GE

AF-650 GP™
General Purpose Drive

Programming Guide

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Contents

1 Introduction

1.1 Software Version

Programming Guide Software version: 2.31
This Programming Guide can be used for all AF-650 GP frequency converters with software version 2.31. The software version number can be seen from *ID-43 Software Version*.

Table 1.1 Software Version

1.2 Approvals

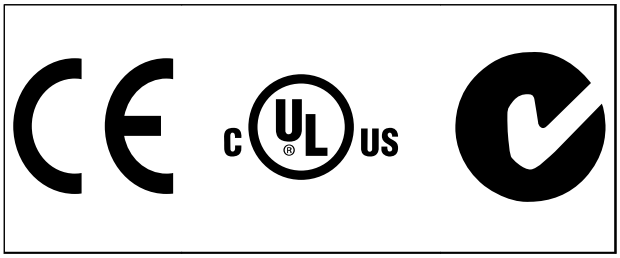


Table 1.2 Approvals

1.3 Symbols

The following symbols are used in this manual.

⚠WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

CAUTION

Indicates a situation that may result in equipment or property-damage-only accidents.

NOTE

Indicates highlighted information that should be regarded with attention to avoid mistakes or operate equipment at less than optimal performance.

1.4 Definitions

1.4.1 Frequency Converter

$I_{DRIVE,MAX}$
Maximum output current.

$I_{DRIVE,N}$
Rated output current supplied by the frequency converter.

$U_{DRIVE,MAX}$
Maximum output voltage.

1.4.2 Input

Control command
Start and stop the connected motor by means of keypad and digital inputs.
Functions are divided into two groups.

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

Group 1	Reset, Coasting stop, Reset and Coasting stop, Quick-stop, DC braking, Stop and the [OFF] key.
Group 2	Start, Pulse start, Reversing, Start reversing, Jog and Freeze output

1.4.3 Motor

Motor Running
Torque generated on output shaft and speed from zero rpm to max. speed on motor.

f_{JOG}
Motor frequency when the jog function is activated (via digital terminals).

f_M
Motor frequency.

f_{MAX}
Maximum motor frequency.

f_{MIN}
Minimum motor frequency.

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

I_M
Motor current (actual).

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

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

n_s
Synchronous motor speed

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

n_{slip}
Motor slip.

$P_{M,N}$
Rated motor power (nameplate data in kW or HP).

$T_{M,N}$
Rated torque (motor).

U_M
Instantaneous motor voltage.

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

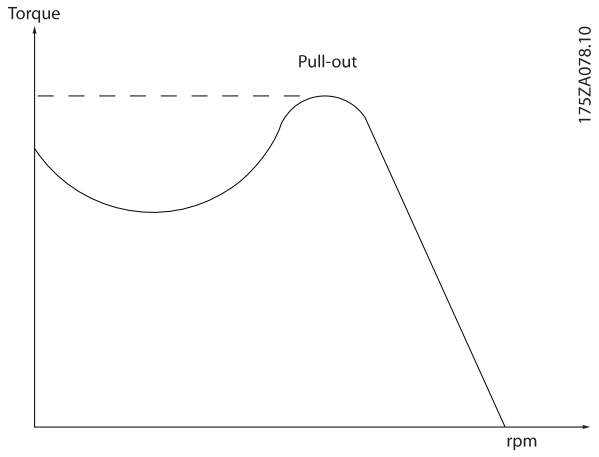


Illustration 1.1 Break-away Torque

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.

1.4.4 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, 20 mA) and the resulting reference. The maximum reference value set in *F-53 Maximum Reference*.

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

1.4.5 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, -10 to +10 V DC.

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

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

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

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 3 m from the frequency converter, i.e. in a front panel with the installation kit option.

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 = 0.5067mm^2.

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

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

PCD
Process Control Data

Power Cycle
Switch off the mains until display is dark – then turn power on again.

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

RCD
Residual Current Device.

Set-up
Save parameter settings in 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 **S**tator **F**lux oriented **A**synchronous **V**ector **M**odulation (*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.

STW
Status Word

Drive Standard Bus
Includes RS-485 bus with drive protocol or MC protocol. See *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° **A**synchronous **V**ector **M**odulation (*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:

$$= \frac{I1 \times \cos\varphi 1}{I_{RMS}} = \frac{I_1}{I_{RMS}} \text{ since } \cos\varphi 1 = 1$$

The power factor indicates to which extent the frequency converter imposes a load on the mains supply.
The lower the power factor, the higher the I_{RMS} for the same kW performance.

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

In addition, a high power factor indicates that the different harmonic currents are low.
The frequency converters' built-in DC coils produce a high power factor, which minimizes the imposed load on the mains supply.

1.5 Safety

⚠WARNING

The voltage of the frequency converter is dangerous whenever connected to mains. Incorrect installation of the motor, frequency converter or network may cause death, serious personal injury or damage to the equipment. 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. [Off] 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 *F-10 Electronic Overload* to data value *[4] Elec. OL trip 1* or data value *[3] Elec. OL warning 1*.
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. 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.
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 by 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.
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.

⚠WARNING

High Voltage

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

NOTE

Hazardous situations shall be identified by the machine builder/ integrator who is responsible for taking necessary preventive means into consideration. Additional monitoring and protective devices may be included, always according to valid national safety regulations, e.g. law on mechanical tools, regulations for the prevention of accidents.

NOTE

Crane, Lifts and Hoists:
The controlling of external brakes must always have a redundant system. The frequency converter can in no circumstances be the primary safety circuit. Comply with relevant standards, e.g.
Hoists and cranes: IEC 60204-32
Lifts: EN 81

Protection Mode

Once a hardware limit on motor current or dc-link voltage is exceeded the frequency converter 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 s after the last fault and increases the reliability and the robustness of the frequency converter while re-establishing full control of the motor.
The “Protection mode” can be disabled by setting *SP-26 Trip Delay at Drive Fault* to zero which means that the frequency converter will trip immediately if one of the hardware limits is exceeded.

1.6 Electrical Wiring

1.6.1 Electrical Wiring - Control Cables

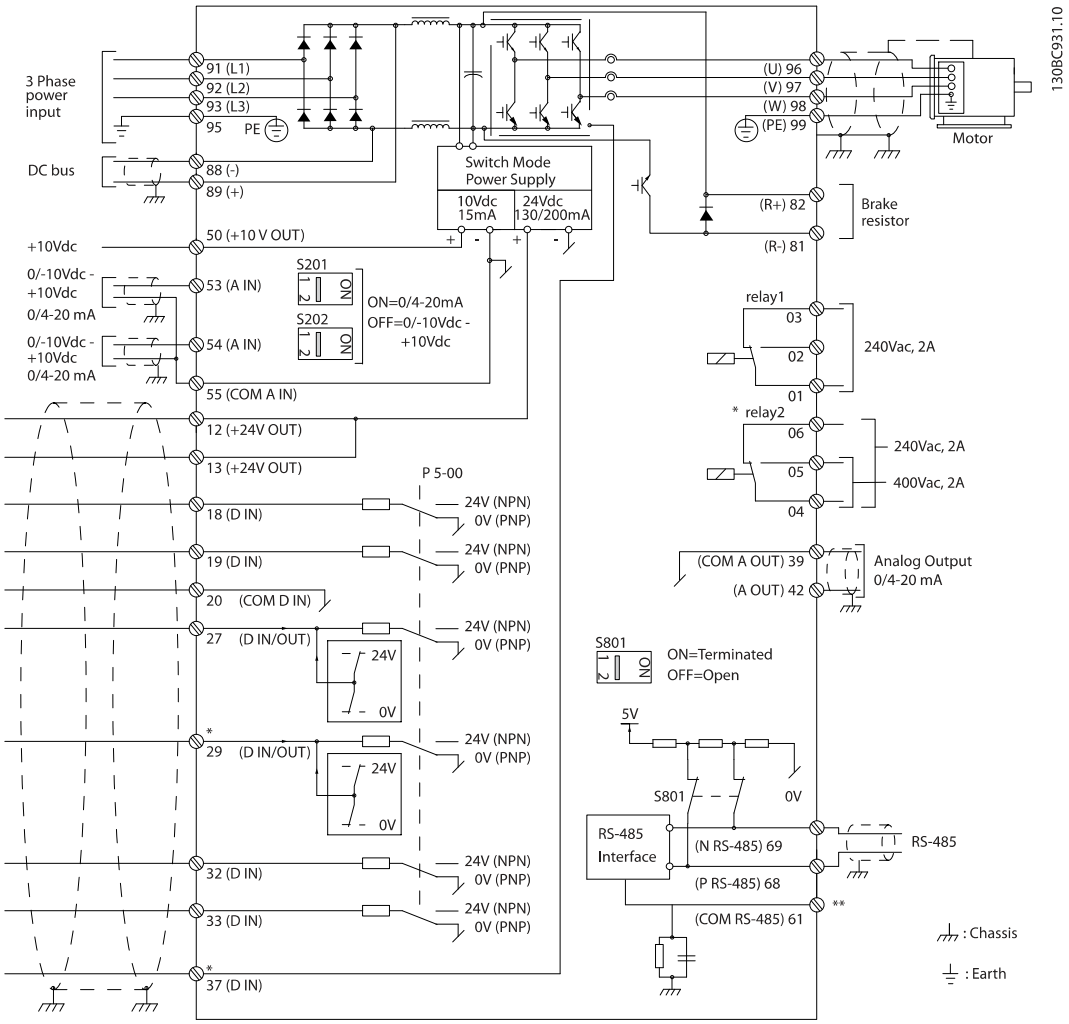


Illustration 1.2 Basic Wiring Schematic Drawing.

A=Analog, D=Digital
Terminal 37 is used for Safe Stop. For Safe Stop installation instructions, refer to the Design and Installation Guide DET-767.
*The brake chopper factory option must be ordered to use dynamic braking resistors
**This is available when ordering the brake chopper option on unit size 23 and above drives.

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

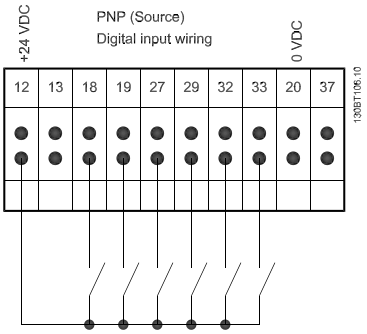


Illustration 1.3 PNP (Source)

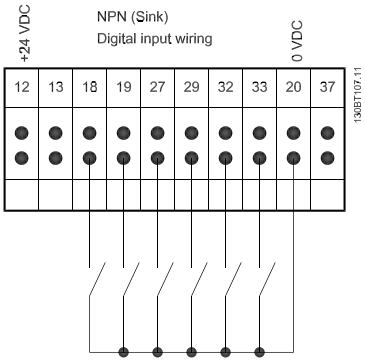


Illustration 1.4 NPN (Sink)

NOTE

Control cables must be screened/armoured.

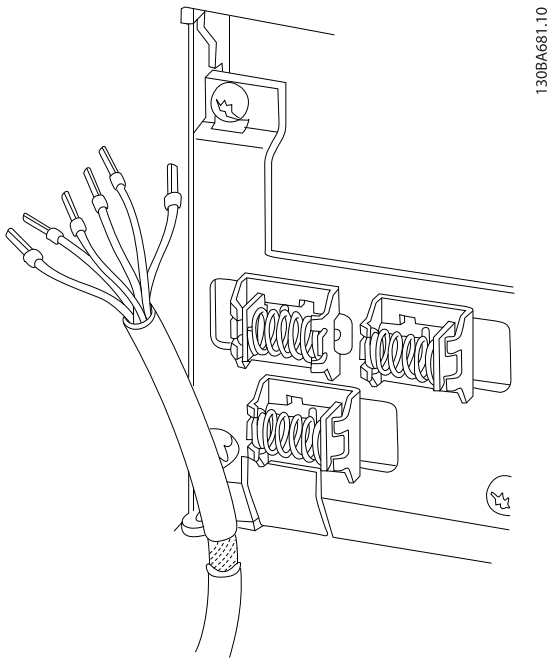
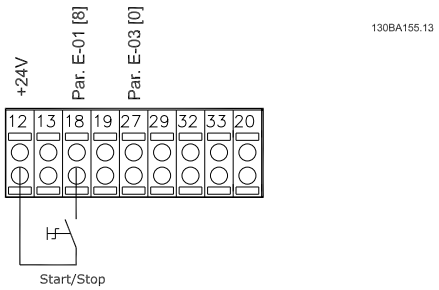


Illustration 1.5 Earthing of Screened/Armoured Control Cables

1.6.2 Start/Stop

Terminal 18 = *E-01 Terminal 18 Digital Input [8] Start*
Terminal 37 = Safe stop (where available)



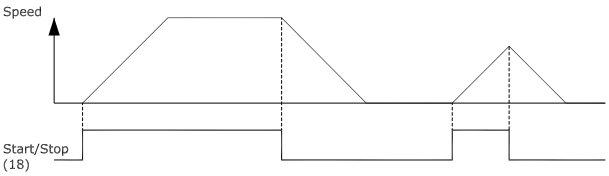


Illustration 1.6 Start/Stop

1.6.3 Pulse Start/Stop

Terminal 18 = *E-01 Terminal 18 Digital Input* Latched start, [9]
Terminal 27= *E-03 Terminal 27 Digital Input* Stop inverse, [6]
Terminal 37 = Safe stop (where available)

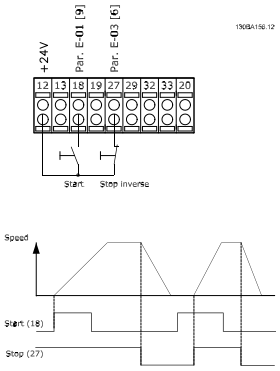


Illustration 1.7 Pulse Start/Stop

1.6.4 Speed Up/Down

Terminals 29/32 = Speed up/down

Terminal 18 = *E-01 Terminal 18 Digital Input* Start [9] (default)

Terminal 27 = *E-03 Terminal 27 Digital Input* Freeze reference [19]

Terminal 29 = *E-04 Terminal 29 Digital Input* Speed up [21]

Terminal 32 = *E-05 Terminal 32 Digital Input* Speed down [22]

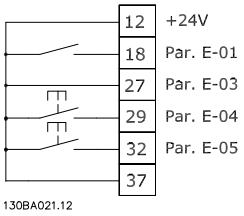


Illustration 1.8 Speed Up/Down

1.6.5 Potentiometer Reference

Voltage reference via a potentiometer

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

Terminal 53, Low Voltage = 0 V

Terminal 53, High Voltage = 10 V

Terminal 53, Low Ref./Feedback = 0 RPM

Terminal 53, High Ref./Feedback = 1500 RPM

Switch S201 = OFF (U)

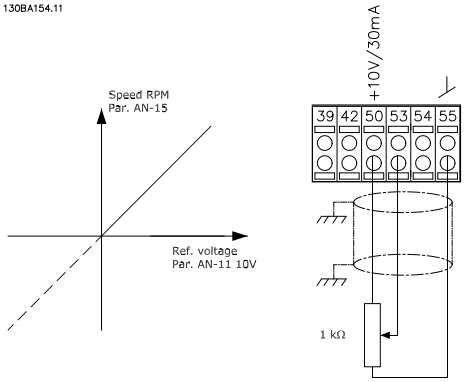


Illustration 1.9 Potentiometer Reference

1.7 External Hand Off Auto Example

Hand Off Auto (HOA), without the use of the Drive keypad

To have a HOA system with an external 0-10 V potentiometer for the hand reference and a 4-20 mA signal for the auto reference, 2 set-ups should be used. In this example we use set-up 1 for the hand mode and set-up 2 for the auto mode. We use analog input 53 for the hand reference (0-10 V potentiometer) and analog input 54 for the auto reference (4-20 mA) and digital input 27 for the set-up selector. Please ensure that the analog inputs have the correct dip settings (A-53 [U] and A-54 [I]).

In the upper right corner of the keypad you can see 2 numbers – like 1(1). The number outside the parenthesis is the active set-up and the number inside the parenthesis is the set-up which will be edited. Default will always be 1(1). Make sure you edit set-up 1.

1. Make all the parameter changes you need, that will be common for auto and hand mode, like motor parameters etc.
2. Set *K-10 Active Set-up* to [9] Multi Set-up. This parameter change is needed to be able to change set-up from an external source, like a digital input.
3. Set *K-11 Edit Set-up* to [9] Active Set-up. This is recommended because then the active setup will always be the set-up that is edited. If you prefer you can also ignore this and manually control what set-up you want to edit through *K-11 Edit Set-up*.
4. Set *E-03 Terminal 27 Digital Input* to [23] Set-up select bit 0. When terminal 27 is OFF, set-up 1 (hand) is active, when it is ON, set-up 2 (auto) is active.
5. Set *F-01 Frequency Setting 1* to Analog input 53 (hand mode).
6. Ensure *C-30 Frequency Command 2* and *C-34 Frequency Command 3* are both No Function. This is good practice to make sure no other references are added.
7. Copy set-up 1 to set-up 2. Set *K-51 Set-up Copy* to [2] Copy to set-up 2. Now setup 1 and 2 are identical.
8. If you need to be able to change between hand and auto mode while the motor is running you will have to link the 2 set-ups together. Set *K-12 This Set-up Linked to* to [2] set-up 2.
9. Change to set-up 2 by setting input 27 ON (if *K-11 Edit Set-up* is [9]) or by setting *K-11 Edit Set-up* to set-up 2.
10. Set *F-01 Frequency Setting 1* to Analog input 54 (auto mode).

If you want different settings in hand and auto mode, like different accel/decel ramps, speed limits etc. you can now program them. You just have to make sure you edit the correct set-up. Set-up 1 is Hand mode and set-up 2 is Auto mode.

External Hand-Off-Auto Selector Switch Wiring

Illustration 1.10 GE 30 mm HOA Cat# (1) 104PSG34B & (3) CR104PXC1

2 How to Program

2.1 The Keypad

The easiest programming of the frequency converter is performed by the 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 [Status], up to one extra line can be added.

c. **Status line:** Status messages displaying text.

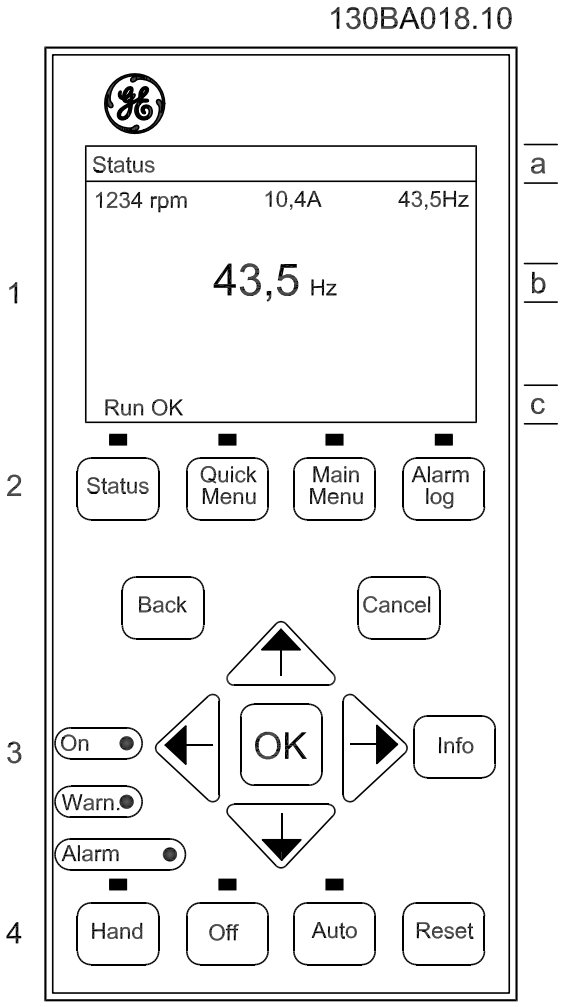


Illustration 2.1 Keypad

2

2.1.1 The LCD-Display

The LCD-display has backlight 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.

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

Middle section
The top line 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.

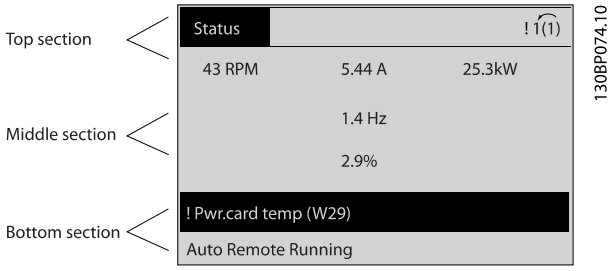


Illustration 2.2 Bottom Section

The active set-up (selected as the active set-up in *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 keypad, unless a password has been created via *K-60 Main Menu Password* or via *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 keypad.
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.

Illustration 2.3 Indicator lights (LEDs)

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.

Illustration 2.4

[Status]
indicates the status of the frequency converter and/or the motor. Choose between 3 different readouts by pressing [Status]: 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 [Status] 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

Press [Quick Start] to program 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 [Main Menu] 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]. Information is displayed about the condition of the frequency converter before it enters the alarm mode.

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

[Cancel]
last change or command will be cancelled 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].

Illustration 2.5 Back

Illustration 2.6 Cancel

Illustration 2.7 Info

Navigation Keys
The four navigation keys 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 Keys
for local control are found at the bottom of the keypad.

Illustration 2.8 Local Control Keys

[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 *[1] Enable* or *[0] Disable* via *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 *[1] Enable* or *[0] Disable* via *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 *[1] Enable* or *[0] Disable* via *K-42 [Auto] Button on Keypad*.

NOTE

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 *[1] Enable* or *[0] Disable* via *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

2.1.2 Quick Transfer of Parameter Settings between Multiple Frequency Converters

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

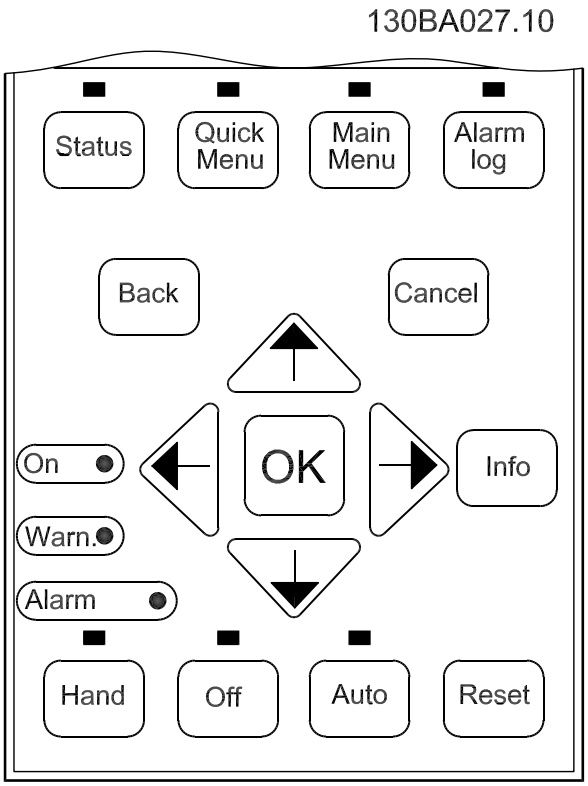


Illustration 2.9 Keypad

Data storage in keypad

NOTE

Stop the motor before performing this operation.

1. Go to *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].

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

NOTE

Stop the motor before performing this operation.

1. Go to *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].

2.1.3 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.

2.1.4 Display Mode - Selection of Read-Outs

It is possible to toggle between three status read-out screens by pressing [Status].
Operating variables with different formatting are shown in each status screen - see below.

Table 2.1 shows the measurements that can be linked to each of the operating variables. When options are mounted, additional measurements are available. Define the links via *K-20 Display Line 1.1 Small*, *K-21 Display Line 1.2 Small*, *K-22 Display Line 1.3 Small*, *K-23 Display Line 2 Large*, and *K-24 Display Line 3 Large*.

Each readout parameter selected in *K-20 Display Line 1.1 Small* to *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 5.25A; 15.2A 105A.

Operating variable	Unit
DR-00 Control Word	hex
DR-01 Reference [Unit]	[unit]
DR-02 Reference [%]	%
DR-03 Status Word	hex
DR-05 Main Actual Value [%]	%
DR-10 Power [kW]	[kW]
DR-11 Power [hp]	[HP]
DR-12 Motor Voltage	[V]
DR-13 Frequency	[Hz]
DR-14 Motor current	[A]
DR-16 Torque [Nm]	Nm
DR-17 Speed [RPM]	[RPM]
DR-18 Motor Thermal	%

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

Table 2.1 Measurements

Status screen I

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

Press [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 *Illustration 2.10*.

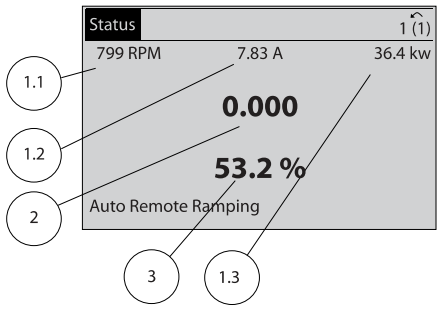


Illustration 2.10 Status screen I

Status screen II

See the operating variables (1.1, 1.2, 1.3 and 2) shown in *Illustration 2.11*.

In the example, speed, motor current, motor power and frequency are selected as variables in the first and second.

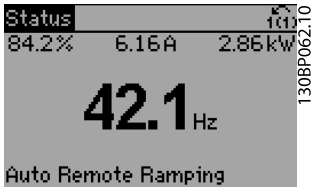


Illustration 2.11 Status screen II

Status screen III

This state displays the event and action of the Logic Controller. For further information, see *3.19 LC-## Logic Controller*.

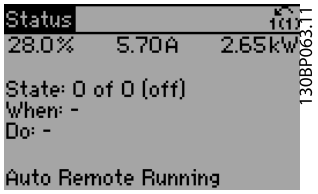


Illustration 2.12 Status screen III

2.1.5 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.

Change a parameter in either Main Menu mode or Quick Menu mode.

2

2.1.6 Quick Menu Key Functions

Pres [Quick Menus] to see a list of different areas contained in the Quick menu.

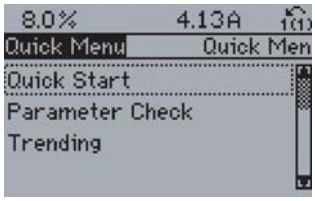


Illustration 2.13 Quick Menus

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

Table 2.2

Select *Parameter Data Check* 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 *K-20 Display Line 1.1 Small* and *K-24 Display Line 3 Large* can be viewed. It is possible to store up to 120 samples in the memory for later reference.

2.1.7 Initial Commissioning

The easiest way of carrying out the initial commissioning is by pressing [Quick Menu] and following the quick set-up procedure (read *Table 2.3* from left to right). The example applies to open loop applications.

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

Table 2.3

2

2.1.8 Main Menu Mode

Start the Main Menu mode by pressing [Main Menu]. The read-out shown below appears on the display.
The middle and bottom sections on the display show a list of parameter groups which can be chosen by toggling [▲] and [▼] keys.

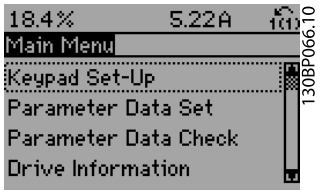


Illustration 2.14 Main Menu Mode

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 (*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.

2.1.9 Parameter Selection

In the Main menu mode, the parameters are divided into groups. Select a parameter group with 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.

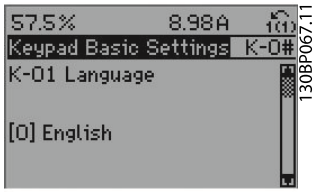


Illustration 2.15 Parameter Selection

2.1.10 Changing Data

The procedure for changing data is the same in the Quick menu and 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.

2.1.11 Changing a Text Value

If the selected parameter is a text value, change the text value with the [▲] [▼] keys.
Place the cursor on the value to save and press [OK].

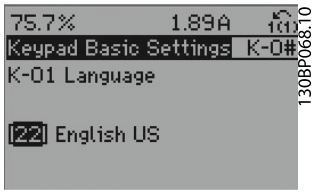


Illustration 2.16 Changing a Text Value

2.1.12 Changing

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. Press [◄] [►] keys to move the cursor horizontally.

Illustration 2.17 Changing a Data Value

Press [▲] [▼] keys to change the data value. [▲] increases the data value, and [▼] decreases the data value. Place the cursor on the value to save and press [OK].

Illustration 2.18 Saving a Data Value

2.1.13 Infinitely Variable Change of Numeric Data Value

If the chosen parameter represents a numeric data value, select a digit with [◄] [►].

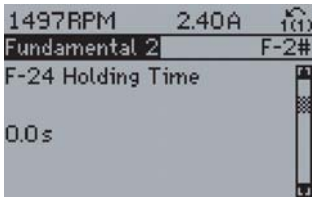


Illustration 2.19 Selecting a Digit

Change the selected digit infinitely variably with [▲] [▼]. The chosen digit is indicated by the cursor. Place the cursor on the digit to save and press [OK].

2.1.14 Value, Step-by-Step

Certain parameters can be changed step by step or infinitely varying. This applies to *P-07 Motor Power [kW]*, *F-05 Motor Rated Voltage* and *F-04 Base Frequency*.
The parameters are changed both as a group of numeric data values and as numeric data values infinitely varying.

2.1.15 Read-out and Programming of Indexed Parameters

Parameters are indexed when placed in a rolling stack. *ID-30 Fault Log: Error Code* to *ID-32 Alarm Log: Time* contain a fault log which can be read out. Choose a parameter, press [OK], and use [▲] [▼] to scroll through the value log.

Use *C-05 Multi-step Frequency 1 - 8* as another example: Choose the parameter, press [OK], and use [▲] [▼] to scroll through the indexed values. To change the parameter value, select the indexed value and press [OK]. Change the value by pressing [▲] [▼]. Press [OK] to accept the new setting. Press [Cancel] to abort. Press [Back] to leave the parameter.

2.1.16 Local Control Keys

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

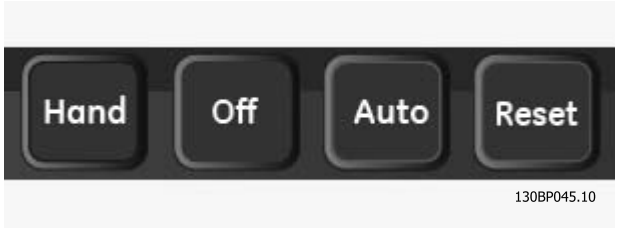


Illustration 2.20 Keypad Keys

[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 *[1] Enable* or *[0] Disable* via *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 are still 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 *[1] Enable* or *[0] Disable* via *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 *[1] Enable* or *[0] Disable* via *K-42 [Auto] Button on Keypad*.

NOTE

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 *[1] Enable* or *[0] Disable* via *K-43 [Reset] Button on Keypad*.

2.1.17 Restoring Drive to Factory Settings

2

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

Recommended

1. Select *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.

H-03 Restore Factory Settings restores all except:

SP-50 RFI Filter

O-30 Protocol

O-31 Address

O-32 Drive Port Baud Rate

O-35 Minimum Response Delay

O-36 Max Response Delay

O-37 Max Inter-Char Delay

ID-00 Operating hours to *ID-05 Over Volt's*

ID-20 Historic Log: Event to *ID-22 Historic Log: Time*

ID-30 Fault Log: Error Code to *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:

ID-00 Operating hours

ID-03 Power Up's

ID-04 Over Temp's

ID-05 Over Volt's

NOTE

A manual restore also resets serial communication, RFI filter settings (*SP-50 RFI Filter*) and fault log settings.

3 Parameter Descriptions

3.1 Parameter Selection

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-##, SF-##

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
EC-##	Feedback Option
RS-##	Resolver Interface
ID-##	Drive Information
DR-##	Data Readouts
LC-##	Logic Controller
B-##	Braking Functions
PI-##	PID Controls
SF-##	Special Features

Table 3.2 Parameter groups

3.2 K-## 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. .
[0] *	English	
[1]	Deutsch	
[2]	Francais	
[4]	Spanish	
[5]	Italiano	
[10]	Chinese	
[22]	English US	
[24]	Russian	

K-02 Motor Speed Unit		
Option:		**Function:**
		NOTE **This parameter cannot be adjusted while the motor is running.** **NOTE** **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:**
		NOTE **This parameter cannot be adjusted while the motor is running.**
[0]	Interna-tional	Activates *P-07 Motor Power [kW]* for setting the motor power in kW and sets the default value of *F-04 Base Frequency* to 50 Hz.
[1] *	US	Activates *P-07 Motor Power [kW]* for setting the motor power in HP and sets the default value of *F-04 Base Frequency* to 60 Hz.

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 and the same start/stop settings (applied by [Hand/Off]) 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 [Hand].
[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 *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 *K-12 This Set-up Linked to* is programmed as required. Using *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 *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.

K-10 Active Set-up		
Option:		**Function:**
[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	*[1] Set-up 1* to *[4] Set-up 4* 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 *K-12 This Set-up Linked to*. Stop the frequency converter before making changes to open- and closed loop functions

Use *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 *K-12 This Set-up Linked to*. Parameters which are 'not changeable during operation' are marked FALSE in the parameter lists in *4 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	*[1] Set-up 1* to *[4] Set-up 4* 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 RS-485, Drive USB or up to five Network sites.

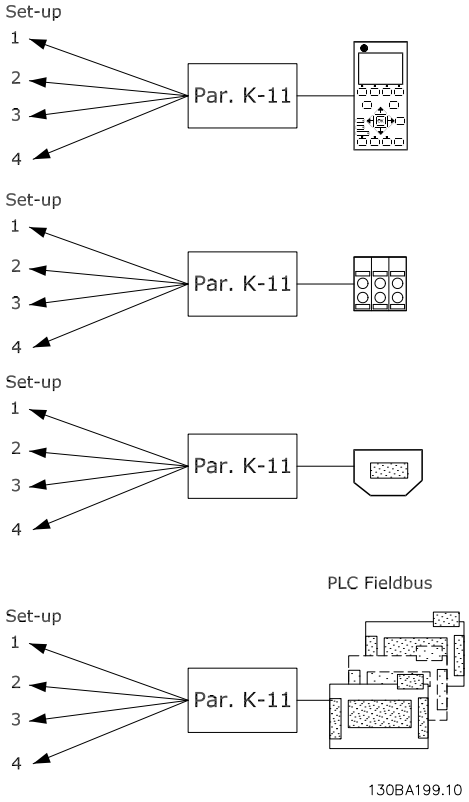
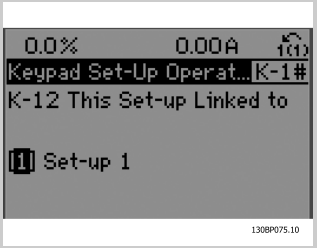
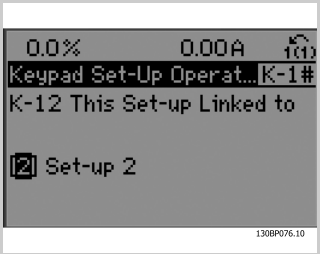


Illustration 3.1 Edit Set-up

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 *4 Parameter Lists*. *K-12 This Set-up Linked to* is used by Multi set-up in *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 *[2] Set-up 2* in *K-11 Edit Set-up* and set *K-12 This Set-up Linked to* to *[1] Set-up 1*. This will start the linking (synchronising) process.

3

K-12 This Set-up Linked to		
Option:		**Function:**
		 **Illustration 3.2 Set-up 1** OR 2. While still in Set-up 1, copy Set-up 1 to Set-up 2. Then set *K-12 This Set-up Linked to* to *[2] Set-up 2*. This will start the linking process.  **Illustration 3.3 Set-up 2** After the link is complete, *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. *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:		**Function:**
0*	[0 - 255]	View a list of all the set-ups linked by means of *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 set-ups are linked to that parameter set-up.

K-13 Readout: Linked Set-ups		
Array [5]		
Range:		**Function:**
		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:		**Function:**
0*	[-2147483648 - 2147483647]	View the setting of *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 *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.

NOTE

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

		Select a variable for display in line 1, left position. The options are the same as listed for parameter group K-2#.
[0]	None	No display value selected.
[953]	Profibus Warning Word	
[2205]	Readout Transmit Error Counter	
[2206]	Readout Receive Error Counter	
[2207]	Readout Bus Off Counter	
[2213]	Warning Parameter	
[1501]	Running Hours	
[1502]	kWh Counter	

[1200]	Control Word	Present control word
[1201]	Reference [Unit]	Total reference (sum of digital/ analog/preset/bus/freeze ref./catch up and slow-down) in selected unit.
[1202]	Reference %	Total reference (sum of digital/ analog/preset/bus/freeze ref./catch up and slow-down) in percent.
[1203]	Status Word	Present status word.
[1205]	Main Actual Value [%]	Actual value as a percentage.
[1209]	Custom Readout	
[1210]	Power [kW]	Actual power consumed by the motor in kW.
[1211]	Power [hp]	Actual power consumed by the motor in HP.
[1212]	Motor Voltage	Voltage supplied to the motor.
[1213]	Frequency	Motor frequency, i.e. the output frequency from the frequency converter in Hz
[1214]	Motor Current	Phase current of the motor measured as effective value.
[1215]	Frequency [%]	Motor frequency, i.e. the output frequency from the frequency converter in percent.
[1216]	Torque	Actual motor torque in Nm
[1217]	Speed [RPM]	Speed in RPM (revolutions per minute) i.e. the motor shaft speed in closed loop.
[1218]	Motor Thermal	Thermal load on the motor, calculated by the Electronic Thermal Overload function.
[1219]	KTY Sensor Temperature	
[1220]	Motor Angle	
[1221]	Phase Angle	
[1222]	Torque %	Present motor load as a percentage of the rated motor torque.
[1230]	DC Link Voltage	Intermediate circuit voltage in the frequency converter.
[1232]	BrakeEnergy/s	Present brake power transferred to an external brake resistor. Stated as an instantaneous value.
[1233]	BrakeEnergy/2 min	Brake power transferred to an external brake resistor. The mean power is calculated continuously for the most recent 120 seconds.
[1234]	Heatsink Temp.	Present heat sink temperature of the frequency converter. The cut-out limit is 95 ±5 ±°C; cutting back in occurs at 70 ±5° C.
[1235]	Inverter Thermal	Percentage load of the inverters.
[1236]	Inv. Nom. Current	Nominal current of the frequency converter.
[1237]	Inv. Max. Current	Maximum current of the frequency converter.
[1238]	Logic Controller State	State of the event executed by the control.
[1239]	Control Card Temp.	Temperature of the control card.
[1250]	External Reference	Sum of the external reference as a percentage, i.e. the sum of analog/ pulse/bus.
[1251]	Pulse Reference	Frequency in Hz connected to the digital inputs (18, 19 or 32, 33).
[1252]	Feedback [Unit]	Reference value from programmed digital input(s).
[1253]	Digi Pot Reference	
[1260]	Digital Input	Signal states form the 6 digital terminals (18, 19, 27, 29, 32 and 33). Input 18 corresponds to the bit at the far left. Signal low = 0; Signal high = 1.
[1261]	Terminal 53 Switch Setting	Setting of input terminal 54. Current = 0; Voltage = 1.
[1262]	Analog Input 53	Actual value at input 53 either as a reference or protection value.
[1263]	Terminal 54 Switch Setting	Setting of input terminal 54. Current = 0; Voltage = 1.
[1264]	Analog Input 54	Actual value at input 54 either as reference or protection value.
[1265]	Analog Output 42 [mA]	Actual value at output 42 in mA. Use *AN-50 Terminal 42 Output* to select the value to be shown.
[1266]	Digital Output [bin]	Binary value of all digital outputs.
[1267]	Freq. Input #29 [Hz]	Actual value of the frequency applied at terminal 29 as an impulse input.
[1268]	Freq. Input #33 [Hz]	Actual value of the frequency applied at terminal 33 as an impulse input.
[1269]	Pulse Output #27 [Hz]	Actual value of impulses applied to terminal 27 in digital output mode.
[1270]	Pulse Output #29 [Hz]	Actual value of impulses applied to terminal 29 in digital output mode.
[1271]	Relay Output [bin]	
[1272]	Counter A	Application dependent (e.g. LC Control)
[1273]	Counter B	Application dependent (e.g. LC Control)
[1274]	Prec. Stop Counter	Display the actual counter value.
[1275]	Analog input X30/11	Actual value at input X30/11 either as reference or protection value.
[1276]	Analog input X30/12	Actual value at input X30/12 either as reference or protection value.
[1277]	Analog output X30/8 mA	Actual value at output X30/8 in mA. Use *AN-60 Terminal X30/8 Output* to select the value to be shown.
[1280]	Fieldbus CTW 1	Control word (CTW) received from the Bus Master.
[1282]	Fieldbus REF 1	Main reference value sent with control word from the Bus Master.

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[1284]	Comm. Option STW	Extended network communication option status word.
[1285]	Drive Port CTW 1	Control word (CTW) received from the Bus Master.
[1286]	Drive Port REF 1	Status word (STW) sent to the Bus Master.
[1290]	Alarm Word	One or more alarms in a Hex code.
[1291]	Alarm Word 2	One or more alarms in a Hex code.
[1292]	Warning Word	One or more warnings in a Hex code.
[1293]	Warning Word 2	One or more warnings in a Hex code.
[1294]	Ext. Status Word	One or more status conditions in a Hex code.
[1295]	Ext. Status Word 2	One or more status conditions in a Hex code.

K-20 Display Line 1.1 Small

Option: Function:

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

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 parameter group 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 parameter group 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 parameter group 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 parameter group K-2#.

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]	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.

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 *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 *K-30 Unit for Custom Readout*, *K-31 Min Value of Custom Readout* (linear only), *K-32 Max Value of Custom Readout*, *F-17 Motor Speed High Limit [RPM]*, *F-15 Motor Speed High Limit [Hz]* and actual speed.

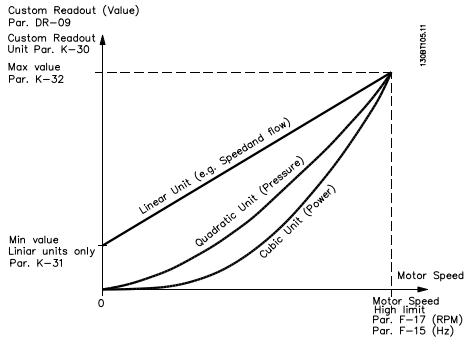

Illustration 3.4

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

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

Table 3.5

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 3.5*). The actual calculated value can be read in *DR-09 Custom Readout*, and/or shown in the display be selecting *[DR-09] Custom Readout* in *K-20 Display Line 1.1 Small* to *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]	m^3/s	
[24]	m^3/min	
[25]	m^3/h	
[30]	kg/s	
[31]	kg/min	
[32]	kg/h	
[33]	t/min	
[34]	t/h	
[40]	m/s	
[41]	m/min	
[45]	m	
[60]	°C	
[70]	mbar	
[71]	bar	
[72]	Pa	
[73]	kPa	
[74]	m WG	
[80]	kW	
[120]	GPM	

K-30 Unit for Custom Readout		
Option:		**Function:**
[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:		**Function:**
0 CustomReadoutUnit*	[-999999.99 - par. K-32 CustomReadoutUnit]	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 *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:		**Function:**
100 CustomReadoutUnit*	[par. K-31 - 999999.99 CustomReadoutUnit]	This parameter sets the max value to be shown when the speed of the motor has reached the set value for *F-17 Motor Speed High Limit [RPM]* or *F-15 Motor Speed High Limit [Hz]* (depends on setting in *K-02 Motor Speed Unit*).

