
[50]	Comparator 4
[51]	Comparator 5



[60]	Logic rule 4
[61]	Logic rule 5
[70]	Logic Controller Time-out 3
[71]	Logic Controller Time-out 4
[72]	Logic Controller Time-out 5
[73]	Logic Controller Time-out 6
[74]	Logic Controller Time-out 7
[75]	Start command given

LC-03 Reset Logic Controller

Option:	Function:
[0] *	Do not reset Logic Controller Retains programmed settings in all group LC-## parameters.
[1]	Reset Logic Controller Resets all group LC-## parameters to default settings.

3.19.2 LC-1# Comparators

Parameters to configure the Logic Controller (LC) comparators. Comparators are used for comparing variables with fixed preset values.

LC-10 Comparator Operand

Array [6]

Option:	Function:
	Choice [1] to [31] are variables which will be compared based on their values. Choice [50] to [186] are digital values (TRUE/FALSE) where the comparison is based on the amount of time during which they are set to TRUE or FALSE, respectively. See par. LC-11 <i>Comparator Operator</i> . Select the variable to be monitored by the comparator.
[0] *	DISABLED <i>DISABLED</i> [0] The comparator is disabled.
[1]	Reference <i>Reference</i> [1] The resulting remote reference (not local) as a percentage.
[2]	Feedback <i>Feedback</i> [2] In the unit [RPM] or [Hz]
[3]	Motor speed <i>Motor speed</i> [3] [RPM] or [Hz]
[4]	Motor Current <i>Motor current</i> [4] [A]
[5]	Motor torque <i>Motor torque</i> [5] [Nm]
[6]	Motor power <i>Motor power</i> [6] [kW] or [hp]
[7]	Motor Rated Voltage <i>Motor voltage</i> [7] [V]
[8]	DC-link voltage <i>DC-link voltage</i> [8] [V]
[9]	Motor Thermal <i>Motor thermal</i> [9] Expressed as a percentage.
[10]	Drive thermal <i>Drive thermal</i> [10] Expressed as a percentage.
[11]	Heat sink temp. <i>Heat sink temp</i> [11] Expressed as a percentage.
[12]	Analog input AI53 <i>Analog input AI53</i> [12] Expressed as a percentage.
[13]	Analog input AI54 <i>Analog input AI54</i> [13] Expressed as a percentage.
[14]	Analog input AIFB10 <i>Analog input AIFB10</i> [14] [V]. AIFB10 is internal 10 V supply.
[15]	Analog input AIS24V <i>Analog input AIS24V</i> [15] [V] Analog input AICCT [17] [°]. AIS24V is switch mode power supply: SMPS 24 V.
[17]	Analog input AICCT <i>Analog input AICCT</i> [17] [°]. AICCT is control card temperature.
[18]	Pulse input FI29 <i>Pulse input FI29</i> [18] Expressed as a percentage.
[19]	Pulse input FI33 <i>Pulse input FI33</i> [19] Expressed as a percentage.



[20]	Alarm number	<i>Alarm number</i> [20] The error number.
[30]	Counter A	<i>Counter A</i> [30] Number of counts
[31]	Counter B	<i>Counter B</i> [31] Number of counts
[50]	FALSE	<i>False</i> [50] Enters the fixed value of false in the comparator.
[51]	TRUE	<i>True</i> [51] Enters the fixed value of true in the comparator.
[52]	Control ready	<i>Control ready</i> [52] The control board receives supply voltage
[53]	Drive ready	<i>Drive ready</i> [53] The frequency converter is ready for operation and applies a supply signal on the control board.
[54]	Running	<i>Running</i> [54] The motor is running.
[55]	Reversing	<i>Reversing</i> [55] The output is high when the frequency converter is running counter clockwise (the logical product of the status bits "running" AND "reverse")
[56]	In range	<i>In range</i> [56] The motor is running within the programmed current and speed ranges set in par. H-70 <i>Warning Current Low</i> to par. H-73 <i>Warning Speed High</i> .
[60]	On reference	<i>On reference</i> [60] The motor is running on reference.
[61]	Below reference, low	<i>Below reference, low</i> [61] The motor is running below the value given in par. H-74 <i>Warning Reference Low</i>
[62]	Above ref, high	<i>Above reference, high</i> [62] The motor is running above the value given in par. H-75 <i>Warning Reference High</i>
[65]	Torque limit	<i>Torque limit</i> [65] The torque limit, set in par. F-40 <i>Torque Limiter (Driving)</i> or par. F-41 <i>Torque Limiter (Braking)</i> , has been exceeded.
[66]	Current Limit	<i>Current limit</i> [66] The motor current limit, set in par. F-43 <i>Current Limit</i> , has been exceeded.
[67]	Out of current range	<i>Out of current range</i> [67] The motor current is outside the range set in par. F-43 <i>Current Limit</i> .
[68]	Below I low	<i>Below I low</i> [68] The motor current is lower than set in par. H-70 <i>Warning Current Low</i> .
[69]	Above I high	<i>Above I high</i> [69] The motor current is higher than set in par. H-71 <i>Warning Current High</i> .
[70]	Out of speed range	<i>Out of speed range</i> [70] The speed is outside the range set in par. H-72 <i>Warning Speed Low</i> and par. H-73 <i>Warning Speed High</i> .
[71]	Below speed low	<i>Below speed low</i> [71] The output speed is lower than the setting in par. H-72 <i>Warning Speed Low</i> .
[72]	Above speed high	<i>Above speed high</i> [72] The output speed is higher than the setting in par. H-73 <i>Warning Speed High</i> .
[75]	Out of feedback range	<i>Out of feedb. Range</i> [75] The feedback is outside the range set in par. H-76 <i>Warning Feedback Low</i> and par. H-77 <i>Warning Feedback High</i> .
[76]	Below feedback low	<i>Below feedb. Low</i> [76] The feedback is below the limit set in par. par. H-76 <i>Warning Feedback Low</i> .
[77]	Above feedback high	<i>Above feedb. High</i> [77] The feedback is above the limit set in par. H-77 <i>Warning Feedback High</i> .
[80]	Thermal warning	<i>Thermal warning</i> [80] The thermal warning turns on when the temperature exceeds the limit in the motor, the frequency converter, the brake resistor or thermistor.
[82]	Mains out of range	<i>Mains out of range</i> [82] The mains voltage is outside the specified voltage range.
[85]	Warning	<i>Warning</i> [85] A warning is active.
[86]	Alarm (trip)	<i>Alarm (trip)</i> [86] A (trip) alarm is active.
[87]	Alarm (trip lock)	<i>Alarm (trip lock)</i> [87] A (Trip lock) alarm is active.
[90]	Bus OK	<i>Bus OK</i> [90] Active communication (no time-out) via the serial communication port.
[91]	Torque limit & stop	<i>Torque limit & stop</i> [91] If the frequency converter has received a stop signal and is at the torque limit, the signal is logic "0".
[92]	Brake fault (IGBT)	<i>Brake fault (IGBT)</i> [92] The brake IGBT is short circuited.



[93]	Mech. brake control	<i>Mech. brake control</i> [93] The mechanical brake is active.
[94]	Safe stop active	
[100]	Comparator 0	<i>Comparator 0</i> [100] The result of comparator 0.
[101]	Comparator 1	<i>Comparator 1</i> [101] The result of comparator 1.
[102]	Comparator 2	<i>Comparator 2</i> [102] The result of comparator 2.
[103]	Comparator 3	<i>Comparator 3</i> [103] The result of comparator 3.
[104]	Comparator 4	<i>Comparator 4</i> [104] The result of comparator 4.
[105]	Comparator 5	<i>Comparator 5</i> [105] The result of comparator 5.
[110]	Logic rule 0	<i>Logic rule 0</i> [110] The result of Logic rule 0.
[111]	Logic rule 1	<i>Logic rule 1</i> [111] The result of Logic rule 1.
[112]	Logic rule 2	<i>Logic rule 2</i> [112] The result of Logic rule 2.
[113]	Logic rule 3	<i>Logic rule 3</i> [113] The result of Logic rule 3.
[114]	Logic rule 4	<i>Logic rule 4</i> [114] The result of Logic rule 4.
[115]	Logic rule 5	<i>Logic rule 5</i> [115] The result of Logic rule 5.
[120]	Logic Controller Time-out 0	<i>SL Time-out 0</i> [120] The result of LC timer 0.
[121]	Logic Controller Time-out 1	<i>SL Time-out 1</i> [121] The result of LC timer 1.
[122]	Logic Controller Time-out 2	<i>SL Time-out 2</i> [122] The result of LC timer 2.
[123]	Logic Controller Time-out 3	<i>SL Time-out 3</i> [123] The result of LC timer 3.
[124]	Logic Controller Time-out 4	<i>SL Time-out 4</i> [124] The result of LC timer 4.
[125]	Logic Controller Time-out 5	<i>SL Time-out 5</i> [125] The result of LC timer 5.
[126]	Logic Controller Time-out 6	<i>SL Time-out 6</i> [126] The result of LC timer 6.
[127]	Logic Controller Time-out 7	<i>SL Time-out 7</i> [127] The result of LC timer 7.
[130]	Digital input DI18	<i>Digital input DI18</i> [130] Digital input 18. High = True.
[131]	Digital input DI19	<i>Digital input DI19</i> [131] Digital input 19. High = True.
[132]	Digital input DI27	<i>Digital input DI27</i> [132] Digital input 27. High = True.
[133]	Digital input DI29	<i>Digital input DI29</i> [133] Digital input 29. High = True.
[134]	Digital input DI32	<i>Digital input DI32</i> [134] Digital input 32. High = True.
[135]	Digital input DI33	<i>Digital input DI33</i> [135] Digital input 33. High = True.
[150]	LC digital output A	
[151]	Logic Controller digital output B	<i>SL digital output B</i> [151] Use the result of the LC output B.
[152]	Logic Controller digital output C	<i>SL digital output C</i> [152] Use the result of the LC output C.
[153]	Logic Controller digital output D	<i>SL digital output D</i> [153] Use the result of the LC output D.
[154]	Logic Controller digital output E	<i>SL digital output E</i> [154] Use the result of the LC output E.
[155]	Logic Controller digital output F	<i>SL digital output F</i> [155] Use the result of the LC output F.
[160]	Relay 1	<i>Relay 1</i> [160] Relay 1 is active
[161]	Relay 2	<i>Relay 2</i> [161] Relay 2 is active
[180]	Local reference active	<i>Local ref. active</i> [180] High when par. F-02 <i>Operation Method</i> = [2] Local or when par. F-02 <i>Operation Method</i> is [0] Linked to hand Auto, at the same time as the Keypad is in Hand mode.



[181]	Remote reference active	<i>Remote ref. active</i> [181] High when par. F-02 <i>Operation Method</i> = [1] Remote or [0] Linked to hand/auto, while the Keypad is in Auto mode.
[182]	Start command	<i>Start command</i> [182] High when there is an active start command, and no stop command.
[183]	Drive stopped	<i>Drive stopped</i> [183] A stop command (Jog, Stop, Qstop, Coast) is issued – and not from the Logic Controller itself.
[185]	Drive in hand mode	<i>Drive in hand mode</i> [185] High when the frequency converter is in hand mode.
[186]	Drive in auto mode	<i>Drive in auto mode</i> [186] High when the frequency converter is in auto mode.
[187]	Start command given	

LC-11 Comparator Operator

Array [6]

Option:

Function:

[0] *	<	Select < [0] for the result of the evaluation to be TRUE, when the variable selected in par. LC-10 <i>Comparator Operand</i> is smaller than the fixed value in par. LC-12 <i>Comparator Value</i> . The result will be FALSE, if the variable selected in par. LC-10 <i>Comparator Operand</i> is greater than the fixed value in par. LC-12 <i>Comparator Value</i> .
[1]	≈ (equal)	Select ≈ [1] for the result of the evaluation to be TRUE, when the variable selected in par. LC-10 <i>Comparator Operand</i> is approximately equal to the fixed value in par. LC-12 <i>Comparator Value</i> .
[2]	>	Select > [2] for the inverse logic of option < [0].

LC-12 Comparator Value

Array [6]

Range:

Function:

0*	[-100000.000 - 100000.000]	Enter the 'trigger level' for the variable that is monitored by this comparator. This is an array parameter containing comparator values 0 to 5.
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3.19.3 LC-2# Timers

Parameters to configure the Logic Controller (LC) timers. Timers are used to define when an event can occur.

LC-20 Logic Controller Timer

Range:

Function:

0.000*	[0.000 - 0.000]	Enter the value to define the duration of the FALSE output from the programmed timer. A timer is only FALSE if it is started by an action (i.e. <i>Start timer 1</i> [29]) and until the given timer value has elapsed.
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3.19.4 LC-4# Logic Rules

Parameters to configure the Logic Controller (LC) Logic Rules. Logic Rules are used to define what conditions need to be met for the LC to step to the next event.

LC-40 Logic Rule Boolean 1

Array [6]

Option:

Function:

[0] *	False	Select the first boolean (TRUE or FALSE) input for the selected logic rule. See par. LC-01 <i>Start Event</i> ([0] - [61]) and par. LC-02 <i>Stop Event</i> ([70] - [75]) for further description.
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	



[5]	Torque limit
[6]	Current Limit
[7]	Out of current range
[8]	Below I low
[9]	Above I high
[10]	Out of speed range
[11]	Below speed low
[12]	Above speed high
[13]	Out of feedb. range
[14]	Below feedb. low
[15]	Above feedb. high
[16]	Thermal warning
[17]	Line voltage 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]	Logic Controller Time-out 0
[31]	Logic Controller Time-out 1
[32]	Logic Controller Time-out 2
[33]	Digital input DI18
[34]	Digital input DI19
[35]	Digital input DI27
[36]	Digital input DI29
[37]	Digital input DI32
[38]	Digital input DI33
[39]	Start command
[40]	Drive stopped
[41]	Reset Trip
[42]	Auto-reset Trip
[43]	Ok key
[44]	Reset key
[45]	Left key
[46]	Right key
[47]	Up key
[48]	Down key
[50]	Comparator 4
[51]	Comparator 5
[60]	Logic rule 4



[61]	Logic rule 5
[70]	Logic Controller Time-out 3
[71]	Logic Controller Time-out 4
[72]	Logic Controller Time-out 5
[73]	Logic Controller Time-out 6
[74]	Logic Controller Time-out 7
[75]	Start command given

LC-41 Logic Rule Operator 1

Array [6]

Option:**Function:**

Select the first logical operator to use on the Boolean inputs from par. LC-40 *Logic Rule Boolean 1* and par. LC-42 *Logic Rule Boolean 2*.
[LC-##] signifies the boolean input of par. LC-##.

[0] *	DISABLED	Ignores par. , par. LC-43 <i>Logic Rule Operator 2</i> , and par. LC-44 <i>Logic Rule Boolean 3</i> .
[1]	AND	Evaluates the expression [LC-40] AND [LC-42].
[2]	OR	evaluates the expression [LC-40] OR [LC-42].
[3]	AND NOT	evaluates the expression [LC-40] AND NOT [LC-42].
[4]	OR NOT	evaluates the expression [LC-40] OR NOT [LC-42].
[5]	NOT AND	evaluates the expression NOT [LC-40] AND [LC-42].
[6]	NOT OR	evaluates the expression NOT [LC-40] OR [LC-42].
[7]	NOT AND NOT	evaluates the expression NOT [LC-40] AND NOT [LC-42].
[8]	NOT OR NOT	evaluates the expression NOT [LC-40] OR NOT [LC-42].

LC-42 Logic Rule Boolean 2

Array [6]

Option:**Function:**

Select the second boolean (TRUE or FALSE) input for the selected logic rule. See par. LC-01 *Start Event* ([0] - [61]) and par. LC-02 *Stop Event* ([70] - [75]) for further description.