K-37 Display Text 1		
Range:		**Function:**
0*	[0 - 0]	Enter a text which can be viewed in the graphical display by selecting *[37] Display Text 1* in *K-20 Display Line 1.1 Small*, *K-21 Display Line 1.2 Small*, *K-22 Display Line 1.3 Small*, *K-23 Display Line 2 Large* or *K-24 Display Line 3 Large*.

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K-38 Display Text 2		
Range:		**Function:**
0*	[0 - 0]	Enter a text which can be viewed in the graphical display by selecting *[38] Display Text 2* in *K-20 Display Line 1.1 Small*, *K-21 Display Line 1.2 Small*, *K-22 Display Line 1.3 Small*, *K-23 Display Line 2 Large* or *K-24 Display Line 3 Large*.

K-39 Display Text 3		
Range:		**Function:**
0*	[0 - 0]	Enter a text which can be viewed in the graphical display by selecting *[39] Display Text 3*in *K-20 Display Line 1.1 Small*, *K-21 Display Line 1.2 Small*, *K-22 Display Line 1.3 Small*, *K-23 Display Line 2 Large* or *K-24 Display Line 3 Large*.

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:		**Function:**
[0]	Disabled	Key disabled avoids accidental usage of the key.
[1] *	Enabled	[Hand] key enabled
[2]	Password Protection	Avoid unauthorized start in Hand mode. If *K-40 [Hand] Button on Keypad* is included in the Quick Start Menu, then define the password in *K-65 Quick Menu Password*. Otherwise define the password in *K-60 Main Menu Password*.
[3]	Enabled without OFF	
[4]	Password without OFF	
[5]	Enabled with OFF	
[6]	Password with OFF	

K-41 [Off] Button on Keypad		
Option:		**Function:**
[0]	Disabled	Avoids accidental stop of the frequency converter.
[1] *	Enabled	[Off] Key enabled
[2]	Password Protection	Avoids unauthorised stop. If *K-41 [Off] Button on Keypad* is included in the Quick Menu, then define the password in *K-65 Quick Menu Password*.
[3]	Hand Off/On	
[4]	Hand Off/On w. Passw.	
[7]	Enabled without OFF	
[8]	Password without OFF	
[9]	Enabled, ref = 0	

K-41 [Off] Button on Keypad		
Option:		**Function:**
[8]	Password without OFF	
[9]	Enabled, ref = 0	

K-42 [Auto] Button on Keypad		
Option:		**Function:**
[0]	Disabled	Avoid accidental start of the frequency converter in Auto mode.
[1] *	Enabled	[Auto] Key enabled
[2]	Password Protection	Avoids unauthorised start in Auto mode. If *K-42 [Auto] Button on Keypad* is included in the Quick Menu, then define the password in *K-65 Quick Menu Password*.
[3]	Hand Off/On	
[4]	Hand Off/On w. Passw.	
[7]	Enabled without OFF	
[8]	Password without OFF	
[9]	Enabled, ref = 0	

K-43 [Reset] Button on Keypad		
Option:		**Function:**
[0]	Disabled	No effect when [Reset] is pressed. Avoids accidental alarm reset.
[1] *	Enabled	[Reset] Key enabled
[2]	Password Protection	Avoids unauthorised resetting. If *K-43 [Reset] Button on Keypad* is included in the Quick Menu, then define the password in *K-65 Quick Menu Password*.
[3]	Hand Off/On	
[4]	Hand Off/On w. Passw.	
[7]	Enabled without OFF	Resets the frequency converter without setting it in *Off* mode.
[8]	Password without OFF	Resets the frequency converter without setting it in *Off* mode. A password is required when pressing [Reset] (see [2]).
[9]	Enabled, ref = 0	

3.2.6 K-5# Copy/Save

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

K-50 Keypad Copy		
Option:		**Function:**
		NOTE **This parameter cannot be adjusted while the motor is running.**

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 program several frequency converters with the same function without disturbing motor data.

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 *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 *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 *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 *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*	[-9999 - 9999]	Define the password for access to the Main Menu via the [Main Menu] key. If *K-61 Access to Main Menu w/o Password* is set to *[0] Full access*, this parameter will be ignored.

K-61 Access to Main Menu w/o Password		
Option:		Function:
[0] *	Full access	Disables password defined in *K-60 Main Menu Password*.
[1]	Keypad: Read only	Prevent unauthorized editing of Main Menu parameters.
[2]	Keypad: No access	Prevent unauthorized viewing and editing of Main Menu parameters.
[3]	Bus: Read only	
[4]	Bus: No access	
[5]	All: Read only	
[6]	All: No access	

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

K-65 Quick Menu Password		
Range:		Function:
200*	[-9999 - 9999]	Define the password for access to the Quick Menu via the [Quick Menu] key. If *K-66 Access to Quick Menu w/o Password* is set to *[0] Full access*, this parameter will be ignored.

K-66 Access to Quick Menu w/o Password		
Option:		Function:
[0] *	Full access	Disables the password defined in *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 Quick Menu parameters on Fieldbus and/ or Drive standard bus.
[4]	Bus: No access	No access to Quick Menu parameters is allowed via Fieldbus and/ or Drive standard bus.
[5]	All: Read only	read only function for Quick Menu parameters on keypad, Fieldbus or Drive standard bus.
[6]	All: No access	No access from keypad, Fieldbus or Drive standard bus is allowed.

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

K-67 Bus Password Access		
Range:		Function:
0*	[0 - 9999]	Writing to this parameter enables users to unlock the frequency converter from network/DCT-10.

3.3 F-## Parameter Data Set

Parameter group related to the fundamental functions of the drive.

3

3.3.1 F-0# Fundamental 0

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

F-01 Frequency Setting 1

Option:		Function:
		Select the reference input to be used for the first reference signal. *F-01 Frequency Setting 1*, *C-30 Frequency Command 2* and *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 Potentiometer	
[21]	Analog input X30-11	(General Purpose I/O Option Module)
[22]	Analog input X30-12	(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. **NOTE** **When set to *[2] Local*, the frequency converter will start with this setting again following a 'power down'.**

F-03 Max Output Frequency 1

Range:		Function:
132 Hz*	[1 - 590 Hz]	**NOTE** **This parameter cannot be adjusted while the motor is running.**

F-03 Max Output Frequency 1

Range:		Function:
		NOTE **Max. output frequency cannot exceed 10% of the carrier frequency (*F-26 Motor Noise (Carrier Freq)*).** 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 *H-40 Configuration Mode*).

F-04 Base Frequency

Range:		Function:
60 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 *H-50 Motor Magnetisation at Zero Speed* to *H-53 Model Shift Frequency*. For 87 Hz operation with 230/400 V motors, set the nameplate data for 230 V/50 Hz. Adapt *F-17 Motor Speed High Limit [RPM]* and *F-53 Maximum Reference* to the 87 Hz application.

F-05 Motor Rated Voltage

Range:		Function:
460 V*	[10 - 1000 V]	Enter the nominal motor voltage according to the motor nameplate data. The default value corresponds to the nominal rated output of the unit.

F-07 Accel Time 1

Range:		Function:
3.00 s*	[0.01 - 3600 s]	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 *F-43 Current Limit* during ramping. The value 0.00 corresponds to 0.01 s in speed mode. See decel time in *F-08 Decel Time 1*. $Par.\ F-07 = \frac{t_{acc}[s] \times n_s[RPM]}{ref[RPM]}$

F-08 Decel Time 1

Range:		Function:
3.00 s*	[0.01 - 3600 s]	Enter the decel time, that is, 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 *F-43 Current Limit*. The value 0.00

F-08 Decel Time 1		
Range:		**Function:**
		corresponds to 0.01 s in speed mode. See accel time in *F-07 Accel Time 1*. $Par.\ F-08 = \frac{t_{dec}[s] \times n_s[RPM]}{ref[RPM]}$

F-09 Torque Boost		
Range:		**Function:**
100 %*	[0 - 300 %]	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

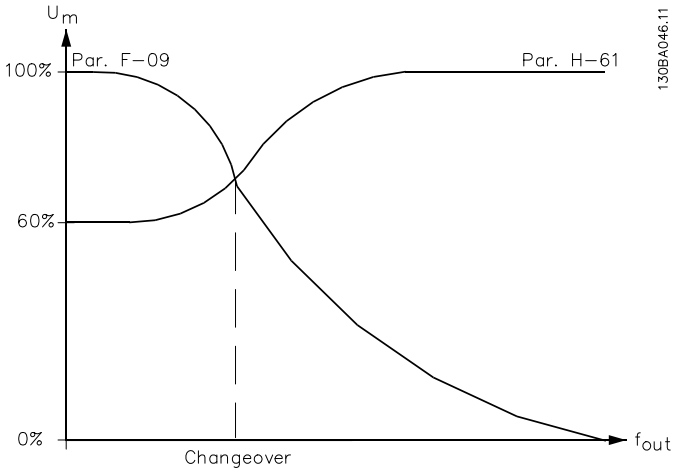


Illustration 3.5 Changeover

3.3.2 F-1# Fundamental 1

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

F-10 Electronic Overload		
Option:		**Function:**
		Thermal motor protection can be implemented using a range of techniques: • Via a PTC sensor in the motor windings connected to one of the analog or digital inputs (*F-12 Motor Thermistor Input*). See *3.3.3.1 PTC Thermistor Connection*. • Via a KTY sensor in the motor winding connected to an analog input (*H-96 KTY Thermistor Input*). See *3.3.3.2 KTY Sensor Connection*. • 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 $f_{M,N}$. See *3.3.3.3 Electronic Thermal Overload*. • Via a mechanical thermal switch (Klixon type). See *3.3.3.4 Klixon*. For the North American market: The electronic overload functions provide class 20 motor overload protection in accordance with NEC.
[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 or KTY sensor in the motor reacts in the event of motor over-temperature. The thermistor cut-out value must be > 3 kΩ. Integrate a thermistor (PTC sensor) in the motor for winding protection.
[3]	Elec. OL Warning 1	Calculates the load when set-up 1 is active and activates a warning on the display when the motor is overloaded. Program a warning signal via one of the digital outputs.
[4]	Elec. OL Trip 1	Calculates the load when set-up 1 is active and stops (trips) 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).
[5]	Elec. OL Warning 2	
[6]	Elec. OL Trip 2	
[7]	Elec. OL Warning 3	
[8]	Elec. OL Trip 3	
[9]	Elec. OL Warning 4	

3

F-10 Electronic Overload		
Option:		**Function:**
[10]	Elec. OL Trip 4	
[20]	ATEX Elec. OL	Activates the thermal monitoring function for Ex-e motors for ATEX. Enables *H-94 ATEX overload cur.lim. speed reduction*, *H-98 ATEX overload interpol. points freq.* and *H-99 ATEX overload interpol points current.*
[21]	Advanced Elec. OL	

3.3.3.1 PTC Thermistor Connection

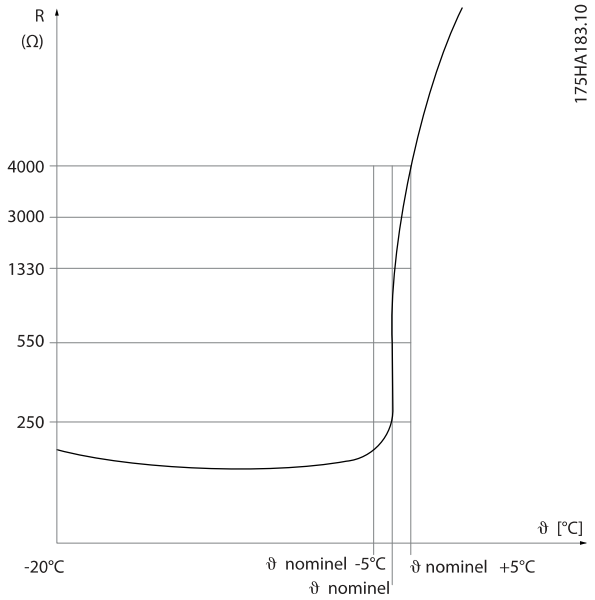


Illustration 3.6 PTC Profile

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 *F-10 Electronic Overload* to *[2] Thermistor Trip*
Set *F-12 Motor Thermistor Input* to *[6] Digital Input*

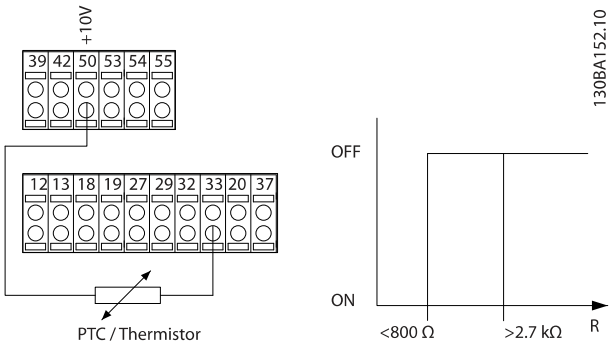


Illustration 3.7 PTC Thermistor Connection - Digital Input

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 *F-10 Electronic Overload* to *[2] Thermistor Trip*
Set *F-12 Motor Thermistor Input* to *[2] Analog Input 54*

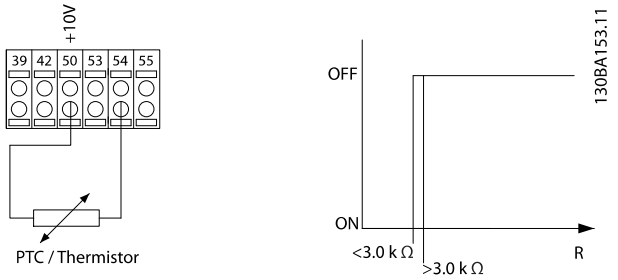


Illustration 3.8 PTC Thermistor Connection - Analog Input

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

NOTE

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

3.3.3.2 KTY Sensor Connection

KTY sensors are used especially in Permanent Magnet Servo Motors (PM motors) for dynamic adjusting of motor parameters as stator resistance (*P-30 Stator Resistance (Rs)*) for PM motors and also rotor resistance (*P-31 Rotor Resistance (Rr)*) for asynchronous motors, depending on winding temperature. The calculation is:

$Rs = Rs_{20^\circ C} \; x\,(1 + \alpha_{cu} \; x\,\Delta T)\,[\Omega]$ where $\alpha_{cu} = 0.00393$

KTY sensors can be used for motor protecting (*H-97 KTY Threshold level*).
AF-650 GP can handle three types of KTY sensors, defined in *H-95 KTY Sensor Type*. The actual sensor temperature can be read out from *DR-19 KTY sensor temperature*.

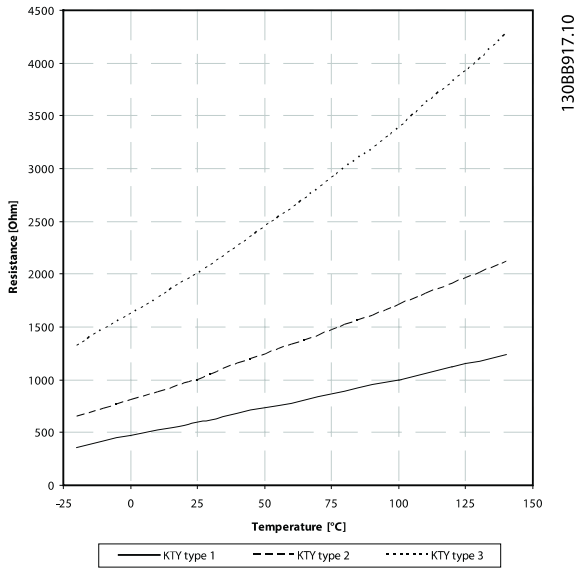


Illustration 3.9 KTY Type Selection

KTY Sensor 1: 1 kΩ at 100 °C (e.g. Philips KTY 84-1)
KTY Sensor 2: 1 kΩ at 25 °C (e.g. Philips KTY 83-1)
KTY Sensor 3: 2 kΩ at 25 °C (e.g. Infineon KTY-10

NOTE

If the temperature of the motor is utilized through a thermistor or KTY sensor the PELV is not complied with in case of short circuits between motor windings and sensor. In order to comply with PELV the sensor must be extra isolated.

3.3.3.3 Electronic Thermal Overload

The calculations estimate the need for a lower load at lower speed due to less cooling from the fan incorporated in the motor.

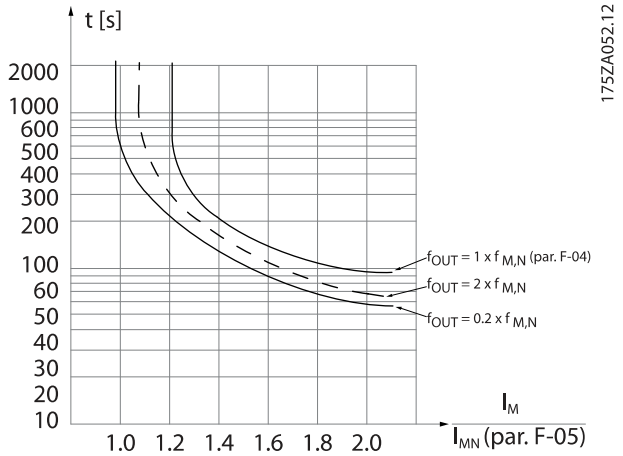


Illustration 3.10 Electronic Thermal Overload Profile

3.3.3.4 Klixon

The Klixon type thermal circuit breaker uses a KLIXON® metal dish. At a predetermined overload, the heat caused by the current through the disc causes a trip.

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 *F-10 Electronic Overload* to *[2] Thermistor Trip*
Set *F-12 Motor Thermistor Input* to *[6] Digital Input*

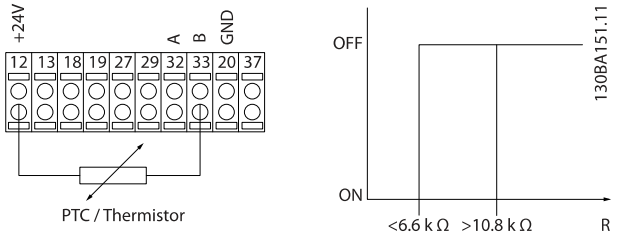


Illustration 3.11 Thermistor Connection

F-11 Motor External Fan		
Option:	**Function:**	
[0] *	No	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 upper curve in graph above (fout = 1 x fM,N) is followed if the motor current is lower than nominal motor current (see *P-03 Motor Current*). If the motor current exceeds nominal current, the operation time still decreases as if no fan were installed.

3

F-12 Motor Thermistor Input		
Option:		**Function:**
		NOTE **This parameter cannot be adjusted while the motor is running.** 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 *F-01 Frequency Setting 1*, *C-30 Frequency Command 2* or *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	

NOTE

Digital input should be set to *[0] PNP - Active at 24 V* in E-0#.

F-15 Motor Speed High Limit [Hz]		
Range:		**Function:**
60.0 Hz*	[par. F-16 - par. F-03 Hz]	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 *F-16 Motor Speed Low Limit [Hz]*. Only *F-17 Motor Speed High Limit [RPM]* or *F-15 Motor Speed High Limit [Hz]* will be displayed depending on other parameters in the Main Menu and depending on default settings dependant on global location.

NOTE

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

F-16 Motor Speed Low Limit [Hz]		
Range:		**Function:**
0 Hz*	[0 - par. F-15 Hz]	Enter the minimum limit for motor speed. The Motor Speed Low Limit can be set to correspond to the minimum output frequency of the motor shaft. The Motor Speed Low Limit must not exceed the setting in *F-15 Motor Speed High Limit [Hz]*.

F-17 Motor Speed High Limit [RPM]		
Range:		**Function:**
3600 RPM*	[par. F-18 - 60000 RPM]	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 *F-18 Motor Speed Low Limit [RPM]*.

NOTE

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

F-18 Motor Speed Low Limit [RPM]		
Range:		**Function:**
0 RPM*	[0 - par. F-17 RPM]	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 *F-17 Motor Speed High Limit [RPM]*.

3.3.4 F-2# Fundamental 2

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

F-20 PM Start Mode		
Option:		**Function:**
[0]	Rotor Detection	Suitable for all applications where the motor is known to be standing still when starting (e.g. conveyors, pumps and non wind milling fans).
[1] *	Parking	If the motor turns at a slight speed (i.e. lower than 2-5% of the nominal speed) e.g. due to fans with light wind milling, select *[1] Parking* and adjust *B-06 Parking Current* and *B-07 Parking Time* accordingly.

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 *F-25 Start Function* to *[3] Start speed cw*, *[4] Horizontal operation* or *[5] Adv. Vector Control/Flux Clockwise*, and set a start delay time in *F-24 Holding Time*.

F-23 Start Speed [Hz]

Range:		Function:
0 Hz*	[0 - 500.0 Hz]	This parameter can be used for hoist applications (cone rotor). Set a motor start speed. After the start signal, the output speed leaps to set value. Set the start function in *F-25 Start Function* to *[3] Start speed cw*, *[4] Horizontal operation* or *[5] Adv. Vector Control/ Flux Clockwise*, and set a start delay time in *F-24 Holding Time*.

F-24 Holding Time

Range:		Function:
0 s*	[0 - 25.5 s]	This parameter refers to the start function selected in *F-25 Start Function*. 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 *F-24 Holding Time*.
[0]	DC Hold/ delay time	Energizes motor with a DC holding current (*B-00 DC Hold Current*) during the start delay time.
[1]	DC Brake/ delay time	Energizes motor with a DC braking current (*B-01 DC Brake Current*) during the start delay time.
[2] *	Coast/delay time	Motor coasted during the start delay time (inverter off).
[3]	Start speed cw	Only possible with Advanced Vector Control. Connect the function described in *F-22 Start Speed [RPM]* and *F-29 Start Current* 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 *F-22 Start Speed [RPM]* or *F-23 Start Speed [Hz]* and the output current corresponds to the setting of the start current in *F-29 Start Current*. 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 Advanced Vector Control. For obtaining the function described in *F-22 Start Speed [RPM]* and *F-29 Start Current* during the start delay time. The motor rotates in the reference direction. If the reference signal equals zero (0), *F-22 Start Speed [RPM]* is ignored and the output speed equals zero (0). The output current corresponds to the setting of the start current in *F-29 Start Current*.
[5]	Adv. Vector Control/Flux Clockwise	For the function described in *F-22 Start Speed [RPM]* 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 *F-22 Start Speed [RPM]*. *[3] Start speed/current clockwise* and *[5] Advanced Vector Control/Flux clockwise* are typically used in hoisting applications. *[4] Start speed/ current in reference direction* is particularly used in applications with counterweight and horizontal movement.
[6]	Hoist Mech. Brake Rel	For utilizing mechanical brake control functions, *B-24 Stop Delay* to *B-28 Gain Boost Factor*. This parameter is only active when *H-41 Motor Control Principle* is set to [3] *Flux w/ motor feedback*.
[7]	Adv. Vector Control/Flux Counter-cw	

F-26 Motor Noise (Carrier Freq)

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

Option:		Function:
[0]	1.0 kHz	
[1]	1.5 kHz	Default switching frequency for 355-1200 kW / 500-1600 HP at 690 V
[2]	2.0 kHz	Default switching frequency for 250-800 kW / 350-1200 HP at 400/460 V and 37-315 kW / 50-450 HP at 690 V
[3]	2.5 kHz	
[4]	3.0 kHz	Default switching frequency for 18.5-37 kW / 25-50 HP at 240 V and 37-200 kW / 50-300 HP at 400/460 V
[5]	3.5 kHz	
[6]	4.0 kHz	Default switching frequency for 5.5-15 kW / 7.5-20 HP at 240 V and 11-30 kW / 15- 40 HP at 400/460 V
[7] *	5.0 kHz	Default switching frequency for 0.25-3.7 kW / 0.33-5 HP at 200 V and 0.37-7.5 kW / 0.5-10 HP at 400/460 V
[8]	6.0 kHz	

3

F-26 Motor Noise (Carrier Freq)		
Select the carrier frequency. Changing the switching frequency can help to reduce acoustic noise from the motor. Default depends on power size.		
Option:		**Function:**
[9]	7.0 kHz	
[10]	8.0 kHz	
[11]	10.0 kHz	
[12]	12.0kHz	
[13]	14.0 kHz	
[14]	16.0kHz	

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-28 Dead Time Compensation		
Option:		**Function:**
[0]	Off	No compensation.
[1] *	On	Activates dead time compensation.

F-29 Start Current		
Range:		**Function:**
0 A*	[0 - par. P-03 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 *F-29 Start Current*. Set *F-22 Start Speed [RPM]*. Set *F-25 Start Function* to *[3] Start speed cw* or *[4] Horizontal operation*, and set a start delay time in *F-24 Holding Time*. This parameter can be used for hoist applications (cone rotor).

3.3.5 F-3# Fundamental 3

Parameters to configure drive Advanced Switching Pattern and Overmodulation.

F-37 Adv. Switching Pattern		
Option:		**Function:**
		Select the switching pattern: 60° AVM or SFAVM.
[0] *	60 AVM	
[1]	SFAVM	

F-38 Overmodulation		
Option:		**Function:**
[0]	Off	Select *[0] Off* 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	Select *[1] On* to enable the overmodulation function for the output voltage. This is the right choice when it is required that the output voltage is higher than 95% of the input voltage (typical when running over-synchronously). The output voltage is increased according to the degree of overmodulation. **NOTE** **Overmodulation leads to increased torque ripple as harmonics are increased.** Control in FLUX mode provides an output current of up to 98% of the input current, regardless of *F-38 Overmodulation*.
[2]	Optimal	

3.3.6 F-4# Fundamental 4

Parameters to configure drive torque and current limits.

F-40 Torque Limiter (Driving)		
Range:		**Function:**
160.0 %* Application dependent*	[0 - 1000.0 %] [Application dependant]	This function limits the torque on the shaft to protect the mechanical installation.

NOTE

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

NOTE

The torque limit reacts on the actual, non-filtrated torque, including torque spikes. This is not the torque that is seen from the keypad or the Fieldbus as that is filtered.

F-41 Torque Limiter (Braking)		
Range:		**Function:**
100 %*	[0 - 1000.0 %]	This function limits the torque on the shaft to protect the mechanical installation.

NOTE

The torque limit reacts on the actual, non-filtrated torque, including torque spikes. This is not the torque that is seen from the keypad or the Fieldbus as that is filtered.

F-43 Current Limit		
Range:		**Function:**
160.0 %*	[1.0 - 1000.0 %]	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.

3.3.7 F-5# Extended References

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

F-50 Reference Range		
Option:		**Function:**
		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 *[1] Speed closed loop* control or *[3] Process* is selected in *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 *[1] Speed closed loop* control or *[3] Process* is selected in *H-40 Configuration Mode*.
[1] *	-Max - +Max	For both positive and negative values (both directions, relative to *H-08 Reverse Lock*).

F-51 Reference/Feedback Unit		
Option:		**Function:**
		Select the unit to be used in Process PID Control references and feedbacks. *H-40 Configuration Mode* must be either *[3] Process* or *[8] Extended PID Control*.
[0] *	None	
[1]	%	
[2]	RPM	
[3]	Hz	
[4]	Nm	
[5]	PPM	
[10]	1/min	
[12]	Pulse/s	
[20]	l/s	
[21]	l/min	
[22]	l/h	
[23]	m^3/s	
[24]	m^3/min	
[25]	m^3/h	
[30]	kg/s	
[31]	kg/min	
[32]	kg/h	
[33]	t/min	
[34]	t/h	
[40]	m/s	
[41]	m/min	
[45]	m	
[60]	°C	
[70]	mbar	
[71]	bar	
[72]	Pa	
[73]	kPa	
[74]	m WG	
[80]	kW	
[120]	GPM	
[121]	gal/s	
[122]	gal/min	
[123]	gal/h	
[124]	CFM	
[125]	ft^3/s	
[126]	ft^3/min	
[127]	ft^3/h	
[130]	lb/s	
[131]	lb/min	
[132]	lb/h	
[140]	ft/s	
[141]	ft/min	
[145]	ft	
[150]	lb ft	
[160]	°F	
[170]	psi	
[171]	lb/in^2	
[172]	in WG	
[173]	ft WG	
[180]	HP	

F-52 Minimum Reference		
Range:		**Function:**
0 Reference-FeedbackUnit*	[-999999.999 - par. F-53 ReferenceFeed-backUnit]	Enter the Minimum Reference. The Minimum Reference is the lowest value obtainable by summing all references. Minimum Reference is active only when *F-50 Reference Range* is set to *[0] Min.- Max*. The Minimum Reference unit matches: • The choice of configuration in *H-40 Configuration Mode Configuration Mode*: for *[1] Speed*

3

F-52 Minimum Reference		
Range:		**Function:**
		closed loop, RPM; for *[2] Torque*, Nm. • The unit selected in *F-51 Reference/ Feedback Unit*.

F-53 Maximum Reference		
Range:		**Function:**
1500.000 ReferenceFeed-backUnit*	[par. F-52 - 999999.999 ReferenceFeed-backUnit]	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 *H-40 Configuration Mode*: for *[1] Speed closed loop*, RPM; for *[2] Torque*, Nm. • The unit selected in *F-50 Reference Range*.

F-54 Reference Function		
Option:		**Function:**
[0] *	Sum	Sums both external and preset reference sources.
[1]	External/Preset	Use either the preset or the external reference source. Shift between external and preset via a command or a digital input.

3.3.8 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:		**Function:**
0 %*	[0 - 100 %]	Enter a percentage (relative) value to be either added to or deducted from the actual reference for Catch up or Slow down respectively. If *Catch up* is selected via one of the digital inputs (*E-01 Terminal 18 Digital Input* to *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 (*E-01 Terminal 18 Digital Input* to *E-06 Terminal 33 Digital Input*), the percentage (relative) value is deducted from the total reference. Obtain

F-62 Catch up/slow Down Value		
Range:		**Function:**
		extended functionality with the DigiPot function. See parameter group *F-9# Digital Pot-Meter*.

F-64 Preset Relative Reference		
Range:		**Function:**
0 %*	[-100 - 100 %]	The actual reference, X, is increased or decreased with the percentage Y, set in *F-64 Preset Relative Reference*. This results in the actual reference Z. Actual reference (X) is the sum of the inputs selected in *F-01 Frequency Setting 1*, *C-30 Frequency Command 2*, *C-34 Frequency Command 3* and *O-02 Control Word Source*.

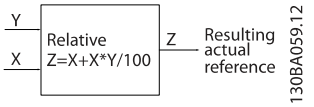


Illustration 3.12 Preset Relative Reference

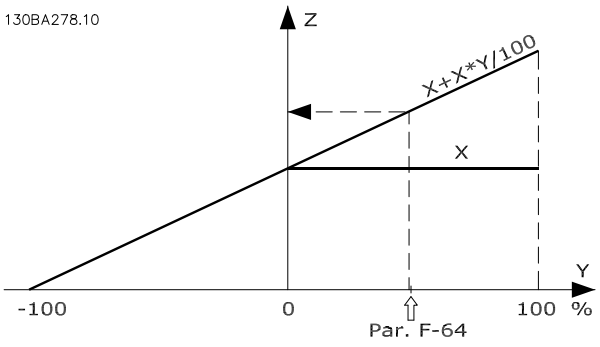
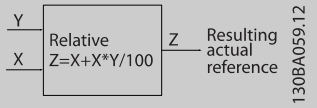


Illustration 3.13 Actual Reference

F-68 Relative Scaling Reference Resource		
Option:		**Function:**
		NOTE **This parameter cannot be adjusted while the motor is running.** Select a variable value to be added to the fixed value (defined in *F-64 Preset Relative Reference*). The sum of the fixed and variable values (labelled Y in *Illustration 3.14*) is multiplied with the actual reference (labelled X in *Illustration 3.14*). This product is then added to the actual reference (X+X*Y/100) to give the resultant actual reference.

F-68 Relative Scaling Reference Resource		
Option:		**Function:**
		 **Illustration 3.14 Resultant 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 Potentiometer	
[21]	Analog input X30-11	
[22]	Analog input X30-12	

3.3.9 F-9# Digital Potentiometer

Parameters to configure drive digital pot-meter function.

F-90 Step Size		
Range:		**Function:**
0.10 %*	[0.01 - 200 %]	Enter the increment size required for INCREASE/DECREASE, as a percentage of the synchronous motor speed, n_s. If INCREASE/DECREASE is activated the resulting reference will be increased/ decreased by the amount set in this parameter.

F-91 Accel/Decel Time		
Range:		**Function:**
1 s*	[0 - 3600 s]	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 *F-95 Accel/ Decel Ramp Delay* the actual reference will be acceled/deceled according to this ramp time. The ramp time is defined as the time used to adjust the reference by the step size specified in *F-90 Step Size*.

F-92 Power Restore		
Option:		**Function:**
[0] *	Off	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:		**Function:**
100 %*	[-200 - 200 %]	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:		**Function:**
-100 %*	[-200 - 200 %]	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:		**Function:**
0*	[0 - 0]	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 *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

3

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 27, 32, 33
Reset	[1]	All
Coast inverse	[2]	All
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

Digital input function	Select	Terminal
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

Table 3.6

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	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 *C-23 Quick Stop Decel Time*. 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 *B-01 DC Brake Current* to *B-03 DC Brake Cut In Speed [RPM]*. The function is only active when the value in *B-02 DC Braking Time* 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 (*F-08 Decel Time 1*, *E-11 Decel Time 2*, *E-13 Decel Time 3*, *E-15 Decel Time 4*). **NOTE** **When the frequency converter is at the torque limit and has received a stop command, it may not stop by itself. To ensure that the frequency converter stops, configure a digital output to *[27] Torque limit & stop*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 *H-08 Reverse Lock*. 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 *C-20 Jog Speed [Hz]*.
[15]	Preset reference on	Shifts between external reference and preset reference. It is assumed that *[1] External/preset* has been selected in *F-54 Reference Function*. 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].

3

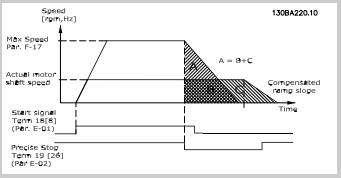
Preset ref. bit	2	1	0
Preset ref. 0	0	0	0
Preset ref. 1	0	0	1
Preset ref. 2	0	1	0
Preset ref. 3	0	1	1
Preset ref. 4	1	0	0
Preset ref. 5	1	0	1
Preset ref. 6	1	1	0
Preset ref. 7	1	1	1

Table 3.7

[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 (*E-10 Accel Time 2* and *E-11 Decel Time 2*) in the range 0 - *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 (*E-10 Accel Time 2* and *E-11 Decel Time 2*) in the range 0 - *F-04 Base Frequency*. **NOTE** **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

Table 3.8

[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 *K-10 Active Set-up* to Multi Set-up.
[24]	Set-up select bit 1	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 *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 *H-83 Precise Stop Function*.  **Illustration 3.15**
[28]	Catch up	Increases reference value by percentage (relative) set in *F-62 Catch up/slow Down Value*.
[29]	Slow down	Reduces reference value by percentage (relative) set in *F-62 Catch up/slow Down Value*.
[30]	Counter input	Precise stop function in *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 *H-84 Precise Stop Counter Value*.
[32]	Pulse input	Use pulse sequence as either reference or feedback. Scaling is done in parameter group 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

Table 3.9

[36]	Mains failure inverse	Activates *SP-10 Line failure*. 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 *H-83 Precise Stop Function*. 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.

NOTE

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

E-01 Terminal 18 Digital Input

Option:		Function:
		The options are the same as those listed for parameter group E-0#.

E-02 Terminal 19 Digital Input

Option:		Function:
		The options are the same as those listed for parameter group E-0#.

E-03 Terminal 27 Digital Input

Option:		Function:
		The options are the same as those listed for parameter group E-0#.

E-04 Terminal 29 Digital Input

Option:		Function:
		The options are the same as those listed for parameter group E-0#.

E-05 Terminal 32 Digital Input

Option:		Function:
		The options are the same as those listed for parameter group E-0#.

E-06 Terminal 33 Digital Input

Option:		Function:
		The options are the same as those listed for parameter group E-0#.

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.

NOTE

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

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

Table 3.10 Overview of Functions, Alarms and Warnings

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:		Function:
3.00 s*	[0.01 - 3600 s]	Enter the accel time from 0 RPM to the rated motor speed n_s. Choose a accel time such that

3

E-10 Accel Time 2		
Range:		**Function:**
		the output current does not exceed the current limit in *F-43 Current Limit* during ramping. The value 0.00 corresponds to 0.01 s in speed mode. See decel time in *E-11 Decel Time 2*. $Par.\ E-10 = \frac{t_{acc}[s] \times n_s[RPM]}{ref[RPM]}$

E-11 Decel Time 2		
Range:		**Function:**
3.00 s*	[0.01 - 3600 s]	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 *F-43 Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See accel time in *E-10 Accel Time 2*. $Par.\ E-11 = \frac{t_{dec}[s] \times n_s[RPM]}{ref[RPM]}$

E-12 Accel Time 3		
Range:		**Function:**
3.00 s*	[0.01 - 3600 s]	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 *F-43 Current Limit* during ramping. The value 0.00 corresponds to 0.01 s in speed mode. See decel time in *E-13 Decel Time 3*.

E-13 Decel Time 3		
Range:		**Function:**
3.00 s*	[0.01 - 3600 s]	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 *F-43 Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See accel time in *E-12 Accel Time 3*. $Par.\ E-13 = \frac{t_{dec}[s] \times n_s[RPM]}{ref[RPM]}$

E-14 Accel Time 4		
Range:		**Function:**
3.00 s*	[0.01 - 3600 s]	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 *F-43 Current Limit* during ramping. The value 0.00 corresponds to 0.01 s in speed mode. See decel time in *E-15 Decel Time 4*. $Par.\ E-14 = \frac{t_{acc}[s] \times n_s[RPM]}{ref[RPM]}$

E-15 Decel Time 4		
Range:		**Function:**
3.00 s*	[0.01 - 3600 s]	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 *F-43 Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See accel time in *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 *E-51 Terminal 27 Mode*, and set the I/O function for terminal 29 in *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]	Drive running	Motor is running.
[6]	Running / no warning	Output speed is higher than the speed set in *H-81 Min Speed for Function at Stop [RPM]*. 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 *H-70 Warning Current Low* to *H-73 Warning Speed High*. 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 *F-40 Torque Limiter (Driving)* or F-41 has been exceeded.
[12]	Out of current range	The motor current is outside the range set in *F-43 Current Limit*.
[13]	Below current, low	Motor current is lower than set in *H-70 Warning Current Low*.
[14]	Above current, high	Motor current is higher than set in *H-71 Warning Current High*.
[15]	Out of range	Output frequency is outside the frequency range set in *H-70 Warning Current Low* and *H-71 Warning Current High*.
[16]	Below speed, low	Output speed is lower than the setting in *H-72 Warning Speed Low*.
[17]	Above speed, high	Output speed is higher than the setting in *H-73 Warning Speed High*.
[18]	Out of feedback range	Feedback is outside the range set in *H-76 Warning Feedback Low* and *H-77 Warning Feedback High*.
[19]	Below feedback low	Feedback is below the limit set in *H-76 Warning Feedback Low*.
[20]	Above feedback high	Feedback is above the limit set in *H-77 Warning Feedback High*.
[21]	Thermal warning	The thermal warning turns on when the temperature exceeds the limit in the motor, the frequency converter, the brake resistor, or the thermistor.
[22]	Ready, no thermal warning	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 *General Specifications* section in the relevant Design Guide).
[25]	Reverse	*Reversing. 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 parameter group *B-2# Mechanical Brake*.
[40]	Out of ref range	Active when the actual speed is outside settings in parameter H-72 to H-75.
[41]	Below reference low	Active when actual speed is below speed reference setting.
[42]	Above reference high	Active when actual speed is above speed reference setting.
[45]	Bus Ctrl	Controls output via bus. The state of the output is set in *E-90 Digital & Relay Bus Control*. The output state is retained in the event of bus time-out.
[46]	Bus Ctrl On at timeout	Controls output via bus. The state of the output is set in *E-90 Digital & Relay Bus Control*. 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 *E-90 Digital & Relay Bus Control*. In the event of bus time-out the output state is set low (Off).
[55]	Pulse output	
[60]	Comparator 0	See parameter group LC-1#. If Comparator 0 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[61]	Comparator 1	See parameter group LC-1#. If Comparator 1 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[62]	Comparator 2	See parameter group LC-1#. If Comparator 2 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[63]	Comparator 3	See parameter group LC-1#. If Comparator 3 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[64]	Comparator 4	See parameter group LC-1#. If Comparator 4 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[65]	Comparator 5	See parameter 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 parameter 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 parameter group LC-4#. If Logic Rule 1 is evaluated as TRUE, the output will go high. Otherwise, it will be low.

3

[72]	Logic Rule 2	See parameter 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 parameter 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 parameter 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 parameter group LC-4#. If Logic Rule 5 is evaluated as TRUE, the output will go high. Otherwise, it will be low.
[80]	Logic Controller Digital Output A	See *LC-52 Logic Controller Action*. The output will go high whenever the Logic Controller Action *[38] Set dig. out. A high* is executed. The output will go low whenever the Logic Controller Action *[32] Set dig. out. A low* is executed.
[81]	Logic Controller Digital Output B	See *LC-52 Logic Controller Action*. The input will go high whenever the Logic Controller Action *[39] Set dig. out. A high* is executed. The input will go low whenever the Logic Controller Action *[33] Set dig. out. A low* is executed.
[82]	Logic Controller Digital Output C	See *LC-52 Logic Controller Action*. The input will go high whenever the Logic Controller Action *[40] Set dig. out. A high* is executed. The input will go low whenever the Logic Controller Action *[34] Set dig. out. A low* is executed.
[83]	Logic Controller Digital Output D	See *LC-52 Logic Controller Action*. The input will go high whenever the Logic Controller Action *[41] Set dig. out. A* high is executed. The input will go low whenever the Logic Controller Action *[35] Set dig. out. A low* is executed.
[84]	Logic Controller Digital Output E	See *LC-52 Logic Controller Action*. The input will go high whenever the Logic Controller Action *[42] Set dig. out. A high* is executed. The input will go low whenever the Logic Controller Action *[36] Set dig. out. A low* is executed.
[85]	Logic Controller Digital Output F	See *LC-52 Logic Controller Action*. The input will go high whenever the Logic Controller Action *[43] Set dig. out. A high* is executed. The input will go low whenever the Logic Controller Action *[37] Set dig. out. A low* is executed.
[120]	Local reference active	Output is high when *F-02 Operation Method* = [2] Local or when *F-02 Operation Method = [0] Linked to hand auto* at the same time as the keypad is in Hand mode.
[121]	Remote reference active	Output is high when *F-02 Operation Method = [1] Remote* or *[0] Linked to hand/auto* 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 [Hand mode] (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

Choices are described under E-2#

E-21 Terminal 29 Digital Output

Choices are described under E-2#

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 6 [5], Relay 7 [6], Relay 8 [7], Relay 9 [8])

Choices are described under E-2#

E-26 On Delay, Relay

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

Range:		Function:
0.01 s*	[0.01 - 600 s]	Enter the delay of the relay cut-in time. The relay will only cut in if the condition in *E-24 Function Relay* is uninterrupted during the specified time. Select one of available mechanical relays and OPCRLY Relay Option Module in an array function. See *E-24 Function Relay*.