[1]	True
[2]	Running
[3]	In range
[4]	On reference
[5]	Torque limit
[6]	Current Limit
[7]	Out of current range
[8]	Below I low
[9]	Above I high
[10]	Out of speed range
[11]	Below speed low
[12]	Above speed high
[13]	Out of feedb. range
[14]	Below feedb. low
[15]	Above feedb. high
[16]	Thermal warning
[17]	Line voltage 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]	Logic Controller Time-out 0
[31]	Logic Controller Time-out 1
[32]	Logic Controller Time-out 2
[33]	Digital input DI18
[34]	Digital input DI19
[35]	Digital input DI27
[36]	Digital input DI29
[37]	Digital input DI32
[38]	Digital input DI33
[39]	Start command
[40]	Drive stopped
[41]	Reset Trip
[42]	Auto-reset Trip
[43]	Ok key
[44]	Reset key
[45]	Left key
[46]	Right key
[47]	Up key
[48]	Down key
[50]	Comparator 4
[51]	Comparator 5
[60]	Logic rule 4
[61]	Logic rule 5
[70]	Logic Controller Time-out 3
[71]	Logic Controller Time-out 4
[72]	Logic Controller Time-out 5
[73]	Logic Controller Time-out 6
[74]	Logic Controller Time-out 7
[75]	Start command given

**LC-43 Logic Rule Operator 2**

Array [6]

Option:**Function:**

Select the second logical operator to be used on the boolean input calculated in par. LC-40 *Logic Rule Boolean 1*, par. LC-41 *Logic Rule Operator 1*, and par. LC-42 *Logic Rule Boolean 2*, and the boolean input coming from par. LC-42 *Logic Rule Boolean 2*.

[LC-44] signifies the boolean input of par. LC-44 *Logic Rule Boolean 3*.

[LC-40/LC-42] signifies the boolean input calculated in par. LC-40 *Logic Rule Boolean 1*, par. LC-41 *Logic Rule Operator 1*, and par. LC-42 *Logic Rule Boolean 2*. DISABLED [0] (factory setting). select this option to ignore par. LC-44 *Logic Rule Boolean 3*.

[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

LC-44 Logic Rule Boolean 3

Array [6]

Option:**Function:**

[0] * False

Select the third boolean (TRUE or FALSE) input for the selected logic rule. See par. LC-01 ([0] - [61]) and par. LC-02 ([70] - [75]) for further description.

[1] True

[2] Running

[3] In range

[4] On reference

[5] Torque limit

[6] Current Limit

[7] Out of current range

[8] Below I low

[9] Above I high

[10] Out of speed range

[11] Below speed low

[12] Above speed high

[13] Out of feedb. range

[14] Below feedb. low

[15] Above feedb. high

[16] Thermal warning

[17] Line voltage 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]	Logic Controller Time-out 0
[31]	Logic Controller Time-out 1
[32]	Logic Controller Time-out 2
[33]	Digital input DI18
[34]	Digital input DI19
[35]	Digital input DI27
[36]	Digital input DI29
[37]	Digital input DI32
[38]	Digital input DI33
[39]	Start command
[40]	Drive stopped
[41]	Reset Trip
[42]	Auto-reset Trip
[43]	Ok key
[44]	Reset key
[45]	Left key
[46]	Right key
[47]	Up key
[48]	Down key
[50]	Comparator 4
[51]	Comparator 5
[60]	Logic rule 4
[61]	Logic rule 5
[70]	Logic Controller Time-out 3
[71]	Logic Controller Time-out 4
[72]	Logic Controller Time-out 5
[73]	Logic Controller Time-out 6
[74]	Logic Controller Time-out 7
[75]	Start command given

3.19.5 LC-5# States

Parameters to configure the Logic Controller (LC) states. States define the events and actions to take place in the drive.

LC-51 Logic Controller Event

Array [20]

Option:

Function:

[0] *	False	Select the boolean input (TRUE or FALSE) to define the Logic Controller event. See par. LC-01 <i>Start Event</i> ([0] - [61]) and par. LC-02 <i>Stop Event</i> ([70] - [74]) for further description.
[1]	True	
[2]	Running	



[3]	In range
[4]	On reference
[5]	Torque limit
[6]	Current Limit
[7]	Out of current range
[8]	Below I low
[9]	Above I high
[10]	Out of speed range
[11]	Below speed low
[12]	Above speed high
[13]	Out of feedb. range
[14]	Below feedb. low
[15]	Above feedb. high
[16]	Thermal warning
[17]	Line voltage 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]	Logic Controller Time-out 0
[31]	Logic Controller Time-out 1
[32]	Logic Controller Time-out 2
[33]	Digital input DI18
[34]	Digital input DI19
[35]	Digital input DI27
[36]	Digital input DI29
[37]	Digital input DI32
[38]	Digital input DI33
[39]	Start command
[40]	Drive stopped
[41]	Reset Trip
[42]	Auto-reset Trip
[43]	Ok key
[44]	Reset key
[45]	Left key
[46]	Right key
[47]	Up key
[48]	Down key
[50]	Comparator 4



[51]	Comparator 5
[60]	Logic rule 4
[61]	Logic rule 5
[70]	Logic Controller Time-out 3
[71]	Logic Controller Time-out 4
[72]	Logic Controller Time-out 5
[73]	Logic Controller Time-out 6
[74]	Logic Controller Time-out 7
[75]	Start command given

LC-52 Logic Controller Action

Array [20]

Option:

Function:

[0] *	DISABLED	Select the action corresponding to the LC event. Actions are executed when the corresponding event (defined in par. LC-51 <i>Logic Controller Event</i>) is evaluated as true. The following actions are available for selection: *DISABLED [0]
[1]	No action	No action [1]
[2]	Select set-up 1	Select set-up 1 [2] - changes the active set-up (par. K-10) to '1'.
[3]	Select set-up 2	Select set-up 2 [3] - changes the active set-up (par. K-10) to '2'.
[4]	Select set-up 3	Select set-up 3 [4] - changes the active set-up (par. K-10) to '3'.
[5]	Select set-up 4	Select set-up 4 [5] - changes the active set-up (par. K-10) to '4'. If the set-up is changed, it will merge with other set-up commands coming from either the digital inputs or via a Network.
[10]	Select preset ref 0	Select preset reference 0 [10] - selects preset reference 0.
[11]	Select preset ref 1	Select preset reference 1 [11] - selects preset reference 1.
[12]	Select preset ref 2	Select preset reference 2 [12] - selects preset reference 2.
[13]	Select preset ref 3	Select preset reference 3 [13] - selects preset reference 3.
[14]	Select preset ref 4	Select preset reference 4 [14] - selects preset reference 4.
[15]	Select preset ref 5	Select preset reference 5 [15] - selects preset reference 5.
[16]	Select preset ref 6	Select preset reference 6 [16] - selects preset reference 6.
[17]	Select preset ref 7	Select preset reference 7 [17] - selects preset reference 7. If the active preset reference is changed, it will merge with other preset reference commands coming from either the digital inputs or via a Network.
[18]	Select Accel/Decel 1	Select ramp 1 [18] - selects ramp 1.
[19]	Select Accel/Decel 2	Select ramp 2 [19] - selects ramp 2.
[20]	Select Accel/Decel 3	Select ramp 3 [20] - selects ramp 3.
[21]	Select Accel/Decel 4	Select ramp 4 [21] - selects ramp 4.
[22]	Run	Run [22] - issues a start command to the frequency converter.
[23]	Run reverse	Run reverse [23] - issues a start reverse command to the frequency converter.
[24]	Stop	Stop [24] - issues a stop command to the frequency converter.
[25]	Qstop	Qstop [25] - issues a quick stop command to the frequency converter.
[26]	Dcstop	Dcstop [26] - issues a DC stop command to the frequency converter.
[27]	Coast	Coast [27] - the frequency converter coasts immediately. All stop commands including the coast command stop the Logic Controller.



[28]	Freeze output	<i>Freeze output [28]</i> - freezes the output frequency of the frequency converter.
[29]	Start timer 0	<i>Start timer 0 [29]</i> - starts timer 0, see par. LC-20 for further description.
[30]	Start timer 1	<i>Start timer 1 [30]</i> - starts timer 1, see par. LC-20 for further description.
[31]	Start timer 2	<i>Start timer 2 [31]</i> - starts timer 2, see par. LC-20 for further description.
[32]	Set digital out A low	<i>Set digital output A low [32]</i> - any output with LC output A will be low.
[33]	Set digital out B low	<i>Set digital output B low [33]</i> - any output with LC output B will be low.
[34]	Set digital out C low	<i>Set digital output C low [34]</i> - any output with LC output C will be low.
[35]	Set digital out D low	<i>Set digital output D low [35]</i> - any output with LC output D will be low.
[36]	Set digital out E low	<i>Set digital output E low [36]</i> - any output with LC output E will be low.
[37]	Set digital out F low	<i>Set digital output F low [37]</i> - any output with LC output F will be low.
[38]	Set digital out A high	<i>Set digital output A high [38]</i> - any output with LC output A will be high.
[39]	Set digital out B high	<i>Set digital output B high [39]</i> - any output with LC output B will be high.
[40]	Set digital out C high	<i>Set digital output C high [40]</i> - any output with LC output C will be high.
[41]	Set digital out D high	<i>Set digital output D high [41]</i> - any output with LC output D will be high.
[42]	Set digital out E high	<i>Set digital output E high [42]</i> - any output with LC output E will be high.
[43]	Set digital out F high	<i>Set digital output F high [43]</i> - any output with LC output F will be high.
[60]	Reset Counter A	<i>Reset Counter A [60]</i> - resets Counter A to zero.
[61]	Reset Counter B	<i>Reset Counter B [61]</i> - resets Counter B to zero.
[70]	Start timer 3	<i>Start Timer 3 [70]</i> - Start Timer 3, see par. LC-20 for further description.
[71]	Start timer 4	<i>Start Timer 4 [71]</i> - Start Timer 4, see par. LC-20 for further description.
[72]	Start timer 5	<i>Start Timer 5 [72]</i> - Start Timer 5, see par. LC-20 for further description.
[73]	Start timer 6	<i>Start Timer 6 [73]</i> - Start Timer 6, see par. LC-20 for further description.
[74]	Start timer 7	<i>Start Timer 7 [74]</i> - Start Timer 7, see par. LC-20 for further description.



3.20 B-## Brakes

Parameter group related to the brake features in the drive.

3.20.1 B-0# DC Brake

Parameters to configure the DC brake and DC hold functions.

3

B-00 DC Hold Current

Range:

50 %* [0 - 160. %]

Function:

Enter a value for holding current as a percentage of the rated motor current $I_{M,N}$ set in par. P-03 *Motor Current*. 100% DC holding current corresponds to $I_{M,N}$.

This parameter holds the motor function (holding torque) or pre-heats the motor.

This parameter is active if *DC hold* is selected in par. F-25 *Start Function* [0] or par. H-80 *Function at Stop* [1].

NB!

The maximum value depends on the rated motor current.

NB!

Avoid 100 % current for too long. It may damage the motor.

B-01 DC Brake Current

Range:

50 %* [0 - 1000. %]

Function:

Enter a value for current as a percentage of the rated motor current $I_{M,N}$, see par. P-03 *Motor Current*. 100% DC braking current corresponds to $I_{M,N}$.

DC brake current is applied on a stop command, when the speed is lower than the limit set in par. B-03 *DC Brake Cut In Speed [RPM]*; when the DC Brake Inverse function is active; or via the serial communication port. The braking current is active during the time period set in par. B-02 *DC Braking Time*.

NB!

The maximum value depends on the rated motor current.

NB!

Avoid 100 % current for too long. It may damage the motor.

B-02 DC Braking Time

Range:

10.0 s* [0.0 - 60.0 s]

Function:

Set the duration of the DC braking current set in par. B-01 *DC Brake Current*, once activated.

B-03 DC Brake Cut In Speed [RPM]

Range:

0 RPM* [0 - par. H-13 RPM]

Function:

Set the DC brake cut-in speed for activation of the DC braking current set in par. B-01 *DC Brake Current*, upon a stop command.

B-04 DC Brake Cut In Speed [Hz]

Range:

0.0 Hz* [0.0 - par. H-14 Hz]

Function:

Set the DC brake cut-in speed for activation of the DC braking current set in par. B-01 *DC Brake Current*, upon a stop command.



3.20.2 B-1# Brake Energy Funct.

Parameters to configure the dynamic braking functions in the drive. Note! This applies only to drives ordered with the optional factory installed brake chopper option.

B-10 Brake Function

Option:

Function:

[0] *	Off	No brake resistor is installed.
[1]	Resistor brake	A brake resistor is incorporated in the system, for dissipation of surplus brake energy as heat. Connecting a brake resistor allows a higher DC link voltage during braking (generating operation). The Resistor brake function is only active in frequency converters with an integral dynamic brake.
[2]	AC brake	Is selected to improve braking without using a brake resistor. This parameter controls an overmagnetization of the motor when running with a generative load. This function can improve the OVC-function. Increasing the electrical losses in the motor allows the OVC function to increase the braking torque without exceeding the over voltage limit. Please note that AC brake is not as effective as dynamic braking with resistor. AC brake is for Adv. Vector Control and flux mode in both open and closed loop.

B-11 Brake Resistor (ohm)

Range:

Function:

50. Ohm*	[5. - 65535. Ohm]	Set the brake resistor value in Ohms. This value is used for monitoring the power to the brake resistor in par. B-13 <i>Braking Thermal Overload</i> . This parameter is only active in frequency converters with an integral dynamic brake. If the selection is xxxx use this parameter. If the selection is xxx.xx, use par. C-23 <i>Quick Stop Decel Time</i> .
----------	-------------------	---

B-12 Brake Power Limit (kW)

Range:

Function:

5.000 kW*	[0.001 - 2000.000 kW]	Set the monitoring limit of the brake power transmitted to the resistor. The monitoring limit is a product of the maximum duty cycle (120 sec.) and the maximum power of the brake resistor at that duty cycle. See the formula below.
-----------	-----------------------	---

For 200 - 240 V units:	$P_{resistor} = \frac{390^2 \times dutytime}{R \times 120}$
For 380 - 480 V units	$P_{resistor} = \frac{778^2 \times dutytime}{R \times 120}$
For 380 - 500 V units	$P_{resistor} = \frac{810^2 \times dutytime}{R \times 120}$
For 575 - 600 V units	$P_{resistor} = \frac{943^2 \times dutytime}{R \times 120}$

This parameter is only active in frequency converters with optional factory installed Brake Chopper..

B-13 Braking Thermal Overload

Option:

Function:

		This parameter is only active in frequency converters with an integral dynamic brake. This parameter enables monitoring of the power to the brake resistor. The power is calculated on the basis of the resistance (par. B-11 <i>Brake Resistor (ohm)</i>), the DC link voltage, and the resistor duty time.
[0] *	Off	No brake power monitoring required.
[1]	Warning	Activates a warning on the display when the power transmitted over 120 s exceeds 100% of the monitoring limit (par. B-12 <i>Brake Power Limit (kW)</i>). The warning disappears when the transmitted power falls below 80% of the monitoring limit.
[2]	Trip	Trips frequency converter and displays an alarm when the calculated power exceeds 100% of the monitoring limit.
[3]	Warning and trip	



If power monitoring is set to *Off* [0] or *Warning* [1], the brake function remains active, even if the monitoring limit is exceeded. This may lead to thermal overload of the resistor. It is also possible to generate a warning via a relay/digital outputs. The measuring accuracy of the power monitoring depends on the accuracy of the resistance of the resistor (better than $\pm 20\%$).

B-15 Brake Check

Option:

Function:

Select type of test and monitoring function to check the connection to the brake resistor, or whether a brake resistor is present, and then display a warning or an alarm in the event of a fault.

NB!

The brake resistor disconnection function is tested during power-up. However the brake IGBT test is performed when there is no braking. A warning or trip disconnects the brake function.

The testing sequence is as follows:

1. The DC link ripple amplitude is measured for 300 ms without braking.
2. The DC link ripple amplitude is measured for 300 ms with the brake turned on.
3. If the DC link ripple amplitude while braking is lower than the DC link ripple amplitude before braking + 1 %: *Brake check has failed by returning a warning or alarm.*
4. If the DC link ripple amplitude while braking is higher than the DC link ripple amplitude before braking + 1 %: *Brake check is OK.*

[0] *	Off	Monitors brake resistor and brake IGBT for a short-circuit during operation. If a short-circuit occurs, warning 25 appears.
[1]	Warning	Monitors brake resistor and brake IGBT for a short-circuit, and runs a test for brake resistor disconnection during power-up.
[2]	Trip	Monitors for a short-circuit or disconnection of the brake resistor, or a short-circuit of the brake IGBT. If a fault occurs, the frequency converter cuts out while displaying an alarm (trip locked).
[3]	Stop and trip	Monitors for a short-circuit or disconnection of the brake resistor, or a short-circuit of the brake IGBT. If a fault occurs, the frequency converter ramps down to coast and then trips. A trip lock alarm is displayed (e.g. warning 25, 27 or 28).
[4]	AC brake	Monitors for a short-circuit or disconnection of the brake resistor, or a short-circuit of the brake IGBT. If a fault occurs, the frequency converter performs a controlled ramp down.

NB!

Remove a warning arising in connection with *Off* [0] or *Warning* [1] by cycling the mains supply. The fault must be corrected first. For *Off* [0] or *Warning* [1], the frequency converter keeps running even if a fault is located.

This parameter is only active in frequency converters with an integral dynamic brake.

B-16 AC brake Max. Current

Range:

Function:

100.0 %* [0.0 - 1000.0 %] Enter the maximum permissible current when using AC brake to avoid overheating of motor windings.

B-17 Over-voltage Control

Option:

Function:

Over-voltage control (OVC) reduces the risk of the frequency converter tripping due to an over voltage on the DC link caused by generative power from the load.

[0] *	Disabled	No OVC required.
[1]	Enabled (not at stop)	Activates OVC except when using a stop signal to stop the frequency converter.
[2]	Enabled	Activates OVC.

**NB!**

OVC must not be enabled in hoisting applications.

3.20.3 B-2# Mechanical Brake

Parameters to configure the operation of an electro-magnetic (mechanical) brake, typically required in hoisting applications.

3

B-20 Release Brake Current**Range:**par. AP-37 [0.00 - par. AP-37 A]
A***Function:**Set the motor current for release of the mechanical brake, when a start condition is present. The upper limit is specified in par. DR-37 *Drive Max. Current*.**B-21 Activate Brake Speed [RPM]****Range:**

0 RPM* [0 - 30000 RPM]

Function:Set the motor speed for activation of the mechanical brake, when a stop condition is present. The upper speed limit is specified in par. H-73 *Warning Speed High*.**B-22 Activate Brake Speed [Hz]****Range:**

0 Hz* [0.0 - 5000.0 Hz]

Function:

Set the motor frequency for activation of the mechanical brake, when a stop condition is present.

B-23 Activate Brake Delay**Range:**

0.0 s* [0.0 - 5.0 s]

Function:Enter the brake delay time of the coast after ramp-down time. The shaft is held at zero speed with full holding torque. Ensure that the mechanical brake has locked the load before the motor enters coast mode. See *Mechanical Brake Control* section in the AF-650 GP Design Guide.**B-24 Stop Delay****Range:**

0.0 s* [0.0 - 5.0 s]

Function:

Set the time interval from the moment when the motor is stopped until the brake closes. This parameter is a part of the stopping function.

B-25 Brake Release Time**Range:**

0.20 s* [0.00 - 5.00 s]

Function:

This value defines the time it takes for the mechanical brake to open/ close. This parameter must act as a time-out when brake feedback is activated.

B-26 Torque Ref**Range:**

0.00 %* [0 - 0 %]

Function:

The value defines the torque applied against the closed mechanical brake, before release

B-27 Torque Ramp Time**Range:**

0.2 s* [0.0 - 5.0 s]

Function:

The value defines the duration of the torque ramp in clockwise direction.

**B-28 Gain Boost Factor****Range:**

1.00* [1.00 - 4.00]

Function:

When a speed PID-control is connected to the output (flux closed loop) it must be possible to boost the proportional gain of the control during the *Activate Brake Delay* (par. B-23 *Activate Brake Delay*). By increasing the gain, the bump when the motor takes over the load from the brake can be reduced. The risk of oscillation is very small due to the relatively short duration and the low (zero) speed.

3

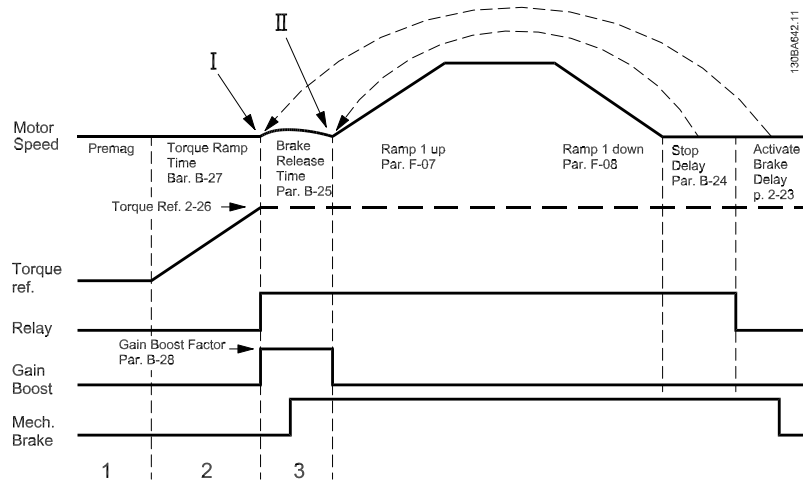


Illustration 3.5: Brake release sequence for hoist mechanical brake control

I) *Activate brake delay*: The frequency converter starts again from the *mechanical brake engaged* position.

II) *Stop delay*: When the time between successive starts is shorter than the setting in par. B-24 *Stop Delay*, the frequency converter starts without applying the mechanical brake (e.g. reversing).



3.21 PI-## PID Controls

Parameter group related to PID Controls

3.21.1 PI-0# Speed PID Control

Parameters to configure the Speed PID Control.

PI-00 Speed PID Feedback Source

Option:**Function:**

Select the encoder for closed loop feedback.

The feedback may come from a different encoder (typically mounted on the application itself) than the motor mounted encoder feedback selected in par. H-42 *Flux Motor Feedback Source*.

This parameter cannot be adjusted while the motor is running.

[0] * Motor feedback par. H-42

[1] 24V encoder

[2] OPCENC

[3] OPCRES

[6] Analog Input 53

[7] Analog Input 54

[8] Frequency input 29

[9] Frequency input 33

PI-02 Speed PID Proportional Gain

Range:**Function:**

0* [0.0000 - 1.0000]

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

PI-03 Speed PID Integral Time

Range:**Function:**

8.0 ms* [2.0 - 20000.0 ms]

Enter the speed controller integral time, which determines the time the internal PID control takes to correct errors. The greater the error, the more quickly the gain increases. The integral time causes a delay of the signal and therefore a dampening effect, and can be used to eliminate steady state speed error. Obtain quick control through a short integral time, though if the integral time is too short, the process becomes unstable. An excessively long integral time disables the integral action, leading to major deviations from the required reference, since the process regulator takes too long to regulate errors. This parameter is used with *Speed open loop* [0] and *Speed closed loop* [1] control, set in par. H-40 *Configuration Mode*.

PI-04 Speed PID Differentiation Time

Range:**Function:**

30.0 ms* [0.0 - 200.0 ms]

Enter the speed controller differentiation time. The differentiator does not react to constant error. It provides gain proportional to the rate of change of the speed feedback. The quicker the error changes, the stronger the gain from the differentiator. The gain is proportional with the speed at which errors change. Setting this parameter to zero disables the differentiator. This parameter is used with par. H-40 *Configuration Mode Speed closed loop* [1] control.

PI-05 Speed PID Diff. Gain Limit

Range:**Function:**

5.0* [1.0 - 20.0]

Set a limit for the gain provided by the differentiator. Since the differential gain increases at higher frequencies, limiting the gain may be useful. For example, set up a pure D-link at low frequencies and a constant D-link at higher frequencies. This parameter is used with par. H-40 *Configuration Mode Speed closed loop* [1] control.

**PI-06 Speed PID Lowpass Filter Time****Range:**

10.0 ms* [1.0 - 100.0 ms]

Function:

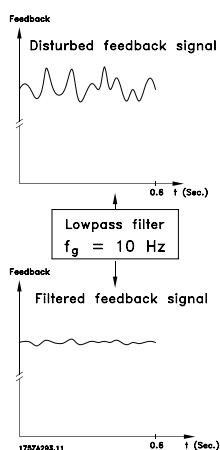
Set a time constant for the speed control low-pass filter. The low-pass filter improves steady-state performance and dampens oscillations on the feedback signal. This is an advantage if there is a great amount on noise in the system, see illustration below. For example, if a time constant (τ) of 100 ms is programmed, the cut-off frequency for the low-pass filter will be $1/0.1 = 10$ RAD/sec., corresponding to $(10/2 \times \pi) = 1.6$ Hz. The PID regulator only regulates a feedback signal that varies by a frequency of less than 1.6 Hz. If the feedback signal varies by a higher frequency than 1.6 Hz, the PID regulator does not react.

Practical settings of par. PI-06 *Speed PID Lowpass Filter Time* taken from the number of pulses per revolutions from encoder:

Encoder PPR	par. PI-06 <i>Speed PID Lowpass Filter Time</i>
512	10 ms
1024	5 ms
2048	2 ms
4096	1 ms

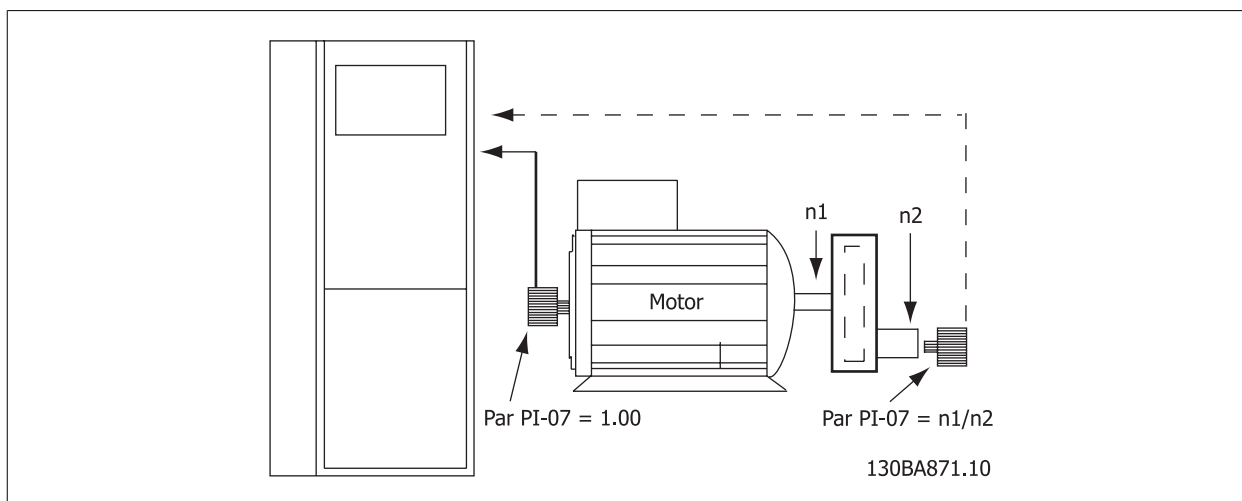
Note that severe filtering can be detrimental to dynamic performance.

This parameter is used with par. H-40 *Configuration Mode Speed closed loop* [1] and *Torque* [2] control. The filter time in flux sensorless must be adjusted to 3-5 ms.

**PI-07 Speed PID Feedback Gear Ratio****Range:**

1.0000* [0.0001 - 32.0000]

Function:

**PI-08 Speed PID Feed Forward Factor****Range:**

0 %* [0 - 500 %]

Function:

The reference signal bypasses the speed controller by the amount specified. This feature increases the dynamic performance of the speed control loop.

3.21.2 PI-1# Torque PI Control**PI-12 Torque PI Proportional Gain****Range:**

100 %* [0 - 500 %]

Function:

Enter the proportional gain value for the torque controller. Selection of a high value makes the controller react faster. Too high a setting leads to controller instability.

PI-13 Torque PI Integration Time**Range:**

0.020 s* [0.002 - 2.000 s]

Function:

Enter the integration time for the torque controller. Selection of a low value makes the controller react faster. Too low a setting leads to control instability.

3.21.3 PI-2# Proces PID Feedback

Parameters to configure the feedback sources for the Process PID Control.

PI-20 Process CL Feedback 1 Resource**Option:****Function:**

The effective feedback signal is made up of the sum of up to two different input signals. Select which frequency converter input should be treated as the source of the first of these signals. The second input signal is defined in par. PI-22 *Process CL Feedback 2 Resource*.

[0] * No function

[1] Analog Input 53

[2] Analog Input 54

[3] Frequency input 29

[4] Frequency input 33

[7] Analog Input X30/11 (OPCGPIO)

[8] Analog Input X30/12 (OPCGPIO)

**PI-22 Process CL Feedback 2 Resource****Option:****Function:**

The effective feedback signal is made up of the sum of up to two different input signals. Select which frequency converter input should be treated as the source of the second of these signals. The first input signal is defined in par. PI-20.

[0] * No function

[1] Analog Input 53

[2] Analog Input 54

[3] Frequency input 29

[4] Frequency input 33

[7] Analog Input X30/11 (OPCGPIO)

[8] Analog Input X30/12 (OPCGPIO)

3.21.4 PI-3# Process PID Control

Parameters to configure the Process PID Controls.

PI-30 Process PID Normal/ Inverse Control**Option:****Function:**

Normal and inverse control are implemented by introducing a difference between the reference signal and the feedback signal.

[0] * Normal Sets process control to increase the output frequency.

[1] Inverse Sets process control to reduce the output frequency.

PI-31 Process PID Anti Windup**Option:****Function:**

[0] Off Ceases regulation of an error when the output frequency can no longer be adjusted.

[1] * On Continues regulation of an error even when the output frequency cannot be increased or decreased.

PI-32 Process PID Start Speed**Range:****Function:**

0 RPM* [0 - 6000 RPM]

Enter the motor speed to be attained as a start signal for commencement of PID control. When the power is switched on, the frequency converter will commence ramping and then operate under speed open loop control. Thereafter, when the Process PID start speed is reached, the frequency converter will change over to Process PID control.

PI-33 Process PID Proportional Gain**Range:****Function:**

0.01* [0.00 - 10.00]

Enter the PID proportional gain. The proportional gain multiplies the error between the set point and the feedback signal.

PI-34 Process PID Integral Time**Range:****Function:**

10000.00 s* [0.01 - 10000.00 s]

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

**PI-35 Process PID Differentiation Time****Range:**

0.00 s* [0.00 - 10.00 s]

Function:

Enter the PID differentiation time. The differentiator does not react to a constant error, but provides a gain only when the error changes. The shorter the PID differentiation time, the stronger the gain from the differentiator.

PI-36 Process PID Diff. Gain Limit**Range:**

5.0* [1.0 - 50.0]

Function:

Enter a limit for the differentiator gain (DG). If there is no limit, the DG will increase when there are fast changes. Limit the DG to obtain a pure differentiator gain at slow changes and a constant differentiator gain where fast changes occur.