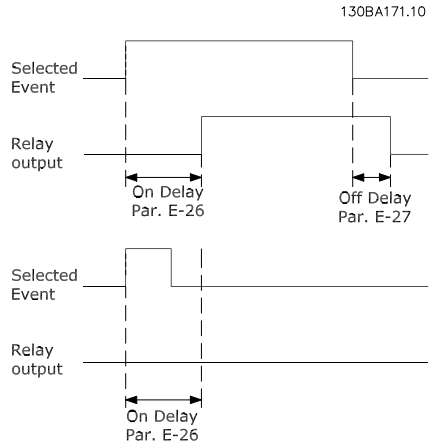


Illustration 3.16 On Delay, Relay

E-27 Off Delay, Relay		
Array[2]: Relay1[0], Relay2[1]		
Range:		**Function:**
0.01 s*	[0.01 - 600 s]	Enter the delay of the relay cut-out time. Select one of available mechanical relays and OPCRLY Relay Option Module in an array function. See *E-24 Function Relay*.

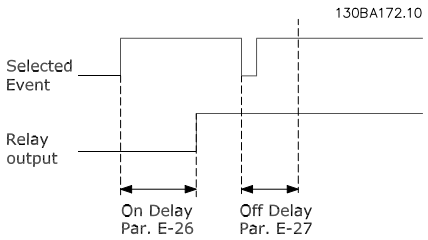


Illustration 3.17 Off Delay, Relay

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

E-51 Terminal 27 Mode		
Option:		**Function:**
		NOTE **This parameter cannot be adjusted while the motor is running.**
[0] *	Input	Defines terminal 27 as a digital input.
[1]	Output	Defines terminal 27 as a digital output.

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.

E-53 Terminal X30/2 Digital Input		
Option:		**Function:**
		The options are the same as listed for parameter group E-0#.

E-54 Terminal X30/3 Digital Input		
Option:		**Function:**
		The options are the same as listed for parameter group E-0#.

E-55 Terminal X30/4 Digital Input		
Option:		**Function:**
		The options are the same as listed for parameter group E-0#.

E-56 Term X30/6 Digi Out (OPCGPIO)
This parameter is active when OPCGPIO General Purpose I/O Option Module is mounted in the frequency converter. Functions are described under *E-2# Digital Outputs*.

E-57 Term X30/7 Digi Out (OPCGPIO)
This parameter is active when OPCGPIO General Purpose I/O Option Module is mounted in the frequency converter. Functions are described under *E-2# Digital Outputs*.

3.4.4 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 *E-62 Term. 29 Low Ref./Feedb. Value*. 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 *E-63 Term. 29 High Ref./Feedb. Value*..

E-62 Term. 29 Low Ref./Feedb. Value		
Range:		**Function:**
0 ReferenceFeed-backUnit*	[-999999.999 - 999999.999 ReferenceFeed-backUnit]	Enter the low reference value limit for the motor shaft speed [RPM]. This is also the lowest feedback value, see also *E-67 Term. 33 Low Ref./ Feedb. Value*. Set terminal 29 to digital input (*E-52 Terminal 29 Mode = [0] input* (default) and *E-04 Terminal 29 Digital Input* = applicable value).

E-63 Term. 29 High Ref./Feedb. Value		
Range:		**Function:**
1500.000 Referen-ceFeedbackUnit*	[-999999.999 - 999999.999 ReferenceFeed-backUnit]	Enter the high reference value [RPM] for the motor shaft speed and the high feedback value, see also *E-68 Term. 33 High Ref./Feedb. Value.*

3

E-63 Term. 29 High Ref./Feedb. Value		
Range:		**Function:**
		Select terminal 29 as a digital input (*E-52 Terminal 29 Mode* = *[0] input* (default) and *E-04 Terminal 29 Digital Input* = 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.

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

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 *E-68 Term. 33 High Ref./Feedb. Value*.

E-67 Term. 33 Low Ref./Feedb. Value		
Range:		**Function:**
0*	[-999999.999 - 999999.999]	Enter the low reference value [RPM] for the motor shaft speed. This is also the low feedback value, see also *E-62 Term. 29 Low Ref./Feedb. Value*.

E-68 Term. 33 High Ref./Feedb. Value		
Range:		**Function:**
1500.000 Reference-FeedbackUnit*	[-999999.999 - 999999.999 ReferenceFeed-backUnit]	Enter the high reference value [RPM] for the motor shaft speed. See also *E-63 Term. 29 High Ref./Feedb. Value*.

E-69 Pulse Filter Time Constant #33		
Range:		**Function:**
100 ms*	[1 - 1000 ms]	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.

3.4.5 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:		**Function:**
[0] *	No operation	Select the desired display output for terminal 27.
[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:		**Function:**
5000 Hz*	[0 - 32000 Hz]	Set the maximum frequency for terminal 27, corresponding to the output variable selected in *E-70 Terminal 27 Pulse Output Variable*.

E-73 Terminal 29 Pulse Output Variable		
Option:		**Function:**
[0] *	No operation	Select the desired display output for terminal 29.
[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	

E-73 Terminal 29 Pulse Output Variable		
Option:		**Function:**
[119]	Torque % lim	

E-76 Terminal X30/6 Pulse Output Variable		
Select the variable for read-out on terminal X30/6. This parameter is active when the General Purpose I/O Option Module (OPCGPIO) is installed in the frequency converter.		
Option:		**Function:**
[0] *	No operation	
[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-78 Pulse Output Max Freq #X30/6		
Range:		**Function:**
5000 Hz*	[0 - 32000 Hz]	

3.4.6 E-8# 24 V Encoder Input

Parameters to configure the Encoder outputs.

E-80 Term 32/33 Pulses Per Revolution		
Range:		**Function:**
1024*	[1 - 4096]	Set the encoder pulses per revolution on the motor shaft. Read the correct value from the encoder.

E-81 Term 32/33 Encoder Direction		
Option:		**Function:**
		NOTE **This parameter cannot be adjusted while the motor is running.** Change the detected encoder rotation direction without changing the wiring to the encoder.
[0] *	Clockwise	Sets channel A 90° (electrical degrees) behind channel B upon clockwise rotation of the encoder shaft.
[1]	Counter clockwise	Sets channel A 90° (electrical degrees) ahead of channel B upon clockwise rotation of the encoder shaft.

3.4.7 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 - 2147483647]	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 9-31	Reserved for future terminals

Table 3.11

E-93 Pulse Out #27 Bus Control		
Range:		**Function:**
0 %*	[0 - 100 %]	Set the output frequency transferred to the output terminal 27 when the terminal is configured as *[45] Bus Controlled* in *E-70 Terminal 27 Pulse Output Variable*.

E-94 Pulse Out #27 Timeout Preset		
Range:		**Function:**
0 %*	[0 - 100 %]	Set the output frequency transferred to the output terminal 27 when the terminal is configured as *[48] Bus Ctrl Timeout* in *E-70 Terminal 27 Pulse Output Variable* and a time-out is detected.

E-95 Pulse Out #29 Bus Control		
Range:		**Function:**
0 %*	[0 - 100 %]	Set the output frequency transferred to the output terminal 29 when the terminal is configured as *[45] Bus Controlled* in *E-73 Terminal 29 Pulse Output Variable*.

E-96 Pulse Out #29 Timeout Preset		
Range:		**Function:**
0 %*	[0 - 100 %]	Set the output frequency transferred to the output terminal 29 when the terminal is

3

E-96 Pulse Out #29 Timeout Preset		
Range:		Function:
		configured as *[48] Bus Ctrl Timeout* in *E-73 Terminal 29 Pulse Output Variable*. And a time-out is detected.

E-97 Pulse Out #X30/6 Bus Control		
Range:		Function:
0 %*	[0 - 100 %]	Set the output frequency transferred to the output terminal X30/6 when the terminal is configured as *[45] Bus ctrl.* in *E-76 Terminal X30/6 Pulse Output Variable*.

E-98 Pulse Out #X30/6 Timeout Preset		
Range:		Function:
0 %*	[0 - 100 %]	Set the output frequency transferred to the output terminal X30/6 when the terminal is configured as *[48] Bus Ctrl Timeout* in *E-76 Terminal X30/6 Pulse Output Variable*. 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:		Function:
0 Hz*	[0 - par. F-15 Hz]	Some systems call for avoiding certain output speeds due to resonance problems in the system. Enter the lower limits of the speeds to be avoided.

C-02 Jump Speed From [RPM]

Array [4]

Range:		Function:
0 RPM*	[0 - par. F-17 RPM]	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:		Function:
0 RPM*	[0 - par. F-17 RPM]	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:		Function:
0 Hz*	[0 - par. F-15 Hz]	Some systems call for avoiding certain output speeds due to resonance problems in the system. Enter the upper limits of the speeds to be avoided.

C-05 Multi-step Frequency 1 - 8

Array [8]
Range: 0-7

Range:		Function:
0 %*	[-100 - 100 %]	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} (*F-53 Maximum Reference*) If a Ref_{MIN} different

C-05 Multi-step Frequency 1 - 8

Array [8]
Range: 0-7

Range:		Function:
		from 0 (*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-##.

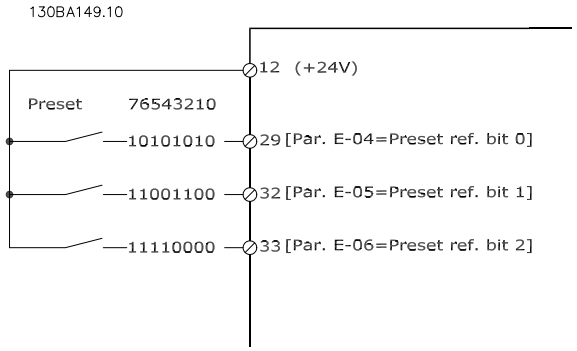


Illustration 3.18 Preset Reference

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

Table 3.12 Preset Ref. Bit

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:		Function:
0 Hz*	[0 - par. F-15 Hz]	The jog speed is a fixed output speed at which the frequency converter is running when the jog function is activated. See also *C-22 Jog Accel/Decel Time*.

3

C-21 Jog Speed [RPM]

Range:		Function:
150 RPM*	[0 - par. 4-13 RPM]	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 *F-17 Motor Speed High Limit [RPM]*. See also *C-22 Jog Accel/Decel Time*.

C-22 Jog Accel/Decel Time

Range:		Function:
3.00 s*	[0.01 - 3600 s]	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 *F-43 Current Limit*. The jog ramp time starts upon activation of a jog signal via the keypad, a selected digital input, or the serial communication port. When jog state is disabled then the normal ramping times are valid.

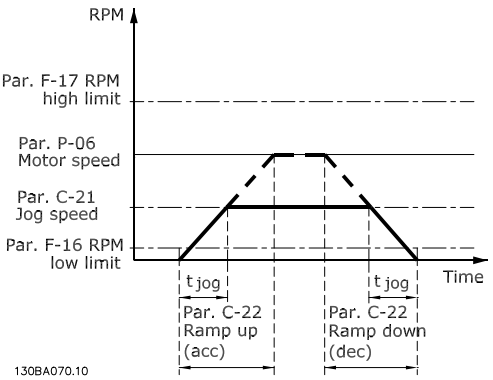


Illustration 3.19 Jog Ramp Time

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

C-23 Quick Stop Decel Time

Range:		Function:
3.00 s*	[0.01 - 3600 s]	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 *F-43 Current Limit*). Quick-stop is activated by means of a signal on a selected digital input, or via the serial communication port.

C-24 Quick Stop Ramp Type

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.

Option:		Function:
[0] *	Linear	
[1]	S-ramp Const Jerk	
[2]	S-ramp Const Time	

C-25 Quick Stop S-ramp Ratio at Decel. Start

Enter the proportion of the total ramp-down time (*C-23 Quick Stop Decel Time*) 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.

Range:		Function:
50 %*	[1 - 99 %]	

C-26 Quick Stop S-ramp Ratio at Decel. End

Enter the proportion of the total ramp-down time (*C-23 Quick Stop Decel Time*) 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.

Range:		Function:
50 %*	[1 - 99 %]	

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. *F-01 Frequency Setting 1*, *C-30 Frequency Command 2* and *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 Potentiometer	
[21]	Analog input X30-11	
[22]	Analog input X30-12	

C-34 Frequency Command 3

Option:		Function:
		Select the reference input to be used for the third reference signal. *F-01 Frequency Setting 1*, *C-30 Frequency Command 2* and *C-34 Frequency Command 3* define

C-34 Frequency Command 3		
Option:		**Function:**
		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 Potentiometer	
[21]	Analog input X30-11	
[22]	Analog input X30-12	
[29]	Analog Input X48/2	

3.6 P-## Motor Data

Parameter group related to setting motor data in the drive.

3.6.1 P-0# Motor Data

3

Parameters to configure Motor, Auto Tuning and Slip Compensation.

P-01 Motor Poles		
Range:		**Function:**
4*	[2 - 100]	Enter the number of motor poles.

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

Table 3.13

Table 3.15 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 *P-01 Motor Poles* based on *F-04 Base Frequency* and *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 *K-03 Regional Settings* is *[1] US*

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:**
		NOTE **This parameter cannot be adjusted while the motor is running.** The Auto Tune function optimises dynamic motor performance by automatically optimising the advanced motor parameters (*P-30 Stator Resistance (Rs)* to *P-35 Main Reactance (Xh)*) at motor standstill. Activate the Auto Tune function by pressing [Hand] after selecting *[1]* or *[2] Reduced Auto Tune*. 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.
[0] *	Off	
[1]	Full 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_h. Do *not* select this option if an LC filter is used between the frequency converter and the motor.
[2]	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.

NOTE

It is important to set motor parameters 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.

NOTE

Avoid generating external torque during Auto Tune.

NOTE

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

NOTE

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. Keep in mind that the accuracy of the measured motor data will be poorer when operating on motors smaller than nominal drive size.

P-05 Motor Cont. Rated Torque		
Range:		**Function:**
0.1 Nm*	[0.1 - 10000 Nm]	Enter the value from the motor nameplate data. The default value corresponds to the nominal rated output. This parameter is available when *P-20 Motor Construction* is set to *[1] PM, non salient SPM*, i.e. the parameter is valid for PM and non-salient SPM motors only.

P-06 Base Speed		
Range:		**Function:**
1420 RPM*	[10 - 60000 RPM]	Enter the nominal motor speed value from the motor nameplate data. The data are used for calculating motor compensations. $n_{m,n} = n_s - n_{slip}$.

P-07 Motor Power [kW]		
Range:		**Function:**
4.00 kW*	[0.09 - 3000.00 kW]	**NOTE** **This parameter cannot be adjusted while the motor is running.** 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 is visible in keypad if *K-03 Regional Settings* is *[0] International*. **NOTE** **Four sizes down, one size up from nominal unit rating.**

P-09 Slip Compensation		
Range:		**Function:**
100 %*	[-500 - 500 %]	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 *H-40 Configuration Mode* is set to *[1] Speed closed loop* or *[2] Torque* Torque control with speed feedback or when *H-41 Motor Control Principle* is set to *[0] U/f* special motor mode.

P-10 Slip Compensation Time Constant		
Range:		**Function:**
0.10 s*	[0.05 - 5 s]	Enter the slip compensation reaction speed. A high value results in slow reaction, and a low value results in quick reaction. If low-frequency resonance problems arise, use a longer time setting.

NOTE

***P-10 Slip Compensation Time Constant* will not have effect when *P-20 Motor Construction* = [1] PM, non salient SPM.**

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 design type.
[0] *	Asynchron	For asynchronous motors.
[1]	PM, non salient SPM	For salient or non-salient PM motors. PM motors are divided into two groups, with either surface mounted (non salient) or interior (salient) magnets.

P-24 Damping Gain		
Range:		**Function:**
140 %*	[0 - 250 %]	The damping gain will stabilize the PM machine in order to run the PM machine smooth and stable. The value of Damping gain will control the dynamic performance of the PM machine. High damping gain will give high dynamic performance and low damping gain will give low dynamic performance. The dynamic performance is related to the machine data and load type. If the damping gain is too high or low the control will become unstable.

P-25 Low Speed Filter Time Const.		
Range:		**Function:**
0.01 s*	[0.01 - 20 s]	This time constant is used below 10% rated speed. Obtain quick control through a short damping time constant. However, if this value is too short, the control gets unstable.

P-26 High Speed Filter Time Const.		
Range:		**Function:**
0.01 s*	[0.01 - 20 s]	This time constant is used above 10% rated speed. Obtain quick control through a short damping time constant. However, if this value is too short, the control gets unstable.

P-27 Voltage filter time const.		
Range:		**Function:**
0.001 s*	[0.001 - 1 s]	Reduces the influence of high frequency ripple and system resonance in the calculation of supply voltage. Without this filter, the ripples in the currents can

P-27 Voltage filter time const.		
Range:		Function:
		distort the calculated voltage and affect the stability of the system.

3

3.6.3 P-3# Adv. Motor Data

Parameters for advanced motor data. The motor data in *P-30 Stator Resistance (Rs)* to *P-39 Motor Poles* must match the relevant motor in order to run the motor optimally. The default settings are figures based on common motor parameter values from normal standard motors. If the motor parameters are not set correctly, a malfunction of the frequency converter system may occur. If the motor data is not known, running an Auto Tune is recommended. See the *Auto Tune* section. The Auto Tune sequence will adjust all motor parameters except the moment of inertia of the rotor and the iron loss resistance (*P-36 Iron Loss Resistance (Rfe)*).

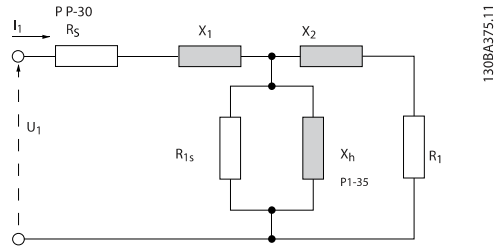
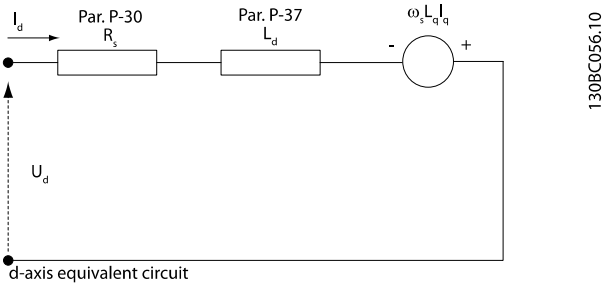


Illustration 3.20 Motor Equivalent Diagram for an Asynchronous Motor



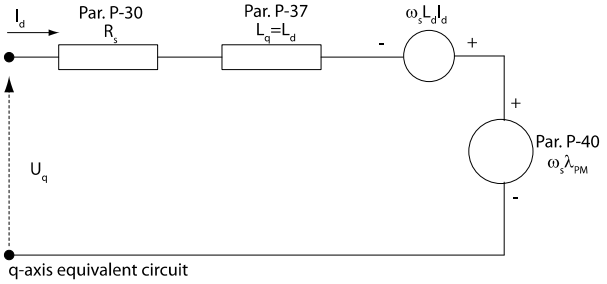


Illustration 3.21 Motor Equivalent Circuit Diagram for a PM Non Salient Motor

P-30 Stator Resistance (Rs)		
Range:		Function:
1.4000 Ohm*	[0.0140 - 140.0000 Ohm]	Set the line to common stator resistance value. Enter the value from a motor data sheet or perform an Auto Tune on a cold motor.

NOTE

For PM motors:
Auto Tune is not available.
If only line-line data are available, divide the line-line value by 2 to achieve the line to common (starpoint) value. Alternatively measure the value with an ohmmeter, this also takes the resistance of the cable into account. Divide the measured value by 2 and enter the result.

P-31 Rotor Resistance (Rr)		
Range:		Function:
1.0000 Ohm*	[0.0100 - 100.0000 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.

NOTE

***P-31 Rotor Resistance (Rr)* will not have effect when *P-20 Motor Construction* = [1] PM, non salient SPM.**

P-33 Stator Leakage Reactance (X1)		
Range:		Function:
4.0000 Ohm*	[0.0400 - 400.0000 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 X_1 value manually. Obtain the value from the motor supplier.

P-33 Stator Leakage Reactance (X1)		
Range:		**Function:**
		3. Use the X_1 default setting. The frequency converter establishes the setting on the basis of the motor name plate data. See *Illustration 3.20.*

NOTE

P-33 Stator Leakage Reactance (X1) **will not have effect when** ***P-20 Motor Construction*** **= [1] PM, non salient SPM.**

P-34 Rotor Leakage Reactance (X2)		
Range:		**Function:**
4.0000 Ohm*	[0.0400 - 400.0000 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 X_2 value manually. Obtain the value from the motor supplier. 3. Use the X_2 default setting. The frequency converter establishes the setting on the basis of the motor name plate data. See *Illustration 3.20.*

NOTE

P-34 Rotor Leakage Reactance (X2) **will not have effect when** ***P-20 Motor Construction*** **= [1] PM, non salient SPM.**

P-35 Main Reactance (Xh)		
Range:		**Function:**
100.0000 Ohm*	[1.0000 - 10000.0000 Ohm]	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:		**Function:**
10000.000 Ohm*	[0 - 10000.000 Ohm]	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 *P-36 Iron Loss Resistance (Rfe)* on default setting.

P-37 d-axis Inductance (Ld)		
Range:		**Function:**
0 mH*	[0.000 - 1000.000 mH]	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.

P-46 Position Detection Gain		
Range:		**Function:**
100 %*	[20 - 200 %]	Adjusts the amplitude of the test pulse during position detection at start. Adjust this parameter to improve the position measurement.

3.7 H-## High Perf Parameters

Parameter group related to high performance functions in the drive.

3

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-01 Option Detection

Selects the behaviour of the frequency converter when a change in the option configuration is detected.

Option:		Function:
[0] *	Protect Option Config.	Freezes the current settings and prevents unwanted changes when missing or defective options are detected.
[1]	Enable Option Change	Changes drive settings and is used when modifying the system configuration. This Parameter setting will return to *[0] Protect Option Config.* after an Option Change.

H-02 Option Data Storage

Range:		Function:
0*	[0 - 65535]	

H-03 Restore Factory Settings

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

H-04 Auto-Reset (Times)

Option:		Function:
		Select the reset function after tripping. Once reset, the frequency converter can be restarted.

H-04 Auto-Reset (Times)

Option:		Function:
[0] *	Manual reset	Select *[0] Manual reset*, to perform a reset via [RESET] or via the digital inputs.
[1]	Automatic reset x 1	Select *Automatic reset x 1…x20* [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 *[13] Infinite Automatic Reset* for continuous resetting after tripping.

NOTE

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 *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.

H-05 Auto-Reset (Reset Interval)

Range:		Function:
10 s*	[0 - 600 s]	Enter the time interval from trip to start of the automatic reset function. This parameter is active when *H-04 Auto-Reset (Times)* is set to *[1] - [13] Automatic reset*.

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 *F-07 Accel Time 1* and *F-08 Decel Time 1*.

NOTE

If *[1] S-ramp Const Jerk* 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.

For each of four ramps (parameter groups F-0#, E-1#, H-0#, SP-7#, SP-8# and SP-9#) configure the ramp parameters: ramp type, ramping times (duration of acceleration and deceleration) and level of jerk compensation for S ramps.

Start by setting the linear ramping times corresponding to the figures.

If S-ramps are selected then set the level of non-linear jerk compensation required. Set jerk compensation by defining the proportion of accel and decel times where acceleration and deceleration are variable (i.e. increasing or decreasing). The S-ramp acceleration and deceleration settings are defined as a percentage of the actual ramp time.

H-08 Reverse Lock		
Option:		**Function:**
		NOTE **This parameter cannot be adjusted while the motor is running.** Select the motor speed direction(s) required. Use this parameter to prevent unwanted reversing. When *H-40 Configuration Mode* is set to *[3] Process*, *H-08 Reverse Lock* is set to *[0] Clockwise* as default. The setting in *H-08 Reverse Lock* does not limit options for setting *F-15 Motor Speed High Limit [Hz]* or *F-17 Motor Speed High Limit [RPM]*.
[0] *	Clockwise	The reference is set to CW rotation. Reversing input (Default term 19) must be open.
[1]	Counter clockwise	The reference is set to CCW rotation. Reversing input (Default term 19) must be closed. If Reversing is required with 'Reverse' input is open the motor direction can be changed by *H-48 Clockwise Direction*
[2]	Both directions	Allows the motor to rotate in both directions.

H-09 Start Mode		
Option:		**Function:**
		NOTE **This parameter cannot be adjusted while motor is running.**
		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	Enables the frequency converter to "catch" and control a spinning motor. When *H-09 Start Mode* is enabled, *F-24 Holding Time* and *F-25 Start Function* have no function.
[2]	Enabled Always	
[3]	Enabled Ref. Dir.	
[4]	Enab. Always Ref. Dir.	

NOTE

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:**
		This function is used to monitor for consistency in feedback signal, i.e. if the feedback signal is available. Select which reaction the frequency converter should take if a feedback fault is detected. The selected action is to take place when the feedback signal differs from the output speed by the value set in *H-21 Motor Feedback Speed Error* for longer than the value set in*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	

Warning 90 is active as soon as the value in *H-21 Motor Feedback Speed Error* is exceeded, regardless of the setting

of *H-22 Motor Feedback Loss Timeout*. Warning/Alarm 61 Feedback Error is related to the Motor Feedback Loss Function.

H-21 Motor Feedback Speed Error		
Range:		**Function:**
300 RPM*	[1 - 600 RPM]	Select the max allowed error in speed (output speed vs. feedback).

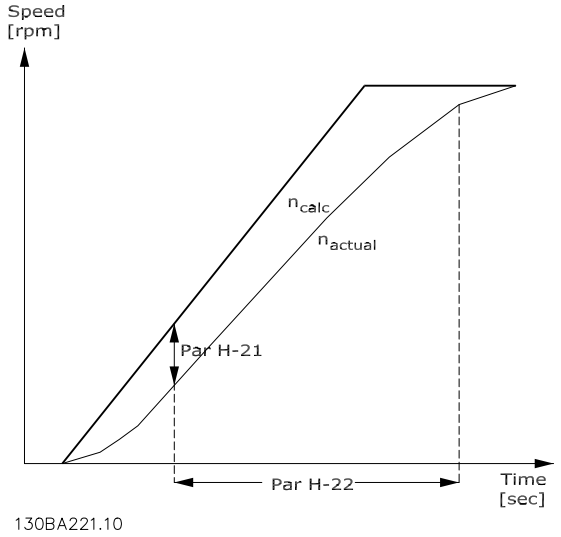


Illustration 3.23 Motor Feedback Speed Error

H-22 Motor Feedback Loss Timeout		
Range:		**Function:**
0.05 s*	[0 - 60 s]	Set the timeout value allowing the speed error set in *H-21 Motor Feedback Speed Error* to be exceeded before enabling the function selected in *H-20 Motor Feedback Loss Function*.

H-24 Tracking Error Function		
Option:		**Function:**
		This function is used to monitor that the application follows the expected speed profile. In Closed loop the speed reference to the PID is compared to the encoder feedback (filtered) In open loop the speed reference to the PID is compensated for slip and compared to the frequency that is sent to the motor (*DR-13 Frequency*). The reaction will be activated if the measured difference is more than specified in *H-25 Tracking Error* for the time specified in *H-26 Tracking Error Timeout*. A tracking error in closed loop does not imply that there is a problem with the feedback signal! A tracking error can be the result of torque limit at too big loads.
[0] *	Disable	

H-24 Tracking Error Function		
Option:		**Function:**
[1]	Warning	
[2]	Trip	
[3]	Trip after stop	

Warning/Alarm 78 Tracking Error is related to the Tracking Error Function.

H-25 Tracking Error		
Range:		**Function:**
10 RPM*	[1 - 600 RPM]	Enter the maximum permissible speed error between the motor speed and the output of the ramp when not ramping. In open loop the motor speed is estimated and in closed loop it is the feedback from encoder/resolver.

H-26 Tracking Error Timeout		
Range:		**Function:**
1 s*	[0 - 60 s]	Enter the time-out period during which an error greater than the value set in *H-25 Tracking Error* is permissible.

H-27 Tracking Error Ramping		
Range:		**Function:**
100 RPM*	[1 - 600 RPM]	Enter the maximum permissible speed error between the motor speed and the output of the ramp when ramping. In open loop the motor speed is estimated and in closed loop it is the feedback from encoder/resolver.

H-28 Tracking Error Ramping Timeout		
Range:		**Function:**
1 s*	[0 - 60 s]	Enter the time-out period during which an error greater than the value set in *H-27 Tracking Error Ramping* while Ramping is permissible.

H-29 Tracking Error After Ramping Timeout		
Range:		**Function:**
5 s*	[0 - 60 s]	Enter the time-out period after ramping where *H-27 Tracking Error Ramping* and *H-28 Tracking Error Ramping Timeout* are still active.

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 *F-02 Operation Method* is set to *[0] Linked to Hand/Auto* or *[1] Remote*.
[0] *	Speed open loop	Enables speed control (without feedback signal from motor) with automatic slip compensation for almost constant speed at varying loads. The speed control parameters are set in parameter group *PI-0# Speed PID Control*.
[1]	Speed closed loop	Enables Speed closed loop control with feedback. Obtain full holding torque at 0 RPM. For increased speed accuracy, provide a feedback signal and set the speed PID control. The speed control parameters are set in parameter group *PI-0# Speed PID Control*.
[2]	Torque	Enables torque closed loop control with feedback. Only possible with "Flux with motor feedback" option, *H-41 Motor Control Principle*.
[3]	Process	Enables the use of process control in the frequency converter. The process control parameters are set in parameter groups PI-2# and PI-3#.
[4]	Torque open loop	Enables the use of torque open loop in Adv. Vector Control mode (*H-41 Motor Control Principle*). The torque PID parameters are set in parameter group PI-1#.
[5]	Wobble	Enables the wobble functionality in *SF-00 Wobble Mode* to *SF-19 Wobble Delta Freq. Scaled*.
[6]	Surface Winder	Enables the surface winder control specific parameters in parameter group PI-2# and PI-3#.
[7]	Extended PID Speed OL	Specific parameters in parameter group PI-2# to PI-5#.
[8]	Extended PID Speed CL	Specific parameters in parameter group PI-2# to PI-5#.

H-41 Motor Control Principle		
Option:		**Function:**
		NOTE **This parameter cannot be adjusted while the motor is running.** Select which motor control principle to employ.

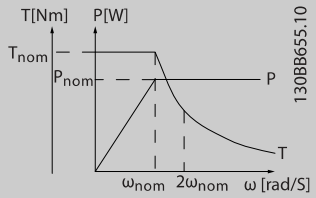
H-41 Motor Control Principle		
Option:		**Function:**
[0]	U/f	special motor mode, for parallel connected motors in special motor applications. When U/f is selected the characteristic of the control principle can be edited in *H-55 U/f Characteristic - U* and *H-56 U/f Characteristic - F*.
[1] *	Advanced 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 *[2] Flux sensorless* and *[3] Flux with encoder feedback*.

H-42 Flux Motor Feedback Source		
Option:		**Function:**
		NOTE **This parameter cannot be adjusted while the motor is running.** 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 *No operation*.
[2]	OPCENC	Encoder module option which can be configured in parameter group EC-1#.
[3]	OPCRES	Optional resolver interface module which can be configured in parameter group RS-5#
[6]	Analog Input 53	
[7]	Analog Input 54	
[8]	Frequency input 29	
[9]	Frequency input 33	

3

H-43 Torque Characteristics

Option:		Function:
		NOTE **This parameter cannot be adjusted while the motor is running.** 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 *SP-40 VT Level*.
[2]	Energy Savings CT	Automatically optimises energy consumption by minimising magnetisation and frequency via *SP-41 Energy Savings Min. Magnetization* and *SP-42 Energy Savings Min. Frequency*.
[5]	Constant Power	The function provides a constant power in the field weakening area. The torque shape of motor mode is used as a limit in the generatoric mode. This is done to limit the power in generatoric mode that otherwise becomes considerable larger than in motor mode, due to the high DC link voltage available in generatoric mode. $P_{shaft}[W] = \omega_{mech}[rad/s] \times T[Nm]$ This relationship with the constant power is illustrated in *Illustration 3.24*:  **Illustration 3.24 Constant Power**

H-44 Constant or Variable Torque OL

Option:		Function:
		NOTE **This parameter cannot be adjusted while the motor is running.**
[0] *	High torque	Allows up to 160% over torque.
[1]	Normal torque	For oversized motor - allows up to 110% over torque.

H-45 Local Mode Configuration

Option:		Function:
		Select which application configuration mode (*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 *F-02 Operation Method* is set to *[0] Linked to Hand/Auto* or *[2] Local*. 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*	[0 - 9000 V]	Set the nominal back EMF for the motor when running at 1000 RPM. Back EMF is the voltage generated by a PM motor when no frequency converter is connected and the shaft is turned externally. Back EMF is normally specified for nominal motor speed or for 1000 RPM measured between two lines. If the value is not available for a motor speed of 1000 RPM, calculate the correct value as follows. If back EMF is eg. 320 V at 1800 RPM, it can be calculated at 1000 RPM as follows: Calculate RPM at 1000 RPM as follows: Back EMF= (Voltage/RPM)*1000 = (320/1800)*1000 = 178. This is the value that must be programmed for *H-46 Back EMF at 1000 RPM* This parameter is only active when *P-20 Motor Construction* is set to *[1] PM motor* (Permanent Magnet Motor). **NOTE** **When using PM motors, it is recommended to use brake resistors.**

H-47 Motor Angle Offset

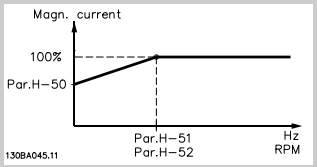
Range:		Function:
0*	[-32768 - 32767]	Enter the correct offset angle between the PM motor and the index position (single-turn) of the attached encoder or resolver. The value range of 0 - 32768 corresponds to 0 - 2 * pi (radians). To obtain the offset angle value: After frequency converter start-up apply DC-hold and enter the value of *DR-20 Motor Angle* into this parameter.

H-47 Motor Angle Offset		
Range:		**Function:**
		This parameter is only active when *P-20 Motor Construction* is set to *[1] PM, non-salient SPM* (Permanent Magnet Motor).

H-48 Clockwise Direction		
Option:		**Function:**
		NOTE **This parameter cannot be adjusted while the motor is running.** This parameter defines the term "Clockwise" corresponding to the keypad direction arrow. Used for easy change of direction of shaft rotation without swapping motor wires.
[0] *	Normal	Motor shaft will turn in clockwise direction when the frequency converter is connected U ⇒ U; V⇒V, and W ⇒ W to motor.
[1]	Inverse	Motor shaft will turn in counter clockwise direction when the frequency converter is connected U⇒U; V⇒V, and W⇒ W to 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 parameter along with *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.  **Illustration 3.25 Motor Magnetisation**

NOTE

***H-50 Motor Magnetisation at Zero Speed* will not have effect when *P-20 Motor Construction* = [1] PM, non salient SPM.**

H-51 Min Speed Normal Magnetising [RPM]		
Range:		**Function:**
15 RPM*	[10 - 300 RPM]	Set the required speed for normal magnetising current. If the speed is set lower than the motor slip speed, *H-50 Motor Magnetisation at Zero Speed* and *H-51 Min Speed Normal Magnetising [RPM]* are of no significance. Use this parameter along with *H-50 Motor Magnetisation at Zero Speed*. See *Table 3.15*.

NOTE

***H-51 Min Speed Normal Magnetising [RPM]* will not have effect when *P-20 Motor Construction* = [1] PM, non salient SPM.**

H-52 Min Speed Normal Magnetising [Hz]		
Range:		**Function:**
12.5 Hz*	[0 - 250.0 Hz]	Set the required frequency for normal magnetising current. If the frequency is set lower than the motor slip frequency, *H-50 Motor Magnetisation at Zero Speed* is inactive. Use this parameter along with *H-50 Motor Magnetisation at Zero Speed*. See drawing for *H-50 Motor Magnetisation at Zero Speed*.

H-53 Model Shift Frequency		
Range:		**Function:**
4.0 Hz*	[4 - 18.0 Hz]	**Flux Model shift** Enter the frequency value for shift between two models for determining motor speed. Choose the value based on settings in *H-40 Configuration Mode* and *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 *H-40 Configuration Mode* is set to *[1] Speed closed loop* or *[2] Torque* and *H-41 Motor Control Principle* is set to *[3] Flux w/ motor feedback*. 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.

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H-53 Model Shift Frequency

Range:	Function:

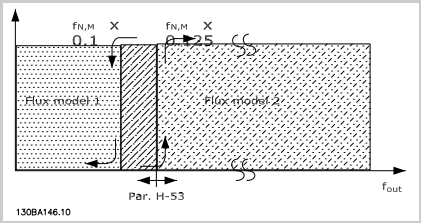

Illustration 3.28 H-40 = [1] Speed closed loop or [2] Torque and H-41 = [3] Flux w/motor feedback

Variable Current - Flux model - Sensorless
This model is used when H-40 is set to *[0]Speed open loop* and H-41 is set to *[2] Flux sensorless*. In speed open loop in flux mode, the speed is determined from the current measurement. Below f_{norm} x 0.1, the drive runs on a Variable Current model. Above f_{norm} x 0.125 the frequency converter runs on a Flux model.

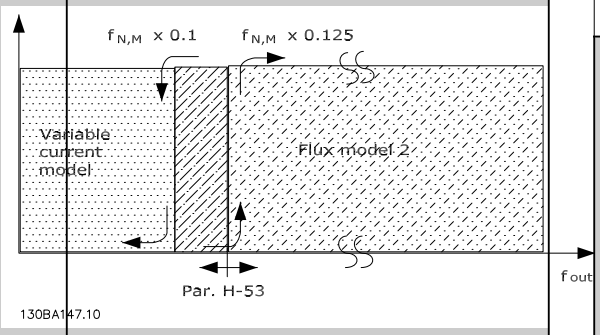

Illustration 3.29 H-40 = [0] Speed open loop, H-41 = [2] Flux sensorless

H-55 U/f Characteristic - U

Range:		Function:
0 V*	[0 - 1000 V]	Enter the voltage at each frequency point to manually form a U/f characteristic matching the motor. The frequency points are defined in *H-56 U/f Characteristic - F*. This parameter is an array parameter [0-5] and is only accessible when *H-41 Motor Control Principle* is set to *[0] U/f*.

H-56 U/f Characteristic - F

Range:		Function:
0 Hz*	[0 - 1000.0 Hz]	Enter the frequency points to manually form a U/f-characteristic matching the motor. The voltage at each point is defined in *H-55 U/f Characteristic - U*.

H-56 U/f Characteristic - F

Range:		Function:
		This parameter is an array parameter [0-5] and is only accessible when *H-41 Motor Control Principle* is set to *[0] U/f*.

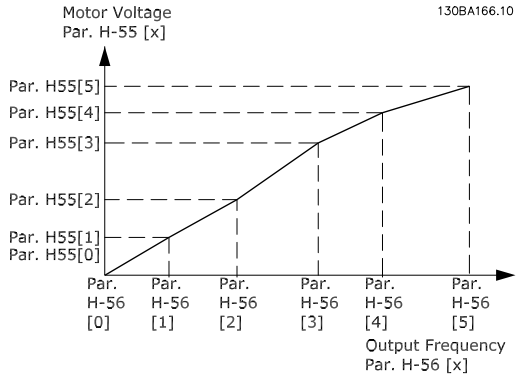

Illustration 3.30 U/f Characteristic

H-58 Flystart Test Pulses Current

Range:		Function:
0 %*	[0 - 0 %]	Sets the current level for the flystart test pulses that are used to detect the motor direction. 100% means $I_{m,n}$. Adjust the value to be big enough to avoid noise influence but low enough to avoid affecting the accuracy (current must be able to drop to zero before the next pulse). Reduce the value to reduce the generated torque. Default is 30% for asynchronous motors, but may vary for PM motors. For PM motors adjusting the value will tune for back EMF and d-axis inductance of the motor. This parameter is only available in Advanced Vector Control.

H-59 Flystart Test Pulses Frequency

Range:		Function:
0 %*	[0 - 0 %]	Sets the frequency of the flystart test pulses that are used to detect the motor direction. 100% means means 2 x fslip. Increase this value to reduce the generated torque. For PM motors this value is the percentage nm,n of the free running PM motor. Above this value flystart is always performed. Below this value, the start mode is selected in *F-20 PM Start Mode* This parameter is only available in Advanced Vector Control.

3.7.5 H-6# Load Depen. Settings

Parameters to configure the load-dependent motor settings.

H-61 High Speed Load Compensation		
Range:		**Function:**
100 %*	[0 - 300 %]	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

Table 3.14

H-64 Resonance Dampening		
Range:		**Function:**
100 %*	[0 - 500 %]	Enter the resonance dampening value. Set *H-64 Resonance Dampening* and *H-65 Resonance Dampening Time Constant* to help eliminate high-frequency resonance problems. To reduce resonance oscillation, increase the value of *H-64 Resonance Dampening*.

NOTE

***H-64 Resonance Dampening* will not have effect when *P-20 Motor Construction = [1] PM*, non salient SPM.**

H-65 Resonance Dampening Time Constant		
Range:		**Function:**
5 ms*	[5 - 50 ms]	Set *H-64 Resonance Dampening* and *H-65 Resonance Dampening Time Constant* to help eliminate high-frequency resonance problems. Enter the time constant that provides the best dampening.

NOTE

***H-65 Resonance Dampening Time Constant* will not have effect when *P-20 Motor Construction = [1] PM*, non salient SPM.**

H-66 Min. Current at Low Speed		
Range:		**Function:**
100 %*	[1 - 200 %]	Enter the minimum motor current at low speed, see *H-53 Model Shift Frequency*. Increasing this current improves motor torque at low speed. *H-66 Min. Current at Low Speed* is enabled when *H-40 Configuration Mode [0] Speed open loop* 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. *F-40 Torque Limiter (Driving)* and/or *F-41 Torque Limiter (Braking)* automatically adjust *H-66 Min. Current at Low Speed*. The parameter with the highest value adjusts *H-66 Min. Current at Low Speed*. The current setting in *H-66 Min. Current at Low Speed* is composed of the torque generating current and the magnetizing current. Example: Set *F-40 Torque Limiter (Driving)* to 100% and set *F-41 Torque Limiter (Braking)* to 60%. *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 the keypad, and can be programmed to be outputs or to be read out via serial bus in the Extended Status Word.