PI-38 Process PID Feed Forward Factor**Range:**

0 %* [0 - 500 %]

Function:

Enter the PID feed forward (FF) factor. The FF factor sends a constant fraction of the reference signal to bypass the PID control, so the PID control only affects the remaining fraction of the control signal. Any change to this parameter will thus affect the motor speed. When the FF factor is activated it provides less overshoot, and high dynamics when changing the set point. par. PI-38 *Process PID Feed Forward Factor* is active when par. H-40 *Configuration Mode* is set to [3] Process.

PI-39 On Reference Bandwidth**Range:**

5 %* [0 - 200 %]

Function:

Enter the On Reference bandwidth. When the PID Control Error (the difference between the reference and the feedback) is less than the set value of this parameter the On Reference status bit is high, i.e. =1.





4 Parameter Lists

Changes during operation

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

4-Set-up

'All set-ups': the parameter can be set individually in each of the four set-ups, i. e. one single parameter can have four different data values.

'1 set-up': data value will be the same in all set-ups.

Conversion index

This number refers to a conversion figure used when writing or reading by means of a frequency converter.

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

Data type	Description	Type
2	Integer 8	Int8
3	Integer 16	Int16
4	Integer 32	Int32
5	Unsigned 8	UInt8
6	Unsigned 16	UInt16
7	Unsigned 32	UInt32
9	Visible String	VisStr
33	Normalized value 2 bytes	N2
35	Bit sequence of 16 boolean variables	V2
54	Time difference w/o date	TimD



4.1.1.1 K-## Keypad Set-up

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
K-0#						
K-01	Language	[0] English	1 set-up	TRUE	-	Uint8
K-02	Motor Speed Unit	[1] Hz	2 set-ups	FALSE	-	Uint8
K-03	Regional Settings	[1] North America	2 set-ups	FALSE	-	Uint8
K-04	Operating State at Power-up	[0] Resume	All set-ups	TRUE	-	Uint8
K-05	Local Mode Unit	[0] As Motor Speed Unit	2 set-ups	FALSE	-	Uint8
K-1#						
K-10	Active Set-up	[1] Set-up 1	1 set-up	TRUE	-	Uint8
K-11	Edit Set-up	[9] Active Set-up	All set-ups	TRUE	-	Uint8
K-12	This Set-up Linked to	[0] Not linked	All set-ups	FALSE	-	Uint8
K-13	Readout: Linked Set-ups	0	All set-ups	FALSE	0	Uint16
K-14	Readout: Edit Set-ups / Channel	0	All set-ups	TRUE	0	Int32
K-2#						
K-20	Display Line 1.1 Small	ExpressionLimit	All set-ups	TRUE	-	Uint16
K-21	Display Line 1.2 Small	ExpressionLimit	All set-ups	TRUE	-	Uint16
K-22	Display Line 1.3 Small	ExpressionLimit	All set-ups	TRUE	-	Uint16
K-23	Display Line 2 Large	ExpressionLimit	All set-ups	TRUE	-	Uint16
K-24	Display Line 3 Large	ExpressionLimit	All set-ups	TRUE	-	Uint16
K-25	Quick Start	ExpressionLimit	1 set-up	TRUE	0	Uint16
K-3#						
K-30	Unit for Custom Readout	[1] %	All set-ups	TRUE	-	Uint8
K-31	Min Value of Custom Readout	ExpressionLimit	All set-ups	TRUE	-2	Int32
K-32	Max Value of Custom Readout	100.00 CustomReadoutUnit	All set-ups	TRUE	-2	Int32
K-37	Display Text 1	0	1 set-up	TRUE	0	VisStr(25)
K-38	Display Text 2	0	1 set-up	TRUE	0	VisStr(25)
K-39	Display Text 3	0	1 set-up	TRUE	0	VisStr(25)
K-4#						
K-40	[Hand] Button on Keypad	[1] Enabled	All set-ups	TRUE	-	Uint8
K-41	[Off] Button on Keypad	[1] Enabled	All set-ups	TRUE	-	Uint8
K-42	[Auto] Button on Keypad	[1] Enabled	All set-ups	TRUE	-	Uint8
K-43	[Reset] Button on Keypad	[1] Enabled	All set-ups	TRUE	-	Uint8
K-44	[Off/Reset] Key on Keypad	[1] Enabled	All set-ups	TRUE	-	Uint8
K-45	[Drive Bypass] Key on Keypad	[1] Enabled	All set-ups	TRUE	-	Uint8
K-5#						
K-50	Keypad Copy	[0] No copy	All set-ups	FALSE	-	Uint8
K-51	Set-up Copy	[0] No copy	All set-ups	FALSE	-	Uint8
K-6#						
K-60	Main Menu Password	100	1 set-up	TRUE	0	Int16
K-61	Access to Main Menu w/o Password	[0] Full access	1 set-up	TRUE	-	Uint8
K-65	Quick Menu Password	200	1 set-up	TRUE	0	Int16
K-66	Access to Quick Menu w/o Password	[0] Full access	1 set-up	TRUE	-	Uint8



4.1.2 F-## Fundamental Parameters

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
F-0#						
F-01	Frequency Setting 1	null	All set-ups	TRUE	-	Unit8
F-02	Operation Method	[0] Linked to Hand / Auto	All set-ups	TRUE	-	Unit8
F-03	Max Output Frequency 1	132.0 Hz	All set-ups	FALSE	-1	Unit16
F-04	Base Frequency	ExpressionLimit	All set-ups	FALSE	0	Unit16
F-05	Motor Rated Voltage	ExpressionLimit	All set-ups	FALSE	0	Unit16
F-07	Accel Time 1	ExpressionLimit	All set-ups	TRUE	-2	Unit32
F-08	Decel Time 1	ExpressionLimit	All set-ups	TRUE	-2	Unit32
F-09	Torque Boost	100 %	All set-ups	TRUE	0	Unit16
F-1#						
F-10	Electronic Overload	[0] No protection	All set-ups	TRUE	-	Unit8
F-11	Motor External Fan	[0] No	All set-ups	TRUE	-	Unit16
F-12	Motor Thermistor Input	[0] None	All set-ups	TRUE	-	Unit8
F-15	Motor Speed High Limit [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Unit16
F-16	Motor Speed Low Limit [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Unit16
F-17	Motor Speed High Limit [RPM]	ExpressionLimit	All set-ups	TRUE	67	Unit16
F-18	Motor Speed Low Limit [RPM]	ExpressionLimit	All set-ups	TRUE	67	Unit16
F-2#						
F-22	Start Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Unit16
F-23	Start Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Unit16
F-24	Holding Time	0.0 s	All set-ups	TRUE	-1	Unit8
F-25	Start Function	[2] Coast/delay time	All set-ups	TRUE	-	Unit8
F-26	Motor Noise (Carrier Freq)	null	All set-ups	TRUE	-	Unit8
F-27	Motor Tone Random	[0] Off	All set-ups	TRUE	-	Unit8
F-29	Start Current	0.00 A	All set-ups	TRUE	-2	Unit32
F-3#						
F-37	Adv. Switching Pattern	[1] SFAVM	All set-ups	TRUE	-	Unit8
F-38	Overmodulation	[1] On	All set-ups	FALSE	-	Unit8
F-4#						
F-40	Torque Limiter (Driving)	ExpressionLimit	All set-ups	TRUE	-1	Unit16
F-41	Torque Limiter (Braking)	100.0 %	All set-ups	TRUE	-1	Unit16
F-43	Current Limit	ExpressionLimit	All set-ups	TRUE	-1	Unit32
F-5#						
F-50	Reference Range	null	All set-ups	TRUE	-	Unit8
F-51	Reference/Feedback Unit	null	All set-ups	TRUE	-	Unit8
F-52	Minimum Reference	0 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Unit32
F-53	Maximum Reference	ExpressionLimit	All set-ups	TRUE	-3	Unit32
F-54	Reference Function	[0] Sum	All set-ups	TRUE	-	Unit8
F-6#						
F-62	Catch up/slow Down Value	0.00 %	All set-ups	TRUE	-2	Unit16
F-64	Preset Relative Reference	0.00 %	All set-ups	TRUE	-2	Unit32
F-68	Relative Scaling Reference Resource	[0] No function	All set-ups	TRUE	-	Unit8
F-9#						
F-90	Step Size	0.10 %	All set-ups	TRUE	-2	Unit16
F-91	Accel/Decel Time	1.00 s	All set-ups	TRUE	-2	Unit32
F-92	Power Restore	[0] Off	All set-ups	TRUE	-	Unit8
F-93	Maximum Limit	100 %	All set-ups	TRUE	0	Unit16
F-94	Minimum Limit	-100 %	All set-ups	TRUE	0	Unit16
F-95	Accel/Decel Ramp Delay	ExpressionLimit	All set-ups	TRUE	-3	Unit16



4.1.3 E-## Digital In/Outs

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
E-0#	Digital I/O Mode	[0] PNP	All set-ups	FALSE	-	UInt8
E-01	Terminal 18 Digital Input	null	All set-ups	TRUE	-	UInt8
E-02	Terminal 19 Digital Input	null	All set-ups	TRUE	-	UInt8
E-03	Terminal 27 Digital Input	null	All set-ups	TRUE	-	UInt8
E-04	Terminal 29 Digital Input	null	All set-ups	TRUE	-	UInt8
E-05	Terminal 32 Digital Input	[0] No operation	All set-ups	TRUE	-	UInt8
E-06	Terminal 33 Digital Input	[0] No operation	All set-ups	TRUE	-	UInt8
E-07	Terminal 37 Safe Stop	[1] Safe Stop Alarm	1 set-up	TRUE	-	UInt8
E-1#						
E-10	Accel Time 2	ExpressionLimit	All set-ups	TRUE	-2	UInt32
E-11	Decel Time 2	ExpressionLimit	All set-ups	TRUE	-2	UInt32
E-12	Accel Time 3	ExpressionLimit	All set-ups	TRUE	-2	UInt32
E-13	Decel Time 3	ExpressionLimit	All set-ups	TRUE	-2	UInt32
E-14	Accel Time 4	ExpressionLimit	All set-ups	TRUE	-2	UInt32
E-15	Decel Time 4	ExpressionLimit	All set-ups	TRUE	-2	UInt32
E-2#						
E-20	Terminal 27 Digital Output	null	All set-ups	TRUE	-	UInt8
E-21	Terminal 29 Digital Output	null	All set-ups	TRUE	-	UInt8
E-24	Function Relay	null	All set-ups	TRUE	-	UInt8
E-26	On Delay, Relay	0.01 s	All set-ups	TRUE	-2	UInt16
E-27	Off Delay, Relay	0.01 s	All set-ups	TRUE	-2	UInt16
E-3#						
E-30	Terminal X46/1 Digital Input	[0] No operation	All set-ups	TRUE	-	UInt8
E-31	Terminal X46/3 Digital Input	[0] No operation	All set-ups	TRUE	-	UInt8
E-32	Terminal X46/5 Digital Input	[0] No operation	All set-ups	TRUE	-	UInt8
E-33	Terminal X46/7 Digital Input	[0] No operation	All set-ups	TRUE	-	UInt8
E-34	Terminal X46/9 Digital Input	[0] No operation	All set-ups	TRUE	-	UInt8
E-35	Terminal X46/11 Digital Input	[0] No operation	All set-ups	TRUE	-	UInt8
E-36	Terminal X46/13 Digital Input	[0] No operation	All set-ups	TRUE	-	UInt8
E-5#						
E-51	Terminal 27 Mode	[0] Input	All set-ups	TRUE	-	UInt8
E-52	Terminal 29 Mode	[0] Input	All set-ups	TRUE	-	UInt8
E-53	Terminal X30/2 Digital Input	[0] No operation	All set-ups	TRUE	-	UInt8
E-54	Terminal X30/3 Digital Input	[0] No operation	All set-ups	TRUE	-	UInt8
E-55	Terminal X30/4 Digital Input	[0] No operation	All set-ups	TRUE	-	UInt8
E-56	Term X30/6 Digi Out (OPCGPIO)	null	All set-ups	TRUE	-	UInt8
E-57	Term X30/7 Digi Out (OPCGPIO)	null	All set-ups	TRUE	-	UInt8
E-6#						
E-60	Term. 29 Low Frequency	100 Hz	All set-ups	TRUE	0	UInt32
E-61	Term. 29 High Frequency	100 Hz	All set-ups	TRUE	0	UInt32
E-62	Term. 29 Low Ref./Feedb. Value	0.000 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Int32
E-63	Term. 29 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
E-64	Pulse Filter Time Constant #29	100 ms	All set-ups	FALSE	-3	UInt16
E-65	Term. 33 Low Frequency	100 Hz	All set-ups	TRUE	0	UInt32
E-66	Term. 33 High Frequency	100 Hz	All set-ups	TRUE	0	UInt32
E-67	Term. 33 Low Ref./Feedb. Value	0.000 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Int32
E-68	Term. 33 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
E-69	Pulse Filter Time Constant #33	100 ms	All set-ups	FALSE	-3	UInt16



Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
E-7#						
E-70	Terminal 27 Pulse Output Variable	null	All set-ups	TRUE	-	Unit8
E-72	Pulse Output Max Freq #27	ExpressionLimit	All set-ups	TRUE	0	Unit32
E-73	Terminal 29 Pulse Output Variable	null	All set-ups	TRUE	-	Unit8
E-75	Pulse Output Max Freq #29	ExpressionLimit	All set-ups	TRUE	0	Unit32
E-76	Terminal X30/6 Pulse Output Variable	null	All set-ups	TRUE	-	Unit8
E-78	Pulse Output Max Freq #X30/6	ExpressionLimit	All set-ups	TRUE	0	Unit32
E-8#						
E-80	Term 32/33 Pulses Per Revolution	1024 N/A	All set-ups	FALSE	0	Unit16
E-81	Term 32/33 Encoder Direction	[0] Clockwise	All set-ups	FALSE	-	Unit8
E-9#						
E-90	Digital & Relay Bus Control	0 N/A	All set-ups	TRUE	0	Unit32
E-93	Pulse Out #27 Bus Control	0.00 %	All set-ups	TRUE	-2	N2
E-94	Pulse Out #27 Timeout Preset	0.00 %	1 set-up	TRUE	-2	Unit16
E-95	Pulse Out #29 Bus Control	0.00 %	All set-ups	TRUE	-2	N2
E-96	Pulse Out #29 Timeout Preset	0.00 %	1 set-up	TRUE	-2	Unit16



4.1.4 C-## Frequency Control Functions

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
C-0#						
C-01	Jump Frequency From [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Unt16
C-02	Jump Speed From [RPM]	ExpressionLimit	All set-ups	TRUE	67	Unt16
C-03	Jump Speed To [RPM]	ExpressionLimit	All set-ups	TRUE	67	Unt16
C-04	Jump Frequency To [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Unt16
C-05	Multi-step Frequency 1 - 8	0.00 %	All set-ups	TRUE	-2	Int16
C-2#						
C-20	Jog Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Unt16
C-21	Jog Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Unt16
C-22	Jog Accel/Decel Time	ExpressionLimit	All set-ups	TRUE	-2	Unt32
C-23	Quick Stop Decel Time	ExpressionLimit	2 set-ups	TRUE	-2	Unt32
C-3#						
C-30	Frequency Command 2	[20] Digital Potentiometer	All set-ups	TRUE	-	Unt8
C-34	Frequency Command 3	[0] No function	All set-ups	TRUE	-	Unt8



4.1.5 P-## Motor Data

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
P-0#						
P-01	Motor Poles	ExpressionLimit	All set-ups	FALSE	0	Uint8
P-02	Motor Power [HP]	ExpressionLimit	All set-ups	FALSE	-2	Uint32
P-03	Motor Current	ExpressionLimit	All set-ups	FALSE	-2	Uint32
P-04	Auto Tune	[0] Off	All set-ups	FALSE	-	Uint8
P-05	Motor Cont. Rated Torque	ExpressionLimit	All set-ups	FALSE	-1	Uint32
P-06	Base Speed	ExpressionLimit	All set-ups	FALSE	67	Uint16
P-07	Motor Power [kW]	ExpressionLimit	All set-ups	FALSE	1	Uint32
P-09	Slip Compensation	ExpressionLimit	All set-ups	TRUE	0	Int16
P-1#						
P-10	Slip Compensation Time Constant	ExpressionLimit	All set-ups	TRUE	-2	Uint16
P-2#						
P-20	Motor Construction	[0] Asynchron	All set-ups	FALSE	-	Uint8
P-3#						
P-30	Stator Resistance (Rs)	ExpressionLimit	All set-ups	FALSE	-4	Uint32
P-31	Rotor Resistance (Rr)	ExpressionLimit	All set-ups	FALSE	-4	Uint32
P-33	Stator Leakage Reactance (X1)	ExpressionLimit	All set-ups	FALSE	-4	Uint32
P-34	Rotor Leakage Reactance (X2)	ExpressionLimit	All set-ups	FALSE	-4	Uint32
P-35	Main Reactance (Xh)	ExpressionLimit	All set-ups	FALSE	-4	Uint32
P-36	Iron Loss Resistance (Rfe)	ExpressionLimit	All set-ups	FALSE	-3	Uint32
P-37	d-axis Inductance (Ld)	ExpressionLimit	All set-ups	FALSE	-6	Int32



4.1.6 H-## High Perf Parameters

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
H-0#	Restore Factory Settings	[0] Normal operation	All set-ups	TRUE	-	Unit8
H-03	Auto-Reset (Times)	[0] Manual reset	All set-ups	TRUE	-	Unit8
H-05	Auto-Reset (Reset Interval)	10 s	All set-ups	TRUE	0	Unit16
H-07	Accel/Decel Time 1 Type	[0] Linear	All set-ups	TRUE	-	Unit8
H-08	Reverse Lock	null	All set-ups	FALSE	-	Unit8
H-09	Start Mode	[0] Disabled	All set-ups	FALSE	-	Unit8
H-2#						
H-20	Motor Feedback Loss Function	[2] Trip	All set-ups	TRUE	-	Unit8
H-21	Motor Feedback Speed Error	300 RPM	All set-ups	TRUE	67	Unit16
H-22	Motor Feedback Loss Timeout	0.05 s	All set-ups	TRUE	-2	Unit16
H-4#						
H-40	Configuration Mode	null	All set-ups	TRUE	-	Unit8
H-41	Motor Control Principle	null	All set-ups	FALSE	-	Unit8
H-42	Flux Motor Feedback Source	[1] 24V encoder	All set-ups	FALSE	-	Unit8
H-43	Torque Characteristics	[0] Constant torque	All set-ups	TRUE	-	Unit8
H-44	Constant or Variable Torque OL	[0] High torque	All set-ups	FALSE	-	Unit8
H-45	Local Mode Configuration	[2] As mode par H-40	All set-ups	TRUE	-	Unit8
H-46	Back EMF at 1000 RPM	ExpressionLimit	All set-ups	FALSE	0	Unit16
H-47	Motor Angle Offset	0 N/A	All set-ups	FALSE	0	Unit16
H-5#						
H-50	Motor Magnetisation at Zero Speed	100 %	All set-ups	TRUE	0	Unit16
H-51	Min Speed Normal Magnetising [RPM]	ExpressionLimit	All set-ups	TRUE	67	Unit16
H-52	Min Speed Normal Magnetising [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Unit16
H-53	Model Shift Frequency	ExpressionLimit	All set-ups	FALSE	-1	Unit16
H-55	U/f Characteristic - U	ExpressionLimit	All set-ups	TRUE	-1	Unit16
H-56	U/f Characteristic - F	ExpressionLimit	All set-ups	TRUE	-1	Unit16
H-6#						
H-61	High Speed Load Compensation	100 %	All set-ups	TRUE	0	Unit16
H-64	Resonance Dampening	100 %	All set-ups	TRUE	0	Unit16
H-65	Resonance Dampening Time Constant	5 ms	All set-ups	TRUE	-3	Unit8
H-66	Min. Current at Low Speed	100 %	All set-ups	TRUE	0	Unit8
H-7#						
H-70	Warning Current Low	0.00 A	All set-ups	TRUE	-2	Unit32
H-71	Warning Current High	Imax Value	All set-up	TRUE	-2	Unit32
H-72	Warning Speed Low	0 RPM	All set-ups	TRUE	67	Unit16
H-73	Warning Speed High	outputSpeedHighLimit	All set-ups	TRUE	67	Unit16
H-74	Warning Reference Low	-999999.999 N/A	All set-ups	TRUE	-3	Unit32
H-75	Warning Reference High	999999.999 N/A	All set-ups	TRUE	-3	Unit32
H-76	Warning Feedback Low	-999999.999 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Unit32
H-77	Warning Feedback High	999999.999 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Unit32
H-78	Missing Motor Phase Function	null	All set-ups	TRUE	-	Unit8
H-8#						
H-80	Function at Stop	[0] Coast	All set-ups	TRUE	-	Unit8
H-81	Min Speed for Function at Stop [RPM]	ExpressionLimit	All set-ups	TRUE	67	Unit16
H-82	Min Speed for Function at Stop [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Unit16
H-83	Precise Stop Function	[0] Precise ramp stop	All set-ups	FALSE	-	Unit8
H-84	Precise Stop Counter Value	100000 N/A	All set-ups	TRUE	0	Unit32
H-85	Precise Stop Speed Compensation Delay	10 ms	All set-ups	TRUE	-3	Unit8
H-87	Load Type	[0] Passive load	All set-ups	TRUE	-	Unit8
H-88	Minimum Inertia	ExpressionLimit	All set-ups	FALSE	-4	Unit32
H-89	Maximum Inertia	ExpressionLimit	All set-ups	FALSE	-4	Unit32
H-9#						
H-95	KTY Sensor Type	[0] KTY Sensor 1	All set-ups	TRUE	-	Unit8
H-96	KTY Thermistor Input	[0] None	All set-ups	TRUE	-	Unit8
H-97	KTY Threshold level	80 °C	1 set-up	TRUE	100	Unit16



4.1.7 AN-## Analog In / Out

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
AN-0#						
AN-00	Live Zero Timeout Time	10 s	All set-ups	TRUE	0	Unit8
AN-01	Live Zero Timeout Function	[0] Off	All set-ups	TRUE	-	Unit8
AN-1#						
AN-10	Terminal 53 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
AN-11	Terminal 53 High Voltage	10.00 V	All set-ups	TRUE	-2	Int16
AN-12	Terminal 53 Low Current	4.00 mA	All set-ups	TRUE	-5	Int16
AN-13	Terminal 53 High Current	20.00 mA	All set-ups	TRUE	-5	Int16
AN-14	Terminal 53 Low Ref./Feedb. Value	0.000	All set-ups	TRUE	-3	Int32
AN-15	Terminal 53 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
AN-16	Terminal 53 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Unit16
AN-17	Terminal 53 Live Zero	[1] Enabled	All set-ups	TRUE	-	Unit8
AN-2#						
AN-20	Terminal 54 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
AN-21	Terminal 54 High Voltage	10.00 V	All set-ups	TRUE	-2	Int16
AN-22	Terminal 54 Low Current	4.00 mA	All set-ups	TRUE	-5	Int16
AN-23	Terminal 54 High Current	20.00 mA	All set-ups	TRUE	-5	Int16
AN-24	Terminal 54 Low Ref./Feedb. Value	0.000	All set-ups	TRUE	-3	Int32
AN-25	Terminal 54 High Ref./Feedb. Value	100.000	All set-ups	TRUE	-3	Int32
AN-26	Terminal 54 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Unit16
AN-27	Terminal 54 Live Zero	[1] Enabled	All set-ups	TRUE	-	Unit8
AN-3#						
AN-30	Terminal X30/11 Low Voltage (OPCGPIO)	0.07 V	All set-ups	TRUE	-2	Int16
AN-31	Terminal X30/11 High Voltage (OPCGPIO)	10.00 V	All set-ups	TRUE	-2	Int16
AN-34	Term. X30/11 Low Ref./Feedb. Value (OPCGPIO)	0.000	All set-ups	TRUE	-3	Int32
AN-35	Term. X30/11 High Ref./Feedb. Value (OPCGPIO)	100.000	All set-ups	TRUE	-3	Int32
AN-36	Term. X30/11 Filter Time Constant (OPCGPIO)	0.001 s	All set-ups	TRUE	-3	Unit16
AN-37	Term. X30/11 Live Zero (OPCGPIO)	[1] Enabled	All set-ups	TRUE	-	Unit8
AN-4#						
AN-40	Terminal X30/12 Low Voltage (OPCGPIO)	0.07 V	All set-ups	TRUE	-2	Int16
AN-41	Terminal X30/12 High Voltage (OPCGPIO)	10.00 V	All set-ups	TRUE	-2	Int16
AN-44	Term. X30/12 Low Ref./Feedb. Value (OPCGPIO)	0.000	All set-ups	TRUE	-3	Int32
AN-45	Term. X30/12 High Ref./Feedb. Value (OPCGPIO)	100.000	All set-ups	TRUE	-3	Int32
AN-46	Term. X30/12 Filter Time Constant (OPCGPIO)	0.001 s	All set-ups	TRUE	-3	Unit16
AN-47	Term. X30/12 Live Zero (OPCGPIO)	[1] Enabled	All set-ups	TRUE	-	Unit8
AN-5#						
AN-50	Terminal 42 Output	null	All set-ups	TRUE	-	Unit8
AN-51	Terminal 42 Output Min Scale	0.00 %	All set-ups	TRUE	-2	Int16
AN-52	Terminal 42 Output Max Scale	100.00 %	All set-ups	TRUE	-2	Int16
AN-53	Terminal 42 Output Bus Control	0.00 %	All set-ups	TRUE	-2	N2
AN-54	Terminal 42 Output Timeout Preset	0.00 %	1 set-up	TRUE	-2	Unit16
AN-6#						
AN-60	Terminal X30/8 Output (OPCGPIO)	[0] No operation	All set-ups	TRUE	-	Unit8
AN-61	Terminal X30/8 Min. Scale (OPCGPIO)	0.00 %	All set-ups	TRUE	-2	Int16
AN-62	Terminal X30/8 Max. Scale (OPCGPIO)	100.00 %	All set-ups	TRUE	-2	Int16
AN-63	Terminal X30/8 Output Bus Control (OPCGPIO)	0.00 %	All set-ups	TRUE	-2	N2
AN-64	Terminal X30/8 Output Timeout Preset (OPCGPIO)	0.00 %	1 set-up	TRUE	-2	Unit16



4.1.8 SP-## Special Functions

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
SP-1#						
SP-10	Line failure	[0] No function	All set-ups	FALSE	-	Uint8
SP-11	Line Voltage at Input Fault	Expression Limit	All set-ups	TRUE	0	Uint16
SP-12	Function at Line Imbalance	[0] Trip	All set-ups	TRUE	-	Uint8
SP-2#						
SP-23	Typecode Setting	null	2 set-ups	FALSE	-	Uint8
SP-24	Trip Delay at Current Limit	60 s	All set-ups	TRUE	0	Uint8
SP-25	Trip Delay at Torque Limit	60 s	All set-ups	TRUE	0	Uint8
SP-26	Trip Delay at Drive Fault	Expression Limit	All set-ups	TRUE	0	Uint8
SP-28	Production Settings	[0] No action	All set-ups	TRUE	-	Uint8
SP-3#						
SP-30	Current Lim Contr. Proportional Gain	100 %	All set-ups	FALSE	0	Uint16
SP-31	Current Lim Contr. Integration Time	0.020 s	All set-ups	FALSE	-3	Uint16
SP-4#						
SP-40	VT Level	66 %	All set-ups	FALSE	0	Uint8
SP-41	Energy Savings Min. Magnetisation	Expression Limit	All set-ups	TRUE	0	Uint8
SP-42	Energy Savings Min. Frequency	10 Hz	All set-ups	TRUE	0	Uint8
SP-43	Motor Cosphi	Expression Limit	All set-ups	TRUE	-2	Uint16
SP-5#						
SP-50	RFI Filter	[1] On	1 set-up	FALSE	-	Uint8
SP-52	Fan Operation	[0] Auto	All set-ups	TRUE	-	Uint8
SP-53	Fan Monitor	[1] Warning	All set-ups	TRUE	-	Uint8
SP-56	Capacitance Output Filter	2.0 uF	1 set-up	FALSE	-7	Uint16
SP-57	Inductance Output Filter	7.000 mH	1 set-up	FALSE	-6	Uint16
SP-59	Actual Number of Inverter Units	Expression Limit	1 set-up	FALSE	0	Uint8
SP-6#						
SP-63	Option Supplied by External 24VDC	[1] Yes	2 set-ups	FALSE	-	Uint8
SP-7#						
SP-71	Accel Time 1 S-ramp Ratio at Accel. Start	50 %	All set-ups	TRUE	0	Uint8
SP-72	Accel Time 1 S-ramp Ratio at Accel. End	50 %	All set-ups	TRUE	0	Uint8
SP-73	Decel Time 1 S-ramp Ratio at Decel. Start	50 %	All set-ups	TRUE	0	Uint8
SP-74	Decel Time 1 S-ramp Ratio at Decel. End	50 %	All set-ups	TRUE	0	Uint8
SP-76	Accel/Decel Time 2 Type	[0] Linear	All set-ups	TRUE	-	Uint8
SP-79	Accel Time 2 S-ramp Ratio at Accel. Start	50 %	All set-ups	TRUE	0	Uint8
SP-8#						
SP-80	Accel Time 2 S-ramp Ratio at Accel. End	50 %	All set-ups	TRUE	0	Uint8
SP-81	Decel Time 2 S-ramp Ratio at Decel. Start	50 %	All set-ups	TRUE	0	Uint8
SP-82	Decel Time 2 S-ramp Ratio at Decel. End	50 %	All set-ups	TRUE	0	Uint8
SP-84	Accel/Decel Ramp 3 Type	[0] Linear	All set-ups	TRUE	-	Uint8
SP-87	Accel Time 3 S-ramp Ratio at Accel. Start	50 %	All set-ups	TRUE	0	Uint8
SP-88	Accel Time 3 S-ramp Ratio at Accel. End	50 %	All set-ups	TRUE	0	Uint8
SP-89	Decel Time 3 S-ramp Ratio at Decel. Start	50 %	All set-ups	TRUE	0	Uint8
SP-9#						
SP-90	Decel Time 3 S-ramp Ratio at Decel. End	50 %	All set-ups	TRUE	0	Uint8
SP-92	Accel/Decel Ramp 4 Type	[0] Linear	All set-ups	TRUE	-	Uint8
SP-95	Accel Time 4 S-ramp Ratio at Accel. Start	50 %	All set-ups	TRUE	0	Uint8
SP-96	Accel Time 4 S-ramp Ratio at Accel. End	50 %	All set-ups	TRUE	0	Uint8
SP-97	Decel Time 4 S-ramp Ratio at Decel. Start	50 %	All set-ups	TRUE	0	Uint8
SP-98	Decel Time 4 S-ramp Ratio at Decel. End	50 %	All set-ups	TRUE	0	Uint8