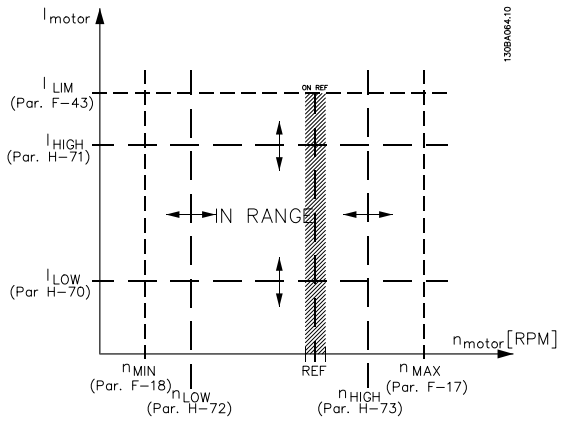

Illustration 3.31 Adjustable Warnings

H-70 Warning Current Low		
Range:		**Function:**
0 A*	[0 - par. H-71 A]	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 *Illustration 3.31*.

H-71 Warning Current High		
Range:		**Function:**
par. DR-37 A*	[par. H-70 - par. DR-37 A]	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 *Illustration 3.31*.

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H-72 Warning Speed Low		
Range:		**Function:**
0 RPM*	[0 - par. H-73 RPM]	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:		**Function:**
par. F-17 RPM*	[par. H-72 - par. F-17 RPM]	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. Program the upper signal limit of the motor speed, n_{HIGH}, within the normal working range of the frequency converter. Refer to *Illustration 3.31*.

H-74 Warning Reference Low		
Range:		**Function:**
-999999.999*	[-999999.999 - par. H-75]	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:		**Function:**
999999.999*	[par. H-74 - 999999.999]	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:		**Function:**
-999999.999 ReferenceFeed-backUnit*	[-999999.999 - par. H-77 ReferenceFeed-backUnit]	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:		**Function:**
999999.999 ReferenceFeed-backUnit*	[par. H-76 - 999999.999 ReferenceFeed-backUnit]	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.
[0] *	Disabled	No alarm is displayed if a missing motor phase occurs.
[1]	Trip 100 ms	An alarm is displayed if a missing motor phase occurs.
[2]	Trip 1000 ms	
[3]	Trip 100 ms lim 3 phase detec.	
[5]	Motor Check	

NOTE

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 decelerated to the settings in *H-81 Min Speed for Function at Stop [RPM]*.
[0] *	Coast	Leaves motor in free mode. The motor is disconnected from the frequency converter.
[1]	DC hold	Energizes motor with a DC holding current (see *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. This allows the motor to produce torque quickly at subsequent start commands (asynchronous motors only). This Pre-magnetizing function does not help the very first start command. Two different

H-80 Function at Stop		
Option:		**Function:**
		solutions are available to pre-magnetize the machine for the first start command: 1. Start the frequency converter with a 0 RPM reference and wait 2 to 4 rotor time constants (see below) before increasing the speed reference. 2a. Set *F-24 Holding Time* to the desired pre-mag time (2 to 4 rotor time constants - see below). 2b. Set *F-25 Start Function* to either *[0] DC-hold* or *[1] DC-Brake*. Set the DC-hold or DC-brake current magnitude (*B-00 DC Hold Current* or *B-01 DC Brake Current*) to be equal to I_pre-mag = Unom/(1.73 x Xh) Sample rotor time constants = (Xh+X2)/(6.3*Freq_nom*Rr) 1 kW = 0.2 s 10 kW = 0.5 s 100 kW = 1.7 s 1000 kW = 2.5 s
[4]	DC Voltage U0	When the motor is stopped, the *H-55 U/f Characteristic - U* [0] parameter defines the voltage at 0 Hz.
[5]	Coast at low reference	When the reference is below *H-81 Min Speed for Function at Stop [RPM]*, the motor is disconnected from the frequency converter.
[6]	Motor check, alarm	

H-81 Min Speed for Function at Stop [RPM]		
Range:		**Function:**
3 RPM*	[0 - 600 RPM]	Set the speed at which to activate *H-80 Function at Stop*.

H-82 Min Speed for Function at Stop [Hz]		
Range:		**Function:**
0.1 Hz*	[0 - 20.0 Hz]	Set the output frequency at which to activate *H-80 Function at Stop*.

H-83 Precise Stop Function		
Option:		**Function:**
		NOTE **This parameter cannot be adjusted while the motor is running.**
[0] *	Precise ramp stop	Only optimal when the operational speed - of e.g. the conveyor belt - is constant. This is an open loop control. Achieves high repetitive precision at the stopping point.
[1]	Cnt stop with reset	Counts the number of pulses, typically from an encoder and generates a stop signal after a pre-programmed number of pulses - *H-84 Precise Stop Counter Value* - has been received at T29 or T33 [30]. This is a direct feedback with one-way closed loop control. 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 decel to 0 RPM is reset.
[2]	Cnt stop w/o reset	Same as [1] but the number of pulses counted during decel to 0 rpm is deducted from the counter value entered in *H-84 Precise Stop Counter Value*. This reset function can for example be used to compensate for the extra distance done during ramping down and to reduce the impacts of gradual wear of mechanical parts.
[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 *F-03 Max Output Frequency 1*). The delay is calculated on the basis of the reference speed of the frequency converter and not on the basis of the actual speed. Please therefore make sure that the frequency converter has ramped up before you activate the speed compensated stop.
[4]	Com cnt stop w/rst	Same as [3] but after each precise stop the number of pulses counted during decel to 0 rpm is reset.
[5]	Comp cnt stop w/o r	Same as [3] but the number of pulses counted during decel to 0 rpm is deducted from the counter value entered in *H-84 Precise Stop Counter Value*. This reset function can for example be used to compensate for the extra distance done during ramping down and to reduce the impacts of gradual wear of mechanical parts.

The Precise Stop Functions are advantageous in applications where high precision is required.
If you use a standard stop command the accuracy is determined by the internal task time. That is not the case when using the precise stop function; it eliminates the task time dependence and increases the accuracy substantially. The frequency converter tolerance is normally given by its task time. However, by using its special precise stop

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function the tolerance is independent of the task time because the stop signal immediately interrupts the execution of the frequency converter program. The precise stop function gives a highly reproducible delay from the stop signal is given until the ramping down starts. A test must be done to find this delay as it is a sum of sensor, PLC, frequency converter and mechanical parts.
To ensure optimum accuracy there should be at least 10 cycles during ramping down, see *F-08 Decel Time 1*, *E-11 Decel Time 2*, *E-13 Decel Time 3* and *E-15 Decel Time 4*.
The Precise Stop Function is set up here and enabled from DI T29 or T33.

H-84 Precise Stop Counter Value		
Range:		**Function:**
100000*	[0 - 999999999]	Enter the counter value to be used in the integrated precise stop function, *H-83 Precise Stop Function*. The maximum permissible frequency at terminal 29 or 33 is 110 kHz. **NOTE** **Not used for selection [0] and [3] in *H-83 Precise Stop Function***

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 *H-83 Precise Stop Function*. In speed compensated stop mode, the delay time at different frequencies has a major influence on the stop function. **NOTE** **Not used for selection [0], [1] and [2] in *H-83 Precise Stop Function***

H-87 Load Type		
Option:		**Function:**
[0] *	Passive load	For conveyers, fan and pump applications.
[1]	Active load	For hoisting applications, used in slip compensation at low speed. When *[1] Active Load* is selected, set *H-66 Min. Current at Low Speed* to a level which corresponds to maximum torque.

H-88 Minimum Inertia		
Range:		**Function:**
0.0048 kgm²*	[0.0001 - par. H-89 kgm²]	**NOTE** **This parameter cannot be adjusted while motor is running.** Needed for average inertia calculation. Enter the minimum moment of inertia of the mechanical system. *H-88 Minimum Inertia* and *H-89 Maximum Inertia* are used for pre-adjustment of the Proportional Gain in the speed control, see *PI-02 Speed PID Proportional Gain*.

H-89 Maximum Inertia		
Range:		**Function:**
0.0048 kgm²*	[par. H-88 - 0.4800 kgm²]	**NOTE** **This parameter cannot be adjusted while motor is running.** Active in Flux Open Loop only. Used to compute the acceleration torque at low speed. Used in the torque limit controller.

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.

KTY Sensor Connection
KTY sensors are used especially in Permanent Magnet Servo Motors (PM motors) for dynamic adjusting of motor parameters as stator resistance (*P-30 Stator Resistance (Rs)*) for PM motors and also rotor resistance (*P-31 Rotor Resistance (Rr)*) for asynchronous motors, depending on winding temperature. The calculation is:

$Rs = Rs_{20^\circ C} \; x\,(1 \; + \; \alpha_{cu} \; x \; \Delta T)\;[\Omega]$ where

$\alpha_{cu} \; = \; 0.00393$

KTY sensors can be used for motor protecting (*H-97 KTY Threshold level*).
AF-650 GP can handle three types of KTY sensors, defined in *H-95 KTY Sensor Type*. The actual sensor temperature can be read out from *DR-19 KTY sensor temperature*.

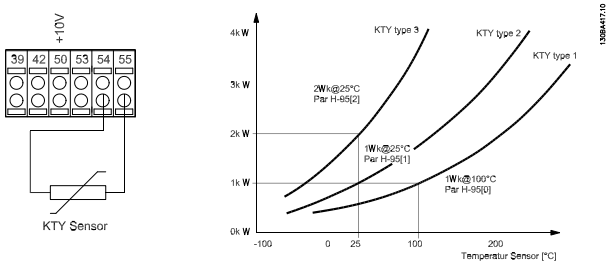

Illustration 3.32

NOTE

If the temperature of the motor is utilized through a thermistor or KTY sensor the PELV is not complied with in case of short circuits between motor windings and sensor. In order to comply with PELV the sensor must be extra isolated.

H-95 KTY Sensor Type		
Option:		**Function:**
		Select the used type of KTY sensor.
[0] *	KTY Sensor 1	1 kΩ at 100 °C
[1]	KTY Sensor 2	1 kΩ at 25 °C
[2]	KTY Sensor 3	2 kΩ at 25 °C

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 *F-01 Frequency Setting 1* to *C-34 Frequency Command 3*). **NOTE** **Connection of KTY-sensor between term. 54 and 55 (GND). See *Illustration 3.9*.**
[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.

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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:		**Function:**
10 s*	[1 - 99 s]	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 *AN-10 Terminal 53 Low Voltage*, *AN-12 Terminal 53 Low Current*, *AN-20 Terminal 54 Low Voltage* or *AN-22 Terminal 54 Low Current* for a time period longer than the time set in *AN-00 Live Zero Timeout Time*, the function selected in *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 *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 *AN-10 Terminal 53 Low Voltage*, *AN-12 Terminal 53 Low Current*, *AN-20 Terminal 54 Low Voltage* or *AN-22 Terminal 54 Low Current* for a time period defined in *AN-00 Live Zero Timeout Time*. If several time-outs occur simultaneously, the frequency converter prioritises the time-out functions as follows: 1. *AN-01 Live Zero Timeout Function* 2. *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:		**Function:**
0.07 V*	[-10.00 - par. AN-11 V]	Enter the low voltage value. This analog input scaling value should correspond to the minimum reference value, set in *AN-14 Terminal 53 Low Ref./Feedb. Value*. See also the section *Reference Handling*.

AN-11 Terminal 53 High Voltage		
Range:		**Function:**
10 V*	[par. AN-10 - 10 V]	Enter the high voltage value. This analog input scaling value should correspond to the high reference/feedback value set in *AN-15 Terminal 53 High Ref./Feedb. Value.*

AN-12 Terminal 53 Low Current		
Range:		**Function:**
0.14 mA*	[0 - par. AN-13 mA]	Enter the low current value. This reference signal should correspond to the minimum reference value, set in *F-52 Minimum Reference*. The value must be set at >2 mA in order to activate the Live Zero Time-out Function in *AN-01 Live Zero Timeout Function*.

AN-13 Terminal 53 High Current		
Range:		**Function:**
20 mA*	[par. AN-12 - 20 mA]	Enter the high current value corresponding to the high reference/ feedback set in *AN-15 Terminal 53 High Ref./Feedb. Value.*

AN-14 Terminal 53 Low Ref./Feedb. Value		
Range:		**Function:**
0*	[-999999.999 - 999999.999]	Enter the analog input scaling value that corresponds to the low voltage/low current set in *AN-10 Terminal 53 Low Voltage* and *AN-12 Terminal 53 Low Current*.

AN-15 Terminal 53 High Ref./Feedb. Value		
Range:		**Function:**
1500.000 ReferenceFeedbackUnit*	[-999999.999 - 999999.999 ReferenceFeedbackUnit]	Enter the analog input scaling value that corresponds to the maximum reference feedback value set in *AN-11 Terminal 53 High Voltage* and

AN-15 Terminal 53 High Ref./Feedb. Value		
Range:		**Function:**
		AN-13 Terminal 53 High Current.

AN-16 Terminal 53 Filter Time Constant		
Range:		**Function:**
0.001 s*	[0.001 - 10 s]	**NOTE** **This parameter cannot be adjusted while the motor is running.** 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.

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:		**Function:**
0.07 V*	[-10.00 - par. AN-21 V]	Enter the low voltage value. This analog input scaling value should correspond to the minimum reference value, set in *F-52 Minimum Reference*. See also .

AN-21 Terminal 54 High Voltage		
Range:		**Function:**
10 V*	[par. AN-20 - 10 V]	Enter the high voltage value. This analog input scaling value should correspond to the high reference/feedback value set in *AN-25 Terminal 54 High Ref./Feedb. Value*.

AN-22 Terminal 54 Low Current		
Range:		**Function:**
0.14 mA*	[0 - par. AN-23 mA]	Enter the low current value. This reference signal should correspond to the minimum reference value, set in *F-52 Minimum Reference*. The value must be set at >2 mA in order to activate the Live Zero Time-out Function in *AN-01 Live Zero Timeout Function*.

AN-23 Terminal 54 High Current		
Range:		**Function:**
20 mA*	[par. AN-22 - 20 mA]	Enter the high current value corresponding to the high reference/ feedback value set in *AN-25 Terminal 54 High Ref./Feedb. Value*.

AN-24 Terminal 54 Low Ref./Feedb. Value		
Range:		**Function:**
0 ReferenceFeedbackUnit*	[-999999.999 - 999999.999 ReferenceFeedbackUnit]	Enter the analog input scaling value that corresponds to the minimum reference feedback value set in *F-52 Minimum Reference*.

AN-25 Terminal 54 High Ref./Feedb. Value		
Range:		**Function:**
1500.000 ReferenceFeedbackUnit*	[-999999.999 - 999999.999 ReferenceFeedbackUnit]	Enter the analog input scaling value that corresponds to the maximum reference feedback value set in *F-53 Maximum Reference*.

AN-26 Terminal 54 Filter Time Constant		
Range:		**Function:**
0.001 s*	[0.001 - 10 s]	**NOTE** **This parameter cannot be adjusted while the motor is running.** 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.

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:		**Function:**
0.07 V*	[0 - par. AN-31 V]	Sets the analog input scaling value to correspond to the low reference/ feedback value (set in *AN-34 Term. X30/11 Low Ref./Feedb. Value*).

AN-31 Terminal X30/11 High Voltage		
Range:		**Function:**
10 V*	[par. AN-30 - 10 V]	Sets the analog input scaling value to correspond to the high reference/ feedback value (set in *AN-35 Term. X30/11 High Ref./Feedb. Value*).

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AN-34 Term. X30/11 Low Ref./Feedb. Value		
Range:		**Function:**
0*	[-999999.999 - 999999.999]	Sets the analog input scaling value to correspond to the low voltage value (set in *AN-30 Terminal X30/11 Low Voltage*).

AN-35 Term. X30/11 High Ref./Feedb. Value		
Range:		**Function:**
100*	[-999999.999 - 999999.999]	Sets the analog input scaling value to correspond to the high voltage value (set in *AN-31 Terminal X30/11 High Voltage*).

AN-36 Term. X30/11 Filter Time Constant		
Range:		**Function:**
0.001 s*	[0.001 - 10 s]	**NOTE** **This parameter cannot be adjusted while the motor is running.** A 1st order digital low pass filter time constant for suppressing electrical noise on terminal X30/11.

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:		**Function:**
0.07 V*	[0 - par. AN-41 V]	Sets the analog input scaling value to correspond to the low reference/ feedback value set in *AN-44 Term. X30/12 Low Ref./Feedb. Value*.

AN-41 Terminal X30/12 High Voltage		
Range:		**Function:**
10 V*	[par. AN-40 - 10 V]	Sets the analog input scaling value to correspond to the high reference/ feedback value set in *AN-45 Term. X30/12 High Ref./Feedb. Value*.

AN-44 Term. X30/12 Low Ref./Feedb. Value		
Range:		**Function:**
0*	[-999999.999 - 999999.999]	Sets the analog output scaling value to correspond to the low voltage value set in *AN-40 Terminal X30/12 Low Voltage*.

AN-45 Term. X30/12 High Ref./Feedb. Value		
Range:		**Function:**
100*	[-999999.999 - 999999.999]	Sets the analog input scaling value to correspond to the high voltage value set in *AN-41 Terminal X30/12 High Voltage*.

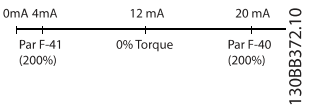
AN-46 Term. X30/12 Filter Time Constant		
Range:		**Function:**
0.001 s*	[0.001 - 10 s]	**NOTE** **This parameter cannot be adjusted while the motor is running.** A 1st order digital low pass filter time constant for suppressing electrical noise on terminal X30/12.

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 *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	*F-50 Reference Range* [Min - Max] 0% = 0 mA; 100% = 20 mA *F-50 Reference Range* [-Max - Max] -100% = 0 mA; 0% = 10 mA; +100% = 20 mA
[102]	Feedback	*F-50 Reference Range* [Min - Max] 0% = 0 mA; 100% = 20 mA *F-50 Reference Range* [-Max - Max] -100% = 0 mA; 0% = 10 mA; +100% = 20 mA
[103]	Motor Current	0–20 mA is equal to the range of 0 A to *DR-37 Drive Max. Current* (160% current) with default scaling. Example: Inverter norm current (11 kW) = 24 A. 160% =38.4 A. Motor Current = 22 A. An analog output of 11.46 mA equals: 11.46 mA x 38.4A/20 mA = 22 A In case 20 mA must be equal to a value different than Imax e.g *P-06 Base Speed* Motor

AN-50 Terminal 42 Output		
Option:		**Function:**
		Current, then the setting of *AN-52 Terminal 42 Output Max Scale* must be: Imotor x 100%/Imax = 22 A x 100%/38.4 A = 57%
[104]	Torque rel to limit	The torque setting is related to setting in *F-40 Torque Limiter (Driving)*
[105]	Torq relate to rated	The torque is related to the motor torque setting.
[106]	Power	Taken from *P-07 Motor Power [kW]*.
[107]	Speed	Taken from *F-53 Maximum Reference*. 20 mA = value in *F-53 Maximum Reference*
[108]	Torque	Torque reference related to 160% torque.
[109]	Max Out Freq	0 Hz = 0 mA,*F-03 Max Output Frequency 1* = 20 mA.
[113]	PID Clamped Output	
[119]	Torque % lim	Torque% lim: Torque reference. *F-50 Reference Range* [Min - Max] 0% = 0 mA; 100% = 20 mA *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	*F-50 Reference Range* [Min-Max] 0% = 4 mA; 100% = 20 mA *F-50 Reference Range* [-Max-Max] -100% = 4 mA; 0% = 12 mA; +100% = 20 mA
[132]	Feedback 4-20mA	Feedback 4-20 mA: *F-50 Reference Range* [Min-Max] 0% = 4 mA; 100% = 20 mA *F-50 Reference Range* [-Max-Max] -100% = 4 mA; 0% = 12 mA; +100% = 20 mA
[133]	Motor cur. 4-20mA	Value is taken from *DR-37 Drive Max. Current*. Inverter max. current (160% current) is equal to 20 mA.
[134]	Torq.% lim 4-20 mA	The torque setting is related to setting in *F-40 Torque Limiter (Driving)*.
[135]	Torq.% nom 4-20mA	The torque setting is related to the motor torque setting.
[136]	Power 4-20mA	Taken from *P-07 Motor Power [kW]*
[137]	Speed 4-20mA	Taken from *F-53 Maximum Reference*. 20 mA = Value in *F-53 Maximum Reference*.
[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.

AN-50 Terminal 42 Output		
Option:		**Function:**
[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.	*H-74 Warning Reference Low* defines the behaviour of the analog output in case of bus time-out.
[142]	Bus ctrl 4-20mA t.o.	*H-74 Warning Reference Low* defines the behaviour of the analog output in case of bus time-out.
[149]	Torque % lim 4-20mA	Analog output at zero torque = 12 mA. Motoric torque will increase the output current to max torque limit 20 mA (set in *F-40 Torque Limiter (Driving)*). Generative torque will decrease the output to torque limit Generator Mode (set in *F-41 Torque Limiter (Braking)*) Ex: *F-40 Torque Limiter (Driving)*: 200% and *F-41 Torque Limiter (Braking)*: 200%. 20 mA = 200% Motoric and 4 mA = 200% Generatoric.  **Illustration 3.33**
[150]	Max Out Fr 4-20mA	0 Hz = 0 mA, *F-03 Max Output Frequency 1* = 20 mA.

AN-51 Terminal 42 Output Min Scale		
Range:		**Function:**
0 %*	[0 - 200 %]	Scale for the minimum output (0 or 4 mA) of the analog signal at terminal 42. Set the value to be the percentage of the full range of the variable selected in *AN-50 Terminal 42 Output*.

AN-52 Terminal 42 Output Max Scale		
Range:		**Function:**
100 %*	[0 - 200 %]	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, 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:

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20 *mA* / *desired maximum current* x 100 %

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

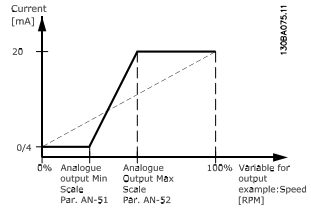


Illustration 3.34 Output Max Scale

AN-53 Terminal 42 Output Bus Control		
Range:		**Function:**
0 %*	[0 - 100 %]	Holds the level of Output 42 if controlled by bus.

AN-54 Terminal 42 Output Timeout Preset		
Range:		**Function:**
0 %*	[0 - 100 %]	Holds the preset level of Output 42. In case of a bus timeout and a timeout function is selected in *AN-50 Terminal 42 Output* the output will preset to this level.

AN-55 Terminal 42 Output Filter		
Option:		**Function:**
		The following readout analog parameters from selection in *AN-50 Terminal 42 Output* have a filter selected when *AN-55 Terminal 42 Output Filter* is on:
[0] *	Off	Filter off
[1]	On	Filter on

Selection	0-20 mA	4-20 mA
Motor current (0 - I_{max})	[103]	[133]
Torque limit (0 - T_{lim})	[104]	[134]
Rated torque (0 - T_{nom})	[105]	[135]
Power (0 - P_{nom})	[106]	[136]
Speed (0 - $Speed_{max}$)	[107]	[137]

Table 3.15 Readout Analog Parameters

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, *DR-77 Analog Out X30/8 [mA]*. See options under parameter AN-50 Terminal 42 Output.

AN-61 Terminal X30/8 Min. Scale		
Range:		**Function:**
0 %*	[0 - 200 %]	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 *AN-62 Terminal X30/8 Max. Scale* 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 %*	[0 - 200 %]	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 ful-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* : $\frac{20-4}{10}$ x 100 = 160 %

AN-63 Terminal X30/8 Bus Control		
Range:		**Function:**
0 %*	[0 - 100 %]	Holds the level of Output X30/8 if controlled by bus.

AN-64 Terminal X30/8 Output Timeout Preset		
Range:		**Function:**
0 %*	[0 - 100 %]	Holds the preset level of Output X30/8. In case of a bus timeout and a timeout function is selected in *AN-60 Terminal X30/8 Output*, the output will preset to this level.

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.

SP-00 Fault Level		
Option:		**Function:**
[0] *	Off	Use this parameter to customize Fault levels. Use *[0] Off* with caution as it will ignore all Warnings & Alarms for the chosen source.
[1]	Warning	
[2]	Trip	
[3]	Trip Lock	

Failure	Alarm	Off	Warning	Trip	Trip Lock
10 V low	1	X	D		
24 V low	47	X			D
1.8 V supply low	48	X			D
Voltage limit	64	X	D		
Earth fault during ramping	14			D	X
Earth fault 2 during cont. operation	45			D	X
Torque Limit	12	X	D		
Over Current	13			X	D
Short Circuit	16			X	D
Heatsink temperature	29			X	D
Heatsink sensor	39			X	D
Control card temperature	65			X	D
Power card temperature	69		1)	X	D
Heatsink temperature[1)]	244			X	D
Heatsink sensor [1)]	245			X	D
Power card temperature [1)]	247				

Table 3.16 Table for Selection of Choice of Action when Selected Alarm Appears

D = Default setting

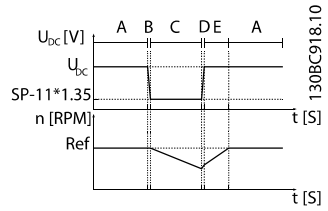
x = possible selection

1) Only drives 125 HP and above. All others is just a warning.

3

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:
		SP-10 Line failure is typically used where very short mains interruptions (voltage dips) are present. At 100% load and a short voltage interruption, the DC voltage on the main capacitors drops quickly. For larger drives it only takes a few milliseconds before the DC level is down to about 373 V DC and the IGBTs cut off and looses the control over the motor. When the mains is restored, and the IGBTs start again, the output frequency and voltage vector does not correspond to the speed/ frequency of the motor, and the result is normally an overvoltage or overcurrent, mostly resulting in a trip lock. *SP-10 Line failure* can be programmed to avoid this situation. Select the function to which the frequency converter must act when the threshold in *SP-11 Line Voltage at Input Fault* has been reached. *SP-10 Line failure* cannot be changed while motor is running.
[0] *	No function	The frequency converter will not compensate for a mains interruption. The voltage on the DC-link will drop quickly and motor control will be lost within milliseconds to seconds. Trip lock will be the result.
[1]	Ctrl. Decel	The frequency converter will remain control of the motor and do a controlled ramp down from *SP-11 Line Voltage at Input Fault* level. If *B-10 Brake Function* is *[0] Off* or *[2] AC brake*, the ramp will follow the Over Voltage Ramping. If *B-10 Brake Function* is *[1] Resistor Brake* the ramp will follow the setting in *C-23 Quick Stop Decel Time*. This selection is particularly useful in pump applications, where the inertia is low and the friction is high. When the mains is restored, the output frequency will ramp the motor up to the reference speed (if the mains interruption is prolonged, the controlled ramp down might take the output frequency all the way down to 0 RPM, and when the mains is restored, the application is ramped up from 0rpm to the previous reference speed via the normal ramp up). If the energy in the DC-link disappears before the motor is ramped to zero the motor will be coasted.
[2]	Ctrl. Decel, trip	This selection is similar to selection [1] except that in [2] a reset is necessary for starting up after power-up.
[3]	Coasting	Centrifuges can run for an hour without power supply. In those situations it is possible to select a coast function at mains interruption, together with a flying start which occurs when the mains is restored.
[4]	Kinetic back-up	Kinetic back-up ensures that the frequency converter keeps running as long as there is energy in the system due to the inertia from motor and load. This is done by converting the mechanical energy to the DC-link and thereby maintaining control of the drive and motor. This can extend the controlled operation, depending on the inertia in the system. For fans it is typically several seconds, for pumps up to 2 seconds and for compressors only for a fraction of a second. Many industry applications can extend controlled operation for many seconds, which is often enough time for the mains to return.  **Illustration 3.35 Kinetick Back-up** A: Normal operation B: Mains failure C: Kinetic back-up D: Mains return E: Normal Operation: ramping **Table 3.17 Legend to *Illustration 3.35*** The DC-level during *[4] Kinetic back-up* is *SP-11 Line Voltage at Input Fault* * 1.35. If the mains do not return U_{DC} is maintained as long as possible by ramping the speed down towards 0 RPM. Finally the frequency converter coasts. If the mains return while in kinetic back-up U_{DC} will increase above *SP-11 Line Voltage at Input Fault**1.35. This is detected in one of the following ways. 1. If U_{DC} > *SP-11 Line Voltage at Input Fault**1.35*1.05 2. If the speed is above the reference. This is relevant if the mains come back at a lower level than before, e.g. *SP-11 Line Voltage at Input Fault**1.35*1.02. This does not fulfil the criterion in point one and the frequency converter will try to

SP-10 Line failure		
Option:		**Function:**
		reduce U_{DC} to *SP-11 Line Voltage at Input Fault**1.35 by increasing the speed. This will not succeed as the mains cannot be lowered. 3. If running motoric. The same mechanism as in point two, but where the inertia will prevent that the speed goes above the reference speed. This will lead to the motor running motoric until the speed is above the reference speed and the situation in point two occurs. Instead of waiting for that criterion three is introduced.
[5]	Kinetic back-up, trip	The difference between kinetic back-up with and without trip is that the latter will always ramp down to 0 RPM and trip, regardless of whether mains return or not. The function is made so that it will not even detect if mains return, this is the reason for the relatively high level on the DC-link during ramp down.
[6]	Alarm	
[7]	Kin. back-up, trip w recovery	Kinetic back-up with recovery combines the features of kinetic back-up and kinetic back-up with trip. This feature makes it possible to select between kinetic back-up and kinetic back-up with trip, based on a recovery speed, configurable in *SP-15 Kin. Backup Trip Recovery Level* to enable detection of mains returning. If mains do not return, the frequency converter ramps down to 0 RPM and trips. If mains return while in kinetic back-up at a speed above the value in *SP-15 Kin. Backup Trip Recovery Level*, normal operation is resumed. This is equal to *[4] Kinetic Back-up*. The DC-level during *[7] Kinetic back-up* is *SP-11 Line Voltage at Input Fault** 1,35.

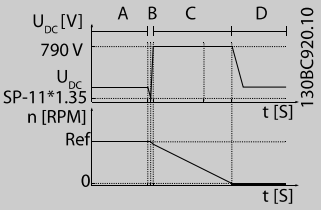
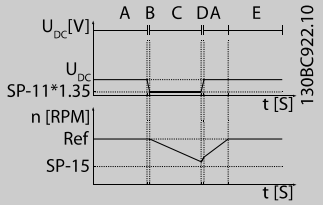
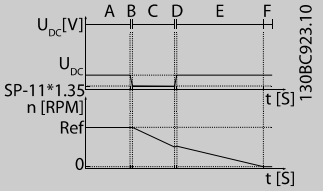


Illustration 3.36 Kinetic Back-up Trip

A	Normal Operation
B	Mains failure
C	Kinetic back-up
D	Trip

Table 3.18 Legend to *Illustration 3.36*

SP-10 Line failure		
Option:		**Function:**
		 **Illustration 3.37 [7] Kinetic Back-Up, trip with recovery where mains return above *SP-15 Kin. Backup Trip Recovery Level*.** A Normal Operation B Mains failure C Kinetic back-up D Mains return E Normal operation: ramping **Table 3.19 Legend to *Illustration 3.37*** If mains return while in kinetic back-up at a speed below *SP-15 Kin. Backup Trip Recovery Level* the frequency converter ramps down to 0 RPM using the ramp and then trips. If the ramp is slower than the system will ramp down on its own, the ramping will be done motoric and U_{DC} will be at the normal level ($U_{DC,\ m}$*1.35).  **Illustration 3.38 [7] Kinetic Back-Up, trip with recovery, trip slow ramp where mains return below *SP-15 Kin. Backup Trip Recovery Level*. In this illustration a slow ramp is used.** A Normal Operation B Mains failure C Kinetic back-up D Mains return E Kinetic back-up, ramping to trip F Trip **Table 3.20 Legend to *Illustration 3.38*** If the ramp is quicker than the system's ramp down on, the ramping will be done generatoric. This results in a higher U_{DC} which is limited using the brake chopper/resistor brake.

3

SP-10 Line failure

Option:	Function:

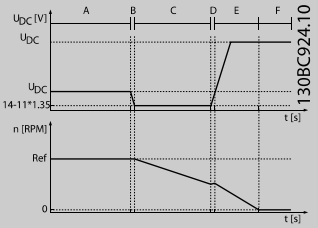


Illustration 3.39 [7] Kinetic Back-Up, trip with recovery where mains return below *SP-15 Kin. Backup Trip Recovery Level*. In this illustration a quick ramp is used.

A	Normal Operation
B	Mains failure
C	Kinetic back-up
D	Mains return
E	Kinetic back-up ramping to trip
F	Trip

Table 3.21 Legend to *Illustration 3.39*

SP-11 Line Voltage at Input Fault

Range:		Function:
342 V*	[180 - 600 V]	This parameter defines the threshold voltage at which the selected function in *SP-10 Line failure* should be activated. It may be considered to choose 90% of the nominal mains as the detection level, depending on the supply quality. For a supply of 380 V *SP-11 Line Voltage at Input Fault* should thus be set to 342 V. This results in a DC detection level of 462 V (*SP-11 Line Voltage at Input Fault* * 1.35)

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:		Function:
[0] *	Trip	Trips the frequency converter
[1]	Warning	Issues a warning
[2]	Disabled	No action

SP-13 Mains Failure Step Factor

Range:		Function:
1*	[0 - 5]	

SP-14 Kin. Backup Time Out

Range:		Function:
60 s*	[0 - 60 s]	This parameter defines the Kinetic Backup Time Out in flux mode when running on low voltage grids. If the supply voltage does not increase above the value defined in *SP-11 Line Voltage at Input Fault* +5% within the specified time, the drive will then automatically run a controlled ramp-down profile before stopping.

SP-15 Kin. Backup Trip Recovery Level

Range:		Function:
60000.000 ReferenceFeedbackUnit*	[0 - 60000.000 ReferenceFeedbackUnit]	This parameter specifies the Kinetic Backup Trip Recovery Level. The unit is defined in *K-02 Motor Speed Unit*.

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:		Function:
60 s*	[0 - 60 s]	Enter the current limit trip delay in seconds. When the output current reaches the current limit (*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:		Function:
60 s*	[0 - 60 s]	Enter the torque limit trip delay in seconds. When the output torque reaches the torque limits (*F-40 Torque Limiter (Driving)* and *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:		Function:
0 s*	[0 - 35 s]	When the frequency converter detects an overvoltage in the set time trip will be effected after the set time.

SP-26 Trip Delay at Drive Fault		
Range:		**Function:**
		If value = 0, *protection mode* is disabled **NOTE** **It is recommended to disable *protection mode* in hoisting applications.**

SP-29 Service Code		
Range:		**Function:**
0*	[-2147483647 - 2147483647]	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 *F-40 Torque Limiter (Driving)* and *F-41 Torque Limiter (Braking)*.

SP-30 Current Lim Ctrl, Proportional Gain		
Range:		**Function:**
100 %*	[0 - 500 %]	Enter the proportional gain value for the current limit controller. Selection of a high value makes the controller react faster. Too high a setting leads to controller instability.

SP-31 Current Lim Ctrl, Integration Time		
Range:		**Function:**
0.020 s*	[0.002 - 2 s]	Controls the current limit control integration time. Setting it to a lower value makes it react faster. A setting too low leads to control instability.

SP-32 Current Lim Ctrl, Filter Time		
Range:		**Function:**
1.0 ms*	[1 - 100 ms]	

SP-35 Stall Protection		
Option:		**Function:**
		SP-35 Stall Protection is active in Flux mode only.
[0]	Disabled	Disables stall protection in field-weakening flux mode and might cause the motor to be lost.
[1] *	Enabled	Enables stall protection in field-weakening flux mode.

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

NOTE

This parameter is not active when *P-20 Motor Construction* is set to *[1] PM non salient SPM*.

SP-41 Energy Savings Min. Magnetization		
Range:		**Function:**
40 %*	[40 - 75 %]	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.

NOTE

This parameter is not active when *P-20 Motor Construction* is set to *[1] PM non salient SPM*.

SP-42 Energy Savings Min. Frequency		
Range:		**Function:**
10 Hz*	[5 - 40 Hz]	Enter the minimum frequency at which the Automatic Energy Savings is to be active.

NOTE

This parameter is not active when *P-20 Motor Construction* is set to *[1] PM non salient SPM*.

SP-43 Motor Cosphi		
Range:		**Function:**
0.66*	[0.40 - 0.95]	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.

3

SP-50 RFI Filter

Option:		Function:
[0]	Off	Select *[0] Off* if the frequency converter is fed by an isolated mains source (IT mains). If a filter is used, select *[0] Off* during charging to prevent a high leakage current making the RCD switch. In this mode, the internal RFI filter capacitors between chassis and the mains RFI filter circuit are cut-out to reduce the ground capacity currents.
[1] *	On	Select *[1] On* to ensure that the frequency converter complies with EMC standards.

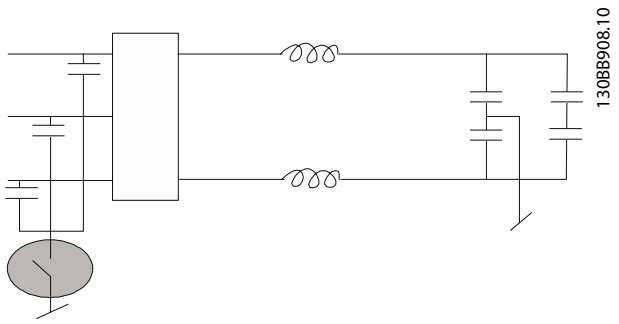


Illustration 3.40 RFI Filter

SP-51 DC Link Compensation

Option:		Function:
		The rectified AC-DC voltage at the frequency converter's DC link is associated with voltage ripples. These ripples can increase in magnitude with increased load. These ripples are undesirable because they can generate current and torque ripples. A compensation method is used to reduce these voltage ripples at DC link. In general, DC link compensation is recommended for most applications, but care must be taken when operating in field weakening as it can generate speed oscillations at the motor shaft. In field weakening, it is recommended to turn DC link compensation off.
[0] *	Off	Select *[0] Off* to disable DC Link Compensation. this disables compensation for ripple in the DC bus and may be set when harmonic filters are used with the drive.
[1]	On	Select *[1] On* to enable DC Link Compensation. This function compensates for lower or higher DC bus voltages to recreate a more perfect sine wave. May overcompensate when harmonic filters are used.

SP-52 Fan Operation

Select minimum speed of the main fan.

Option:		Function:
[0] *	Auto	Select *[0] Auto* to run fan only when internal temperature in frequency converter is in range 35 °C to approx. 55 °C. Fan will run at low speed below 35 °C, and at full speed at approx. 55 °C.
[1]	On 50%	The fan will always run at 50% speed or above. The fan will run at 50% speed at 35 °C, and at full speed at approx. 55 °C.
[2]	On 75%	The fan will always run at 75% speed or above. The fan will run at 75% speed at 35 °C, and at full speed at approx. 55 °C.
[3]	On 100%	The fan will run at 100% speed always.
[4]	Auto (Low temp env.)	This selection is the same as *[0] Auto* but with special considerations around and below 0°C. In selection *[0] Auto* there is a risk that the fan will start running around 0°C as the frequency converter will fear a sensor fault and thus protect the frequency converter while reporting warning 66 "Heatsink Temperature Low". Selection *[4] Auto (Low temp env.)* can be used in very cold environments and prevent the negative effects of this further cooling and avoid warning 66.

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:
		NOTE **This parameter cannot be adjusted while motor is running.** Select if a Sine-Wave output filter connected.
[0] *	No Filter	This is the default setting and should be used with dU/dt filters or high-frequency common-mode (HF-CM) filters.
[1]	Sine-Wave Filter	This setting is only for backwards compatibility. It enables operation with FLUX control principle when the parameters *SP-56 Capacitance Output Filter* and *SP-57 Inductance Output Filter* are programmed with the output filter capacitance and inductance. It DOES NOT limit the range of the switching frequency.

SP-55 Output Filter		
Option:		**Function:**
[2]	Sine-Wave Filter Fixed	This parameter sets a minimum allowed limit to the switching frequency and ensures that the filter will be operated within the safe range of switching frequencies. Operation is possible with all control principles. For FLUX control principle the parameters *SP-56 Capacitance Output Filter* and *SP-57 Inductance Output Filter* have to be programmed (these parameters have no effect in Advanced Vector Control and U/f). The modulation pattern will be set to SFAVM which gives the lowest acoustic noise in the filter. Always set *SP-55 Output Filter* to *[2] Sine-wave fixed* when using a sine-wave filter.

SP-56 Capacitance Output Filter		
Range:		**Function:**
2.0 uF*	[0.1 - 6500 uF]	Set the capacitance of the output filter. The value can be found on the filter label. **NOTE** **This is required for correct compensation in Flux mode (*H-41 Motor Control Principle*)**

SP-57 Inductance Output Filter		
Range:		**Function:**
7.000 mH*	[0.001 - 65 mH]	Set the inductance of the output filter. The value can be found on the filter label. **NOTE** **This is required for correct compensation in Flux mode (*H-41 Motor Control Principle*)**

SP-59 Actual Number of Inverter Units		
Range:		**Function:**
1*	[1 - 1]	Set the actual number of power units.

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.

For each of four ramps (parameter groups F-0#, E-1#, H-0#, SP-7#, SP-8# and SP-9#) configure the ramp parameters: ramp type, ramping times (duration of acceleration and deceleration) and level of jerk compensation for S ramps.

Start by setting the linear ramping times corresponding to the figures.

If S-ramps are selected then set the level of non-linear jerk compensation required. Set jerk compensation by defining the proportion of ramp-up and ramp-down times where acceleration and deceleration are variable (i.e. increasing or decreasing). The S-ramp acceleration and deceleration settings are defined as a percentage of the actual ramp time.

SP-71 Accel Time 1 S-ramp Ratio at Accel. Start		
Range:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total accel time (*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:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total accel time (*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:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total decel time (*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:		**Function:**
50 %*	[1 - 99 %]	Enter the proportion of the total decel time (*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:		**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

3

SP-76 Accel/Decel Time 2 Type		
Option:		Function:
[2]	S-ramp Const Time	S-ramp based on the values set in *E-10 Accel Time 2* and *E-11 Decel Time 2*

NOTE

If *[1] S-ramp Const Jerk* 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:		Function:
50 %*	[1 - 99 %]	Enter the proportion of the total accel time (*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:		Function:
50 %*	[1 - 99 %]	Enter the proportion of the total accel time (*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:		Function:
50 %*	[1 - 99 %]	Enter the proportion of the total decel time (*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:		Function:
50 %*	[1 - 99 %]	Enter the proportion of the total decel time (*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 *E-12 Accel Time 3* and *E-13 Decel Time 3*

NOTE

If *[1] S-ramp Const Jerk* 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:		Function:
50 %*	[1 - 99 %]	Enter the proportion of the total accel time (*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:		Function:
50 %*	[1 - 99 %]	Enter the proportion of the total accel time (*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:		Function:
50 %*	[1 - 99 %]	Enter the proportion of the total decel time (*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:		Function:
50 %*	[1 - 99 %]	Enter the proportion of the total decel time (*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 *E-14 Accel Time 4* and *E-15 Decel Time 4*.

NOTE

If *[1] S-ramp Const Jerk* 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 (*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 (*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 (*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 (*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

3.10 O-## Options/Comms

Parameter group related to communications and options.

3.10.1 O-0# General Settings

3

Parameters to configure the general settings for communications and options.