4.1.9 O-## Options/Comms

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
O-0#						
O-01	Control Site	null	All set-ups	TRUE	-	Uint8
O-02	Control Word Source	null	All set-ups	TRUE	-	Uint8
O-03	Control Word Timeout Time	ExpressionLimit	1 set-up	TRUE	-1	Uint32
O-04	Control Word Timeout Function	[0] Off	1 set-up	TRUE	-	Uint8
O-05	End-of-Timeout Function	[1] Resume set-up	1 set-up	TRUE	-	Uint8
O-06	Reset Control Word Timeout	[0] Do not reset	All set-ups	TRUE	-	Uint8
O-07	Diagnosis Trigger	[0] Disable	2 set-ups	TRUE	-	Uint8
O-1#						
O-10	Control Word Profile	[0] Drive Profile	All set-ups	TRUE	-	Uint8
O-13	Configurable Status Word STW	[1] Profile Default	All set-ups	TRUE	-	Uint8
O-3#						
O-30	Protocol	null	1 set-up	TRUE	-	Uint8
O-31	Address	ExpressionLimit	1 set-up	TRUE	0	Uint8
O-32	Drive Port Baud Rate	null	1 set-up	TRUE	-	Uint8
O-33	Drive Port Parity	null	1 set-up	TRUE	-	Uint8
O-35	Minimum Response Delay	ExpressionLimit	1 set-up	TRUE	-3	Uint16
O-36	Maximum Response Delay	ExpressionLimit	1 set-up	TRUE	-3	Uint16
O-37	Maximum Inter-Char Delay	ExpressionLimit	1 set-up	TRUE	-5	Uint16
O-4#						
O-40	Telegram Selection	[1] Standard telegram 1	2 set-ups	TRUE	-	Uint8
O-5#						
O-50	Coasting Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
O-52	DC Brake Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
O-53	Start Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
O-54	Reversing Select	null	All set-ups	TRUE	-	Uint8
O-55	Set-up Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
O-56	Preset Reference Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
O-8#						
O-80	Bus Message Count	0	All set-ups	TRUE	0	Uint32
O-81	Bus Error Count	0	All set-ups	TRUE	0	Uint32
O-82	Slave Messages Rcvd	0	All set-ups	TRUE	0	Uint32
O-83	Slave Error Count	0	All set-ups	TRUE	0	Uint32
O-89	Diagnostics Count	0	1 set-up	TRUE	0	Int32
O-9#						
O-90	Bus Jog 1 Speed	100 RPM	All set-ups	TRUE	67	Uint16
O-91	Bus Jog 2 Speed	200 RPM	All set-ups	TRUE	67	Uint16
O-94	Bus Feedback 1	0	1 set-up	TRUE	0	N2
O-95	Bus Feedback 2	0	1 set-up	TRUE	0	N2
O-96	Bus Feedback 3	0	1 set-up	TRUE	0	N2



4.1.1.10 DN-## DeviceNet

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
DN-0#						
DN-00	DeviceNet Protocol	null	2 set-ups	FALSE	-	Uint8
DN-01	Baud Rate Select	null	2 set-ups	TRUE	-	Uint8
DN-02	MAC ID	Expression Limit	2 set-ups	TRUE	0	Uint8
DN-05	Readout Transmit Error Counter	0	All set-ups	TRUE	0	Uint8
DN-06	Readout Receive Error Counter	0	All set-ups	TRUE	0	Uint8
DN-07	Readout Bus Off Counter	0	All set-ups	TRUE	0	Uint8
DN-1#						
DN-10	Process Data Type Selection	null	All set-ups	TRUE	-	Uint8
DN-11	Process Data Config Write	Expression Limit	2 set-ups	TRUE	-	Uint16
DN-12	Process Data Config Read	Expression Limit	2 set-ups	TRUE	-	Uint16
DN-13	Warning Parameter	0	All set-ups	TRUE	0	Uint16
DN-14	Net Reference	[0] Off	2 set-ups	TRUE	-	Uint8
DN-15	Net Control	[0] Off	2 set-ups	TRUE	-	Uint8
DN-2#						
DN-20	COS Filter 1	0	All set-ups	FALSE	0	Uint16
DN-21	COS Filter 2	0	All set-ups	FALSE	0	Uint16
DN-22	COS Filter 3	0	All set-ups	FALSE	0	Uint16
DN-23	COS Filter 4	0	All set-ups	FALSE	0	Uint16
DN-3#						
DN-30	Array Index	0	2 set-ups	TRUE	0	Uint8
DN-31	Store Data Values	[0] Off	All set-ups	TRUE	-	Uint8
DN-32	DeviceNet Revision	Expression Limit	All set-ups	TRUE	0	Uint16
DN-33	Store Always	[0] Off	1 set-up	TRUE	-	Uint8
DN-34	DeviceNet Product Code	210	1 set-up	TRUE	0	Uint16
DN-39	DeviceNet F Parameters	0	All set-ups	TRUE	0	Uint32



4.1.11 PB-## Profibus

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
PB-0#						
PB-00	Setpoint	0	All set-ups	TRUE	0	Uint16
PB-07	Actual Value	0	All set-ups	FALSE	0	Uint16
PB-1#						
PB-15	PCD Write Configuration	ExpressionLimit	2 set-ups	TRUE	-	Uint16
PB-16	PCD Read Configuration	ExpressionLimit	2 set-ups	TRUE	-	Uint16
PB-18	Node Address	126	1 set-up	TRUE	0	Uint8
PB-2#						
PB-22	Telegram Selection	[108] PPO 8	1 set-up	TRUE	-	Uint8
PB-23	Parameters for Signals	0	All set-ups	TRUE	-	Uint16
PB-27	Parameter Edit	[1] Enabled	2 set-ups	FALSE	-	Uint16
PB-28	Process Control	[1] Enable cyclic master	2 set-ups	FALSE	-	Uint8
PB-4#						
PB-44	Fault Message Counter	0	All set-ups	TRUE	0	Uint16
PB-45	Fault Code	0	All set-ups	TRUE	0	Uint16
PB-47	Fault Number	0	All set-ups	TRUE	0	Uint16
PB-5#						
PB-52	Fault Situation Counter	0	All set-ups	TRUE	0	Uint16
PB-53	Profibus Warning Word	0	All set-ups	TRUE	0	V2
PB-6#						
PB-63	Actual Baud Rate	[255] No baudrate found	All set-ups	TRUE	-	Uint8
PB-64	Device Identification	0	All set-ups	TRUE	0	Uint16
PB-65	Profile Number	0	All set-ups	TRUE	0	OctStr[2]
PB-67	Control Word 1	0	All set-ups	TRUE	0	V2
PB-68	Status Word 1	0	All set-ups	TRUE	0	V2
PB-7#						
PB-71	Profibus Save Data Values	[0] Off	All set-ups	TRUE	-	Uint8
PB-72	ProfibusDriveReset	[0] No action	1 set-up	FALSE	-	Uint8
PB-8#						
PB-80	Defined Parameters (1)	0	All set-ups	FALSE	0	Uint16
PB-81	Defined Parameters (2)	0	All set-ups	FALSE	0	Uint16
PB-82	Defined Parameters (3)	0	All set-ups	FALSE	0	Uint16
PB-83	Defined Parameters (4)	0	All set-ups	FALSE	0	Uint16
PB-84	Defined Parameters (5)	0	All set-ups	FALSE	0	Uint16
PB-9#						
PB-90	Changed Parameters (1)	0	All set-ups	FALSE	0	Uint16
PB-91	Changed Parameters (2)	0	All set-ups	FALSE	0	Uint16
PB-92	Changed Parameters (3)	0	All set-ups	FALSE	0	Uint16
PB-93	Changed Parameters (4)	0	All set-ups	FALSE	0	Uint16
PB-94	Changed Parameters (5)	0	All set-ups	FALSE	0	Uint16



4.1.12 ID-## Drive Information

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
ID-0#						
ID-00	Operating Hours	0 h	All set-ups	FALSE	74	Uint32
ID-01	Running Hours	0 h	All set-ups	FALSE	74	Uint32
ID-02	kWh Counter	0 kWh	All set-ups	FALSE	75	Uint32
ID-03	Power Up's	0	All set-ups	FALSE	0	Uint32
ID-04	Over Temp's	0	All set-ups	FALSE	0	Uint16
ID-05	Over Volt's	0	All set-ups	FALSE	0	Uint16
ID-06	Reset kWh Counter	[0] Do not reset	All set-ups	TRUE	-	Uint8
ID-07	Reset Running Hours Counter	[0] Do not reset	All set-ups	TRUE	-	Uint8
ID-08	Number of Starts	0	All set-ups	FALSE	0	Uint32
ID-1#						
ID-10	Trending Source	0	2 set-ups	TRUE	-	Uint16
ID-11	Trending Interval	Expression Limit	2 set-ups	TRUE	-3	TimD
ID-12	Trigger Event	[0] False	1 set-up	TRUE	-	Uint8
ID-13	Trending Mode	[0] Trend always	2 set-ups	TRUE	-	Uint8
ID-14	Samples Before Trigger	50	2 set-ups	TRUE	0	Uint8
ID-2#						
ID-20	Historic Log: Event	0	All set-ups	FALSE	0	Uint8
ID-21	Historic Log: Value	0	All set-ups	FALSE	0	Uint32
ID-22	Historic Log: Time	0 ms	All set-ups	FALSE	-3	Uint32
ID-3#						
ID-30	Alarm Log: Error Code	0	All set-ups	FALSE	0	Uint8
ID-31	Alarm Log: Value	0	All set-ups	FALSE	0	Int16
ID-32	Alarm Log: Time	0 s	All set-ups	FALSE	0	Uint32
ID-4#						
ID-40	Drive Type	0	All set-ups	FALSE	0	VisStr[6]
ID-41	Power Section	0	All set-ups	FALSE	0	VisStr[20]
ID-42	Voltage	0	All set-ups	FALSE	0	VisStr[20]
ID-43	Software Version	0	All set-ups	FALSE	0	VisStr[15]
ID-46	GE Product No.	0	All set-ups	FALSE	0	VisStr[8]
ID-47	GE Power Card Model No	0	All set-ups	FALSE	0	VisStr[8]
ID-48	Keypad ID Number	0	All set-ups	FALSE	0	VisStr[20]
ID-49	SW ID Control Card	0	All set-ups	FALSE	0	VisStr[20]
ID-5#						
ID-50	SW ID Power Card	0	All set-ups	FALSE	0	VisStr[20]
ID-51	Drive Serial Number	0	All set-ups	FALSE	0	VisStr[10]
ID-53	Power Card Serial Number	0	All set-ups	FALSE	0	VisStr[19]
ID-6#						
ID-60	Option Mounted	0	All set-ups	FALSE	0	VisStr[30]
ID-61	Option SW Version	0	All set-ups	FALSE	0	VisStr[20]
ID-62	Option Ordering No	0	All set-ups	FALSE	0	VisStr[8]
ID-63	Option Serial No	0	All set-ups	FALSE	0	VisStr[18]
ID-9#						
ID-92	Defined Parameters	0	All set-ups	FALSE	0	Uint16
ID-93	Modified Parameters	0	All set-ups	FALSE	0	Uint16
ID-99	Parameter Metadata	0	All set-ups	FALSE	0	Uint16



4.1.13 DR-## Data Readouts

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
DR-0#						
DR-00	Control Word	0 N/A	All set-ups	FALSE	0	V2
DR-01	Reference [Unit]	0.000 ReferenceFeedbackUnit	All set-ups	FALSE	-3	Int32
DR-02	Reference %	0.0 %	All set-ups	FALSE	-1	Int16
DR-03	Status Word	0 N/A	All set-ups	FALSE	0	V2
DR-05	Main Actual Value [%]	0.00 %	All set-ups	FALSE	-2	N2
DR-09	Custom Readout	0.00 CustomReadoutUnit	All set-ups	FALSE	-2	Int32
DR-1#						
DR-10	Power [kW]	0.00 kW	All set-ups	FALSE	1	Int32
DR-11	Power [hp]	0.00 hp	All set-ups	FALSE	-2	Int32
DR-12	Motor Rated Voltage	0.0 V	All set-ups	FALSE	-1	Unit16
DR-13	Frequency	0.0 Hz	All set-ups	FALSE	-1	Unit16
DR-14	Motor Current	0.00 A	All set-ups	FALSE	-2	Int32
DR-15	Frequency [%]	0.00 %	All set-ups	FALSE	-2	N2
DR-16	Torque [Nm]	0.0 Nm	All set-ups	FALSE	-1	Int16
DR-17	Speed [RPM]	0 RPM	All set-ups	FALSE	67	Int32
DR-19	KTY sensor temperature	0 °C	All set-ups	FALSE	100	Int16
DR-2#						
DR-20	Motor Angle	0 N/A	All set-ups	TRUE	0	Unit16
DR-22	Torque [%]	0 %	All set-ups	FALSE	0	Int16
DR-25	Torque [Nm] High	0.0 Nm	All set-ups	FALSE	-1	Int32
DR-3#						
DR-30	DC Link Voltage	0 V	All set-ups	FALSE	0	Unit16
DR-32	Brake Energy /s	0.000 kW	All set-ups	FALSE	0	Unit32
DR-34	Heatsink Temp.	0 °C	All set-ups	FALSE	100	Unit8
DR-35	Drive Thermal	0 %	All set-ups	FALSE	0	Unit8
DR-36	Drive Nominal Current	Expression Limit	All set-ups	FALSE	-2	Unit32
DR-37	Drive Max. Current	Expression Limit	All set-ups	FALSE	-2	Unit32
DR-38	Logic Controller State	0 N/A	All set-ups	FALSE	0	Unit8
DR-39	Control Card Temp.	0 °C	All set-ups	FALSE	100	Unit8
DR-4#						
DR-40	Trending Buffer Full	[0] No	All set-ups	TRUE	-	Unit8
DR-5#						
DR-50	External Reference	0.0 N/A	All set-ups	FALSE	-1	Int16
DR-51	Pulse Reference	0.0 N/A	All set-ups	FALSE	-1	Int16
DR-52	Feedback [Unit]	0.000 ReferenceFeedbackUnit	All set-ups	FALSE	-3	Int32
DR-53	Digi Pot Reference	0.00 N/A	All set-ups	FALSE	-2	Int16
DR-6#						
DR-60	Digital Input	0 N/A	All set-ups	FALSE	0	Unit16
DR-61	Terminal 53 Switch Setting	[0] Current	All set-ups	FALSE	-	Unit8
DR-62	Analog Input 53	0.000 N/A	All set-ups	FALSE	-3	Int32
DR-63	Terminal 54 Switch Setting	[0] Current	All set-ups	FALSE	-	Unit8
DR-64	Analog Input 54	0.000 N/A	All set-ups	FALSE	-3	Int32
DR-65	Analog Output 42 [mA]	0.000 N/A	All set-ups	FALSE	-3	Int16
DR-66	Digital Output [bin]	0 N/A	All set-ups	FALSE	0	Int16
DR-67	Freq. Input #29 [Hz]	0 N/A	All set-ups	FALSE	0	Int32
DR-68	Freq. Input #33 [Hz]	0 N/A	All set-ups	FALSE	0	Int32
DR-69	Pulse Output #27 [Hz]	0 N/A	All set-ups	FALSE	0	Int32



Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
DR-7#						
DR-70	Pulse Output #29 [Hz]	0 N/A	All set-ups	FALSE	0	Int32
DR-71	Relay Output [bin]	0 N/A	All set-ups	FALSE	0	Int16
DR-72	Counter A	0 N/A	All set-ups	TRUE	0	Int32
DR-73	Counter B	0 N/A	All set-ups	TRUE	0	Int32
DR-74	Prec. Stop Counter	0 N/A	All set-ups	TRUE	0	Int32
DR-75	Analog In X30/I1	0.000 N/A	All set-ups	FALSE	-3	Int32
DR-76	Analog In X30/I2	0.000 N/A	All set-ups	FALSE	-3	Int32
DR-77	Analog Out X30/O8 [mA]	0.000 N/A	All set-ups	FALSE	-3	Int16
DR-78	Analog Out X45/O1 [mA]	0.000 N/A	All set-ups	FALSE	-3	Int16
DR-79	Analog Out X45/O3 [mA]	0.000 N/A	All set-ups	FALSE	-3	Int16
DR-8#						
DR-80	Fieldbus CTW 1	0 N/A	All set-ups	FALSE	0	V2
DR-82	Fieldbus REF 1	0 N/A	All set-ups	FALSE	0	N2
DR-84	Comm. Option STW	0 N/A	All set-ups	FALSE	0	V2
DR-85	Drive Port CTW 1	0 N/A	All set-ups	FALSE	0	V2
DR-86	Drive Port REF 1	0 N/A	All set-ups	FALSE	0	N2
DR-9#						
DR-90	Alarm Word	0 N/A	All set-ups	FALSE	0	Int32
DR-91	Alarm Word 2	0 N/A	All set-ups	FALSE	0	Int32
DR-92	Warning Word	0 N/A	All set-ups	FALSE	0	Int32
DR-93	Warning Word 2	0 N/A	All set-ups	FALSE	0	Int32
DR-94	Ext. Status Word	0 N/A	All set-ups	FALSE	0	Int32