O-01 Control Site

Option:		Function:
		The setting in this parameter overrides the settings in *O-50 Coasting Select* to *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

Option:		Function:
		NOTE **This parameter cannot be adjusted while the motor is running.** 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 *[3] Option A* if it detects a valid fieldbus option module installed in slot A. If the option is removed, the frequency converter detects a change in the configuration, sets *O-02 Control Word Source* back to default setting RS-485, and the frequency converter trips. If an option is installed after initial power-up, the setting of *O-02 Control Word Source* does not change, but the frequency converter trips and displays: Alarm 67 *Option Changed*. When retrofitting a bus option into a frequency converter, that did not have a bus option installed to begin with, take an ACTIVE decision to move the control to Bus based. This is done for safety reasons to avoid an accidental change.
[0]	None	
[1]	Drive RS485	
[2]	Drive USB	
[3] *	Option A	
[4]	Option B	

O-03 Control Word Timeout Time

Range:		Function:
1 s*	[0.1 - 18000 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 *O-04 Control Word Timeout Function*is then carried out. A valid control word triggers the time-out counter.

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 *O-03 Control Word Timeout Time*.

Option:		Function:
[0] *	Off	Resumes control via serial bus (fieldbus 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 to restart: via the fieldbus, via [Reset], 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 after a time-out, *O-05 End-of-Timeout Function* 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] Select setup 1*
[9]	Select setup 3	See *[7] Select setup 1*
[10]	Select setup 4	See *[7] Select setup 1*
[26]	Trip	

NOTE

To change the set-up after a time-out, the following configuration is required:
Set *K-10 Active Set-up* to *[9] Multi set-up* and select the relevant link in *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 *O-04 Control*

O-05 End-of-Timeout Function

Option:		Function:
		Word Timeout Function is set to *[7] Set-up 1*, *[8] Set-up 2*, *[9]Set-up 3* or *[10] Set-up 4*.
[0]	Hold set-up	Retains the set-up selected in *O-04 Control Word Timeout Function* and displays a warning, until *O-06 Reset Control Word Timeout* toggles. Then the frequency converter resumes its original set-up.
[1] *	Resume set-up	Resumes the set-up active before the time-out.

O-06 Reset Control Word Timeout

This parameter is active only when *[0] Hold set-up* has been selected in *O-05 End-of-Timeout Function*.

Option:		Function:
[0] *	Do not reset	Retains the set-up specified in *O-04 Control Word Timeout Function*, 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 *[0] Do not reset* 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.

NOTE

This is only valid for Profibus.

- *[0] Disable*: Do not send extended diagnosis data even if they appear in the frequency converter.
- *[1] Trigger on alarms*: Send extended diagnosis data when one or more alarms appear in alarm *DR-90 Alarm Word* or *PB-53 Profibus Warning Word*.
- *[2] Trigger alarms/warn.*: Send extended diagnosis data if one or more alarms or warnings appear in alarm *DR-90 Alarm Word*, *PB-53 Profibus Warning Word*, or warning *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	*DR-92 Warning Word*	
14 - 17	*DR-03 Status Word*	status word
18 - 21	*DR-90 Alarm Word*	
22 - 23	*PB-53 Profibus Warning Word*	Communication warning word (Profibus)

Table 3.22

Enabling diagnosis may cause increased bus traffic. Diagnosis functions are not supported by all network types.

O-07 Diagnosis Trigger

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

O-08 Readout Filtering

If the speed feedback value readouts on fieldbus are fluctuating, this function is used. Select filtered if the function is required. A power-cycle is required for changes to take effect.

Option:		Function:
[0]	Motor Data Std-Filt.	Select *[0]* for normal bus readouts.
[1]	Motor Data LP-Filter	Select *[1]* for filtered bus readouts of the following parameters: *DR-10 Power [kW]* *DR-11 Power [hp]* *DR-12 Motor Voltage* *DR-14 Motor current* *DR-16 Torque [Nm]* *DR-17 Speed [RPM]* *DR-22 Torque [%]* *DR-25 Torque [Nm] High*

3

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 fieldbus. Only the selections valid for the fieldbus installed in slot A will be visible in the keypad display.
For guidelines in selection of *GE Drive profile* and *[1] PROFIdrive profile* refer to the *design guide* of the related product.
For additional guidelines in the selection of *[1] PROFIdrive profile* and *[5] ODVA* , see *Operating Instructions* for the installed fieldbus.

Option:		Function:
[0] *	Drive Profile	
[1]	PROFIdrive profile	
[5]	ODVA	

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 *O-10 Control Word Profile*.

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	
[4]	PID error inverse	When enabled, it inverts the resulting error from the process PID controller. Available only if "Configuration Mode" is set to "Surface Winder", "Extended PID Speed OL" or "Extended PID Speed CL".
[5]	PID reset I part	When enabled, resets the I-part of the Process PID controller. Equivalent to *PI-40 Process PID I-part Reset*. Available only if "Configuration Mode" is set to "Surface Winder", "Extended PID Speed OL" or "Extended PID Speed CL".
[6]	PID enable	When enabled, enables the extended process PID controller. Equivalent to *PI-50 Process PID Extended PID*. Available only if "Configuration Mode" is set "Extended PID Speed OL" or "Extended PID Speed CL".

3.10.3 O-3# Drive Port Settings

Parameters to configure the GE drive port.

O-30 Protocol

Option:		Function:
[0]	Drive	Communication according to the Drive Protocol.
[1]	Drive MC	Select the protocol for the drive (standard) port.
[2] *	Modbus RTU	

O-31 Address

Range:		Function:
1*	[1 - 255]	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 *O-30 Protocol* using the Drive Port. For some of the protocols, not all options are 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-34 Estimated cycle time

Range:		Function:
0 ms*	[0 - 1000000 ms]	In noisy environments, the interface may be blocked by due to overload of bad frames. This parameter specifies the time between two consecutive frames on the network. If the interface does not detect valid frames in that time it flushes the receive buffer.

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. If a response from the frequency converter is exceeding the time setting then it will be discarded.

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 *O-30 Protocol* is set to *[1] Drive MC* protocol.

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	Enables use of freely configurable messages or standard messages for the Drive port.
[100]	None	
[101]	PPO 1	
[102]	PPO 2	
[103]	PPO 3	
[104]	PPO 4	
[105]	PPO 5	
[106]	PPO 6	
[107]	PPO 7	
[108]	PPO 8	
[200]	Custom telegram 1	Enables use of freely configurable messages or standard messages for the Drive port.
[202]	Custom telegram 3	

O-41 Parameters for Signals		
Option:		**Function:**
[0] *	None	This parameter contains a list of signals available for selection in *O-42 PCD Write Configuration* and *O-43 PCD Read Configuration*.
[7]	Accel Time 1	
[8]	Decel Time 1	
[15]	Motor Speed High Limit [Hz]	
[16]	Motor Speed Low Limit [Hz]	
[17]	Motor Speed High Limit [RPM]	
[18]	Motor Speed Low Limit [RPM]	
[40]	Torque Limiter (Driving)	
[41]	Torque Limiter (Braking)	
[52]	Minimum Reference	
[53]	Maximum Reference	
[62]	Catch up/slow Down Value	
[110]	Accel Time 2	
[111]	Decel Time 2	
[190]	Digital & Relay Bus Control	
[193]	Pulse Out #27 Bus Control	
[195]	Pulse Out #29 Bus Control	
[197]	Pulse Out #X30/6 Bus Control	
[222]	Jog Accel/Decel Time	
[223]	Quick Stop Decel Time	
[515]	Readout: actual setup	
[653]	Terminal 42 Output Bus Control	
[663]	Terminal X30/8 Bus Control	
[748]	PCD Feed Forward	
[890]	Bus Jog 1 Speed	
[891]	Bus Jog 2 Speed	
[1201]	Reference [Unit]	
[1202]	Reference %	
[1203]	Status Word	
[1205]	Main Actual Value [%]	
[1209]	Custom Readout	
[1210]	Power [kW]	
[1211]	Power [hp]	
[1212]	Motor Voltage	
[1213]	Frequency	
[1214]	Motor current	
[1215]	Frequency [%]	
[1216]	Torque [Nm]	
[1217]	Speed [RPM]	
[1218]	Motor Thermal	
[1219]	KTY sensor temperature	
[1220]	Motor Angle	
[1221]	Torque [%] High Res.	
[1222]	Torque [%]	
[1225]	Torque [Nm] High	
[1230]	DC Link Voltage	
[1232]	Brake Energy /s	
[1233]	Brake Energy /2 min	
[1234]	Heatsink Temp.	

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O-41 Parameters for Signals		
Option:		Function:
[1235]	Drive Thermal	
[1238]	Logic Controller State	
[1239]	Control Card Temp.	
[1248]	Speed Ref. After Ramp [RPM]	
[1250]	External Reference	
[1251]	Pulse Reference	
[1252]	Feedback[Unit]	
[1253]	Digi Pot Reference	
[1257]	Feedback [RPM]	
[1260]	Digital Input	
[1261]	Terminal 53 Switch Setting	
[1262]	Analog Input 53	
[1263]	Terminal 54 Switch Setting	
[1264]	Analog Input 54	
[1265]	Analog Output 42 [mA]	
[1266]	Digital Output [bin]	
[1267]	Freq. Input #29 [Hz]	
[1268]	Freq. Input #33 [Hz]	
[1269]	Pulse Output #27 [Hz]	
[1270]	Pulse Output #29 [Hz]	
[1271]	Relay Output [bin]	
[1272]	Counter A	
[1273]	Counter B	
[1274]	Prec. Stop Counter	
[1275]	Analog In X30/11	
[1276]	Analog In X30/12	
[1277]	Analog Out X30/8 [mA]	
[1280]	Fieldbus CTW 1	
[1282]	Fieldbus REF 1	
[1284]	Comm. Option STW	
[1285]	Drive Port CTW 1	
[1287]	Bus Readout Alarm/Warning	
[1290]	Alarm Word	
[1291]	Alarm Word 2	
[1292]	Warning Word	
[1293]	Warning Word 2	
[1294]	Ext. Status Word	
[1500]	Operating hours	
[1501]	Running Hours	
[1502]	kWh Counter	
[1600]	Control Word	

O-42 PCD Write Configuration		
Range:		Function:
[0] *	None	
[7]	Accel Time 1	
[8]	Decel Time 1	
[15]	Motor Speed High Limit [Hz]	
[16]	Motor Speed Low Limit [Hz]	
[17]	Motor Speed High Limit [RPM]	
[18]	Motor Speed Low Limit [RPM]	
[40]	Torque Limiter (Driving)	

O-42 PCD Write Configuration		
Range:		Function:
[41]	Torque Limiter (Braking)	
[52]	Minimum Reference	
[53]	Maximum Reference	
[62]	Catch up/slow Down Value	
[110]	Accel Time 2	
[111]	Decel Time 2	
[190]	Digital & Relay Bus Control	
[193]	Pulse Out #27 Bus Control	
[195]	Pulse Out #29 Bus Control	
[197]	Pulse Out #X30/6 Bus Control	
[222]	Jog Accel/Decel Time	
[223]	Quick Stop Decel Time	
[653]	Terminal 42 Output Bus Control	
[663]	Terminal X30/8 Bus Control	
[748]	PCD Feed Forward	
[890]	Bus Jog 1 Speed	
[891]	Bus Jog 2 Speed	
[1280]	Fieldbus CTW 1	
[1282]	Fieldbus REF 1	

O-43 PCD Read Configuration		
Range:		Function:
[0] *	None	
[515]	Readout: actual setup	
[1200]	Control Word	
[1201]	Reference [Unit]	
[1202]	Reference %	
[1203]	Status Word	
[1205]	Main Actual Value [%]	
[1209]	Custom Readout	
[1210]	Power [kW]	
[1211]	Power [hp]	
[1212]	Motor Voltage	
[1213]	Frequency	
[1214]	Motor current	
[1215]	Frequency [%]	
[1216]	Torque [Nm]	
[1217]	Speed [RPM]	
[1218]	Motor Thermal	
[1219]	KTY sensor temperature	
[1220]	Motor Angle	
[1221]	Torque [%] High Res.	
[1222]	Torque [%]	
[1225]	Torque [Nm] High	
[1230]	DC Link Voltage	
[1232]	Brake Energy /s	
[1233]	Brake Energy /2 min	
[1234]	Heatsink Temp.	
[1235]	Drive Thermal	
[1238]	Logic Controller State	
[1239]	Control Card Temp.	
[1248]	Speed Ref. After Ramp [RPM]	

O-43 PCD Read Configuration		
Range:		**Function:**
[1250]	External Reference	
[1251]	Pulse Reference	
[1252]	Feedback[Unit]	
[1253]	Digi Pot Reference	
[1257]	Feedback [RPM]	
[1260]	Digital Input	
[1261]	Terminal 53 Switch Setting	
[1262]	Analog Input 53	
[1263]	Terminal 54 Switch Setting	
[1264]	Analog Input 54	
[1265]	Analog Output 42 [mA]	
[1266]	Digital Output [bin]	
[1267]	Freq. Input #29 [Hz]	
[1268]	Freq. Input #33 [Hz]	
[1269]	Pulse Output #27 [Hz]	
[1270]	Pulse Output #29 [Hz]	
[1271]	Relay Output [bin]	
[1272]	Counter A	
[1273]	Counter B	
[1274]	Prec. Stop Counter	
[1275]	Analog In X30/11	
[1276]	Analog In X30/12	
[1277]	Analog Out X30/8 [mA]	
[1284]	Comm. Option STW	
[1285]	Drive Port CTW 1	
[1287]	Bus Readout Alarm/Warning	
[1290]	Alarm Word	
[1291]	Alarm Word 2	
[1292]	Warning Word	
[1293]	Warning Word 2	
[1294]	Ext. Status Word	
[1500]	Operating hours	
[1501]	Running Hours	
[1502]	kWh Counter	

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]	Digital input	Activates Coast command via a digital input.
[1]	Bus	Activates Coast command via the serial communication port or network option module.
[2]	Logic AND	Activates Coast command via the network/ serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activates Coast command via the network/ serial communication port OR via one of the digital inputs.

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	

O-52 DC Brake Select		
Option:		**Function:**
		Select control of the DC brake via the terminals (digital input) and/or via the fieldbus. **NOTE** **Only selection *[0] Digital input* is available when *P-20 Motor Construction* is set to *[1] PM non-salient SPM*.**
[0] *	Digital input	ActivatesDC Brake command via a digital input.
[1]	Bus	ActivatesDC Brake command via the serial communication port or network option module.
[2]	Logic AND	ActivatesDC Brake command via the network/ serial communication port, AND additionally via one of the digital inputs.
[3]	Logic OR	ActivatesDC Brake command via the network/ serial communication port OR via one of the digital inputs.

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]	Digital 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.

3

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 fieldbus.
[1]	Bus	Activates the Reverse command via the serial communication port or fieldbus optionmodule.
[2]	Logic AND	Activates the Reverse command via the fieldbus/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activates the Reverse command via the fieldbus/serial communication port OR via one of the digital inputs.

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]	Digital 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.

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]	Digital 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.

3.10.6 O-8# Drive Port Diagnostics

O-80 Bus Message Count		
Range:		Function:
0*	[0 - 0]	This parameter shows the number of valid messages detected on the network.

O-81 Bus Error Count		
Range:		Function:
0*	[0 - 0]	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 - 0]	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 - 0]	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:		Function:
100 RPM*	[0 - par. F-17 RPM]	Enter the jog speed. Activate this fixed jog speed via the serial port or network option.

O-91 Bus Jog 2 Speed		
Range:		Function:
200 RPM*	[0 - par. F-17 RPM]	Enter the jog speed. Activate this fixed jog speed via the serial port or network option.

3.11 DN-## DeviceNet Fieldbus

Parameter group related to Field Installed DeviceNet Network Communications Option Module.

3.11.1 DN-0# Common Settings

Parameters to configure the commom settings for DeviceNet.

DN-00 DeviceNet Protocol		
Option:		**Function:**
[1] *	DeviceNet	View the active CAN protocol.

NOTE

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 - 255]	View the number of CAN control transmission errors since the last power-up.

DN-06 Readout Receive Error Counter		
Range:		**Function:**
0*	[0 - 255]	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 *O-10 Control Word Profile*. When *O-10 Control Word Profile* is set to [0] *[0] Drive protocol*, *DN-10 Process Data Type Selection* options *[0] INSTANCE 100/150* and *[1] INSTANCE 101/151* are available. When *O-10 Control Word Profile* is set to *[5] ODVA*, *DN-10 Process Data Type Selection* options *[2] INSTANCE 20/70* and *[3] INSTANCE 21/71* 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, refer to the *DeviceNet Operating Instructions*. **NOTE** **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:**
[0] *	None	
[7]	Accel Time 1	
[8]	Decel Time 1	
[15]	Motor Speed High Limit [Hz]	
[16]	Motor Speed Low Limit [Hz]	
[17]	Motor Speed High Limit [RPM]	
[18]	Motor Speed Low Limit [RPM]	
[40]	Torque Limiter (Driving)	
[41]	Torque Limiter (Braking)	
[52]	Minimum Reference	
[53]	Maximum Reference	
[62]	Catch up/slow Down Value	

3

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:
[110]	Accel Time 2	
[111]	Decel Time 2	
[190]	Digital & Relay Bus Control	
[193]	Pulse Out #27 Bus Control	
[195]	Pulse Out #29 Bus Control	
[197]	Pulse Out #X30/6 Bus Control	
[222]	Jog Accel/Decel Time	
[223]	Quick Stop Decel Time	
[653]	Terminal 42 Output Bus Control	
[663]	Terminal X30/8 Bus Control	
[748]	PCD Feed Forward	
[890]	Bus Jog 1 Speed	
[891]	Bus Jog 2 Speed	
[1280]	Fieldbus CTW 1	
[1282]	Fieldbus REF 1	

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:
[0] *	None	
[515]	Readout: actual setup	
[1200]	Control Word	
[1201]	Reference [Unit]	
[1202]	Reference %	
[1203]	Status Word	
[1205]	Main Actual Value [%]	
[1209]	Custom Readout	
[1210]	Power [kW]	
[1211]	Power [hp]	
[1212]	Motor Voltage	
[1213]	Frequency	
[1214]	Motor current	
[1215]	Frequency [%]	
[1216]	Torque [Nm]	
[1217]	Speed [RPM]	
[1218]	Motor Thermal	
[1219]	KTY sensor temperature	
[1220]	Motor Angle	
[1221]	Torque [%] High Res.	
[1222]	Torque [%]	
[1225]	Torque [Nm] High	
[1230]	DC Link Voltage	
[1232]	Brake Energy /s	

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:
[1233]	Brake Energy /2 min	
[1234]	Heatsink Temp.	
[1235]	Drive Thermal	
[1238]	Logic Controller State	
[1239]	Control Card Temp.	
[1248]	Speed Ref. After Ramp [RPM]	
[1250]	External Reference	
[1251]	Pulse Reference	
[1252]	Feedback[Unit]	
[1253]	Digi Pot Reference	
[1257]	Feedback [RPM]	
[1260]	Digital Input	
[1261]	Terminal 53 Switch Setting	
[1262]	Analog Input 53	
[1263]	Terminal 54 Switch Setting	
[1264]	Analog Input 54	
[1265]	Analog Output 42 [mA]	
[1266]	Digital Output [bin]	
[1267]	Freq. Input #29 [Hz]	
[1268]	Freq. Input #33 [Hz]	
[1269]	Pulse Output #27 [Hz]	
[1270]	Pulse Output #29 [Hz]	
[1271]	Relay Output [bin]	
[1272]	Counter A	
[1273]	Counter B	
[1274]	Prec. Stop Counter	
[1275]	Analog In X30/11	
[1276]	Analog In X30/12	
[1277]	Analog Out X30/8 [mA]	
[1284]	Comm. Option STW	
[1285]	Drive Port CTW 1	
[1287]	Bus Readout Alarm/Warning	
[1290]	Alarm Word	
[1291]	Alarm Word 2	
[1292]	Warning Word	
[1293]	Warning Word 2	
[1294]	Ext. Status Word	
[1500]	Operating hours	
[1501]	Running Hours	
[1502]	kWh Counter	

DN-13 Warning Parameter		
Range:		Function:
0*	[0 - 65535]	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

Table 3.25

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 - 65535]	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 - 65535]	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 - 65535]	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 - 65535]	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 acces 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.

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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 edit setup	Stores all parameter values from the active set-up in the non-volatile memory. The selection returns to *[0] Off* when all values have been stored.
[2]	Store all setups	Stores all parameter values for all set-ups in the non-volatile memory. The selection returns to *[0] Off* when all parameter values have been stored.

DN-32 Devicenet Revision		
Range:		**Function:**
0*	[0 - 65535]	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*	[0 - 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:		**Function:**
0*	[0 - 65535]	This parameter receives cyclical reference from a Master Class 2. If the control priority is set to Master Class 2, the reference for the frequency converter is taken from this parameter, whereas the cyclical reference will be ignored.

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

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 *PB-22 Telegram Selection*.
[0] *	None	
[7]	Accel Time 1	
[8]	Decel Time 1	
[15]	Motor Speed High Limit [Hz]	
[16]	Motor Speed Low Limit [Hz]	
[17]	Motor Speed High Limit [RPM]	
[18]	Motor Speed Low Limit [RPM]	
[40]	Torque Limiter (Driving)	
[41]	Torque Limiter (Braking)	
[52]	Minimum Reference	
[53]	Maximum Reference	
[62]	Catch up/slow Down Value	
[110]	Accel Time 2	
[111]	Decel Time 2	
[190]	Digital & Relay Bus Control	
[193]	Pulse Out #27 Bus Control	
[195]	Pulse Out #29 Bus Control	
[197]	Pulse Out #X30/6 Bus Control	
[222]	Jog Accel/Decel Time	
[223]	Quick Stop Decel Time	

PB-15 PCD Write Configuration		
Array [10]		
Option:		**Function:**
[653]	Terminal 42 Output Bus Control	
[663]	Terminal X30/8 Bus Control	
[748]	PCD Feed Forward	
[890]	Bus Jog 1 Speed	
[891]	Bus Jog 2 Speed	
[1280]	Fieldbus CTW 1	
[1282]	Fieldbus REF 1	

PB-16 PCD Read Configuration		
[10] Array		
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 *PB-22 Telegram Selection*.
[0] *	None	
[515]	Readout: actual setup	
[1200]	Control Word	
[1201]	Reference [Unit]	
[1202]	Reference %	
[1203]	Status Word	
[1205]	Main Actual Value [%]	
[1209]	Custom Readout	
[1210]	Power [kW]	
[1211]	Power [hp]	
[1212]	Motor Voltage	
[1213]	Frequency	
[1214]	Motor current	
[1215]	Frequency [%]	
[1216]	Torque [Nm]	
[1217]	Speed [RPM]	
[1218]	Motor Thermal	
[1219]	KTY sensor temperature	
[1220]	Motor Angle	
[1221]	Torque [%] High Res.	
[1222]	Torque [%]	
[1225]	Torque [Nm] High	
[1230]	DC Link Voltage	
[1232]	Brake Energy /s	
[1233]	Brake Energy /2 min	
[1234]	Heatsink Temp.	
[1235]	Drive Thermal	
[1238]	Logic Controller State	
[1239]	Control Card Temp.	

3

PB-16 PCD Read Configuration

[10] Array

Option:		Function:
[1248]	Speed Ref. After Ramp [RPM]	
[1250]	External Reference	
[1251]	Pulse Reference	
[1252]	Feedback[Unit]	
[1253]	Digi Pot Reference	
[1257]	Feedback [RPM]	
[1260]	Digital Input	
[1261]	Terminal 53 Switch Setting	
[1262]	Analog Input 53	
[1263]	Terminal 54 Switch Setting	
[1264]	Analog Input 54	
[1265]	Analog Output 42 [mA]	
[1266]	Digital Output [bin]	
[1267]	Freq. Input #29 [Hz]	
[1268]	Freq. Input #33 [Hz]	
[1269]	Pulse Output #27 [Hz]	
[1270]	Pulse Output #29 [Hz]	
[1271]	Relay Output [bin]	
[1272]	Counter A	
[1273]	Counter B	
[1274]	Prec. Stop Counter	
[1275]	Analog In X30/11	
[1276]	Analog In X30/12	
[1277]	Analog Out X30/8 [mA]	
[1284]	Comm. Option STW	
[1285]	Drive Port CTW 1	
[1287]	Bus Readout Alarm/Warning	
[1290]	Alarm Word	
[1291]	Alarm Word 2	
[1292]	Warning Word	
[1293]	Warning Word 2	
[1294]	Ext. Status Word	
[1500]	Operating hours	
[1501]	Running Hours	
[1502]	kWh Counter	

PB-18 Node Address

Range:		Function:
126*	[0 - 126]	Enter the station address in this parameter or alternatively in the hardware switch. In order to adjust the station address in *PB-18 Node Address*, the hardware switch must be set to 126 or 127 (that is, all switches set to 'on'). Otherwise this parameter displays the actual setting of the switch.

PB-22 Telegram Selection

Displays the Profibus message configuration.

Option:		Function:
[1]	Standard telegram 1	
[100] *	None	

PB-22 Telegram Selection

Displays the Profibus message configuration.

Option:		Function:
[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	
[202]	Custom telegram 3	

PB-23 Parameters for Signals

Array [1000]
Read only

Option:	Function:	
		This parameter contains a list of signals available for selection in *PB-15 PCD Write Configuration* and *PB-16 PCD Read Configuration*.

PB-27 Parameter Edit

Option:		Function:
		Parameters can be edited via Profibus, the standard RS-485 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 *O-50 Coasting Select* to *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 *PB-45 Fault Code* and *PB-47 Fault Number*. The maximum buffer

PB-44 Fault Message Counter		
Range:	**Function:**	
		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*	[0 - 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*	[0 - 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*	[0 - 65535]	This parameter displays Profibus communication warnings. Refer to the *Profibus Operating Instructions* for further information.

Read only

Bit	Meaning
0	Connection with DP-master is not ok
1	Not used
2	(Network 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	Restore 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 occured
13	Not configured
14	Timeout active
15	Warning 34 active

Table 3.26

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*	[0 - 0]	This parameter displays the device identification. Refer to the *Operating Instructions for Profibus*, for further explanation.

PB-65 Profile Number		
Range:	**Function:**	
0*	[0 - 0]	This parameter contains the profile identification. Byte 1 contains the profile number and byte 2 the version number of the profile.

NOTE

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.

3

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 edit setup	Stores all parameter values for all set-ups in the non-volatile memory. The selection returns to *[0] Off* when all parameter values have been stored.
[2]	Store all setups	Stores all parameter values for all set-ups in the non-volatile memory. The selection returns to *[0] Off* when all parameter values have been stored.

PB-72 ProfibusDriveReset

Option:		Function:
[0] *	No action	
[1]	Power-on reset	Resets frequency converter upon power-up, as for power-cycle.
[2]	Power-on reset prep	
[3]	Comm option reset	Resets the Profibus option only, useful after changing certain settings in parameter group PB-##, for example, *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 - 9999]	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 - 9999]	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 - 9999]	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 - 9999]	This parameter displays a list of all the defined frequency converter parameters available for Profibus.

PB-84 Defined Parameters (5)

Range:		Function:
0*	[0 - 9999]	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:		Function:
0*	[0 - 9999]	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:		Function:
0*	[0 - 9999]	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:		Function:
0*	[0 - 9999]	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:		**Function:**
0*	[0 - 9999]	This parameter displays a list of all the frequency converter parameters deviating from default setting.

3.13 EN-## Ethernet

The parameters in this group are common for Ethernet IP and Modbus TCP.

3

EN-00 IP Address Assignment

Option:		Function:
		Selects the IP Address assignment method.
[0] *	Manual	IP-address can be set in *EN-01 IP Address* IP Address.
[1]	DHCP	IP-address is assigned via DHCP server.
[2]	BOOTP	IP-address is assigned via BOOTP server.

EN-01 IP Address

Range:	Function:
[000.000.000.000 - 255.255.255.255]	Configure the IP address of the option. Read-only if *EN-00 IP Address Assignment* set to DHCP or BOOTP.

EN-02 Subnet Mask

Range:	Function:
[000.000.000.000 - 255.255.255.255]	Configure the IP subnet mask of the option. Read-only if *EN-00 IP Address Assignment* set to DHCP or BOOTP.

EN-03 Default Gateway

Range:	Function:
[000.000.000.000 – 255.255.255.255]	Configure the IP default gateway of the option. Read-only if *EN-00 IP Address Assignment* set to DHCP or BOOTP.

EN-04 DHCP Server

Range:	Function:
[000.000.000.000 – 255.255.255.255]	Read only. Displays the IP address of the found DHCP or BOOTP server.

NOTE

A power-cycle is necessary after setting the IP parameters manually.

EN-05 Lease Expires

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

EN-06 Name Servers

Range:		Function:
0*	[0 - 2147483647]	IP addresses of Domain Name Servers. Can be automatically assigned when using DHCP.

EN-07 Domain Name

Range:		Function:
0	[0 - 2147483647]	Domain name of the attached network. Can be automatically assigned when using DHCP network.

EN-08 Host Name

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

EN-09 Physical Address

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

EN-1# Ethernet Link parameters

Option:		Function:
		Applies for whole parameter group.
[0]	Port 1	Index [0] goes for Port 1.
[1]	Port 2	Index [1] goes for Port 2.

EN-10 Link Status

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

EN-11 Link Duration

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

EN-12 Auto Negotiation

Option:		Function:
		Configures Auto Negotiation of Ethernet link parameters, for each port: ON or OFF.
[0]	Off	*Link Speed* and *Link Duplex* can be configured in *EN-13 Link Speed* and *EN-14 Link Duplex*.
[1]	On	

EN-13 Link Speed

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

EN-14 Link Duplex

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

EN-20 Control Instance

Range:	Function:
[None, 20, 21, 23, 100, 101, 103]	Read only. Displays the connection to the master. In Ethernet/IP: If no CIP connection is present, "None" is displayed.

EN-21 Process Data Config Write

Range:	Function:
[[0 - 9] PCD read 0 - 9]	Configuration of readable process data.

EN-22 Process Data Config Read

Range:	Function:
[[0 - 9] PCD read 0 - 9]	Configuration of readable process data.

EN-28 Store Data Values

Option:		Function:
		This parameter activates a function that stores all parameter values in the non-volatile memory (EEPROM) thus retaining parameter values at power-down. The parameter returns to "Off".
[0] *	Off	The store function is inactive.
[1]	Store All set-ups	All parameter value will be stored in the non-volatile memory, in all four setups.

EN-29 Store Always

Option:		Function:
		Activates function that always stores received parameter data in non-volatile memory (EEPROM).
[0] *	Off	
[1]	On	

EN-30 Warning parameter

Range:	Function:
[0000–FFFF hex]	Read only. Displays the Ethernet/IP specific 16-bit Status-word.

Bit	Description
0	Owned
1	Not used
2	Configured
3	Not used
4	Not used
5	Not used
6	Not used
7	Not used
8	Minor recoverable fault
9	Minor unrecoverable fault
10	Major recoverable fault
11	Major unrecoverable fault
12	Not used
13	Not used
14	Not used
15	Not used

Table 3.27

EN-31 Net Reference

Option:		Function:
		Read only. Displays the reference source in Instance 21/71.
[0] *	Off	Reference from the network is not active.
[1]	On	Reference from the network is active.

EN-32 Net Control

Option:		Function:
		Read only. Displays the control source in Instance 21/71.
[0] *	Off	Control via the network is not active.
[1]	On	Control via the network is active

EN-33 CIP Revision

Option:		Function:
		Read only. Displays the CIP-version of the option software.
[0]	Major version (00 - 99)	
[1]	Minor version (00-99)	

EN-34 CIP Product Code

Range:		Function:
1100 (AF-650 GP) 1110 (AF-650 GP)*	[0–9999]	Read only. Displays the CIP product code.

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EN-37 COS Inhibit Timer

Range:	Function:
[0–65.535 ms]	Read only Change-Of-State inhibit timer. If the option is configured for COS operation, this inhibit timer can be configured in the Forward Open telegram to prevent that continuously changing PCD data generates extensive network traffic. The inhibit time is in milliseconds, 0=disabled.

EN-38 COS Filters

Range:	Function:
[[0-9] Filter 0–9 (0000-FFFFhex)]	Change-Of-State PCD filters. Sets up a filter mask for each word of process data when operating in COS-mode. Single bits in the PCD's can be filtered in/out.

EN-40 Status Parameter

Range:		Function:
0*	[0 - 0]	

NOTE

This parameter is for Modbus TCP only

EN-41 Slave Message Count

Range:		Function:
0*	[0 - 0]	

NOTE

This parameter is for Modbus TCP only

EN-42 Slave Exception Message Count

Range:		Function:
0*	[0 - 0]	

NOTE

This parameter is for Modbus TCP only

EN-80 FTP Server

Option:		Function:
[0] *	Disabled	Disables the built-in FTP server.
[1]	Enabled	Enables the built-in FTP server.

EN-81 HTTP Server

Option:		Function:
[0] *	Disabled	
[1]	Enabled	Enables the built-in HTTP (web) server.

EN-82 SMTP Service

Option:		Function:
[0] *	Disabled	
[1]	Enabled	Enables the SMTP (e-mail) service on the option.

EN-89 Transent Socket Channel Port

Range:		Function:
0*	[0–9999]	Configures the TCP port-number for the transent socket channel. This enables Drive-messages to be sent transently on Ethernet via TCP. Default value is 4000, 0 means disabled.

EN-90 Cable Diagnostic

Option:		Function:
		Enables/disables advanced Cable diagnosis function. If enabled, the distance to cable errors can be read out in *EN-93 Cable Error Length*. The parameter resumes to the default setting of Disable after the diagnostics have finished.
[0] *	Disabled	
[1]	Enabled	

NOTE

The cable diagnostics function is only issued on ports where there is no link (see *EN-10 Link Status*, *Link Status*)

EN-91 Auto Cross-Over

Option:		Function:
[0]	Disable	Disables the auto cross-over function.
[1] *	Enable	Enables the auto cross-over function.

NOTE

Disabling of the auto cross-over function requires crossed Ethernet cables for daisy-chaining the options.

EN-92 IGMP Snooping

Option:		Function:
		This prevents flooding of the Ethernet protocol stack by only forwarding multicast packets to ports that are a member of the multicast group.
[0]	Disable	Disables the IGMP snooping function.
[1] *	Enable	Enables the IGMP snooping function.

EN-93 Cable Error Length

Range:		Function:
0*	[0 - 65535]	If Cable Diagnostics is enabled in *EN-90 Cable Diagnostic*, the built-in switch is possible via Time Domain Reflectometry (TDR). This measurement technique detects common cabling problems such as open circuits, short circuits, and impedance mismatches or breaks in transmission cables. The distance from the option to the error is displayed in meters with an accuracy of ±2 m. The value 0 means that no errors detected.

EN-94 Broadcast Storm Protection		
Range:		**Function:**
-1 %*	[-1 - 20 %]	The built-in switch is capable of protecting the switch system from receiving too many broadcast packages, which can use up network resources. The value indicates a percentage of the total bandwidth that is allowed for broadcast messages. Example: The "OFF" means that the filter is disabled - all broadcast messages passes through. The value "0%" means that no broadcast messages passes through. A value of "10%" means that 10% of the total bandwidth is allowed for broadcast messages, if the amount of broadcast messages increases above the 10% threshold, they will be blocked.
-1 %*	[-1 - 20 %]	

EN-95 Broadcast Storm Filter		
Option:		**Function:**
		Applies to *EN-94 Broadcast Storm Protection*; if the Broadcast Storm Protection should also include Multicast messages.
[0] *	Broadcast only	
[1]	Broadcast & Multicast	

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

EN-99 Media Counters		
Range:		**Function:**
0*	[0 - 4294967295]	Read only. Advanced Interface counters, from built-in switch, can be used for low-level troubleshooting, The parameter shows a sum of port 1+port 2.

3

3.14 EC-## Feedback Option

3.14.1 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 *[0] None* if the feedback sensor is an absolute encoder only.

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.

3.14.2 EC-2# Abs. Enc. Interface

EC-20 Protocol Selection

Option:		Function:
		NOTE **This parameter cannot be adjusted while the motor is running.** Select *[1] HIPERFACE* if the encoder is absolute only. Select *[0] None* if the feedback sensor is an incremental encoder only.
[0] *	None	
[1]	HIPERFACE	
[2]	EnDat	
[4]	SSI	

EC-21 Resolution (Positions/Rev)

Range:		Function:
8192*	[4 - 131072]	Select the resolution of the absolute encoder, i.e. the number of counts per revolution. The value depends on setting in *EC-20 Protocol Selection*.

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:
260 kHz*	[100 - 260 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

Option:		Function:
		NOTE **This parameter cannot be adjusted while the motor is running.** Select the baud rate of the attached encoder. The parameter is only accessible when *EC-20 Protocol Selection* is set to *[1] HIPERFACE*.
[0]	600	
[1]	1200	
[2]	2400	
[3]	4800	
[4] *	9600	
[5]	19200	
[6]	38400	

3.14.3 EC-6# Monitoring and App.

EC-60 Feedback Direction

Option:		Function:
		NOTE **This parameter cannot be adjusted while the motor is running.** Change the detected encoder rotation direction without changing the wiring to the encoder.
[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 *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	

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 *EC-61 Feedback Signal Monitoring* is an electrical check of the hardware circuit in the encoder system.

Option:		Function:
[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	

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3.15 RS-## Resolver Interface

RS-50 Poles		
Range:		**Function:**
2*	[2 - 8]	Set the number of poles on the resolver. The value is stated in the data sheet for resolvers.

RS-51 Input Voltage		
Range:		**Function:**
7 V*	[2 - 8 V]	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:		**Function:**
10 kHz*	[2 - 15 kHz]	Set the input frequency to the resolver. The value is stated in the data sheet for resolvers.

RS-53 Transformation Ratio		
Range:		**Function:**
0.5*	[0.1 - 1.1]	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 *RS-50 Poles – RS-53 Transformation Ratio* must be adjusted before activating this parameter.		
Option:		**Function:**
[0] *	Disabled	
[1]	Enabled	

3.16 Parameter Data Check

3.16.1 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.

3.16.2 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.

3.17 ID-## Drive Information

Parameter group related to drive information such as operating data, hardware configuration and software version.

3.17.1 ID-0# Operating Data

Parameters to view operating hours. kWh counters, power ups, etc.

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

ID-01 Running Hours		
Range:		**Function:**
0 h*	[0 - 2147483647 h]	View how many hours the motor has run. Reset the counter in *ID-07 Reset Running Hours Counter*. The value is saved when the frequency converter is turned off.

ID-02 kWh Counter		
Range:		**Function:**
0 kWh*	[0 - 2147483647 kWh]	Registering the power consumption of the motor as a mean value over one hour. Reset the counter in *ID-06 Reset kWh Counter*.

ID-03 Power Up's		
Range:		**Function:**
0*	[0 - 2147483647]	View the number of times the frequency converter has been powered up.

ID-04 Over Temp's		
Range:		**Function:**
0*	[0 - 65535]	View the number of frequency converter temperature faults which have occurred.

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

ID-06 Reset kWh Counter		
Option:		**Function:**
[0] *	Do not reset	Nno reset of the kWh counter is desired.
[1]	Reset counter	Press [OK] to reset the kWh counter to zero (see *ID-02 kWh Counter*).

NOTE

The reset is carried out by pressing [OK].

ID-07 Reset Running Hours Counter		
Option:		**Function:**
[0] *	Do not reset	
[1]	Reset counter	Select *[1] Reset* and press [OK] to reset the Running Hours counter to zero (see *ID-01 Running Hours*). This parameter cannot be selected via the serial port, RS-485. Select *[0] Do not reset* 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.

NOTE

This parameter will be reset when resetting *ID-07 Reset Running Hours Counter*.

3.17.2 ID-1# Data Trending Settings

Data Log Settings enables continous logging of up to 4 data sources (*ID-10 Trending Source*) at individual rates (*ID-11 Trending Interval*). A trigger event (*ID-12 Trigger Event*) and window (*ID-14 Samples Before Trigger*) are used to start and stop the logging conditionally.

ID-10 Trending Source		
Array [4]		
Option:		**Function:**
		Select which variables are to be logged.
[0] *	None	
[515]	Readout: actual setup	
[1200]	Control Word	
[1201]	Reference [Unit]	
[1202]	Reference %	
[1203]	Status Word	
[1210]	Power [kW]	
[1211]	Power [hp]	
[1212]	Motor Voltage	
[1213]	Frequency	
[1214]	Motor current	
[1216]	Torque [Nm]	
[1217]	Speed [RPM]	
[1218]	Motor Thermal	
[1221]	Torque [%] High Res.	
[1222]	Torque [%]	

ID-10 Trending Source		
Array [4]		
Option:		**Function:**
[1225]	Torque [Nm] High	
[1230]	DC Link Voltage	
[1232]	Brake Energy /s	
[1233]	Brake Energy /2 min	
[1234]	Heatsink Temp.	
[1235]	Drive Thermal	
[1248]	Speed Ref. After Ramp [RPM]	
[1250]	External Reference	
[1251]	Pulse Reference	
[1252]	Feedback[Unit]	
[1257]	Feedback [RPM]	
[1260]	Digital Input	
[1262]	Analog Input 53	
[1264]	Analog Input 54	
[1265]	Analog Output 42 [mA]	
[1266]	Digital Output [bin]	
[1275]	Analog In X30/11	
[1276]	Analog In X30/12	
[1277]	Analog Out X30/8 [mA]	
[1290]	Alarm Word	
[1292]	Warning Word	
[1294]	Ext. Status Word	

ID-11 Trending Interval		
Array [4]		
Range:		**Function:**
0.000*	[0.000 - 0.000]	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 (*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	

3

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 (*ID-14 Samples Before Trigger*).
Choices are described under E-## Digital Output.

Option:		Function:
[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 *[0] Log always* for continuous logging.
[1]	Trend once on trigger	Select *[1] Log once on trigger* to conditionally start and stop logging using *ID-12 Trigger Event* and *ID-14 Samples Before Trigger*.

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 *ID-12 Trigger Event* and *ID-13 Trending Mode*.

3.17.3 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:		Function:
0*	[0 - 2147483647]	View the value of the logged event. Interpret the event values according to this table:

Digtal input	Decimal value. See *DR-60 Digital Input* for description after converting to binary value.
Digital output	Decimal value. See *DR-66 Digital Output [bin]* for description after converting to binary value.
Warning word	Decimal value. See *DR-92 Warning Word* for description.
Alarm word	Decimal value. See *DR-90 Alarm Word* for description.
Status word	Decimal value. See *DR-03 Status Word* for description after converting to binary value.
Control word	Decimal value. See *DR-00 Control Word* for description.
Extended status word	Decimal value. See *DR-94 Ext. Status Word* for description.

Table 3.29

ID-22 Historic Log: Time		
Array [50]		
Range:		**Function:**
0 ms*	[0 - 2147483647 ms]	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.

3.17.4 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:		**Function:**
0*	[0 - 255]	View the error code and look up its meaning in *5 Troubleshooting*.

ID-31 Alarm Log: Value		
Array [10]		
Range:		**Function:**
0*	[-32767 - 32767]	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:		**Function:**
0 s*	[0 - 2147483647 s]	View the time when the logged event occurred. Time is measured in seconds from frequency converter start-up.