4.1.14 LC-## Logic Controller

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
LC-0#						
LC-00	Logic Controller Mode	null	2 set-ups	TRUE	-	UInt8
LC-01	Start Event	null	2 set-ups	TRUE	-	UInt8
LC-02	Stop Event	null	2 set-ups	TRUE	-	UInt8
LC-03	Reset Logic Controller	[0] Do not reset Logic Controller	All set-ups	TRUE	-	UInt8
LC-1#						
LC-10	Comparator Operand	null	2 set-ups	TRUE	-	UInt8
LC-11	Comparator Operator	null	2 set-ups	TRUE	-	UInt8
LC-12	Comparator Value	ExpressionLimit	2 set-ups	TRUE	-3	Int32
LC-2#						
LC-20	Logic Controller Timer	ExpressionLimit	1 set-up	TRUE	-3	TimD
LC-4#						
LC-40	Logic Rule Boolean 1	null	2 set-ups	TRUE	-	UInt8
LC-41	Logic Rule Operator 1	null	2 set-ups	TRUE	-	UInt8
LC-42	Logic Rule Boolean 2	null	2 set-ups	TRUE	-	UInt8
LC-43	Logic Rule Operator 2	null	2 set-ups	TRUE	-	UInt8
LC-44	Logic Rule Boolean 3	null	2 set-ups	TRUE	-	UInt8
LC-5#						
LC-51	Logic Controller Event	null	2 set-ups	TRUE	-	UInt8
LC-52	Logic Controller Action	null	2 set-ups	TRUE	-	UInt8



4.1.15 B-## Braking Functions

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
B-0#						
B-00	DC Hold Current	50 %	All set-ups	TRUE	0	Uint8
B-01	DC Brake Current	50 %	All set-ups	TRUE	0	Uint16
B-02	DC Braking Time	10.0 s	All set-ups	TRUE	-1	Uint16
B-03	DC Brake Cut In Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
B-04	DC Brake Cut In Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
B-1#						
B-10	Brake Function	null	All set-ups	TRUE	-	Uint8
B-11	Brake Resistor (ohm)	ExpressionLimit	All set-ups	TRUE	-2	Uint32
B-12	Brake Power Limit (kW)	ExpressionLimit	All set-ups	TRUE	0	Uint32
B-13	Braking Thermal Overload	[0] Off	All set-ups	TRUE	-	Uint8
B-15	Brake Check	[0] Off	All set-ups	TRUE	-	Uint8
B-16	AC brake Max. Current	100.0 %	All set-ups	TRUE	-1	Uint32
B-17	Over-voltage Control	[0] Disabled	All set-ups	TRUE	-	Uint8
B-2#						
B-20	Release Brake Current	Imax	All set-ups	TRUE	-2	Uint32
B-21	Activate Brake Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
B-22	Activate Brake Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
B-23	Activate Brake Delay	0.0 s	All set-ups	TRUE	-1	Uint8
B-24	Stop Delay	0.0 s	All set-ups	TRUE	-1	Uint8
B-25	Brake Release Time	0.20 s	All set-ups	TRUE	-2	Uint16
B-26	Torque Ref	0.00 %	All set-ups	TRUE	-2	Int16
B-27	Torque Ramp Time	0.2 s	All set-ups	TRUE	-1	Uint8
B-28	Gain Boost Factor	1.00 N/A	All set-ups	TRUE	-2	Uint16



4.1.16 PI-## PID Controls

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
PI-0#						
PI-00	Speed PID Feedback Source	null	All set-ups	FALSE	-	Uint8
PI-02	Speed PID Proportional Gain	ExpressionLimit	All set-ups	TRUE	-4	Uint32
PI-03	Speed PID Integral Time	ExpressionLimit	All set-ups	TRUE	-4	Uint32
PI-04	Speed PID Differentiation Time	ExpressionLimit	All set-ups	TRUE	-4	Uint16
PI-05	Speed PID Diff. Gain Limit	5.0	All set-ups	TRUE	-1	Uint16
PI-06	Speed PID Lowpass Filter Time	10.0 ms	All set-ups	TRUE	-4	Uint16
PI-07	Speed PID Feedback Gear Ratio	1.0000	All set-ups	FALSE	-4	Uint32
PI-08	Speed PID Feed Forward Factor	0 %	All set-ups	FALSE	0	Uint16
PI-1#						
PI-12	Torque PI Proportional Gain	100 %	All set-ups	TRUE	0	Uint16
PI-13	Torque PI Integration Time	0.020 s	All set-ups	TRUE	-3	Uint16
PI-2#						
PI-20	Process CL Feedback 1 Resource	[0] No function	All set-ups	TRUE	-	Uint8
PI-22	Process CL Feedback 2 Resource	[0] No function	All set-ups	TRUE	-	Uint8
PI-3#						
PI-30	Process PID Normal/ Inverse Control	[0] Normal	All set-ups	TRUE	-	Uint8
PI-31	Process PID Anti Windup	[1] On	All set-ups	TRUE	-	Uint8
PI-32	Process PID Start Speed	0 RPM	All set-ups	TRUE	67	Uint16
PI-33	Process PID Proportional Gain	0.01	All set-ups	TRUE	-2	Uint16
PI-34	Process PID Integral Time	10000.00 s	All set-ups	TRUE	-2	Uint32
PI-35	Process PID Differentiation Time	0.00 s	All set-ups	TRUE	-2	Uint16
PI-36	Process PID Diff. Gain Limit	5.0	All set-ups	TRUE	-1	Uint16
PI-38	Process PID Feed Forward Factor	0 %	All set-ups	TRUE	0	Uint16
PI-39	On Reference Bandwidth	5 %	All set-ups	TRUE	0	Uint8



4.1.1.17 EC-## Feedback Option

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
EC-1#						
EC-10	Signal Type	[1] RS422 (5V TTL)	All set-ups	FALSE	-	Unit8
EC-11	Resolution (PPR)	1024	All set-ups	FALSE	0	Unit16
EC-2#						
EC-20	Protocol Selection	[0] None	All set-ups	FALSE	-	Unit8
EC-21	Resolution (Positions/Rev)	ExpressionLimit	All set-ups	FALSE	0	Unit32
EC-24	SSI Data Length	13	All set-ups	FALSE	0	Unit8
EC-25	Clock Rate	ExpressionLimit	All set-ups	FALSE	3	Unit16
EC-26	SSI Data Format	[0] Gray code	All set-ups	FALSE	-	Unit8
EC-34	HIPERFACE Baudrate	[4] 9600	All set-ups	FALSE	-	Unit8
EC-6#						
EC-60	Feedback Direction	[0] Clockwise	All set-ups	FALSE	-	Unit8
EC-61	Feedback Signal Monitoring	[1] Warning	All set-ups	TRUE	-	Unit8



4.1.18 RS-## Resolver Interface

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
RS-5#						
RS-50	Poles	2	1 set-up	FALSE	0	Uint8
RS-51	Input Voltage	7.0 V	1 set-up	FALSE	-1	Uint8
RS-52	Input Frequency	10.0 kHz	1 set-up	FALSE	2	Uint8
RS-53	Transformation Ratio	0.5	1 set-up	FALSE	-1	Uint8
RS-59	Resolver Interface	[0] Disabled	All set-ups	FALSE	-	Uint8





5 Troubleshooting

5.1.1 Warnings/Alarm Messages

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 motor may still be continued. Warning messages may be critical, but are not necessarily so.

In the event of an alarm, the frequency converter will have tripped. Alarms must be reset to restart operation once their cause has been rectified.

This may be done in three ways:

1. By using the [RESET] control button on the Keypad control panel.
2. Via a digital input with the "Reset" function.
3. Via serial communication/optional network.

NB!

After a manual reset using the [RESET] button on the Keypad, the [AUTO] button must be pressed to restart the motor.

If an alarm cannot be reset, the reason may be that its cause has not been rectified, or the alarm is trip-locked (see also table on following page).

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 par. H-04 *Auto-Reset (Times)* (Warning: automatic wake-up is possible!)

If a warning and alarm is marked against a code in the table on the following page, this means that either a warning occurs before an alarm, or else that you can specify whether it is a warning or an alarm that is to be displayed for a given fault.

This is possible, for instance, in par. F-10 *Electronic Overload*. After an alarm or trip, the motor carries on coasting, and the alarm and warning flash. Once the problem has been rectified, only the alarm continues flashing until the frequency converter is reset.



No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
1	10 Volts low	X			
2	Live zero error	(X)	(X)		par. AN-01 Live Zero Time-out Function
3	No motor	(X)			par. H-80 Function at Stop
4	Mains phase loss	(X)	(X)	(X)	par. SP-12 Function at Line Imbalance
5	DC link voltage high	X			
6	DC link voltage low	X			
7	DC over-voltage	X	X		
8	DC under voltage	X	X		
9	Inverter overloaded	X	X		
10	Motor Electronic OL over temperature	(X)	(X)		par. F-10 Electronic Overload
11	Motor thermistor over temperature	(X)	(X)		par. F-10 Electronic Overload
12	Torque limit	X	X		
13	Over Current	X	X	X	
14	Earth Fault	X	X	X	
15	Hardware mismatch		X	X	
16	Short Circuit		X	X	
17	Control word time-out	(X)	(X)		par. O-04 Control Word Timeout Function
22	Hoist Mech. Brake				
23	Internal Fan Fault	X			
24	External Fan Fault	X			par. SP-53 Fan Monitor
25	Brake resistor short-circuited	X			
26	Brake resistor power limit	(X)	(X)		par. B-13 Braking Thermal Overload
27	Brake chopper short-circuited	X	X		
28	Brake check	(X)	(X)		par. B-15 Brake Check
29	Heatsink temp	X	X	X	
30	Motor phase U missing	(X)	(X)	(X)	par. H-78 Missing Motor Phase Function
31	Motor phase V missing	(X)	(X)	(X)	par. H-78 Missing Motor Phase Function
32	Motor phase W missing	(X)	(X)	(X)	par. H-78 Missing Motor Phase Function
33	Inrush Fault		X	X	
34	Network communication fault	X	X		
36	Mains failure	X	X		
38	Internal Fault		X	X	
39	Heatsink sensor		X	X	
40	Overload of Digital Output Terminal 27	(X)			par. E-00 Digital I/O Mode, par. E-51 Terminal 27 Mode
41	Overload of Digital Output Terminal 29	(X)			par. E-00 Digital I/O Mode, par. E-52 Terminal 29 Mode
42	Overload of Digital Output On X30/6 (OPCGPIO)	(X)			par. E-56 Term X30/6 Digi Out (OPCGPIO)
42	Overload of Digital Output On X30/7 (OPCGPIO)	(X)			par. E-57 Term X30/7 Digi Out (OPCGPIO)
46	Pwr. card supply		X	X	
47	24 V supply low	X	X	X	
48	1.8 V supply low		X	X	
49	Speed limit	X			
50	Auto Tune calibration failed		X		
51	Auto Tune check U_{nom} and I_{nom}		X		
52	Auto Tune low I_{nom}		X		
53	Auto Tune motor too big		X		

Table 5.1: Alarm/Warning code list



No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
54	Auto Tune motor too small		X		
55	Auto Tune parameter out of range		X		
56	Auto Tune interrupted by user		X		
57	Auto Tune time-out		X		
58	Auto Tune internal fault	X	X		
59	Current limit	X			
61	Tracking Error	(X)	(X)		par. H-20 Motor Feedback Loss Function
62	Output Frequency at Maximum Limit	X			
63	Mechanical Brake Low		(X)		par. B-20 Release Brake Current
64	Voltage Limit	X			
65	Control Board Over-temperature	X	X	X	
66	Heat sink Temperature Low	X			
67	Option Module Configuration has Changed		X		
68	Safe Stop	(X)	(X) ¹⁾		par. E-07 Terminal 37 Safe Stop
69	Pwr. Card Temp		X	X	
70	Illegal Drive configuration			X	
71	Safe Stop	X	X ¹⁾		par. E-07 Terminal 37 Safe Stop
72	Dangerous Failure			X ¹⁾	par. E-07 Terminal 37 Safe Stop
73	Safe Stop Auto Restart				
77	Reduced power mode	X			par. SP-59 Actual Number of Inverter Units
79	Illegal PS config		X	X	
80	Drive Restored to Factory Settings		X		
81	CSIV corrupt				
82	CSIV parameter error				
85	Profibus/Profisafe Error				
90	Encoder Loss	(X)	(X)		par. EC-61 Feedback Signal Monitoring S202
91	Analog input 54 wrong settings			X	
243	Brake IGBT	X	X		
244	Heatsink temp	X	X	X	
245	Heatsink sensor		X	X	
246	Pwr.card supply		X	X	
247	Pwr.card temp		X	X	
248	Illegal PS config		X	X	
250	New spare part			X	
251	New Model Number		X	X	

Table 5.2: Alarm/Warning code list

(X) Dependent on parameter

1) Can not be Auto reset via par. H-04 Auto-Reset (Times)

A trip is the action when an alarm has appeared. The trip will coast the motor and can be reset by pressing the reset button or make a reset by a digital input (Par. E-1# [1]). The origin 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.

LED indication

Warning	yellow
Alarm	flashing red
Trip locked	yellow and red



Alarm Word Extended Status Word							
Bit	Hex	Dec	Alarm Word	Alarm Word 2	Warning Word	Warning Word 2	Extended Status Word
0	00000001	1	Brake Check	ServiceTrip, Read/Write	Brake Check		Ramping
1	00000002	2	Pwr. Card Temp	ServiceTrip, (re-served)	Pwr. Card Temp		Auto Tune Running
2	00000004	4	Earth Fault	ServiceTrip, Type-code/Sparespart	Earth Fault		Start CW/CCW
3	00000008	8	Ctrl.Card Temp	ServiceTrip, (re-served)	Ctrl.Card Temp		Slow Down
4	00000010	16	Ctrl. Word TO	ServiceTrip, (re-served)	Ctrl. Word TO		Catch Up
5	00000020	32	Over Current		Over Current		Feedback High
6	00000040	64	Torque Limit		Torque Limit		Feedback Low
7	00000080	128	Motor Th Over		Motor Th Over		Output Current High
8	00000100	256	Motor Electronic OL Over		Motor Electronic OL Over		Output Current Low
9	00000200	512	Drive Overld.		Drive Overld.		Output Freq High
10	00000400	1024	DC under Volt		DC under Volt		Output Freq Low
11	00000800	2048	DC over Volt		DC over Volt		Brake Check OK
12	00001000	4096	Short Circuit		DC Voltage Low		Braking Max
13	00002000	8192	Inrush Fault		DC Voltage High		Braking
14	00004000	16384	Mains ph. Loss		Mains ph. Loss		Out of Speed Range
15	00008000	32768	Auto Tune Not OK		No Motor		OVC Active
16	00010000	65536	Live Zero Error		Live Zero Error		AC Brake
17	00020000	131072	Internal Fault	KTY error	10V Low	KTY Warn	Password Timelock
18	00040000	262144	Brake Overload	Fans error	Brake Overload	Fans Warn	Password Protection
19	00080000	524288	U phase Loss	ECB error	Brake Resistor	ECB Warn	
20	00100000	1048576	V phase Loss		Brake IGBT		
21	00200000	2097152	W phase Loss		Speed Limit		
22	00400000	4194304	Network Fault		Network Fault		Unused
23	00800000	8388608	24 V Supply Low		24V Supply Low		Unused
24	01000000	16777216	Mains Failure		Mains Failure		Unused
25	02000000	33554432	1.8V Supply Low		Current Limit		Unused
26	04000000	67108864	Brake Resistor		Low Temp		Unused
27	08000000	134217728	Brake IGBT		Voltage Limit		Unused
28	10000000	268435456	Option Change		Encoder loss		Unused
29	20000000	536870912	Drive Restored to factory settings		Output freq. lim.		Unused
30	40000000	1073741824	Safe Stop (A68)	Safe Stop (A71)	Safe Stop (W68)	Safe Stop (W71)	Unused
31	80000000	2147483648	Mech. brake low	Dangerous Failure (A72)	Extended Status Word		Unused

Table 5.3: Description of Alarm Word, Warning Word and Extended Status Word

The alarm words, warning words and extended status words can be read out via serial bus or optional network for diagnose. See also par. DR-94 Ext. Status Word.