3.17.5 ID-4# Drive Identification

Parameters to view the information about the hardware and software configuration of the drive.

ID-40 Drive Type		
Range:		**Function:**
0*	[0 - 0]	View the frequency converter type.

ID-41 Power Section		
Range:		**Function:**
0*	[0 - 0]	View the power section.

ID-42 Voltage		
Range:		**Function:**
0*	[0 - 0]	View the voltage.

ID-43 Software Version		
Range:		**Function:**
0*	[0 - 0]	View the SW version

ID-46 GE Product No.		
Range:		**Function:**
0*	[0 - 0]	View the 8-digit number.

ID-47 GE Power Card Model No		
Range:		**Function:**
0*	[0 - 0]	View the power card model number.

ID-48 Keypad ID Number		
Range:		**Function:**
0*	[0 - 0]	View the keypad ID number.

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

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

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

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

3.17.6 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		
Array [8]		
Range:		**Function:**
0*	[0 - 0]	View the installed option type.

ID-61 Option SW Version		
Array [8]		
Range:		**Function:**
0*	[0 - 0]	View the installed option software version.

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

ID-63 Option Serial No		
Array [8]		
Range:	**Function:**	
0*	[0 - 0]	View the installed option serial number.

3.17.7 ID-9# Parameter Info

Parameters to view defined parameters and modified parameters.

ID-92 Defined Parameters		
Array [1000]		
Range:	**Function:**	
0*	[0 - 9999]	View a list of all defined parameters in the frequency converter. The list ends with 0.

ID-93 Modified Parameters		
Array [1000]		
Range:	**Function:**	
0*	[0 - 9999]	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 s after implementation.

ID-99 Parameter Metadata		
Array [30]		
Range:	**Function:**	
0*	[0 - 9999]	This parameter contains data used by the DCT10 software tool.

3.18 DR-## Data Read-outs

Parameter group related to data readouts in the drive for references, voltages, control, alarms, warnings, and status words.

3.18.1 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 - 65535]	View the Control word sent from the frequency converter via the serial communication port in hex code.

DR-01 Reference [Unit]		
Range:		**Function:**
0 ReferenceFeedbackUnit*	[-999999 - 999999 ReferenceFeedbackUnit]	View the present reference value applied on impulse or analog basis in the unit resulting from the configuration selected in *H-40 Configuration Mode* (Hz, Nm or RPM).

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

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

DR-05 Main Actual Value [%]		
Range:		**Function:**
0 %*	[-100 - 100 %]	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 CustomReadoutUnit*	[0 - 0 CustomReadoutUnit]	View the value of custom readout from *K-30 Unit for Custom Readout* to *K-32 Max Value of Custom Readout*

3.18.2 DR-1# Motor Status

Parameters to view the motor status values.

DR-10 Power [kW]		
Range:		**Function:**
0 kW*	[0 - 10000 kW]	Displays 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. The resolution of read-out value on fieldbus is in 10 W steps.

DR-11 Power [hp]		
Range:		**Function:**
0 hp*	[0 - 10000 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 Voltage		
Range:		**Function:**
0 V*	[0 - 6000 V]	View the motor voltage, a calculated value used for controlling the motor.

DR-13 Frequency		
Range:		**Function:**
0 Hz*	[0 - 6500 Hz]	View the motor frequency, without resonance dampening.

DR-14 Motor current		
Range:		**Function:**
0 A*	[0 - 10000 A]	View the motor current measured as a mean value, I_{RMS}. The value is filtered, and thus approximately 30 ms may pass from when an input value changes to when the data read-out values change.

DR-15 Frequency [%]		
Range:		**Function:**
0 %*	[-100 - 100 %]	View a two-byte word reporting the actual motor frequency (without resonance dampening) as a percentage (scale 0000-4000 Hex) of *F-03 Max Output Frequency 1*. Set *PB-16 PCD Read Configuration* index 1 to send it with the Status Word instead of the MAV.

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DR-16 Torque [Nm]		
Range:		**Function:**
0 Nm*	[-3000 - 3000 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 *F-10 Electronic Overload*.

DR-19 KTY sensor temperature		
Range:		**Function:**
0 °C*	[0 - 0 °C]	Returning the actual temperature on KTY sensor buil into the motor. See parameter group 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:		**Function:**
0 Nm*	[-200000000 - 200000000 Nm]	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 *DR-16 Torque [Nm]*.

DR-25 Torque [Nm] High		
Range:		**Function:**
		show higher values than the standard readout in *DR-16 Torque [Nm]*.

3.18.3 DR-3# Drive Status

Parameters to view the drive status values.

DR-30 DC Link Voltage		
Range:		**Function:**
0 V*	[0 - 10000 V]	View a measured value. The value is filtered with an 30 ms time constant.

DR-32 Brake Energy /s		
Range:		**Function:**
0 kW*	[0 - 10000 kW]	View the brake power transmitted to an external brake resistor, stated as an instantaneous value.

DR-33 Brake Energy /2 min		
Range:		**Function:**
0 kW*	[0 - 10000 kW]	View the brake power transmitted to an external brake resistor. The mean power is calculated on an average basis for the most recent 120 s.

DR-34 Heatsink Temp.		
Range:		**Function:**
0 °C*	[0 - 255 °C]	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:		**Function:**
0 %*	[0 - 100 %]	View the percentage load on the inverter.

DR-36 Drive Nominal Current		
Range:		**Function:**
10.00 A*	[0.01 - 10000 A]	View the inverter nominal current, which should match the nameplate data on the connected motor. The data are used for calculation of torque, motor protection, etc.

DR-37 Drive Max. Current		
Range:		**Function:**
16.00 A*	[0.01 - 10000 A]	View the inverter maximum current, which should match the nameplate data on the connected motor. The data are used for calculation of torque, motor protection, etc.

DR-38 Logic Controller State		
Range:		**Function:**
0*	[0 - 100]	View the state of the event under execution by the LC controller.

DR-39 Control Card Temp.		
Range:		**Function:**
0 °C*	[0 - 100 °C]	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 parameter group ID-1#). The logging buffer will never be full when *ID-13 Trending Mode* is set to *[0] Log always*.
[0] *	No	
[1]	Yes	

DR-48 Speed Ref. After Ramp [RPM]		
Range:		**Function:**
0 RPM*	[-30000 - 30000 RPM]	This parameter specifies the reference given to the frequency converter after the speed ramp.

DR-49 Current Fault Source		
Range:		**Function:**
0*	[0 - 8]	Value indicates source of current faults including short circuit, over current, and phase imbalance (from left): 1-4 Inverter 5-8 Rectifier 0 No fault recorded

3.18.4 DR-5# Ref. & Feedb.

Parameters to view the reference and feedback status values.

DR-50 External Reference		
Range:		**Function:**
0*	[-200 - 200]	View the total reference, the sum of digital, analog, preset, bus and freeze references, plus catch-up and slow-down.

DR-51 Pulse Reference		
Range:		**Function:**
0*	[-200 - 200]	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 ReferenceFeedbackUnit*	[-999999.999 - 999999.999 ReferenceFeedbackUnit]	View the feedback unit resulting from the selection of unit and scaling in *F-50 Reference Range*, *F-51 Reference/ Feedback Unit*, *F-52 Minimum Reference* and *F-53 Maximum Reference*.

DR-53 Digi Pot Reference		
Range:		**Function:**
0*	[-200 - 200]	View the contribution of the Digital Potentiometer to the actual reference.

DR-57 Feedback [RPM]		
Range:		**Function:**
0 RPM*	[-30000 - 30000 RPM]	Read-out parameter where the actual motor RPM from the feed-back source can be read in both closed loop and open loop. The feed-back source is selected by *PI-00 Speed PID Feedback Source*.

3.18.5 DR-6# Inputs/Outputs

Parameters to view the digital and analog I/O status values.

3

DR-60 Digital Input

Range:		Function:
0*	[0 - 1023]	View the signal states from the active digital inputs. Example: Input 18 corresponds to bit no. 5, '0' = no signal, '1' = connected signal.

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

Table 3.30 Active Digital Inputs

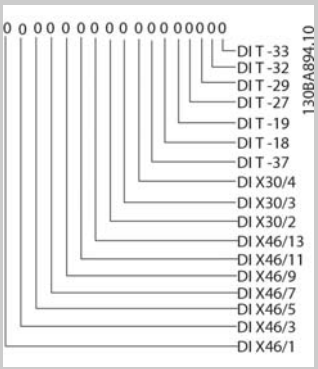

Illustration 3.41 Relay Settings

DR-61 Terminal 53 Switch Setting

Option:		Function:
		View the setting of input terminal 53.
[0] *	Current	
[1]	Voltage	
[2]	Pt 1000 [°C]	
[3]	Pt 1000 [°F]	
[4]	Ni 1000 [°C]	
[5]	Ni 1000 [°F]	

DR-62 Analog Input 53

Range:		Function:
0*	[-20 - 20]	View the actual value at input 53.

DR-63 Terminal 54 Switch Setting

Option:		Function:
		View the setting of input terminal 54.
[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*	[-20 - 20]	View the actual value at input 54.

DR-65 Analog Output 42 [mA]

Range:		Function:
0*	[0 - 30]	View the actual value at output 42 in mA. The value shown reflects the selection in *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.

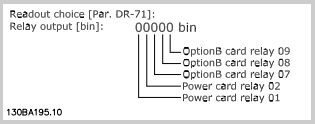

Illustration 3.43 Relay Settings

DR-72 Counter A		
Range:		Function:
0*	[-2147483648 - 2147483647]	View the present value of Counter A. Counters are useful as comparator operands, see *LC-10 Comparator Operand*. The value can be reset or changed either via digital inputs (parameter group *E-## Digital Inputs*) or by using an LC action (*LC-52 Logic Controller Action*).

DR-73 Counter B		
Range:		Function:
0*	[-2147483648 - 2147483647]	View the present value of Counter B. Counters are useful as comparator operands (*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 (*LC-52 Logic Controller Action*).

DR-74 Prec. Stop Counter		
Range:		Function:
0*	[0 - 2147483647]	Returns the actual counter value of precise counter (*H-84 Precise Stop Counter Value*).

DR-75 Analog In X30/11		
Range:		Function:
0*	[-20 - 20]	View the actual value at input X30/11 of OPCGPIO General Purpose I/O Option Module.

DR-76 Analog In X30/12		
Range:		Function:
0*	[-20 - 20]	View the actual value at input X30/12 of OPCGPIO General Purpose I/O Option Module.

DR-77 Analog Out X30/8 [mA]		
Range:		Function:
0*	[0 - 30]	View the actual value at input X30/8 .

3.18.6 DR-8# Fieldbus & Drive Port

Parameters to view the bus references and control words.

DR-80 Fieldbus 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 Fieldbus option installed and the Control word profile selected in *O-10 Control Word Profile*. For more information, refer to the relevant Fieldbus 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, refer to the relevant network manual.

DR-84 Comm. Option STW		
Range:		Function:
0*	[0 - 65535]	View the extended Fieldbus 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 Fieldbus option installed and the Control word profile selected in *O-10 Control Word Profile*.

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 *O-10 Control Word Profile*.

3.18.7 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.

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DR-94 Ext. Status Word		
Range:		Function:
0*	[0 - 4294967295]	Returns the extended warning word sent via the serial communication port in hex code.

3.19 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 *LC-52 Logic Controller Action*) 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

Select the boolean (TRUE or FALSE) input to activate Logic Controller.

Option:		Function:
[0] *	False	Select the boolean (TRUE or FALSE) input to activate Logic Controller. Enters the fixed value - FALSE
[1]	True	Enters the fixed value - TRUE.
[2]	Running	The motor is running.
[3]	In range	The motor is running within the programmed current and speed ranges set in *H-70 Warning Current Low* to *H-73 Warning Speed High*.
[4]	On reference	The motor is running on reference.
[5]	Torque limit	The torque limit, set in *F-40 Torque Limiter (Driving)* or *F-41 Torque Limiter (Braking)*, has been exceeded.
[6]	Current Limit	The motor current limit, set in *F-43 Current Limit*, has been exceeded.
[7]	Out of current range	The motor current is outside the range set in *F-43 Current Limit*.
[8]	Below I low	The motor current is lower than set in *H-70 Warning Current Low*.
[9]	Above I high	The motor current is higher than set in *H-71 Warning Current High*.
[10]	Out of speed range	The speed is outside the range set in *H-72 Warning Speed Low* and *H-73 Warning Speed High*.
[11]	Below speed low	The output speed is lower than the setting in *H-72 Warning Speed Low*.
[12]	Above speed high	The output speed is higher than the setting in *H-73 Warning Speed High*.

LC-01 Start Event

Select the boolean (TRUE or FALSE) input to activate Logic Controller.

Option:		Function:
[13]	Out of feedb. range	The feedback is outside the range set in *H-76 Warning Feedback Low* and *H-77 Warning Feedback High*.
[14]	Below feedb. low	The feedback is below the limit set in *H-76 Warning Feedback Low*.
[15]	Above feedb. high	The feedback is above the limit set in *H-77 Warning Feedback High*.
[16]	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.
[17]	Line voltage out of range	The mains voltage is outside the specified voltage range.
[18]	Reversing	The output is high when the frequency converter is running counter clockwise (the logical product of the status bits “running” AND “reverse”).
[19]	Warning	A warning is active.
[20]	Alarm (trip)	A (trip) alarm is active.
[21]	Alarm (trip lock)	A (Trip lock) alarm is active.
[22]	Comparator 0	Use the result of comparator 0.
[23]	Comparator 1	Use the result of comparator 1.
[24]	Comparator 2	Use the result of comparator 2.
[25]	Comparator 3	Use the result of comparator 3.
[26]	Logic rule 0	Use the result of logic rule 0.
[27]	Logic rule 1	Use the result of logic rule 1.
[28]	Logic rule 2	Use the result of logic rule 2.
[29]	Logic rule 3	Use the result of logic rule 3.
[33]	Digital input DI18	Use the result of digital input 18.
[34]	Digital input DI19	Use the result of digital input 19.
[35]	Digital input DI27	Use the result of digital input 27.
[36]	Digital input DI29	Use the result of digital input 29.
[37]	Digital input DI32	Use the result of digital input 32.
[38]	Digital input DI33	Use the result of digital input 33.
[39]	Start command	A start command is issued.
[40]	Drive stopped	A stop command (Jog, Stop, Qstop, Coast) is issued – and not from the Logic Controller itself.
[41]	Reset Trip	A reset is issued
[42]	Auto-reset Trip	An Auto reset is performed.
[43]	Ok key	[OK] is pressed.

3

LC-01 Start Event

Select the boolean (TRUE or FALSE) input to activate Logic Controller.

Option:		Function:
[44]	Reset key	[Reset] is pressed.
[45]	Left key	[◄] is pressed.
[46]	Right key	[►] is pressed.
[47]	Up key	[▲] is pressed.
[48]	Down key	[▼] is pressed.
[50]	Comparator 4	Use the result of comparator 4.
[51]	Comparator 5	Use the result of comparator 5.
[60]	Logic rule 4	Use the result of logic rule 4.
[61]	Logic rule 5	Use the result of logic rule 5.
[94]	RS Flipflop 0	See parameter group *LC-1# Comparators*
[95]	RS Flipflop 1	See parameter group *LC-1# Comparators*
[96]	RS Flipflop 2	See parameter group *LC-1# Comparators*
[97]	RS Flipflop 3	See parameter group *LC-1# Comparators*
[98]	RS Flipflop 4	See parameter group *LC-1# Comparators*
[99]	RS Flipflop 5	See parameter group *LC-1# Comparators*
[100]	RS Flipflop 6	See parameter group *LC-1# Comparators*
[101]	RS Flipflop 7	See parameter group *LC-1# Comparators*

LC-02 Stop Event

Select the boolean (TRUE or FALSE) input to deactivate Logic Controller.

Option:		Function:
[0] *	False	For descriptions [0]-[61], see *LC-01 Start Event Start Event*
[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	

LC-02 Stop Event

Select the boolean (TRUE or FALSE) input to deactivate Logic Controller.

Option:		Function:
[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	Logic Controller timer 3 is timed out.
[71]	Logic Controller Time-out 4	Logic Controller timer 4 is timed out.
[72]	Logic Controller Time-out 5	Logic Controller timer 5 is timed out.
[73]	Logic Controller Time-out 6	Logic Controller timer 6 is timed out.

LC-02 Stop Event		
Select the boolean (TRUE or FALSE) input to deactivate Logic Controller.		
Option:		**Function:**
[74]	Logic Controller Time-out 7	Logic Controller timer 7 is timed out.
[75]	Start command given	
[76]	Digital input x30 2	
[77]	Digital input x30 3	
[78]	Digital input x30 4	
[94]	RS Flipflop 0	See parameter group *LC-1# Comparators*
[95]	RS Flipflop 1	See parameter group *LC-1# Comparators*
[96]	RS Flipflop 2	See parameter group *LC-1# Comparators*
[97]	RS Flipflop 3	See parameter group *LC-1# Comparators*
[98]	RS Flipflop 4	See parameter group *LC-1# Comparators*
[99]	RS Flipflop 5	See parameter group *LC-1# Comparators*
[100]	RS Flipflop 6	See parameter group *LC-1# Comparators*
[101]	RS Flipflop 7	See parameter group *LC-1# Comparators*

LC-03 Reset Logic Controller		
Option:		**Function:**
[0] *	Do not reset Logic Controller	Retains programmed settings in all parameter group *LC-## Logic Controller*.
[1]	Reset Logic Controller	Resets all parameters in parameter group *LC-## Logic Controller* 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:**
		Choices [1] to [31] are variables which will be compared based on their values. Choices [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 *LC-11 Comparator Operator*. Select the variable to be monitored by the comparator.
[0] *	DISABLED	The comparator is disabled.
[1]	Reference	The resulting remote reference (not local) as a percentage.
[2]	Feedback	In the unit [RPM] or [Hz]
[3]	Motor speed	[RPM] or [Hz]
[4]	Motor Current	[A]
[5]	Motor torque	[Nm]
[6]	Motor power	[kW] or [hp]
[7]	Motor Rated Voltage	[V]
[8]	DC-link voltage	[V]
[9]	Motor Thermal	Expressed as a percentage.
[10]	Drive thermal	Expressed as a percentage.
[11]	Heat sink temp.	Expressed as a percentage.
[12]	Analog input AI53	Expressed as a percentage.
[13]	Analog input AI54	Expressed as a percentage.
[14]	Analog input AIFB10	[V]. AIFB10 is internal 10 V supply.
[15]	Analog input AIS24V	[V] Analog input AICCT [17] [°]. AIS24V is switch mode power supply: SMPS 24V.
[17]	Analog input AICCT	[°]. AICCT is control card temperature.
[18]	Pulse input FI29	Expressed as a percentage.
[19]	Pulse input FI33	Expressed as a percentage.
[20]	Alarm number	The error number.
[21]	Warning number	
[22]	Analog input x30 11	
[23]	Analog input x30 12	
[30]	Counter A	Number of counts
[31]	Counter B	Number of counts
[50]	FALSE	Enters the fixed value of false in the comparator.
[51]	TRUE	Enters the fixed value of true in the comparator.
[52]	Control ready	The control board receives supply voltage

3

LC-10 Comparator Operand		
Array [6]		
Option:		**Function:**
[53]	Drive ready	The frequency converter is ready for operation and applies a supply signal on the control board.
[54]	Running	The motor is running.
[55]	Reversing	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	The motor is running within the programmed current and speed ranges set in *H-70 Warning Current Low* to *H-73 Warning Speed High*.
[60]	On reference	The motor is running on reference.
[61]	Below reference, low	The motor is running below the value given in *H-74 Warning Reference Low*.
[62]	Above ref, high	The motor is running above the value given in *H-75 Warning Reference High*
[65]	Torque limit	The torque limit, set in *F-40 Torque Limiter (Driving)* or *F-41 Torque Limiter (Braking)*, has been exceeded.
[66]	Current Limit	The motor current limit, set in *F-43 Current Limit*, has been exceeded.
[67]	Out of current range	The motor current is outside the range set in *F-43 Current Limit*.
[68]	Below I low	The motor current is lower than set in *H-70 Warning Current Low*.
[69]	Above I high	The motor current is higher than set in *H-71 Warning Current High*.
[70]	Out of speed range	The speed is outside the range set in *H-72 Warning Speed Low* and *H-73 Warning Speed High*.
[71]	Below speed low	The output speed is lower than the setting in *H-72 Warning Speed Low*.
[72]	Above speed high	The output speed is higher than the setting in *H-73 Warning Speed High*.
[75]	Out of feedback range	The feedback is outside the range set in *H-76 Warning Feedback Low* and *H-77 Warning Feedback High*.
[76]	Below feedback low	The feedback is below the limit set in *H-76 Warning Feedback Low*.
[77]	Above feedback high	The feedback is above the limit set in *H-77 Warning Feedback High*.
[80]	Thermal warning	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	The mains voltage is outside the specified voltage range.
[85]	Warning	A warning is active.
[86]	Alarm (trip)	A (trip) alarm is active.
[87]	Alarm (trip lock)	A (Trip lock) alarm is active.
[90]	Bus OK	Active communication (no time-out) via the serial communication port.
[91]	Torque limit & stop	If the frequency converter has received a stop signal and is at the torque limit, the signal is logic "0".
[92]	Brake fault (IGBT)	The brake IGBT is short circuited.
[93]	Mech. brake control	The mechanical brake is active.
[94]	Safe stop active	
[100]	Comparator 0	The result of comparator 0.
[101]	Comparator 1	The result of comparator 1.
[102]	Comparator 2	The result of comparator 2.
[103]	Comparator 3	The result of comparator 3.
[104]	Comparator 4	The result of comparator 4.
[105]	Comparator 5	The result of comparator 5.
[110]	Logic rule 0	The result of Logic rule 0.
[111]	Logic rule 1	The result of Logic rule 1.
[112]	Logic rule 2	The result of Logic rule 2.
[113]	Logic rule 3	The result of Logic rule 3.
[114]	Logic rule 4	The result of Logic rule 4.
[115]	Logic rule 5	The result of Logic rule 5.
[120]	Logic Controller Time-out 0	The result of LC timer 0.
[121]	Logic Controller Time-out 1	The result of LC timer 1.
[122]	Logic Controller Time-out 2	The result of LC timer 2.
[123]	Logic Controller Time-out 3	The result of LC timer 3.
[124]	Logic Controller Time-out 4	The result of LC timer 4.
[125]	Logic Controller Time-out 5	The result of LC timer 5.
[126]	Logic Controller Time-out 6	The result of LC timer 6.
[127]	Logic Controller Time-out 7	The result of LC timer 7.
[130]	Digital input DI18	Digital input 18. High = True.

LC-10 Comparator Operand

Array [6]

Option:		Function:
[131]	Digital input DI19	Digital input 19. High = True.
[132]	Digital input DI27	Digital input 27. High = True.
[133]	Digital input DI29	Digital input 29. High = True.
[134]	Digital input DI32	Digital input 32. High = True.
[135]	Digital input DI33	Digital input 33. High = True.
[150]	Logic Controller digital output A	Use the result of the Logic Controller output A.
[151]	Logic Controller digital output B	Use the result of the LC output B.
[152]	Logic Controller digital output C	Use the result of the LC output C.
[153]	Logic Controller digital output D	Use the result of the LC output D.
[154]	Logic Controller digital output E	Use the result of the LC output E.
[155]	Logic Controller digital output F	Use the result of the LC output F.
[160]	Relay 1	Relay 1 is active
[161]	Relay 2	Relay 2 is active
[180]	Local referecnce active	High when *F-02 Operation Method = [2] Local* or when *F-02 Operation Method* is *[0] Linked to hand Auto*, at the same time as the keypad is in Hand mode.
[181]	Remote reference active	High when *F-02 Operation Method= [1] Remote* or *[0] Linked to hand/auto*, while the keypad is in Auto mode.
[182]	Start command	High when there is an active start command, and no stop command.
[183]	Drive stopped	A stop command (Jog, Stop, Qstop, Coast) is issued – and not from the Logic Controller itself.
[185]	Drive in hand mode	High when the frequency converter is in hand mode.
[186]	Drive in auto mode	High when the frequency converter is in auto mode.
[187]	Start command given	
[190]	Digital input x30 2	
[191]	Digital input x30 3	
[192]	Digital input x30 4	

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 *LC-10 Comparator Operand* is smaller than the fixed value in *LC-12 Comparator Value*. The result will be FALSE, if the variable selected in *LC-10 Comparator Operand* is greater than the fixed value in *LC-12 Comparator Value*.
[1] *	≈ (equal)	Select *[1]* ≈ for the result of the evaluation to be TRUE, when the variable selected in *LC-10 Comparator Operand* is approximately equal to the fixed value in *LC-12 Comparator Value*.
[2]	>	Select *[2]* > for the inverse logic of option *[0]* <.
[5]	TRUE longer than..	
[6]	FALSE longer than..	
[7]	TRUE shorter than..	
[8]	FALSE shorter than..	

LC-12 Comparator Value

Array [6]

Range:		Function:
0*	[-100000 - 100000]	Enter the 'trigger level' for the variable that is monitored by this comtor. This is an array parameter containing comtor values 0 to 5.

LC-15 RS-FF Operand S

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	

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LC-15 RS-FF Operand S		
Option:		Function:
[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	
[76]	Digital input x30 2	
[77]	Digital input x30 3	
[78]	Digital input x30 4	
[90]	ATEX OL cur. warning	
[91]	ATEX OL cur. alarm	
[92]	ATEX OL freq. warning	
[93]	ATEX OL freq. alarm	
[94]	RS Flipflop 0	
[95]	RS Flipflop 1	

LC-15 RS-FF Operand S		
Option:		Function:
[96]	RS Flipflop 2	
[97]	RS Flipflop 3	
[98]	RS Flipflop 4	
[99]	RS Flipflop 5	
[100]	RS Flipflop 6	
[101]	RS Flipflop 7	

LC-16 RS-FF Operand R		
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	
[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	

LC-16 RS-FF Operand R		
Option:		**Function:**
[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	
[76]	Digital input x30 2	
[77]	Digital input x30 3	
[78]	Digital input x30 4	
[90]	ATEX OL cur. warning	
[91]	ATEX OL cur. alarm	
[92]	ATEX OL freq. warning	
[93]	ATEX OL freq. alarm	
[94]	RS Flipflop 0	
[95]	RS Flipflop 1	
[96]	RS Flipflop 2	
[97]	RS Flipflop 3	
[98]	RS Flipflop 4	
[99]	RS Flipflop 5	
[100]	RS Flipflop 6	
[101]	RS Flipflop 7	

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. *[29] Start timer 1*) and until the given timer value has elapsed.

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 *LC-01 Start Event* ([0] - [61]) and *LC-02 Stop Event* ([70] - [75]) for further description.

LC-41 Logic Rule Operator 1		
Array [6]		
Option:		**Function:**
		Select the first logical operator to use on the Boolean inputs from *LC-40 Logic Rule Boolean 1* and *LC-42 Logic Rule Boolean 2*. [LC-##] signifies the boolean input of parameter group *LC-## Logic Controller*.
[0] *	DISABLED	Ignores *LC-42 Logic Rule Boolean 2*, *LC-43 Logic Rule Operator 2*, and *LC-44 Logic Rule Boolean 3*.
[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:**
[0] *	False	Select the second boolean (TRUE or FALSE) input for the selected logic rule. See *LC-01 Start Event* ([0] - [61]) and *LC-02 Stop Event* ([70] - [75]) for further description.

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LC-43 Logic Rule Operator 2		
Array [6]		
Option:		**Function:**
		Select the second logical operator to be used on the boolean input calculated in *LC-40 Logic Rule Boolean 1*, *LC-41 Logic Rule Operator 1*, and *LC-42 Logic Rule Boolean 2*, and the boolean input coming from *LC-42 Logic Rule Boolean 2*. [LC-44] signifies the boolean input of *LC-44 Logic Rule Boolean 3*. [LC-40/LC-42] signifies the boolean input calculated in *LC-40 Logic Rule Boolean 1*, *LC-41 Logic Rule Operator 1*, and *LC-42 Logic Rule Boolean 2*. *[0] DISABLED* (factory setting). select this option to ignore *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 *LC-01 Start Event* ([0] - [61]) and *LC-02 Stop Event* ([70] - [75]) for further description.

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 *LC-01 Start Event* ([0] - [61]) and *LC-02 Stop Event* ([70] - [74]) for further description.

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 *LC-51 Logic Controller Event*) is evaluated as true. The following actions are available for selection: *[0] *DISABLED*
[1]	No action	
[2]	Select set-up 1	Changes the active set-up (*K-10 Active Set-up*) to '1'. If the set-up is changed, it will merge with other set-up commands coming from either the digital inputs or via a Network.
[3]	Select set-up 2	Changes the active set-up *K-10 Active Set-up*) to '2'. If the set-up is changed, it will merge with other set-up commands coming from either the digital inputs or via a Network.
[4]	Select set-up 3	Changes the active set-up (*K-10 Active Set-up*) to '3'. If the set-up is changed, it will merge with other set-up commands coming from either the digital inputs or via a Network.
[5]	Select set-up 4	Changes the active set-up (*K-10 Active Set-up*) 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	Selects preset reference 0. 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.
[11]	Select preset ref 1	Selects preset reference 1. 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.
[12]	Select preset ref 2	Selects preset reference 2. 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.
[13]	Select preset ref 3	Selects preset reference 3. 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.

LC-52 Logic Controller Action		
Array [20]		
Option:		**Function:**
[14]	Select preset ref 4	Selects preset reference 4. 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.
[15]	Select preset ref 5	Selects preset reference 5. 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.
[16]	Select preset ref 6	Selects preset reference 6. 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.
[17]	Select preset ref 7	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	Selects ramp 1.
[19]	Select Accel/ Decel 2	Selects ramp 2.
[20]	Select Accel/ Decel 3	Selects ramp 3.
[21]	Select Accel/ Decel 4	Selects ramp 4.
[22]	Run	Issues a start command to the frequency converter.
[23]	Run reverse	Issues a start reverse command to the frequency converter.
[24]	Stop	Issues a stop command to the frequency converter.
[25]	Qstop	Issues a quick stop command to the frequency converter.
[26]	Dcstop	Issues a DC stop command to the frequency converter.
[27]	Coast	The frequency converter coasts immediately. All stop commands including the coast command stop the Logic Controller.
[28]	Freeze output	Freezes the output frequency of the frequency converter.
[29]	Start timer 0	Starts timer 0, see *LC-20 Logic Controller Timer* for further description.
[30]	Start timer 1	Starts timer 1, see *LC-20 Logic Controller Timer* for further description.

LC-52 Logic Controller Action		
Array [20]		
Option:		**Function:**
[31]	Start timer 2	Starts timer 2, see *LC-20 Logic Controller Timer* for further description.
[32]	Set digital out A low	Any output with LC output A will be low.
[33]	Set digital out B low	Any output with LC output B will be low.
[34]	Set digital out C low	Any output with LC output Cwill be low.
[35]	Set digital out D low	Any output with LC output D will be low.
[36]	Set digital out E low	Any output with LC output E will be low.
[37]	Set digital out F low	Any output with LC output F will be low.
[38]	Set digital out A high	Any output with LC output A will be high.
[39]	Set digital out B high	Any output with LC output B will be high.
[40]	Set digital out C high	Any output with LC output C will be high.
[41]	Set digital out D high	Any output with LC output D will be high.
[42]	Set digital out E high	Any output with LC output E will be high.
[43]	Set digital out F high	Any output with LC output Fwill be high.
[60]	Reset Counter A	Resets Counter A to zero.
[61]	Reset Counter B	Resets Counter B to zero.
[70]	Start timer 3	Start Timer 3, see *LC-20 Logic Controller Timer* for further description.
[71]	Start timer 4	Start Timer 4, see *LC-20 Logic Controller Timer* for further description.
[72]	Start timer 5	Start Timer 5, see *LC-20 Logic Controller Timer* for further description.
[73]	Start timer 6	Start Timer 6, see *LC-20 Logic Controller Timer* for further description.
[74]	Start timer 7	Start Timer 7, see *LC-20 Logic Controller Timer* 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.

B-00 DC Hold Current		
Range:		**Function:**
50 %*	[0 - 160 %]	Enter a value for holding current as a percentage of the rated motor current $I_{M,N}$ set in *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 *F-25 Start Function* [0] or *H-80 Function at Stop* [1].

NOTE

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

Low values of DC hold will produce larger than expected currents with larger motor power sizes. This error will increase as the motor power increases.

B-01 DC Brake Current		
Range:		**Function:**
50 %*	[0 - 1000 %]	Enter a value for current as a percentage of the rated motor current $I_{M,N}$, see *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 *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 *B-02 DC Braking Time*.

NOTE

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

B-02 DC Braking Time		
Range:		**Function:**
10 s*	[0 - 60 s]	Set the duration of the DC braking current set in *B-01 DC Brake Current*, once activated.

B-03 DC Brake Cut In Speed [RPM]		
Range:		**Function:**
0 RPM*	[0 - 60000 RPM]	Set the DC brake cut-in speed for activation of the DC braking current set in *B-01 DC Brake Current*, upon a stop command.

B-04 DC Brake Cut In Speed [Hz]		
Range:		**Function:**
0.0 Hz*	[0 - 1000.0 Hz]	Set the DC brake cut-in speed for activation of the DC braking current set in *B-01 DC Brake Current*, upon a stop command.

B-05 Maximum Reference		
Range:		**Function:**
par. F-53 ReferenceFeedbackUnit*	[par. F-52 - 999999.999 ReferenceFeedbackUnit]	

B-06 Parking Current		
Range:		**Function:**
50 %*	[0 - 1000 %]	Set current as percentage of rated motor current, *P-03 Motor Current*. Will be used when enabled in *F-20 PM Start Mode*.

B-07 Parking Time		
Range:		**Function:**
3 s*	[0.1 - 60 s]	Set the duration of the Parking Current set in *B-06 Parking Current*, once activated.

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 generatoric 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

B-10 Brake Function		
Option:		**Function:**
		that AC brake is not as effective as dynamic breaking 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:**
50.00 Ohm*	[5.00 - 65535.00 Ohm]	Set the brake resistor value in Ohms. This value is used for monitoring the power to the brake resistor in *B-13 Braking Thermal Overload*. This parameter is only active in frequency converters with an integral dynamic brake. Use this parameter for values without decimals. For a selection with two decimals, use *B-11 Brake Resistor (ohm)*.

B-12 Brake Power Limit (kW)		
Range:		**Function:**
5.000 kW*	[0.001 - 2000.000 kW]	*B-12 Brake Power Limit (kW)* is the expected average power dissipated in the brake resistor over a period of 120 s. It is used as the monitoring limit for *DR-33 Brake Energy /2 min* and thereby specifies when a warning/ alarm is to be given. To calculate *B-12 Brake Power Limit (kW)*, the following formula can be used. $P_{br,avg}[W] = \frac{U_{br}^2[V] \times t_{br}[s]}{R_{br}[\Omega] \times T_{br}[s]}$ $P_{br,avg}$ is the average power dissipated in the brake resistor, R_{br} is the resistance of the brake resistor. t_{br} is the active breaking time within the 120 s period, T_{br}. U_{br} is the DC voltage where the brake resistor is active. This depends on the unit as follows: 200-240 V: 390 V 380-480 V: 778 V 525-600 V: 943 V 525-690 V: 1099 V **NOTE** **If R_{br} is not known or if T_{br} is different from 120 s, the practical approach is to run the brake application, readout *DR-33 Brake Energy /2 min* and then enter this + 20% in *B-12 Brake Power Limit (kW)*.**

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 (*B-11 Brake Resistor (ohm)*), 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 (*B-12 Brake Power Limit (kW)* . 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	Activates both of the above, including warning, trip and alarm.

If power monitoring is set to *[0] Off* or *[1] Warning*, 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 ±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. **NOTE** **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

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B-15 Brake Check		
Option:		**Function:**
		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 decels 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 decel.
[5]	Trip Lock	

NOTE

Remove a warning arising in connection with *[0] Off* or *[1] Warning* by cycling the mains supply. The fault must be corrected first. For *[0] Off* or *[1] Warning*, 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 - 1000.0 %]	Enter the maximum permissible current when using AC brake to avoid overheating of motor windings.

NOTE

***B-16 AC brake Max. Current* will not have effect when *P-20 Motor Construction* = [1] PM, non salient SPM.**

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.

NOTE

OVC must not be enabled in hoisting applications.

B-18 Brake Check Condition		
Range:		**Function:**
[0] *	At Power Up	Brake check will be performed at power up
[1]	After Coast Situations	Brake check will be performed after coast situations

3.20.3 B-2# Mechanical Brake

Parameters for controlling operation of an electro-magnetic (mechanical) brake, typically required in hoisting applications. To control a mechanical brake, a relay output (relay 01 or relay 02) or a programmed digital output (terminal 27 or 29) is required. Normally this output must be closed during periods when the frequency converter is unable to 'hold' the motor, e.g. due to an excessive load. Select *[32] Mechanical Brake Control* for applications with an electro-magnetic brake in *E-24 Function Relay*, *E-20 Terminal 27 Digital Output*, or *E-21 Terminal 29 Digital Output*. When selecting *[32] Mechanical brake control*, the mechanical brake is closed from start up until the output current is above the level selected in *B-20 Release Brake Current*. During stop, the mechanical brake activates when the speed falls below the level specified in *B-21 Activate Brake Speed [RPM]*. If the frequency converter enters an alarm condition or an over-current or over-voltage situation, the mechanical brake immediately cuts in. This is also the case during safe stop.

NOTE

Protection mode and trip delay features (*SP-25 Trip Delay at Torque Limit* and *SP-26 Trip Delay at Drive Fault*) may delay the activation of the mechanical brake in an alarm condition. These features must be disabled in hoisting applications.

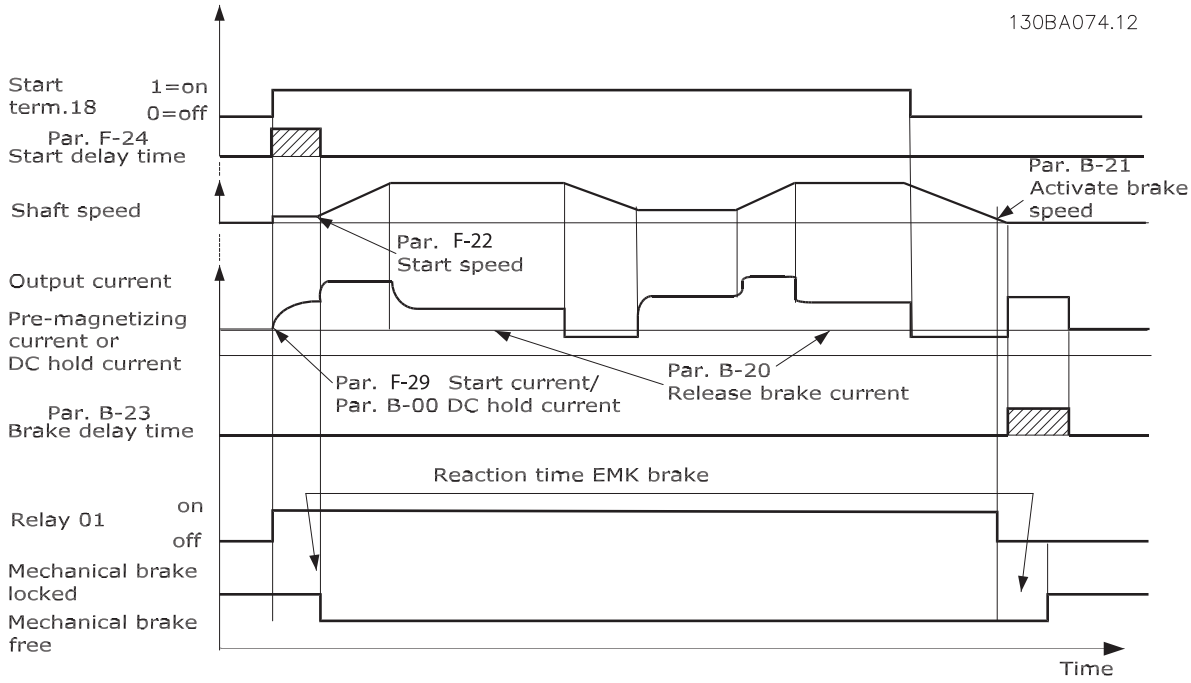

Illustration 3.44

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B-20 Release Brake Current

Range:		Function:
par. DR-37 A*	[0 - par. DR-37 A]	Set the motor current for release of the mechanical brake, when a start condition is present. The default value is the maximum current the inverter can provide for the particular power size. The upper limit is specified in *DR-37 Drive Max. Current*.

NOTE

When Mechanical brake control output is selected but no mechanical brake is connected, the function will not work by default setting due to too low motor current.

B-21 Activate Brake Speed [RPM]

Range:		Function:
0 RPM*	[0 - 30000 RPM]	Set the motor speed for activation of the mechanical brake, when a stop condition is present. The upper speed limit is specified in *H-73 Warning Speed High*.

B-22 Activate Brake Speed [Hz]

Range:		Function:
0 Hz*	[0 - 5000.0 Hz]	Set the motor frequency for activation of the mechanical brake, when a stop condition is present.

B-23 Activate Brake Delay

Range:		Function:
0 s*	[0 - 5 s]	Enter the brake delay time of the coast after decel 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. To adjust transition of the load to the mechanical brake, set *B-23 Activate Brake Delay* and *B-24 Stop Delay*. Setting of brake delay parameters does not impact the torque. The frequency converter does not register that mechanical brake is holding the load.

B-23 Activate Brake Delay

Range:		Function:
		After setting *B-23 Activate Brake Delay* the torque drops to zero in few minutes. The sudden torque change leads to movement and noise.

B-24 Stop Delay

Range:		Function:
0 s*	[0 - 5 s]	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:		Function:
0.20 s*	[0 - 5 s]	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:		Function:
0 %*	[0 - 0 %]	The value defines the torque applied against the closed mechanical brake, before release

B-27 Torque Ramp Time

Range:		Function:
0.2 s*	[0 - 5 s]	The value defines the duration of the torque ramp in clockwise direction.

B-28 Gain Boost Factor

Range:		Function:
1*	[0 - 4]	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* (*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.

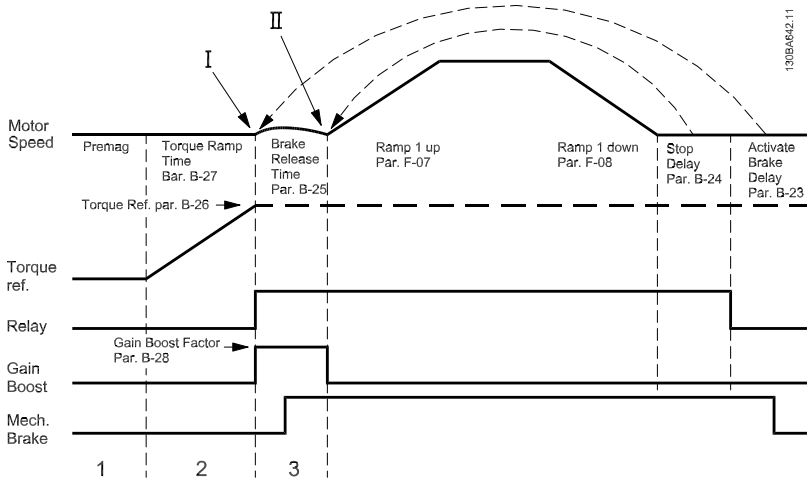

Illustration 3.45 Brake release sequence for hoist mechanical brake control

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 *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

3

Parameters to configure the Speed PID Control.