WARNING 1, 10 Volts low:

The 10 V voltage from terminal 50 on the control card is below 10 V.
Remove some of the load from terminal 50, as the 10 V supply is overloaded.
Max. 15 mA or minimum 590 Ω.

WARNING/ALARM 2, Live zero error:

The signal on terminal 53 or 54 is less than 50% of the value set in par.
AN-10 Terminal 53 Low Voltage, par. AN-12 Terminal 53 Low Current, par.
AN-20 Terminal 54 Low Voltage, or par. AN-22 Terminal 54 Low Current respectively.

WARNING/ALARM 3, No motor:

No motor has been connected to the output of the frequency converter.

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 in case of a fault in the input rectifier on the frequency converter.
Check the supply voltage and supply currents to the frequency converter.

WARNING 5, DC link voltage high:

The intermediate circuit voltage (DC) is higher than the overvoltage limit of the control system. The frequency converter is still active.

WARNING 6, DC link voltage low

The intermediate circuit voltage (DC) is below the undervoltage limit of the control system. The frequency converter is still active.

WARNING/ALARM 7, DC over voltage:

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

Possible corrections:

- Connect a brake resistor
- Extend the ramp time
- Activate functions in par. B-10 Brake Function
- Increase par. SP-26 Trip Delay at Drive Fault

**Alarm/warning limits:**

	3 x 200 - 240 V	3 x 380 - 500 V	3 x 525 - 600 V
	[VDC]	[VDC]	[VDC]
Undervoltage	185	373	532
Voltage warning low	205	410	585
Voltage warning high (w/o brake - w/ brake)	390/405	810/840	943/965
Overvoltage	410	855	975

The voltages stated are the intermediate circuit voltage of the frequency converter with a tolerance of $\pm 5\%$. The corresponding mains voltage is the intermediate circuit voltage (DC-link) divided by 1.35

WARNING/ALARM 8, DC under voltage:

If the intermediate circuit voltage (DC) drops below the "voltage warning low" limit (see table above), the frequency converter checks if 24 V backup supply is connected.

If no 24 V backup supply is connected, the frequency converter trips after a given time depending on the unit.

To check whether the supply voltage matches the frequency converter, see *General Specifications*.

WARNING/ALARM 9, Drive 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 98% and trips at 100%, while giving an alarm. You can not reset the frequency converter until the counter is below 90%.

The fault is that the frequency converter is overloaded by more than 100% for too long.

WARNING/ALARM 10, Motor electronic overload over temperature:

According to the electronic thermal protection, the motor is too hot. You can choose if you want the frequency converter to give a warning or an alarm when the counter reaches 100% in par. F-10 *Electronic Overload*. The fault is that the motor is overloaded by more than 100% for too long. Check that the motor par. P-03 *Motor Current* is set correctly.

WARNING/ALARM 11, Motor thermistor over temp:

The thermistor or the thermistor connection is disconnected. You can choose if you want the frequency converter to give a warning or an alarm when the counter reaches 100% in par. F-10 *Electronic Overload*. Check that the thermistor is connected correctly between terminal 53 or 54 (analog voltage input) and terminal 50 (+ 10 V supply), or between terminal 18 or 19 (digital input PNP only) and terminal 50. If aKTY sensor is used, check for correct connection between terminal 54 and 55.

WARNING/ALARM 12, Torque limit:

The torque is higher than the value in par. F-40 *Torque Limiter (Driving)* (in motor operation) or the torque is higher than the value in par. F-41 *Torque Limiter (Braking)* (in regenerative operation).

WARNING/ALARM 13, Over Current:

The inverter peak current limit (approx. 200% of the rated current) is exceeded. The warning will last approx. 8-12 sec., then the frequency converter trips and issues an alarm. Turn off the frequency converter and check if the motor shaft can be turned and if the motor size matches the frequency converter. If extended mechanical brake control is selected, trip can be reset externally.

ALARM 14, Earth fault:

There is a discharge from the output phases to earth, either in the cable between the frequency converter and the motor or in the motor itself. Turn off the frequency converter and remove the earth fault.

ALARM 15, Incomplete hardware:

A fitted option is not handled by the present control board (hardware or software).

ALARM 16, Short-circuit

There is short-circuiting in the motor or on the motor terminals. Turn off the frequency converter and remove the short-circuit.

WARNING/ALARM 17, Control word timeout:

There is no communication to the frequency converter.

The warning will only be active when par. O-04 *Control Word Timeout Function* is NOT set to OFF.

If par. O-04 *Control Word Timeout Function* is set to *Stop and Trip*, a warning appears and the frequency converter ramps down until it trips, while giving an alarm.

par. O-03 *Control Word Timeout Time* could possibly be increased.

WARNING 23, Internal 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 par. SP-53 *Fan Monitor* (set to [0] Disabled).

WARNING 24, External 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 par. SP-53 *Fan Monitor* (set to [0] Disabled).

WARNING 25, Brake resistor short-circuited:

The brake resistor is monitored during operation. If it short-circuits, the brake function is disconnected and the warning appears. The frequency converter still works, but without the brake function. Turn off the frequency converter and replace the brake resistor (see par. B-15 *Brake Check*).

ALARM/WARNING 26, Brake resistor power limit:

The power transmitted to the brake resistor is calculated as a percentage, as a mean value over the last 120 s, on the basis of the resistance value of the brake resistor (par. B-11 *Brake Resistor (ohm)*) and the intermediate circuit voltage. The warning is active when the dissipated braking power is higher than 90%. If *Trip [2]* has been selected in par. B-13 *Braking Thermal Overload*, the frequency converter cuts out and issues this alarm, when the dissipated braking power is higher than 100%.

ALARM/ WARNING 27, Brake chopper fault:

The brake transistor is monitored during operation and if it short-circuits, the brake function disconnects and the warning comes up. The frequency converter is still able to run, but since the brake transistor has short-circuited, substantial power is transmitted to the brake resistor, even if it is inactive.

Turn off the frequency converter and remove the brake resistor.

This alarm/ warning could also occur should the brake resistor overheat. Terminal 104 to 106 are available as brake resistor. Klaxon inputs, see section Brake Resistor Temperature Switch.



Warning: There is a risk of substantial power being transmitted to the brake resistor if the brake transistor is short-circuited.

ALARM/WARNING 28, Brake check failed:

Brake resistor fault: the brake resistor is not connected/working.

ALARM 29, Drive over temperature:

If the drive type is IP20 Open Chassis, IP20 with Nema 1 kit, or Nema 1 the cut-out temperature of the heat-sink is $95\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$. The temperature fault cannot be reset, until the temperature of the heatsink is below $70\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.

**The fault could be:**

- Ambient temperature too high
- Too long motor cable

ALARM 30, Motor phase U missing:

Motor phase U between the frequency converter and the 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 33, Inrush fault:

Too many power ups have occurred within a short time period. See the chapter *General Specifications* for the allowed number of power ups within one minute.

WARNING/ALARM 34, Network communication fault:

The network option card is not working correctly. Please check parameters associated with the module and make sure module is properly inserted in Slot A of the drive.

WARNING/ALARM 36, Mains failure:

This warning/alarm is only active if the supply voltage to the frequency converter is lost and par. SP-10 *Line failure* is NOT set to OFF. Possible correction: check the fuses/circuit breaker connected to the frequency converter

ALARM 38, Internal fault:

Internal drive fault. Please contact your GE supplier. Some typical alarm messages:

0	The serial port cannot be initialized. Serious hardware failure
256	The power EEPROM data is defected or outdated.
512	The control board EEPROM data is defected or outdated.
513	Communication time out Reading EEPROM data
514	Communication time out Reading EEPROM data
515	The Application Orientated Control cannot recognize the EEPROM data
516	Cannot write write to the EEPROM because a write command is on progress
517	The write command is under time out
518	Failure in the EEPROM
519	Missing or invalid BarCode data in EEPROM 1024 – 1279 CAN telegram cannot be sent. (1027 indicate a possible hardware failure)
1281	Digital Signal Processor flash time-out
1282	Power micro software version mismatch
1283	Power EEPROM data version mismatch
1284	Cannot read Digital Signal Processor software version
1299	Option SW in slot A is outdated
1300	Option SW in slot B is outdated
1311	Option SW in slot C0 is outdated
1312	Option SW in slot C1 is outdated
1315	Option SW in slot A is not supported (not allowed)
1316	Option SW in slot B is not supported (not allowed)
1317	Option SW in slot C0 is not supported (not allowed)
1318	Option SW in slot C1 is not supported (not allowed)
1536	An exception in the Application Orientated Control is registered. Debug information written in Keypad
1792	DSP watchdog is active. Debugging of power part data Motor Orientated Control data not transferred correctly
2049	Power data restarted
2315	Missing SW version from power unit
2816	Stack overflow Control board module
2817	Scheduler slow tasks
2818	Fast tasks
2819	Parameter thread
2820	Keypad stack overflow

2821	Serial port overflow
2822	USB port overflow
3072-512	Parameter value is outside its limits. Perform a initialization. 2 Parameter number causing the alarm: Subtract the code from 3072. Ex Error code 3238: 3238-3072 = 166 is outside the limit
5123	Option in slot A: Hardware incompatible with Control board hardware
5124	Option in slot B: Hardware incompatible with Control board hardware
5125	Option in slot C0: Hardware incompatible with Control board hardware
5126	Option in slot C1: Hardware incompatible with Control board hardware
5376-623	Out of memory
1	

WARNING 40, Overload of Digital Output Terminal 27

Check the load connected to terminal 27 or remove short-circuit connection.
Check par. E-00 *Digital I/O Mode* and par. E-51 *Terminal 27 Mode*.

WARNING 41, Overload of Digital Output Terminal 29:

Check the load connected to terminal 29 or remove short-circuit connection.
Check par. E-00 *Digital I/O Mode* and par. E-52 *Terminal 29 Mode*.

WARNING 42, Overload of Digital Output On X30/6 :

Check the load connected to X30/6 or remove short-circuit connection. Check par. E-56 *Term X30/6 Digi Out (OPCGPIO)*.

WARNING 42, Overload of Digital Output On X30/7 :

Check the load connected to X30/7 or remove short-circuit connection. Check par. E-57 *Term X30/7 Digi Out (OPCGPIO)*.

WARNING 47, 24 V supply low:

The external 24 V DC backup power supply may be overloaded, otherwise
Contact your GE supplier.

WARNING 48, 1.8 V supply low:

Contact your GE supplier.

WARNING 49, Speed limit:

The speed is not within the specified range in par. F-18 *Motor Speed Low Limit [RPM]* and par. F-17 *Motor Speed High Limit [RPM]*.

ALARM 50, Auto Tune calibration failed:

Contact your GE supplier.

ALARM 51, Auto Tune check Unom and Inom:

The setting of motor voltage, motor current, and motor power are set set correctly. Please check parameters (P-##).

ALARM 52, Auto Tune low Inom:

The motor current is too low. Check the settings.

ALARM 53, Auto Tune motor too big:

The motor is too big for the Auto Tune to be carried out.

ALARM 54, Auto Tune motor too small:

The motor is too small for the Auto Tune to be carried out.

ALARM 55, Auto Tune par. out of range:

The motor parameter values set for the motor are outside acceptable range.

ALARM 56, Auto Tune interrupted by user:

The Auto Tune has been interrupted by the user.

ALARM 57, Auto Tune timeout:

Try to start the Auto Tune again a number of times, until the Auto Tune is carried out. Please note that repeated runs may heat the motor to a level where the resistance Rs and Rr are increased. In most cases, however, this is not critical.

**ALARM 58, Auto Tune internal fault:**

Contact your GE supplier.

WARNING 59, Current limit:

The current is higher than the value in par. F-43 *Current Limit*.

WARNING 61, Tracking Error:

An error has been detected between calculated speed and speed measurement from feedback device. The function Warning/Alarm/Disabling setting is in par. H-20 *Motor Feedback Loss Function*. Accepted error setting in par. H-21 *Motor Feedback Speed Error* and the allowed time the error occur setting in par. H-22 *Motor Feedback Loss Timeout*. During a commissioning procedure the function may be effective.

WARNING 62, Output Frequency at Maximum Limit:

The output frequency is higher than the value set in par. F-03 *Max Output Frequency 1*

ALARM 63, Mechanical Brake Low:

The actual motor current has not exceeded the "release brake" current within the "Start delay" time window.

WARNING 64, Voltage Limit:

The load and speed combination demands a motor voltage higher than the actual DC link voltage.

WARNING/ALARM/TRIP 65, Control Card Over Temperature:

Control card over temperature: The cut-out temperature of the control card is 80° C.

WARNING 66, Heatsink Temperature Low:

The heat sink temperature is measured as 0° C. This could indicate that the temperature sensor is defect and thus the fan speed is increased to the maximum in case the power part or control card is very hot.

ALARM 67, Option Module Configuration has Changed:

One or more options modules have either been added or removed since the last power down.

ALARM 68, Safe Stop:

Safe Stop has been activated. To resume normal operation, apply 24 V DC to terminal # 37., then send a reset signal (via Bus, Digital I/O, or by pressing [RESET]).

WARNING 68, Safe Stop:

Safe Stop has been activated. Normal operation is resumed when Safe Stop is disabled. Warning: Automatic Restart!

ALARM 70, Illegal Drive Configuration:

Actual combination of control board and power board is illegal.

ALARM 71, 1 Safe Stop:

Safe Stop has been activated from external source. Normal operation can be resumed when 24V dc is applied to terminal # 37. When that happens, a reset signal must be sent (via Bus, Digital I/O, or by pressing [RESET]).

WARNING 71, Safe Stop:

Safe Stop has been activated from external source. Normal operation can be resumed when 24V dc is applied to terminal # 37.. Warning: Automatic Restart.

ALARM 72, Dangerous Failure:

Safe Stop with Trip Lock. Unexpected signal levels on Safe Stop.

ALARM 80, Drive Restored to Factory Settings:

Parameter settings are restored to factory settings after a manual (three-finger) reset.

ALARM 90, Encoder loss:

Check the connection to encoder option and eventually replace the OPCEN-Cor OPCRES.

ALARM 91, Analogue Input 54 Wrong Settings:

Switch S202 has to be set in position OFF (voltage input) when a KTY sensor is connected to analogue input terminal 54.

ALARM 250, New Spare Part:

The power or Switch Mode Power Supply has been exchanged. The frequency converter model number must be restored in the EEPROM. Remember to select 'Save to EEPROM' to complete.

ALARM 251, New Model Number:

The Frequency Converter has got a new model number.



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The instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the GE company.

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