PI-00 Speed PID Feedback Source

Option:		Function:
		NOTE **This parameter cannot be adjusted while the motor is running.** 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 *H-42 Flux Motor Feedback Source*.
[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 - 1]	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*	[1.0 - 20000 ms]	Enter the speed controller integral time, which determines the time the internal PID control takes to correct errors. The greater the error, the more quickly the gain increases. The integral time causes a delay of the signal and therefore a dampening effect, and can be used to eliminate steady state speed error. Obtain quick control through a short integral time, though if the integral time is too short, the process becomes unstable. An excessively long integral time disables the integral action, leading to major deviations from the required reference, since the process regulator takes too

PI-03 Speed PID Integral Time

Range:		Function:
		long to regulate errors. This parameter is used with *[0] Speed open loop* and *[1] Speed closed loop* control, set in *H-40 Configuration Mode*.

PI-04 Speed PID Differentiation Time

Range:		Function:
30.0 ms*	[0 - 200 ms]	Enter the speed controller differentiation time. The differentiator does not react to constant error. It provides gain proportional to the rate of change of the speed feedback. The quicker the error changes, the stronger the gain from the differentiator. The gain is proportional with the speed at which errors change. Setting this parameter to zero disables the differentiator. This parameter is used with *H-40 Configuration Mode [1] Speed closed loop* control.

PI-05 Speed PID Diff. Gain Limit

Range:		Function:
5*	[1 - 20]	Set a limit for the gain provided by the differentiator. Since the differential gain increases at higher frequencies, limiting the gain may be useful. For example, set up a pure D-link at low frequencies and a constant D-link at higher frequencies. This parameter is used with *H-40 Configuration Mode [1] Speed closed loop* control.

PI-06 Speed PID Lowpass Filter Time

Range:		Function:
10.0 ms*	[0.1 - 100 ms]	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 3.46*. 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/s., corresponding to (10/2 x π) = 1.6 Hz. The PID regulator only regulates a feedback signal that varies by a frequency of less than 1.6 Hz. If the feedback signal varies by a higher frequency than 1.6 Hz, the PID regulator does not react. Practical settings of *PI-06 Speed PID Lowpass Filter Time* taken from the number of pulses per revolutions from encoder:

Encoder PPR	PI-06 Speed PID Lowpass Filter Time
512	10 ms
1024	5 ms
2048	2 ms
4096	1 ms

NOTE

Severe filtering can be detrimental to dynamic performance.
This parameter is used with *H-40 Configuration Mode [1] Speed closed loop* and *[2] Torque* control.
The filter time in flux sensorless must be adjusted to 3-5 ms.

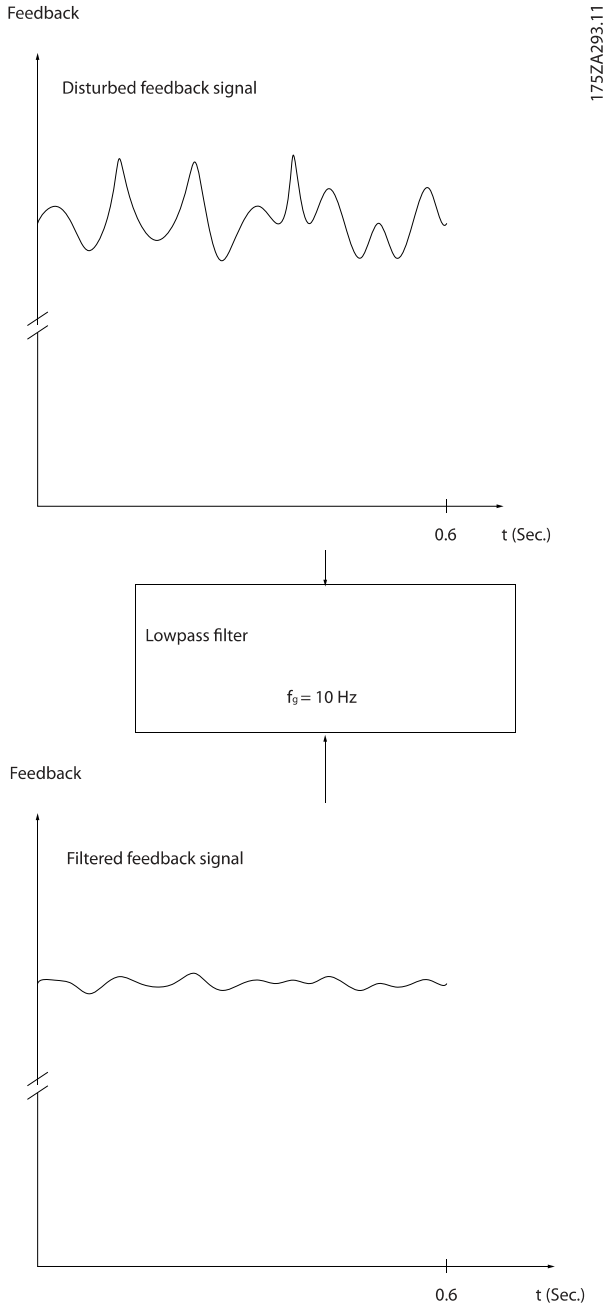

Illustration 3.46 Feedback Signal

PI-07 Speed PID Feedback Gear Ratio		
Range:		**Function:**
1*	[0.0001 - 32.0000]	

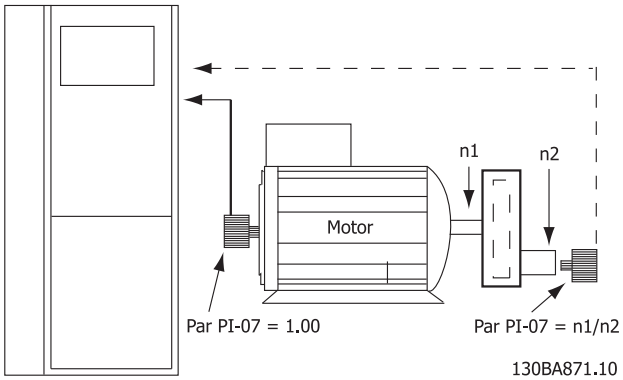

Illustration 3.47

PI-08 Speed PID Feed Forward Factor		
Range:		**Function:**
0 %*	[0 - 500 %]	The reference signal bypasses the speed controller by the amount specified. This feature increases the dynamic performance of the speed control loop.

3.21.2 PI-1# Torque PI Control

PI-12 Torque PI Proportional Gain		
Range:		**Function:**
100 %*	[0 - 500 %]	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:		**Function:**
0.020 s*	[0.002 - 2 s]	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

3

PI-20 Process CL Feedback 1 Resource		
Option:		**Function:**
		of the first of these signals. The second input signal is defined in *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 *PI-20 Process CL Feedback 1 Resource*.
[0] *	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[3]	Frequency input 29	
[4]	Frequency input 33	
[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	Continues regulation of an error even when the output frequency cannot be increased or decreased.
[1] *	On	Ceases regulation of an error when the output frequency can no longer be adjusted.

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 - 10]	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 s*	[0.01 - 10000 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:		**Function:**
0 s*	[0 - 10 s]	Enter the PID differentiation time. The differentiator does not react to a constant error, but provides a gain only when the error changes. The shorter the PID differentiation time, the stronger the gain from the differentiator.

PI-36 Process PID Diff. Gain Limit		
Range:		**Function:**
5*	[1 - 50]	Enter a limit for the differentiator gain (DG). If there is no limit, the DG 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:		**Function:**
0 %*	[0 - 200 %]	Enter the PID feed forward (FF) factor. The FF factor sends a constant fraction of the reference signal to bypass the PID control, so the PID control only affects the remaining fraction of the control signal. Any change to this parameter will thus affect the motor speed. When the FF factor is activated it provides less overshoot, and high dynamics when changing the set point.

PI-38 Process PID Feed Forward Factor		
Range:		**Function:**
		PI-38 Process PID Feed Forward Factor is active when *H-40 Configuration Mode* is set to *[3] Process*.

PI-39 On Reference Bandwidth		
Range:		**Function:**
5 %*	[0 - 200 %]	Enter the On Reference bandwidth. When the PID Control Error (the difference between the reference and the feedback) is less than the set value of this parameter the On Reference status bit is high, i.e. =1.

PI-40 Process PID I-part Reset		
Option:		**Function:**
[0] *	No	
[1]	Yes	Select *[1] Yes* to reset the I-part of the process PID controller. The selection will automatically revert to *[0] No*. Resetting the I-part makes it possible to start from a welldefined point after changing something in the process, e.g. changing a textile roll.

PI-41 Process PID Output Neg. Clamp		
Range:		**Function:**
-100 %*	[-100 - par. PI-42 %]	Enter a negative limit for the process PID controller output.

PI-42 Process PID Output Pos. Clamp		
Range:		**Function:**
100 %*	[par. PI-41 - 100 %]	Enter a positive limit for the process PID controller output.

PI-43 Process PID Gain Scale at Min. Ref.		
Range:		**Function:**
100 %*	[0 - 100 %]	Enter a scaling percentage to apply to the process PID output when operating at the minimum reference. The scaling percentage will be adjusted linearly between the scale at min. ref. (*PI-43 Process PID Gain Scale at Min. Ref.*) and the scale at max. ref. (*PI-44 Process PID Gain Scale at Max. Ref.*).

PI-44 Process PID Gain Scale at Max. Ref.		
Range:		**Function:**
100 %*	[0 - 100 %]	Enter a scaling percentage to apply to the process PID output when operating at the maximum reference. The scaling percentage will be adjusted linearly between the scale at min. ref. (*PI-43 Process PID Gain Scale at Min. Ref.*) and the scale at max. ref. (*PI-44 Process PID Gain Scale at Max. Ref.*).

PI-45 Process PID Feed Fwd Resource		
Option:		**Function:**
[0] *	No function	Select which drive input should be used as the feed forward factor. The FF factor is added directly to the output of the PID controller. This increases dynamic performance.
[1]	Analog Input 53	
[2]	Analog Input 54	
[7]	Frequency input 29	
[8]	Frequency input 33	
[11]	Local bus reference	
[20]	Digital Potenti-ometer	
[21]	Analog input X30-11	
[22]	Analog input X30-12	
[32]	Bus PCD	Selects a bus reference configured by *O-02 Control Word Source*. Change *O-42 PCD Write Configuration* for the bus used in order to make the feed-forward available in *B-48 PCD Feed Forward*. Use index 1 for feed-forward [748] (and index 2 for reference [1682]).

PI-46 Process PID Feed Fwd Normal/ Inv. Ctrl.		
Option:		**Function:**
[0] *	Normal	Select *[0] Normal* to set the feed forward factor to treat the FF resource as a positive value.
[1]	Inverse	Select *[1] Inverse* to treat the FF resource as a negative value.

PI-49 Process PID Output Normal/ Inv. Ctrl.		
Option:		**Function:**
[0] *	Normal	Select *[0] Normal* to use the resulting output from the process PID controller as is.
[1]	Inverse	Select *[1] Inverse* to invert the resulting output from the process PID controller. This operation is performed after the feed forward factor is applied.

3.21.5 PI-5# Ext. Process PID Ctrl.

This parameter group is only used if *H-40 Configuration Mode* is set to *[7] Extended PID speed CL* or *[8] Extended PID Speed OL*.

PI-50 Process PID Extended PID		
Option:		**Function:**
[0]	Disabled	Disables the extended parts of the process PID controller.
[1] *	Enabled	Enables the extended parts of the PID controller.

3

PI-51 Process PID Feed Fwd Gain

Range:		Function:
1*	[0 - 100]	The feed forward is used to obtain the desired level, based on a well-known signal available. The PID controller then only takes care of the smaler part of the control, necessary because of unknown characters. The standard feed fwd factor in *PI-38 Process PID Feed Forward Factor* is always related to the reference whereas *PI-51 Process PID Feed Fwd Gain* has more choices. In winder applications, the feed fwd factor will typically be the line speed of the system.

PI-52 Process PID Feed Fwd Ramp up

Range:		Function:
0.01 s*	[0.01 - 10 s]	Controls the dynamics of the feed forward signal when ramping up.

PI-53 Process PID Feed Fwd Ramp down

Range:		Function:
0.01 s*	[0.01 - 10 s]	Controls the dynamics of the feed forward signal when ramping down.

PI-56 Process PID Ref. Filter Time

Range:		Function:
0.001 s*	[0.001 - 1 s]	Set a time constant for the reference first order low-pass filter. The low-pass filter improves steady-state performance and dampens oscillations on the reference/ feedback signals. However severe filtering can be detrimental to dynamic performance.

PI-57 Process PID Fb. Filter Time

Range:		Function:
0.001 s*	[0.001 - 1 s]	Set a time constant for the feedback first order low-pass filter. The low-pass filter improves steady-state performance and dampens oscillations on the reference/ feedback signals. However severe filtering can be detrimental to dynamic performance.

PI-60 Process PID Error

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

PI-61 Process PID Output

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

PI-62 Process PID Clamped Output

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

PI-63 Process PID Gain Scaled Output

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

3.22 SF-# Special Functions

3.22.1 SF-## Wobble Function

The wobble function is primarily used for synthetic yarn winding applications. The wobble option is to be installed in the frequency converter controlling the traverse drive. The traverse drive frequency converter will move the yarn back and forth in a diamond pattern across the surface of the yarn package. To prevent a buildup of yarn at the same points at the surface, this pattern must be altered. The wobble option can accomplish this by continuously varying the traverse velocity in a programmable cycle. The wobble function is created by superimposing a delta frequency around a center frequency. To compensate for the inertia in the system a quick frequency jump can be included. Especially suitable for elastic yarn applications the option features a randomized wobble ratio.

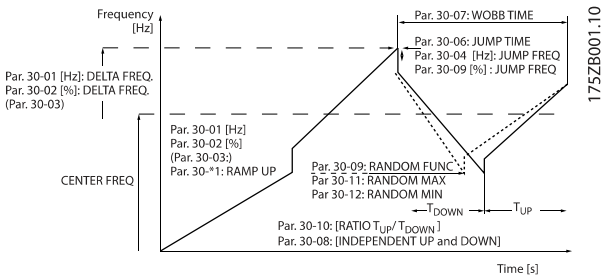

Illustration 3.48 Wobble Function

SF-00 Wobble Mode		
Option:		**Function:**
		NOTE **This parameter cannot be adjusted while running.** The standard speed open loop mode in *H-40 Configuration Mode* is extended with a wobble function. In this parameter it is possible to select which method to be used for the wobbler. The parameters can be set as absolute values (direct frequencies) or as relative values (percentage of other parameter). The wobble cycle time can be set as an absolute alue or as independent up- and down times. When using an absolute cycle time, the up- and down times are configured through the wobble ratio.
[0] *	Abs. Freq., Abs. Time	
[1]	Abs. Freq., Up/ Down Time	
[2]	Rel. Freq., Abs. Time	
[3]	Rel. Freq., Up/ Down Time	

NOTE

The setting of "Center Frequency" takes place via the normal reference handling parameter group.

SF-01 Wobble Delta Frequency [Hz]		
Range:		**Function:**
5 Hz*	[0 - 25 Hz]	The delta frequency is determining the magnitude of the wobble frequency. The delta frequency is superimposed on the center frequency. *SF-01 Wobble Delta Frequency [Hz]* is selecting both the positive and negative delta frequency. The setting of *SF-01 Wobble Delta Frequency [Hz]* must thus not be higher than the setting of the center frequency. The initial ramp up time from standstill until the wobble sequence is running is determined.

SF-02 Wobble Delta Frequency [%]		
Range:		**Function:**
25 %*	[0 - 100 %]	The delta frequency can also be expressed as percentage of the center frequency and can thus be maximum 100%. The function is the same as for *SF-01 Wobble Delta Frequency [Hz]*.

SF-03 Wobble Delta Freq. Scaling Resource		
Option:		**Function:**
		Select which drive input should be used to scale the delta frequency setting.
[0] *	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[3]	Frequency input 29	
[4]	Frequency input 33	
[7]	Analog Input X30/11	
[8]	Analog Input X30/12	
[15]	Analog Input X48/2	

SF-04 Wobble Jump Frequency [Hz]		
Range:		**Function:**
0 Hz*	[0 - 20.0 Hz]	The jump frequency is used to compensate for the inertia in the traverse system. If a jump in the output frequency is required in the top and in the bottom of the wobble sequence, the frequency jump is set in this parameter. If the traverse system has a very high inertia a high jump frequency may create a torque limit warning or trip (warning/alarm 12) or an over

3

SF-04 Wobble Jump Frequency [Hz]		
Range:		**Function:**
		voltage warning or trip (warning/alarm 7). This parameter can only be changed in stop-mode

SF-05 Wobble Jump Frequency [%]		
Range:		**Function:**
0 %*	[0 - 100 %]	The jump frequency can also be expressed as percentage of the center frequency. The function is the same as for *SF-04 Wobble Jump Frequency [Hz]*.

SF-06 Wobble Jump Time		
Range:		**Function:**
0.005 s*	[0.005 - 5.000 s]	

SF-07 Wobble Sequence Time		
Range:		**Function:**
10 s*	[1 - 1000 s]	This parameter determines the wobble sequence period. This parameter can only be changed in stop-mode. Wobble time = t_{up} + t_{down}

SF-08 Wobble Up/ Down Time		
Range:		**Function:**
5 s*	[0.1 - 1000 s]	Defines the individual up- and down times for each wobble cycle.

SF-09 Wobble Random Function		
Option:		**Function:**
[0] *	Off	
[1]	On	

SF-10 Wobble Ratio		
Range:		**Function:**
1*	[0.1 - 20.0]	If the ratio 0.1 is selected: t_{down} is 10 times greater than t_{up}. If the ratio 10 is selected: t_{up} is 10 times greater than t_{down}.

SF-11 Wobble Random Ratio Max.		
Range:		**Function:**
10*	[par. RS-53 - 10]	Enter the maximum allowed wobble ratio.

SF-12 Wobble Random Ratio Min.		
Range:		**Function:**
0.1*	[0.1 - par. SF-11]	Enter the minimum allowed wobble ratio.

SF-19 Wobble Delta Freq. Scaled		
Range:		**Function:**
0 Hz*	[0 - 1000 Hz]	Readout parameter. View the actual wobble delta frequency after scaling has been applied.

3.22.2 SF-2# Adv. Start Adjust

SF-20 High Starting Torque Time [s]		
Range:		**Function:**
0.0 s*	[0 - 60 s]	High starting torque time for PM-Motor in Flux mode without feedback.

SF-21 High Starting Torque Current [%]		
Range:		**Function:**
100.0 %*	[0 - 200.0 %]	High starting torque current for PM-Motor in advanced vector control and Flux mode without feedback.

SF-22 Locked Rotor Protection		
Locked Rotor Protection for PM-Motor in Flux mode without feedback.		
Option:		**Function:**
[0] *	Off	
[1]	On	

SF-23 Locked Rotor Detection Time [s]		
This parameter is available for AF-650 GP only.		
Range:		**Function:**
0.10 s*	[0.05 - 1 s]	Locked Rotor Detection Time for PM-Motor in Flux mode without feedback.

4 Parameter Lists

4.1 Parameter Options

4.1.1 Introduction

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.

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

Table 4.1 Data Type

4

4.1.2 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	[0] RPM	2 set-ups	FALSE	-	Uint8
K-03	Regional Settings	[1] US	2 set-ups	FALSE	-	Uint8
K-04	Operating State at Power-up	[1] Forced stop, ref=old	All set-ups	TRUE	-	Uint8
K-1#						
K-10	Active Set-up	[1] Set-up 1	1 set-up	TRUE	-	Uint8
K-11	Edit Set-up	[1] Set-up 1	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 N/A	All set-ups	FALSE	0	Uint16
K-14	Readout: Edit Set-ups / Channel	0 N/A	All set-ups	TRUE	0	Int32
K-15	Readout: actual setup	0 N/A	All set-ups	FALSE	0	Uint8
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	[0] None	All set-ups	TRUE	-	Uint8
K-31	Min Value of Custom Readout	0 CustomReadoutUnit	All set-ups	TRUE	-2	Int32
K-32	Max Value of Custom Readout	100 CustomReadoutUnit	All set-ups	TRUE	-2	Int32
K-37	Display Text 1	0 N/A	1 set-up	TRUE	0	VisStr[25]
K-38	Display Text 2	0 N/A	1 set-up	TRUE	0	VisStr[25]
K-39	Display Text 3	0 N/A	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-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 N/A	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 N/A	1 set-up	TRUE	0	Int16
K-66	Access to Quick Menu w/o Password	[0] Full access	1 set-up	TRUE	-	Uint8
K-67	Bus Password Access	0 N/A	All set-ups	TRUE	0	Uint16

4.1.3 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	ExpressionLimit	All set-ups	TRUE	-	Uint8
F-02	Operation Method	[0] Linked to Hand / Auto	All set-ups	TRUE	-	Uint8

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
F-03	Max Output Frequency 1	132 Hz	All set-ups	FALSE	-1	Uint16
F-04	Base Frequency	ExpressionLimit	All set-ups	FALSE	0	Uint16
F-05	Motor Rated Voltage	ExpressionLimit	All set-ups	FALSE	0	Uint16
F-07	Accel Time 1	ExpressionLimit	All set-ups	TRUE	-2	Uint32
F-08	Decel Time 1	ExpressionLimit	All set-ups	TRUE	-2	Uint32
F-09	Torque Boost	100 %	All set-ups	TRUE	0	Int16
F-1#						
F-10	Electronic Overload	[0] No protection	All set-ups	TRUE	-	Uint8
F-11	Motor External Fan	[0] No	All set-ups	TRUE	-	Uint16
F-12	Motor Thermistor Input	[0] None	All set-ups	TRUE	-	Uint8
F-15	Motor Speed High Limit [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
F-16	Motor Speed Low Limit [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
F-17	Motor Speed High Limit [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
F-18	Motor Speed Low Limit [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
F-2#						
F-20	PM Start Mode	[0] Rotor Detection	All set-ups	TRUE	-	Uint8
F-22	Start Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
F-23	Start Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
F-24	Holding Time	0 s	All set-ups	TRUE	-1	Uint8
F-25	Start Function	[2] Coast/delay time	All set-ups	TRUE	-	Uint8
F-26	Motor Noise (Carrier Freq)	ExpressionLimit	All set-ups	TRUE	-	Uint8
F-27	Motor Tone Random	[0] Off	All set-ups	TRUE	-	Uint8
F-28	Dead Time Compensation	[1] On	All set-ups	TRUE	-	Uint8
F-29	Start Current	0 A	All set-ups	TRUE	-2	Uint32
F-3#						
F-37	Adv. Switching Pattern	ExpressionLimit	All set-ups	TRUE	-	Uint8
F-38	Overmodulation	[1] On	All set-ups	FALSE	-	Uint8
F-4#						
F-40	Torque Limiter (Driving)	ExpressionLimit	All set-ups	TRUE	-1	Uint16
F-41	Torque Limiter (Braking)	100 %	All set-ups	TRUE	-1	Uint16
F-43	Current Limit	ExpressionLimit	All set-ups	TRUE	-1	Uint32
F-5#						
F-50	Reference Range	ExpressionLimit	All set-ups	TRUE	-	Uint8
F-51	Reference/Feedback Unit	ExpressionLimit	All set-ups	TRUE	-	Uint8
F-52	Minimum Reference	ExpressionLimit	All set-ups	TRUE	-3	Int32
F-53	Maximum Reference	ExpressionLimit	All set-ups	TRUE	-3	Int32
F-54	Reference Function	[0] Sum	All set-ups	TRUE	-	Uint8
F-6#						
F-62	Catch up/slow Down Value	0 %	All set-ups	TRUE	-2	Int16
F-64	Preset Relative Reference	0 %	All set-ups	TRUE	-2	Int32
F-68	Relative Scaling Reference Resource	[0] No function	All set-ups	TRUE	-	Uint8
F-9#						
F-90	Step Size	0.10 %	All set-ups	TRUE	-2	Uint16
F-91	Accel/Decel Time	1 s	All set-ups	TRUE	-2	Uint32
F-92	Power Restore	[0] Off	All set-ups	TRUE	-	Uint8
F-93	Maximum Limit	100 %	All set-ups	TRUE	0	Int16
F-94	Minimum Limit	-100 %	All set-ups	TRUE	0	Int16
F-95	Accel/Decel Ramp Delay	ExpressionLimit	All set-ups	TRUE	-3	TimD

4.1.4 E-## Digital In/Outs

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
E-0#						
E-00	Digital I/O Mode	[0] PNP	All set-ups	FALSE	-	Uint8
E-01	Terminal 18 Digital Input	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-02	Terminal 19 Digital Input	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-03	Terminal 27 Digital Input	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-04	Terminal 29 Digital Input	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-05	Terminal 32 Digital Input	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-06	Terminal 33 Digital Input	ExpressionLimit	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	[0] No operation	All set-ups	TRUE	-	Uint8
E-21	Terminal 29 Digital Output	[0] No operation	All set-ups	TRUE	-	Uint8
E-24	Function Relay	ExpressionLimit	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-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	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-54	Terminal X30/3 Digital Input	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-55	Terminal X30/4 Digital Input	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-56	Term X30/6 Digi Out (OPCGPIO)	[0] No operation	All set-ups	TRUE	-	Uint8
E-57	Term X30/7 Digi Out (OPCGPIO)	[0] No operation	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 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 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
E-7#						
E-70	Terminal 27 Pulse Output Variable	[0] No operation	All set-ups	TRUE	-	Uint8
E-72	Pulse Output Max Freq #27	5000 Hz	All set-ups	TRUE	0	Uint32
E-73	Terminal 29 Pulse Output Variable	[0] No operation	All set-ups	TRUE	-	Uint8
E-75	Pulse Output Max Freq #29	5000 Hz	All set-ups	TRUE	0	Uint32
E-76	Terminal X30/6 Pulse Output Variable	[0] No operation	All set-ups	TRUE	-	Uint8

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
E-78	Pulse Output Max Freq #X30/6	5000 Hz	All set-ups	TRUE	0	Uint32
E-8#						
E-80	Term 32/33 Pulses Per Revolution	1024 N/A	All set-ups	FALSE	0	Uint16
E-81	Term 32/33 Encoder Direction	[0] Clockwise	All set-ups	FALSE	-	Uint8
E-9#						
E-90	Digital & Relay Bus Control	0 N/A	All set-ups	TRUE	0	Uint32
E-93	Pulse Out #27 Bus Control	0 %	All set-ups	TRUE	-2	N2
E-94	Pulse Out #27 Timeout Preset	0 %	1 set-up	TRUE	-2	Uint16
E-95	Pulse Out #29 Bus Control	0 %	All set-ups	TRUE	-2	N2
E-96	Pulse Out #29 Timeout Preset	0 %	1 set-up	TRUE	-2	Uint16
E-97	Pulse Out #X30/6 Bus Control	0 %	All set-ups	TRUE	-2	N2
E-98	Pulse Out #X30/6 Timeout Preset	0 %	1 set-up	TRUE	-2	Uint16

4.1.5 C-## Frequency Control Functions

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
C-0#						
C-01	Jump Frequency From [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
C-02	Jump Speed From [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
C-03	Jump Speed To [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
C-04	Jump Frequency To [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
C-05	Multi-step Frequency 1 - 8	0 %	All set-ups	TRUE	-2	Int16
C-2#						
C-20	Jog Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
C-21	Jog Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
C-22	Jog Accel/Decel Time	ExpressionLimit	All set-ups	TRUE	-2	Uint32
C-23	Quick Stop Decel Time	ExpressionLimit	2 set-ups	TRUE	-2	Uint32
C-24	Quick Stop Ramp Type	[0] Linear	All set-ups	TRUE	-	Uint8
C-25	Quick Stop S-ramp Ratio at Decel. Start	50 %	All set-ups	TRUE	0	Uint8
C-26	Quick Stop S-ramp Ratio at Decel. End	50 %	All set-ups	TRUE	0	Uint8
C-3#						
C-30	Frequency Command 2	ExpressionLimit	All set-ups	TRUE	-	Uint8
C-34	Frequency Command 3	ExpressionLimit	All set-ups	TRUE	-	Uint8

4.1.6 P-## Motor Data

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion 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	100 %	All set-ups	TRUE	0	Int16
P-1#						

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
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-24	Damping Gain	140 %	All set-ups	TRUE	0	Int16
P-25	Low Speed Filter Time Const.	ExpressionLimit	All set-ups	TRUE	-2	Uint16
P-26	High Speed Filter Time Const.	ExpressionLimit	All set-ups	TRUE	-2	Uint16
P-27	Voltage filter time const.	ExpressionLimit	All set-ups	TRUE	-3	Uint16
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
P-4#						
P-46	Position Detection Gain	100 %	All set-ups	TRUE	0	Uint16

4.1.7 H-## High Perf Parameters

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
H-0#						
H-01	Option Detection	[0] Protect Option Config.	1 set-up	TRUE	-	Uint8
H-02	Option Data Storage	0 N/A	2 set-ups	TRUE	0	Uint16
H-03	Restore Factory Settings	[0] Normal operation	All set-ups	TRUE	-	Uint8
H-04	Auto-Reset (Times)	[0] Manual reset	All set-ups	TRUE	-	Uint8
H-05	Auto-Reset (Reset Interval)	ExpressionLimit	All set-ups	TRUE	0	Uint16
H-07	Accel/Decel Time 1 Type	[0] Linear	All set-ups	TRUE	-	Uint8
H-08	Reverse Lock	[0] Clockwise	All set-ups	FALSE	-	Uint8
H-09	Start Mode	ExpressionLimit	All set-ups	FALSE	-	Uint8
H-2#						
H-20	Motor Feedback Loss Function	[2] Trip	All set-ups	TRUE	-	Uint8
H-21	Motor Feedback Speed Error	300 RPM	All set-ups	TRUE	67	Uint16
H-22	Motor Feedback Loss Timeout	0.05 s	All set-ups	TRUE	-2	Uint16
H-24	Tracking Error Function	ExpressionLimit	All set-ups	TRUE	-	Uint8
H-25	Tracking Error	10 RPM	All set-ups	TRUE	67	Uint16
H-26	Tracking Error Timeout	1 s	All set-ups	TRUE	-2	Uint16
H-27	Tracking Error Ramping	100 RPM	All set-ups	TRUE	67	Uint16
H-28	Tracking Error Ramping Timeout	1 s	All set-ups	TRUE	-2	Uint16
H-29	Tracking Error After Ramping Timeout	5 s	All set-ups	TRUE	-2	Uint16
H-4#						
H-40	Configuration Mode	ExpressionLimit	All set-ups	TRUE	-	Uint8
H-41	Motor Control Principle	ExpressionLimit	All set-ups	FALSE	-	Uint8
H-42	Flux Motor Feedback Source	[1] 24V encoder	All set-ups	FALSE	-	Uint8
H-43	Torque Characteristics	[0] Constant torque	All set-ups	TRUE	-	Uint8
H-44	Constant or Variable Torque OL	[0] High torque	All set-ups	FALSE	-	Uint8
H-45	Local Mode Configuration	[2] As mode par H-40	All set-ups	TRUE	-	Uint8
H-46	Back EMF at 1000 RPM	ExpressionLimit	All set-ups	FALSE	0	Uint16
H-47	Motor Angle Offset	0 N/A	All set-ups	FALSE	0	Int16

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
H-48	Clockwise Direction	[0] Normal	All set-ups	FALSE	-	Uint8
H-49	Motor Angle Offset Adjust	[0] Manual	All set-ups	FALSE	-	Uint8
H-5#						
H-50	Motor Magnetisation at Zero Speed	100 %	All set-ups	TRUE	0	Uint16
H-51	Min Speed Normal Magnetising [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
H-52	Min Speed Normal Magnetising [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
H-53	Model Shift Frequency	ExpressionLimit	All set-ups	FALSE	-1	Uint16
H-54	Voltage reduction in fieldweakening	0 V	All set-ups	FALSE	0	Uint8
H-55	U/f Characteristic - U	ExpressionLimit	All set-ups	TRUE	-1	Uint16
H-56	U/f Characteristic - F	ExpressionLimit	All set-ups	TRUE	-1	Uint16
H-58	Flystart Test Pulses Current	ExpressionLimit	All set-ups	FALSE	0	Uint16
H-59	Flystart Test Pulses Frequency	ExpressionLimit	All set-ups	FALSE	0	Uint16
H-6#						
H-61	High Speed Load Compensation	100 %	All set-ups	TRUE	0	Int16
H-64	Resonance Dampening	100 %	All set-ups	TRUE	0	Uint16
H-65	Resonance Dampening Time Constant	5 ms	All set-ups	TRUE	-3	Uint8
H-66	Min. Current at Low Speed	ExpressionLimit	All set-ups	TRUE	0	Uint32
H-67	Torque Limit Factor Source	[0] No function	All set-ups	TRUE	-	Uint8
H-68	Speed Limit Factor Source	[0] No function	All set-ups	TRUE	-	Uint8
H-7#						
H-70	Warning Current Low	0 A	All set-ups	TRUE	-2	Uint32
H-71	Warning Current High	ExpressionLimit	All set-ups	TRUE	-2	Uint32
H-72	Warning Speed Low	0 RPM	All set-ups	TRUE	67	Uint16
H-73	Warning Speed High	ExpressionLimit	All set-ups	TRUE	67	Uint16
H-74	Warning Reference Low	-999999.999 N/A	All set-ups	TRUE	-3	Int32
H-75	Warning Reference High	999999.999 N/A	All set-ups	TRUE	-3	Int32
H-76	Warning Feedback Low	-999999.999 ReferenceFeed-backUnit	All set-ups	TRUE	-3	Int32
H-77	Warning Feedback High	999999.999 ReferenceFeed-backUnit	All set-ups	TRUE	-3	Int32
H-78	Missing Motor Phase Function	ExpressionLimit	All set-ups	TRUE	-	Uint8
H-8#						
H-80	Function at Stop	[0] Coast	All set-ups	TRUE	-	Uint8
H-81	Min Speed for Function at Stop [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
H-82	Min Speed for Function at Stop [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
H-83	Precise Stop Function	[0] Precise ramp stop	All set-ups	FALSE	-	Uint8
H-84	Precise Stop Counter Value	100000 N/A	All set-ups	TRUE	0	Uint32
H-85	Precise Stop Speed Compensation Delay	10 ms	All set-ups	TRUE	-3	Uint8
H-87	Load Type	[0] Passive load	All set-ups	TRUE	-	Uint8
H-88	Minimum Inertia	ExpressionLimit	All set-ups	FALSE	-4	Uint32
H-89	Maximum Inertia	ExpressionLimit	All set-ups	FALSE	-4	Uint32
H-9#						
H-95	KTY Sensor Type	[0] KTY Sensor 1	All set-ups	TRUE	-	Uint8
H-96	KTY Thermistor Input	[0] None	All set-ups	TRUE	-	Uint8
H-97	KTY Threshold level	80 °C	1 set-up	TRUE	100	Int16

4.1.8 AN-## Analog In / Out

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
AN-0#						
AN-00	Live Zero Timeout Time	10 s	All set-ups	TRUE	0	Uint8
AN-01	Live Zero Timeout Function	[0] Off	All set-ups	TRUE	-	Uint8
AN-1#						
AN-10	Terminal 53 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
AN-11	Terminal 53 High Voltage	10 V	All set-ups	TRUE	-2	Int16
AN-12	Terminal 53 Low Current	0.14 mA	All set-ups	TRUE	-5	Int16
AN-13	Terminal 53 High Current	20 mA	All set-ups	TRUE	-5	Int16
AN-14	Terminal 53 Low Ref./Feedb. Value	0 ReferenceFeedbackUnit	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	Uint16
AN-2#						
AN-20	Terminal 54 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
AN-21	Terminal 54 High Voltage	10 V	All set-ups	TRUE	-2	Int16
AN-22	Terminal 54 Low Current	0.14 mA	All set-ups	TRUE	-5	Int16
AN-23	Terminal 54 High Current	20 mA	All set-ups	TRUE	-5	Int16
AN-24	Terminal 54 Low Ref./Feedb. Value	0 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Int32
AN-25	Terminal 54 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
AN-26	Terminal 54 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
AN-3#						
AN-30	Terminal X30/11 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
AN-31	Terminal X30/11 High Voltage	10 V	All set-ups	TRUE	-2	Int16
AN-34	Term. X30/11 Low Ref./Feedb. Value	0 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Int32
AN-35	Term. X30/11 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
AN-36	Term. X30/11 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
AN-4#						
AN-40	Terminal X30/12 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
AN-41	Terminal X30/12 High Voltage	10 V	All set-ups	TRUE	-2	Int16
AN-44	Term. X30/12 Low Ref./Feedb. Value	0 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Int32
AN-45	Term. X30/12 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
AN-46	Term. X30/12 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
AN-5#						
AN-50	Terminal 42 Output	ExpressionLimit	All set-ups	TRUE	-	Uint8
AN-51	Terminal 42 Output Min Scale	0 %	All set-ups	TRUE	-2	Int16
AN-52	Terminal 42 Output Max Scale	100 %	All set-ups	TRUE	-2	Int16
AN-53	Terminal 42 Output Bus Control	0 %	All set-ups	TRUE	-2	N2
AN-54	Terminal 42 Output Timeout Preset	0 %	1 set-up	TRUE	-2	Uint16
AN-55	Terminal 42 Output Filter	[0] Off	1 set-up	TRUE	-	Uint8
AN-6#						
AN-60	Terminal X30/8 Output	ExpressionLimit	All set-ups	TRUE	-	Uint8
AN-61	Terminal X30/8 Min. Scale	0 %	All set-ups	TRUE	-2	Int16
AN-62	Terminal X30/8 Max. Scale	100 %	All set-ups	TRUE	-2	Int16
AN-63	Terminal X30/8 Bus Control	0 %	All set-ups	TRUE	-2	N2
AN-64	Terminal X30/8 Output Timeout Preset	0 %	1 set-up	TRUE	-2	Uint16

4.1.9 SP-## Special Functions

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
SP-0#						
SP-00	Fault Level	ExpressionLimit	1 set-up	TRUE	-	Uint8
SP-1#						
SP-10	Line failure	[0] No function	All set-ups	FALSE	-	Uint8
SP-11	Line Voltage at Input Fault	ExpressionLimit	All set-ups	TRUE	0	Uint16
SP-12	Function at Line Imbalance	[0] Trip	All set-ups	TRUE	-	Uint8
SP-13	Mains Failure Step Factor	1 N/A	All set-ups	TRUE	-1	Uint8
SP-14	Kin. Backup Time Out	60 s	All set-ups	TRUE	0	Uint8
SP-15	Kin. Backup Trip Recovery Level	ExpressionLimit	All set-ups	TRUE	-3	Uint32
SP-2#						
SP-23	Typecode Setting	ExpressionLimit	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	ExpressionLimit	All set-ups	TRUE	0	Uint8
SP-28	Production Settings	[0] No action	All set-ups	TRUE	-	Uint8
SP-29	Service Code	0 N/A	All set-ups	TRUE	0	Int32
SP-3#						
SP-30	Current Lim Cont, Proportional Gain	100 %	All set-ups	FALSE	0	Uint16
SP-31	Current Lim Contr, Integration Time	ExpressionLimit	All set-ups	FALSE	-3	Uint16
SP-32	Current Lim Ctrl, Filter Time	ExpressionLimit	All set-ups	TRUE	-4	Uint16
SP-35	Stall Protection	[1] Enabled	All set-ups	FALSE	-	Uint8
SP-4#						
SP-40	VT Level	66 %	All set-ups	FALSE	0	Uint8
SP-41	Energy Savings Min. Magnetisation	ExpressionLimit	All set-ups	TRUE	0	Uint8
SP-42	Energy Savings Min. Frequency	10 Hz	All set-ups	TRUE	0	Uint8
SP-43	Motor Cosphi	ExpressionLimit	All set-ups	TRUE	-2	Uint16
SP-5#						
SP-50	RFI Filter	[1] On	1 set-up	FALSE	-	Uint8
SP-51	DC Link Compensation	ExpressionLimit	1 set-up	TRUE	-	Uint8
SP-52	Fan Operation	[0] Auto	All set-ups	TRUE	-	Uint8
SP-53	Fan Monitor	[1] Warning	All set-ups	TRUE	-	Uint8
SP-55	Output Filter	[0] No Filter	All set-ups	FALSE	-	Uint8
SP-56	Capacitance Output Filter	ExpressionLimit	All set-ups	FALSE	-7	Uint16
SP-57	Inductance Output Filter	ExpressionLimit	All set-ups	FALSE	-6	Uint16
SP-59	Actual Number of Inverter Units	ExpressionLimit	1 set-up	FALSE	0	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

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

4.1.10 O-## Options/Comms

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
O-0#						
O-01	Control Site	[0] Digital and ctrl.word	All set-ups	TRUE	-	Uint8
O-02	Control Word Source	ExpressionLimit	All set-ups	TRUE	-	Uint8
O-03	Control Word Timeout Time	1 s	1 set-up	TRUE	-1	Uint32
O-04	Control Word Timeout Function	ExpressionLimit	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-08	Readout Filtering	ExpressionLimit	All 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	ExpressionLimit	All set-ups	TRUE	-	Uint8
O-14	Configurable Control Word CTW	[1] Profile default	All set-ups	TRUE	-	Uint8
O-19	Product Code	ExpressionLimit	1 set-up	TRUE	0	Uint32
O-3#						
O-30	Protocol	[2] Modbus RTU	1 set-up	TRUE	-	Uint8
O-31	Address	1 N/A	1 set-up	TRUE	0	Uint8
O-32	Drive Port Baud Rate	ExpressionLimit	1 set-up	TRUE	-	Uint8
O-33	Drive Port Parity	[0] Even Parity, 1 Stop Bit	1 set-up	TRUE	-	Uint8
O-34	Estimated cycle time	0 ms	2 set-ups	TRUE	-3	Uint32
O-35	Minimum Response Delay	10 ms	All set-ups	TRUE	-3	Uint16
O-36	Max Response Delay	ExpressionLimit	1 set-up	TRUE	-3	Uint16
O-37	Max 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-41	Parameters for Signals	0	All set-ups	FALSE	-	Uint16
O-42	PCD Write Configuration	ExpressionLimit	2 set-ups	TRUE	-	Uint16
O-43	PCD Read Configuration	ExpressionLimit	2 set-ups	TRUE	-	Uint16
O-5#						
O-50	Coasting Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
O-51	Quick Stop Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
O-52	DC Brake Select	ExpressionLimit	All set-ups	TRUE	-	Uint8
O-53	Start Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
O-54	Reversing Select	[3] Logic OR	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-57	Profidrive OFF2 Select	[3] Logic OR	All set-ups	TRUE	-	Uint8

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
O-58	Profidrive OFF3 Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
O-8#						
O-80	Bus Message Count	0 N/A	All set-ups	TRUE	0	Uint32
O-81	Bus Error Count	0 N/A	All set-ups	TRUE	0	Uint32
O-82	Slave Messages Rcvd	0 N/A	All set-ups	TRUE	0	Uint32
O-83	Slave Error Count	0 N/A	All set-ups	TRUE	0	Uint32
O-9#						
O-90	Bus Jog 1 Speed	100 RPM	All set-ups	TRUE	67	Uint16
O-91	Bus Jog 2 Speed	ExpressionLimit	All set-ups	TRUE	67	Uint16

4.1.11 DN-## DeviceNet

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
DN-0#						
DN-00	DeviceNet Protocol	ExpressionLimit	2 set-ups	FALSE	-	Uint8
DN-01	Baud Rate Select	ExpressionLimit	2 set-ups	TRUE	-	Uint8
DN-02	MAC ID	ExpressionLimit	2 set-ups	TRUE	0	Uint8
DN-05	Readout Transmit Error Counter	0 N/A	All set-ups	TRUE	0	Uint8
DN-06	Readout Receive Error Counter	0 N/A	All set-ups	TRUE	0	Uint8
DN-07	Readout Bus Off Counter	0 N/A	All set-ups	TRUE	0	Uint8
DN-1#						
DN-10	Process Data Type Selection	ExpressionLimit	All set-ups	TRUE	-	Uint8
DN-11	Process Data Config Write	ExpressionLimit	All set-ups	TRUE	-	Uint16
DN-12	Process Data Config Read	ExpressionLimit	All set-ups	TRUE	-	Uint16
DN-13	Warning Parameter	0 N/A	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 N/A	All set-ups	FALSE	0	Uint16
DN-21	COS Filter 2	0 N/A	All set-ups	FALSE	0	Uint16
DN-22	COS Filter 3	0 N/A	All set-ups	FALSE	0	Uint16
DN-23	COS Filter 4	0 N/A	All set-ups	FALSE	0	Uint16
DN-3#						
DN-30	Array Index	0 N/A	2 set-ups	TRUE	0	Uint8
DN-31	Store Data Values	[0] Off	All set-ups	TRUE	-	Uint8
DN-32	Devicenet Revision	ExpressionLimit	All set-ups	TRUE	0	Uint16
DN-33	Store Always	[0] Off	1 set-up	TRUE	-	Uint8
DN-34	DeviceNet Product Code	ExpressionLimit	1 set-up	TRUE	0	Uint16
DN-39	Devicenet F Parameters	0 N/A	All set-ups	TRUE	0	Uint32

4.1.12 PB-## Profibus

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
PB-0#						
PB-00	Setpoint	0 N/A	All set-ups	TRUE	0	Uint16
PB-07	Actual Value	0 N/A	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 N/A	1 set-up	TRUE	0	Uint8
PB-2#						
PB-22	Telegram Selection	[100] None	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 N/A	All set-ups	TRUE	0	Uint16
PB-45	Fault Code	0 N/A	All set-ups	TRUE	0	Uint16
PB-47	Fault Number	0 N/A	All set-ups	TRUE	0	Uint16
PB-5#						
PB-52	Fault Situation Counter	0 N/A	All set-ups	TRUE	0	Uint16
PB-53	Profibus Warning Word	0 N/A	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 N/A	All set-ups	TRUE	0	Uint16
PB-65	Profile Number	0 N/A	All set-ups	TRUE	0	OctStr[2]
PB-67	Control Word 1	0 N/A	All set-ups	TRUE	0	V2
PB-68	Status Word 1	0 N/A	All set-ups	TRUE	0	V2
PB-7#						
PB-70	Edit Set-up	[1] Set-up 1	All set-ups	TRUE	-	Uint8
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-75	DO Identification	0 N/A	All set-ups	TRUE	0	Uint16
PB-8#						
PB-80	Defined Parameters (1)	0 N/A	All set-ups	FALSE	0	Uint16
PB-81	Defined Parameters (2)	0 N/A	All set-ups	FALSE	0	Uint16
PB-82	Defined Parameters (3)	0 N/A	All set-ups	FALSE	0	Uint16
PB-83	Defined Parameters (4)	0 N/A	All set-ups	FALSE	0	Uint16
PB-84	Defined Parameters (5)	0 N/A	All set-ups	FALSE	0	Uint16
PB-9#						
PB-90	Changed Parameters (1)	0 N/A	All set-ups	FALSE	0	Uint16
PB-91	Changed Parameters (2)	0 N/A	All set-ups	FALSE	0	Uint16
PB-92	Changed Parameters (3)	0 N/A	All set-ups	FALSE	0	Uint16
PB-93	Changed Parameters (4)	0 N/A	All set-ups	FALSE	0	Uint16
PB-94	Changed Parameters (5)	0 N/A	All set-ups	FALSE	0	Uint16
PB-99	Profibus Revision Counter	0 N/A	All set-ups	TRUE	0	Uint16

4.1.13 EN-## Ethernet

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
EN-0#						
EN-00	IP Address Assignment	ExpressionLimit	2 set-ups	TRUE	-	Uint8
EN-01	IP Address	0 N/A	1 set-up	TRUE	0	OctStr[4]
EN-02	Subnet Mask	0 N/A	1 set-up	TRUE	0	OctStr[4]
EN-03	Default Gateway	0 N/A	1 set-up	TRUE	0	OctStr[4]
EN-04	DHCP Server	0 N/A	2 set-ups	TRUE	0	OctStr[4]
EN-05	Lease Expires	ExpressionLimit	All set-ups	TRUE	0	TimD
EN-06	Name Servers	0 N/A	1 set-up	TRUE	0	OctStr[4]
EN-07	Domain Name	0 N/A	1 set-up	TRUE	0	VisStr[48]
EN-08	Host Name	0 N/A	1 set-up	TRUE	0	VisStr[48]
EN-09	Physical Address	0 N/A	1 set-up	TRUE	0	VisStr[17]
EN-1#						
EN-10	Link Status	[0] No Link	All set-ups	TRUE	-	Uint8
EN-11	Link Duration	ExpressionLimit	All set-ups	TRUE	0	TimD
EN-12	Auto Negotiation	[1] On	2 set-ups	TRUE	-	Uint8
EN-13	Link Speed	[0] None	2 set-ups	TRUE	-	Uint8
EN-14	Link Duplex	[1] Full Duplex	2 set-ups	TRUE	-	Uint8
EN-2#						
EN-20	Control Instance	ExpressionLimit	1 set-up	TRUE	0	Uint8
EN-21	Process Data Config Write	ExpressionLimit	All set-ups	TRUE	-	Uint16
EN-22	Process Data Config Read	ExpressionLimit	All set-ups	TRUE	-	Uint16
EN-23	Process Data Config Write Size	16 N/A	All set-ups	TRUE	0	Uint32
EN-24	Process Data Config Read Size	16 N/A	All set-ups	TRUE	0	Uint32
EN-27	Primary Master	0 N/A	2 set-ups	FALSE	0	OctStr[4]
EN-28	Store Data Values	[0] Off	All set-ups	TRUE	-	Uint8
EN-29	Store Always	[0] Off	1 set-up	TRUE	-	Uint8
EN-3#						
EN-30	Warning Parameter	0 N/A	All set-ups	TRUE	0	Uint16
EN-31	Net Reference	[0] Off	2 set-ups	TRUE	-	Uint8
EN-32	Net Control	[0] Off	2 set-ups	TRUE	-	Uint8
EN-33	CIP Revision	ExpressionLimit	All set-ups	TRUE	0	Uint16
EN-34	CIP Product Code	ExpressionLimit	1 set-up	TRUE	0	Uint16
EN-35	EDS Parameter	0 N/A	All set-ups	TRUE	0	Uint32
EN-37	COS Inhibit Timer	0 N/A	All set-ups	TRUE	0	Uint16
EN-38	COS Filter	0 N/A	All set-ups	TRUE	0	Uint16
EN-4#						
EN-40	Status Parameter	0 N/A	All set-ups	TRUE	0	Uint16
EN-41	Slave Message Count	0 N/A	All set-ups	TRUE	0	Uint32
EN-42	Slave Exception Message Count	0 N/A	All set-ups	TRUE	0	Uint32
EN-8#						
EN-80	FTP Server	[0] Disabled	2 set-ups	TRUE	-	Uint8
EN-81	HTTP Server	[0] Disabled	2 set-ups	TRUE	-	Uint8
EN-82	SMTP Service	[0] Disabled	2 set-ups	TRUE	-	Uint8
EN-89	Transparent Socket Channel Port	ExpressionLimit	2 set-ups	TRUE	0	Uint16
EN-9#						
EN-90	Cable Diagnostic	[0] Disabled	2 set-ups	TRUE	-	Uint8
EN-91	MDI-X	[1] Enabled	2 set-ups	TRUE	-	Uint8
EN-92	IGMP Snooping	[1] Enabled	2 set-ups	TRUE	-	Uint8
EN-93	Cable Error Length	0 N/A	1 set-up	TRUE	0	Uint16

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
EN-94	Broadcast Storm Protection	-1 %	2 set-ups	TRUE	0	Int8
EN-95	Broadcast Storm Filter	[0] Broadcast only	2 set-ups	TRUE	-	Uint8
EN-96	Port Mirroring	ExpressionLimit	2 set-ups	TRUE	-	Uint8
EN-98	Interface Counters	4000 N/A	All set-ups	TRUE	0	Uint32
EN-99	Media Counters	0 N/A	All set-ups	TRUE	0	Uint32

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4.1.14 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	-	Uint8
EC-11	Resolution (PPR)	1024 N/A	All set-ups	FALSE	0	Uint16
EC-2#						
EC-20	Protocol Selection	[0] None	All set-ups	FALSE	-	Uint8
EC-21	Resolution (Positions/Rev)	ExpressionLimit	All set-ups	FALSE	0	Uint32
EC-24	SSI Data Length	13 N/A	All set-ups	FALSE	0	Uint8
EC-25	Clock Rate	ExpressionLimit	All set-ups	FALSE	3	Uint16
EC-26	SSI Data Format	[0] Gray code	All set-ups	FALSE	-	Uint8
EC-3#						
EC-34	HIPERFACE Baudrate	[4] 9600	All set-ups	FALSE	-	Uint8
EC-6#						
EC-60	Feedback Direction	[0] Clockwise	All set-ups	FALSE	-	Uint8
EC-61	Feedback Signal Monitoring	[1] Warning	All set-ups	TRUE	-	Uint8

4.1.15 RS-## Resolver Interface

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
RS-5#						
RS-50	Poles	2 N/A	1 set-up	FALSE	0	Uint8
RS-51	Input Voltage	7 V	1 set-up	FALSE	-1	Uint8
RS-52	Input Frequency	10 kHz	1 set-up	FALSE	2	Uint8
RS-53	Transformation Ratio	0.5 N/A	1 set-up	FALSE	-1	Uint8
RS-56	Encoder Sim. Resolution	[0] Disabled	1 set-up	FALSE	-	Uint8
RS-59	Resolver Interface	[0] Disabled	All set-ups	FALSE	-	Uint8

4.1.16 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 N/A	All set-ups	FALSE	0	Uint32
ID-04	Over Temp's	0 N/A	All set-ups	FALSE	0	Uint16
ID-05	Over Volt's	0 N/A	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-1#						
ID-10	Trending Source	0	2 set-ups	TRUE	-	Uint16
ID-11	Trending Interval	ExpressionLimit	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 N/A	2 set-ups	TRUE	0	Uint8
ID-2#						
ID-20	Historic Log: Event	0 N/A	All set-ups	FALSE	0	Uint8
ID-21	Historic Log: Value	0 N/A	All set-ups	FALSE	0	Uint32
ID-22	Historic Log: Time	0 ms	All set-ups	FALSE	-3	Uint32
ID-3#						
ID-30	Fault Log: Error Code	0 N/A	All set-ups	FALSE	0	Uint8
ID-31	Fault Log: Value	0 N/A	All set-ups	FALSE	0	Int16
ID-32	Fault Log: Time	0 s	All set-ups	FALSE	0	Uint32
ID-4#						
ID-40	Drive Type	0 N/A	All set-ups	FALSE	0	VisStr[6]
ID-41	Power Section	0 N/A	All set-ups	FALSE	0	VisStr[20]
ID-42	Voltage	0 N/A	All set-ups	FALSE	0	VisStr[20]
ID-43	Software Version	0 N/A	All set-ups	FALSE	0	VisStr[5]
ID-44	Ordered Typecode String	0 N/A	All set-ups	FALSE	0	VisStr[40]
ID-45	Actual Typecode String	0 N/A	All set-ups	FALSE	0	VisStr[40]
ID-46	GE Product No.	0 N/A	All set-ups	FALSE	0	VisStr[8]
ID-47	Power Card Ordering No	0 N/A	All set-ups	FALSE	0	VisStr[8]
ID-48	Keypad ID Number	0 N/A	All set-ups	FALSE	0	VisStr[20]
ID-49	SW ID Control Card	0 N/A	All set-ups	FALSE	0	VisStr[20]
ID-5#						
ID-50	SW ID Power Card	0 N/A	All set-ups	FALSE	0	VisStr[20]
ID-51	Drive Serial Number	0 N/A	All set-ups	FALSE	0	VisStr[10]
ID-53	Power Card Serial Number	0 N/A	All set-ups	FALSE	0	VisStr[19]
ID-59	CSIV Filename	ExpressionLimit	1 set-up	FALSE	0	VisStr[16]
ID-6#						
ID-60	Option Mounted	0 N/A	All set-ups	FALSE	0	VisStr[30]
ID-61	Option SW Version	0 N/A	All set-ups	FALSE	0	VisStr[20]
ID-62	Option Ordering No	0 N/A	All set-ups	FALSE	0	VisStr[8]
ID-63	Option Serial No	0 N/A	All set-ups	FALSE	0	VisStr[18]
ID-7#						
ID-70	Option in Slot A	0 N/A	All set-ups	FALSE	0	VisStr[30]
ID-71	Slot A Option SW Version	0 N/A	All set-ups	FALSE	0	VisStr[20]
ID-72	Option in Slot B	0 N/A	All set-ups	FALSE	0	VisStr[30]
ID-73	Slot B Option SW Version	0 N/A	All set-ups	FALSE	0	VisStr[20]

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
ID-8#						
ID-80	Fan Running Hours	0 h	All set-ups	TRUE	74	Uint32
ID-81	Preset Fan Running Hours	0 h	All set-ups	TRUE	74	Uint32
ID-9#						
ID-92	Defined Parameters	0 N/A	All set-ups	FALSE	0	Uint16
ID-93	Modified Parameters	0 N/A	All set-ups	FALSE	0	Uint16
ID-98	Drive Identification	0 N/A	All set-ups	FALSE	0	VisStr[40]
ID-99	Parameter Metadata	0 N/A	All set-ups	FALSE	0	Uint16

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4.1.17 DR-## Data Readouts

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
DR-0#						
DR-00	Control Word	0 N/A	All set-ups	FALSE	0	V2
DR-01	Reference [Unit]	0 ReferenceFeedbackUnit	All set-ups	FALSE	-3	Int32
DR-02	Reference %	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 %	All set-ups	FALSE	-2	N2
DR-09	Custom Readout	0 CustomReadoutUnit	All set-ups	FALSE	-2	Int32
DR-1#						
DR-10	Power [kW]	0 kW	All set-ups	FALSE	1	Int32
DR-11	Power [hp]	0 hp	All set-ups	FALSE	-2	Int32
DR-12	Motor Voltage	0 V	All set-ups	FALSE	-1	Uint16
DR-13	Frequency	0 Hz	All set-ups	FALSE	-1	Uint16
DR-14	Motor current	0 A	All set-ups	FALSE	-2	Int32
DR-15	Frequency [%]	0 %	All set-ups	FALSE	-2	N2
DR-16	Torque [Nm]	0 Nm	All set-ups	FALSE	-1	Int16
DR-17	Speed [RPM]	0 RPM	All set-ups	FALSE	67	Int32
DR-18	Motor Thermal	0 %	All set-ups	FALSE	0	Uint8
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	Uint16
DR-21	Torque [%] High Res.	0 %	All set-ups	FALSE	-1	Int16
DR-22	Torque [%]	0 %	All set-ups	FALSE	0	Int16
DR-25	Torque [Nm] High	0 Nm	All set-ups	FALSE	-1	Int32
DR-3#						
DR-30	DC Link Voltage	0 V	All set-ups	FALSE	0	Uint16
DR-32	Brake Energy /s	0 kW	All set-ups	FALSE	0	Uint32
DR-33	Brake Energy /2 min	0 kW	All set-ups	FALSE	0	Uint32
DR-34	Heatsink Temp.	0 °C	All set-ups	FALSE	100	Uint8
DR-35	Drive Thermal	0 %	All set-ups	FALSE	0	Uint8
DR-36	Drive Nominal Current	ExpressionLimit	All set-ups	FALSE	-2	Uint32
DR-37	Drive Max. Current	ExpressionLimit	All set-ups	FALSE	-2	Uint32
DR-38	Logic Controller State	0 N/A	All set-ups	FALSE	0	Uint8
DR-39	Control Card Temp.	0 °C	All set-ups	FALSE	100	Uint8
DR-4#						
DR-40	Trending Buffer Full	[0] No	All set-ups	TRUE	-	Uint8
DR-41	Keypad Bottom Statusline	0 N/A	All set-ups	TRUE	0	VisStr[50]
DR-48	Speed Ref. After Ramp [RPM]	0 RPM	All set-ups	FALSE	67	Int32

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
DR-49	Current Fault Source	0 N/A	All set-ups	TRUE	0	Uint8
DR-5#						
DR-50	External Reference	0 N/A	All set-ups	FALSE	-1	Int16
DR-51	Pulse Reference	0 N/A	All set-ups	FALSE	-1	Int16
DR-52	Feedback[Unit]	0 ReferenceFeedbackUnit	All set-ups	FALSE	-3	Int32
DR-53	Digi Pot Reference	0 N/A	All set-ups	FALSE	-2	Int16
DR-57	Feedback [RPM]	0 RPM	All set-ups	FALSE	67	Int32
DR-6#						
DR-60	Digital Input	0 N/A	All set-ups	FALSE	0	Uint16
DR-61	Terminal 53 Switch Setting	[0] Current	All set-ups	FALSE	-	Uint8
DR-62	Analog Input 53	0 N/A	All set-ups	FALSE	-3	Int32
DR-63	Terminal 54 Switch Setting	[0] Current	All set-ups	FALSE	-	Uint8
DR-64	Analog Input 54	0 N/A	All set-ups	FALSE	-3	Int32
DR-65	Analog Output 42 [mA]	0 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
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	Uint32
DR-75	Analog In X30/11	0 N/A	All set-ups	FALSE	-3	Int32
DR-76	Analog In X30/12	0 N/A	All set-ups	FALSE	-3	Int32
DR-77	Analog Out X30/8 [mA]	0 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-87	Bus Readout Alarm/Warning	0 N/A	All set-ups	FALSE	0	Uint16
DR-9#						
DR-90	Alarm Word	0 N/A	All set-ups	FALSE	0	Uint32
DR-91	Alarm Word 2	0 N/A	All set-ups	FALSE	0	Uint32
DR-92	Warning Word	0 N/A	All set-ups	FALSE	0	Uint32
DR-93	Warning Word 2	0 N/A	All set-ups	FALSE	0	Uint32
DR-94	Ext. Status Word	0 N/A	All set-ups	FALSE	0	Uint32

4.1.18 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	ExpressionLimit	2 set-ups	TRUE	-	Uint8
LC-01	Start Event	ExpressionLimit	2 set-ups	TRUE	-	Uint8
LC-02	Stop Event	ExpressionLimit	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	ExpressionLimit	2 set-ups	TRUE	-	Uint8
LC-11	Comparator Operator	ExpressionLimit	2 set-ups	TRUE	-	Uint8
LC-12	Comparator Value	ExpressionLimit	2 set-ups	TRUE	-3	Int32
LC-15	RS-FF Operand S	ExpressionLimit	All set-ups	TRUE	-	Uint8
LC-16	RS-FF Operand R	ExpressionLimit	All set-ups	TRUE	-	Uint8
LC-2#						
LC-20	Logic Controller Timer	ExpressionLimit	1 set-up	TRUE	-3	TimD
LC-4#						
LC-40	Logic Rule Boolean 1	ExpressionLimit	2 set-ups	TRUE	-	Uint8
LC-41	Logic Rule Operator 1	ExpressionLimit	2 set-ups	TRUE	-	Uint8
LC-42	Logic Rule Boolean 2	ExpressionLimit	2 set-ups	TRUE	-	Uint8
LC-43	Logic Rule Operator 2	ExpressionLimit	2 set-ups	TRUE	-	Uint8
LC-44	Logic Rule Boolean 3	ExpressionLimit	2 set-ups	TRUE	-	Uint8
LC-5#						
LC-51	Logic Controller Event	ExpressionLimit	2 set-ups	TRUE	-	Uint8
LC-52	Logic Controller Action	ExpressionLimit	2 set-ups	TRUE	-	Uint8

4.1.19 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 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-05	Maximum Reference	ExpressionLimit	All set-ups	TRUE	-3	Int32
B-06	Parking Current	50 %	All set-ups	TRUE	0	Uint16
B-07	Parking Time	3 s	All set-ups	TRUE	-1	Uint16
B-1#						
B-10	Brake Function	ExpressionLimit	All set-ups	TRUE	-	Uint8
B-11	Brake Resistor (ohm)	ExpressionLimit	1 set-up	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 %	All set-ups	TRUE	-1	Uint32
B-17	Over-voltage Control	[0] Disabled	All set-ups	TRUE	-	Uint8
B-18	Brake Check Condition	[0] At Power Up	All set-ups	TRUE	-	Uint8
B-19	Over-voltage Gain	100 %	All set-ups	TRUE	0	Uint16
B-2#						
B-20	Release Brake Current	ExpressionLimit	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 s	All set-ups	TRUE	-1	Uint8
B-24	Stop Delay	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 %	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 N/A	All set-ups	TRUE	-2	Uint16

4.1.20 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	ExpressionLimit	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 N/A	All set-ups	TRUE	-1	Uint16
PI-06	Speed PID Lowpass Filter Time	ExpressionLimit	All set-ups	TRUE	-4	Uint16
PI-07	Speed PID Feedback Gear Ratio	1 N/A	All set-ups	FALSE	-4	Uint32
PI-08	Speed PID Feed Forward Factor	0 %	All set-ups	FALSE	0	Uint16
PI-09	Speed PID Error Correction w/ Ramp	300 RPM	All set-ups	TRUE	67	Uint32
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 N/A	All set-ups	TRUE	-2	Uint16
PI-34	Process PID Integral Time	10000 s	All set-ups	TRUE	-2	Uint32
PI-35	Process PID Differentiation Time	0 s	All set-ups	TRUE	-2	Uint16
PI-36	Process PID Diff. Gain Limit	5 N/A	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
PI-4#						
PI-40	Process PID I-part Reset	[0] No	All set-ups	TRUE	-	Uint8
PI-41	Process PID Output Neg. Clamp	-100 %	All set-ups	TRUE	0	Int16
PI-42	Process PID Output Pos. Clamp	100 %	All set-ups	TRUE	0	Int16
PI-43	Process PID Gain Scale at Min. Ref.	100 %	All set-ups	TRUE	0	Int16
PI-44	Process PID Gain Scale at Max. Ref.	100 %	All set-ups	TRUE	0	Int16
PI-45	Process PID Feed Fwd Resource	[0] No function	All set-ups	TRUE	-	Uint8
PI-46	Process PID Feed Fwd Normal/ Inv. Ctrl.	[0] Normal	All set-ups	TRUE	-	Uint8
PI-49	Process PID Output Normal/ Inv. Ctrl.	[0] Normal	All set-ups	TRUE	-	Uint8
PI-5#						
PI-50	Process PID Extended PID	[1] Enabled	All set-ups	TRUE	-	Uint8
PI-51	Process PID Feed Fwd Gain	1 N/A	All set-ups	TRUE	-2	Uint16
PI-52	Process PID Feed Fwd Ramp up	0.01 s	All set-ups	TRUE	-2	Uint32
PI-53	Process PID Feed Fwd Ramp down	0.01 s	All set-ups	TRUE	-2	Uint32
PI-56	Process PID Ref. Filter Time	0.001 s	All set-ups	TRUE	-3	Uint16
PI-57	Process PID Fb. Filter Time	0.001 s	All set-ups	TRUE	-3	Uint16
PI-6#						
PI-60	Process PID Error	0 %	All set-ups	FALSE	-1	Int16
PI-61	Process PID Output	0 %	All set-ups	FALSE	-1	Int16
PI-62	Process PID Clamped Output	0 %	All set-ups	FALSE	-1	Int16
PI-63	Process PID Gain Scaled Output	0 %	All set-ups	FALSE	-1	Int16

4.1.21 SF-# Special Functions

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
SF-0#						
SF-00	Wobble Mode	[0] Abs. Freq., Abs. Time	All set-ups	FALSE	-	Uint8
SF-01	Wobble Delta Frequency [Hz]	5 Hz	All set-ups	TRUE	-1	Uint8
SF-02	Wobble Delta Frequency [%]	25 %	All set-ups	TRUE	0	Uint8
SF-03	Wobble Delta Freq. Scaling Resource	[0] No function	All set-ups	TRUE	-	Uint8
SF-04	Wobble Jump Frequency [Hz]	0 Hz	All set-ups	TRUE	-1	Uint8
SF-05	Wobble Jump Frequency [%]	0 %	All set-ups	TRUE	0	Uint8
SF-06	Wobble Jump Time	ExpressionLimit	All set-ups	TRUE	-3	Uint16
SF-07	Wobble Sequence Time	10 s	All set-ups	TRUE	-1	Uint16
SF-08	Wobble Up/ Down Time	5 s	All set-ups	TRUE	-1	Uint16
SF-09	Wobble Random Function	[0] Off	All set-ups	TRUE	-	Uint8
SF-1#						
SF-10	Wobble Ratio	1 N/A	All set-ups	TRUE	-1	Uint8
SF-11	Wobble Random Ratio Max.	10 N/A	All set-ups	TRUE	-1	Uint8
SF-12	Wobble Random Ratio Min.	0.1 N/A	All set-ups	TRUE	-1	Uint8
SF-19	Wobble Delta Freq. Scaled	0 Hz	All set-ups	FALSE	-1	Uint16
SF-2#						
SF-20	High Starting Torque Time [s]	ExpressionLimit	All set-ups	TRUE	-2	Uint16
SF-21	High Starting Torque Current [%]	ExpressionLimit	All set-ups	TRUE	-1	Uint32
SF-22	Locked Rotor Protection	[0] Off	All set-ups	TRUE	-	Uint8
SF-23	Locked Rotor Detection Time [s]	ExpressionLimit	All set-ups	TRUE	-2	Uint8
SF-8#						
SF-84	Process PID Proportional Gain	0.100 N/A	All set-ups	TRUE	-3	Uint16

5 Troubleshooting

5.1 Status Messages

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 trips. Reset the alarm to resume operation once the cause has been rectified.

Three ways to reset:

- Press [Reset].
- Via a digital input with the "Reset" function.
- Via serial communication/optional network.

NOTE

After a manual reset pressing [Reset], press [Auto] 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 5.1*).

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 can 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 *H-04 Auto-Reset (Times)* (Warning: automatic wake-up is possible!)

If a warning or alarm is marked against a code in *Table 5.1*, this means that either a warning occurs before an alarm, or else that it is possible to specify whether a warning or an alarm should be displayed for a given fault.

This is possible, for instance, in *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.

NOTE

No missing motor phase detection (numbers 30-32) and no stall detection is active when *P-20 Motor Construction* is set to *[1] PM non salient SPM*.

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
1	10 Volts low	X			
2	Live zero error	(X)	(X)		AN-01 Live Zero Timeout Function
3	No motor	(X)			H-80 Function at Stop
4	Mains phase loss	(X)	(X)	(X)	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)		F-10 Electronic Overload
11	Motor thermistor over temperature	(X)	(X)		F-10 Electronic Overload
12	Torque limit	X	X		
13	Over Current	X	X	X	
14	Earth Fault	X	X		

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
15	Hardware mismatch		X	X	
16	Short Circuit		X	X	
17	Control word time-out	(X)	(X)		O-04 Control Word Timeout Function
20	Temp. Input Error				
21	Param Error				
23	Internal Fans	X			
24	External Fans	X			
25	Brake resistor short-circuited	X			
26	Brake resistor power limit	(X)	(X)		B-13 Braking Thermal Overload
27	Brake chopper short-circuited	X	X		
28	Brake check	(X)	(X)		B-15 Brake Check
29	Heatsink temp	X	X	X	
30	Motor phase U missing	(X)	(X)	(X)	H-78 Missing Motor Phase Function
31	Motor phase V missing	(X)	(X)	(X)	H-78 Missing Motor Phase Function
32	Motor phase W missing	(X)	(X)	(X)	H-78 Missing Motor Phase Function
33	Inrush Fault		X	X	
34	Network communication fault	X	X		
35	Option Fault				
36	Mains failure	X	X		
37	Phase imbalance		X		
38	Internal Fault		X	X	
39	Heatsink sensor		X	X	
40	Overload of Digital Output Terminal 27	(X)			E-00 Digital I/O Mode, E-51 Terminal 27 Mode
41	Overload of Digital Output Terminal 29	(X)			E-00 Digital I/O Mode, E-52 Terminal 29 Mode
42	Ovrld X30/6-7	(X)			
43	Ext. Supply (option)				
45	Earth Fault 2	X	X		
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		H-36 Trip Speed Low [RPM]
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		
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	Feedback Error	(X)	(X)		H-20 Motor Feedback Loss Function
62	Output Frequency at Maximum Limit	X			

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
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		
69	Pwr. Card Temp		X	X	
70	Illegal Drive configuration			X	
75	Illegal Profile Sel.		X		
76	Power Unit Setup	X			
77	Reduced power mode	X			SP-59 Actual Number of Inverter Units
78	Tracking Error	(X)	(X)		H-24 Tracking Error Function
79	Illegal PS config		X	X	
80	Drive Restored to Factory Settings		X		
81	CSIV corrupt		X		
82	CSIV parameter error		X		
83	Illegal Option Combination			X	
88	Option Detection			X	
91	Analog input 54 wrong settings			X	S202
246	Pwr.card supply				
250	New spare parts			X	
251	New Type Code		X	X	

Table 5.1 Alarm/Warning Code List

(X) Dependent on parameter

1) Cannot be Auto reset via H-04 Auto-Reset (Times)

A trip is the action following an alarm. The trip coasts the motor and is reset by pressing [Reset] or by a digital input (parameter group 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 could damage the frequency converter or connected parts. A trip lock situation can only be reset by a power cycling.

Warning	yellow
Alarm	flashing red
Trip locked	yellow and red

Table 5.2 LED Indication

Bit	Hex	Dec	Alarm Word	Alarm Word 2	Warning Word	Warning Word 2	Extended Status Word
Alarm Word Extended Status Word							
0	00000001	1	Brake Check (A28)	ServiceTrip, Read/Write	Brake Check (W28)	reserved	Ramping
1	00000002	2	Pwr. Card Temp (A69)	ServiceTrip, (reserved)	Pwr. Card Temp (W69)	reserved	Auto Tune Running
2	00000004	4	Earth Fault (A14)	ServiceTrip, Typecode/ Sparepart	Earth Fault (W14)	reserved	Start CW/CCW
3	00000008	8	Ctrl.Card Temp (A65)	ServiceTrip, (reserved)	Ctrl.Card Temp (W65)	reserved	Slow Down
4	00000010	16	Ctrl. Word TO (A17)	ServiceTrip, (reserved)	Ctrl. Word TO (W17)		Catch Up
5	00000020	32	Over Current (A13)	reserved	Over Current (W13)	reserved	Feedback High
6	00000040	64	Torque Limit (A12)	reserved	Torque Limit (W12)	reserved	Feedback Low

Bit	Hex	Dec	Alarm Word	Alarm Word 2	Warning Word	Warning Word 2	Extended Status Word
7	00000080	128	Motor Th Over (A11)	reserved	Motor Th Over (W11)	reserved	Output Current High
8	00000100	256	Motor Electronic OL Over (A10)	reserved	Motor Electronic OL Over (W10)	reserved	Output Current Low
9	00000200	512	Drive Overld. (A9)	reserved	Drive Overld (W9)	reserved	Output Freq High
10	00000400	1024	DC under Volt (A8)	reserved	DC under Volt (W8)		Output Freq Low
11	00000800	2048	DC over Volt (A7)	reserved	DC over Volt (W7)		Brake Check OK
12	00001000	4096	Short Circuit (A16)	reserved	DC Voltage Low (W6)	reserved	Braking Max
13	00002000	8192	Inrush Fault (A33)	reserved	DC Voltage High (W5)		Braking
14	00004000	16384	Mains ph. Loss (A4)	reserved	Mains ph. Loss (W4)		Out of Speed Range
15	00008000	32768	Auto Tune Not OK	reserved	No Motor (W3)		OVC Active
16	00010000	65536	Live Zero Error (A2)	reserved	Live Zero Error (W2)		AC Brake
17	00020000	131072	Internal Fault (A38)	KTY error	10V Low (W1)	KTY Warn	Password Timelock
18	00040000	262144	Brake Overload (A26)	Fans error	Brake Overload (W26)	Fans Warn	Password Protection
19	00080000	524288	U phase Loss (A30)	reserved	Brake Resistor (W25)	reserved	
20	00100000	1048576	V phase Loss (A31)	reserved	Brake IGBT (W27)	reserved	
21	00200000	2097152	W phase Loss (A32)	reserved	Speed Limit (W49)	reserved	
22	00400000	4194304	Network Fault (A34)	reserved	Network Fault (W34)	reserved	Unused
23	00800000	8388608	24 V Supply Low (A47)	reserved	24V Supply Low (W47)	reserved	Unused
24	01000000	16777216	Mains Failure (A36)	reserved	Mains Failure (W36)	reserved	Unused
25	02000000	33554432	1.8V Supply Low (A48)	reserved	Current Limit (W59)	reserved	Unused
26	04000000	67108864	Brake Resistor (A25)	reserved	Low Temp (W66)	reserved	Unused
27	08000000	134217728	Brake IGBT (A27)	reserved	Voltage Limit (W64)	reserved	Unused
28	10000000	268435456	Option Change (A67)	reserved	Encoder loss (W90)	reserved	Unused
29	20000000	536870912	Drive Restored to factory settings(A80)	Feedback Fault (A61, A90)	Feedback Fault (W61, W90)		Unused
30	40000000	1073741824	Safe Stop (A68)	Safe Stop (A71)	Safe Stop (W68)	Safe Stop (W71)	Unused
31	80000000	2147483648	Mech. brake low (A63)	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 diagnostics. See also *DR-94 Ext. Status Word*.

WARNING 1, 10 Volts low
The control card voltage is below 10 V from terminal 50. Remove some of the load from terminal 50, as the 10 V supply is overloaded. Max. 15 mA or minimum 590 Ω.

This condition can be caused by a short in a connected potentiometer or improper wiring of the potentiometer.

Troubleshooting
Remove the wiring from terminal 50. If the warning clears, the problem is with the customer wiring. If the warning does not clear, replace the control card.

5

WARNING/ALARM 2, Live zero error
This warning or alarm only appears if programmed by the user in *AN-01 Live Zero Timeout Function*. The signal on one of the analog inputs is less than 50% of the minimum value programmed for that input. Broken wiring or faulty device sending the signal can cause this condition.

Troubleshooting

Check connections on all the analog input terminals. Control card terminals 53 and 54 for signals, terminal 55 common. OPCGPIO terminals 11 and 12 for signals, terminal 10 common. OPCAIO terminals 1, 3, 5 for signals, terminals 2, 4, 6 common).

Check that the frequency converter programming and switch settings match the analog signal type.

Perform Input Terminal Signal Test.

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 for a fault in the input rectifier on the frequency converter. Options are programmed at *SP-12 Function at Line Imbalance*.

Troubleshooting
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 high voltage warning limit. The limit is dependent on the frequency converter voltage rating. The unit is still active.

WARNING 6, DC link voltage low
The intermediate circuit voltage (DC) is lower than the low voltage warning limit. The limit is dependent on the frequency converter voltage rating. The unit is still active.

WARNING/ALARM 7, DC overvoltage
If the intermediate circuit voltage exceeds the limit, the frequency converter trips after a time.

Troubleshooting

Connect a brake resistor

Extend the ramp time

Change the ramp type

Activate the functions in *B-10 Brake Function*

Increase *SP-26 Trip Delay at Drive Fault*

If the alarm/warning occurs during a power sag the solution is to use kinetic back-up (*SP-10 Line failure*)

WARNING/ALARM 8, DC under voltage
If the intermediate circuit voltage (DC link) drops below the under voltage limit, the frequency converter checks if a 24 V DC backup supply is connected. If no 24 V DC backup supply is connected, the frequency converter trips after a fixed time delay. The time delay varies with unit size.

Troubleshooting

Check that the supply voltage matches the frequency converter voltage.

Perform input voltage test.

Perform soft charge circuit test.

WARNING/ALARM 9, Inverter overload
The frequency converter is about to cut out because of an overload (too high current for too long). The counter for electronic, thermal inverter protection issues a warning at 98% and trips at 100%, while giving an alarm. The frequency converter *cannot* be reset until the counter is below 90%.
The fault is that the frequency converter has run with more than 100% overload for too long.

Troubleshooting

Compare the output current shown on the keypad with the frequency converter rated current.

Compare the output current shown on the keypad with measured motor current.

Display the Thermal Drive Load on the keypad and monitor the value. When running above the frequency converter continuous current rating, the counter increases. When running below the frequency converter continuous current rating, the counter decreases.

WARNING/ALARM 10, Motor overload temperature
According to the electronic thermal protection, the motor is too hot. Select whether the frequency converter issues a warning or an alarm when the counter reaches 100% in *F-10 Electronic Overload*. The fault occurs when the motor runs with more than 100% overload for too long.

Troubleshooting

Check for motor overheating.

Check if the motor is mechanically overloaded

Check that the motor current set in *P-03 Motor Current* is correct.

Ensure that Motor data in parameters P-02, P-03, P-06, P-07, F-04 and F-05 are set correctly.

If an external fan is in use, check in *F-11 Motor External Fan* that it is selected.

Running Auto tune in *P-04 Auto Tune* tunes the frequency converter to the motor more accurately and reduces thermal loading.

WARNING/ALARM 11, Motor thermistor over temp
Check whether the thermistor is disconnected. Select whether the frequency converter issues a warning or an alarm in *F-10 Electronic Overload*.

Troubleshooting

Check for motor overheating.

Check if the motor is mechanically overloaded.

When using terminal 53 or 54, check that the thermistor is connected correctly between either terminal 53 or 54 (analog voltage input) and terminal 50 (+10 V supply). Also check that the terminal switch for 53 or 54 is set for voltage. Check *F-12 Motor Thermistor Input* selects terminal 53 or 54.

When using digital inputs 18 or 19, check that the thermistor is connected correctly between either terminal 18 or 19 (digital input PNP only) and terminal 50. Check *F-12 Motor Thermistor Input* selects terminal 18 or 19.

WARNING/ALARM 12, Torque limit
The torque has exceeded the value in *F-40 Torque Limiter (Driving)* or the value in *F-41 Torque Limiter (Braking)*. *SP-25 Trip Delay at Torque Limit* can change this from a warning only condition to a warning followed by an alarm.

Troubleshooting

If the motor torque limit is exceeded during ramp, extend the ramp time.

If the generator torque limit is exceeded during ramp, extend the ramp time.

If torque limit occurs while running, possibly increase the torque limit. Make sure that the system can operate safely at a higher torque.

Check the application for excessive current draw on the motor.

WARNING/ALARM 13, Over current
The inverter peak current limit (approximately 200% of the rated current) is exceeded. The warning lasts about 1.5 s, then the frequency converter trips and issues an alarm. This fault can be caused by shock loading or quick acceleration with high inertia loads. It can also appear after kinetic back-up if the acceleration during ramp up is quick. If extended mechanical brake control is selected, trip can be reset externally.

Troubleshooting

Remove power and check if the motor shaft can be turned.

Check that the motor size matches the frequency converter.

Check parameters P-02, P-03, P-06, P-07, F-04 and F-05 for correct motor data.

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

Troubleshooting:

Remove power to the frequency converter and repair the earth fault.

Check for earth faults in the motor by measuring the resistance to ground of the motor leads and the motor with a megohmmeter.

ALARM 15, Hardware mismatch
A fitted option is not operational with the present control board hardware or software.

Record the value of the following parameters and contact your GE supplier:

ID-40 Drive Type

ID-41 Power Section

ID-42 Voltage

ID-43 Software Version

ID-45 Actual Typecode String

ID-49 SW ID Control Card

ID-50 SW ID Power Card

ID-60 Option Mounted

ID-61 Option SW Version (for each option slot)

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

Remove power to the frequency converter and repair the short circuit.

WARNING/ALARM 17, Control word timeout
There is no communication to the frequency converter. The warning is only active when *O-04 Control Word Timeout Function* is NOT set to *[0] Off*.
If *O-04 Control Word Timeout Function* is set to *[5] Stop and Trip*, a warning appears and the frequency converter ramps down until it stops then displays an alarm.

Troubleshooting

Check connections on the serial communication cable.

Increase *O-03 Control Word Timeout Time*

Check the operation of the communication equipment.

Verify a proper installation based on EMC requirements.

WARNING/ALARM 20, Temp. input error
The temperature sensor is not connected.

WARNING/ALARM 21, Parameter error
The parameter is out of range. The parameter number is reported in the keypad. The affected parameter must be set to a valid value.

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WARNING/ALARM 22, Hoist mechanical brake
Report value shows what kind it is.
0 = The torque ref. was not reached before timeout.
1 = There was no brake feedback before timeout.

WARNING 23, Internal fan fault
The fan warning function is an extra protective function that checks if the fan is running/mounted. The fan warning can be disabled in *SP-53 Fan Monitor* (*[0] Disabled*).

Troubleshooting

Check for proper fan operation.

Cycle power to the frequency converter and check that the fan operates briefly at start-up.

Check the sensors on the heatsink and control card.

WARNING 24, External fan fault
The fan warning function is an extra protective function that checks if the fan is running/mounted. The fan warning can be disabled in *SP-53 Fan Monitor* (*[0] Disabled*).

Troubleshooting

Check for proper fan operation.

Cycle power to the frequency converter and check that the fan operates briefly at start-up.

Check the sensors on the heatsink and control card.

WARNING 25, Brake resistor short circuit
The brake resistor is monitored during operation. If a short circuit occurs, the brake function is disabled and the warning appears. The frequency converter is still operational but without the brake function. Remove power to the frequency converter and replace the brake resistor (see *B-15 Brake Check*).

WARNING/ALARM 26, Brake resistor power limit
The power transmitted to the brake resistor is calculated as a mean value over the last 120 seconds of run time. The calculation is based on the intermediate circuit voltage and the brake resistance value set in *B-16 AC brake Max. Current*. The warning is active when the dissipated braking is higher than 90% of the brake resistance power. If *[2] Trip* is selected in *B-13 Braking Thermal Overload*, the frequency converter trips when the dissipated braking power reaches 100%.

WARNING/ALARM 27, Brake chopper fault
The brake transistor is monitored during operation and if a short circuit occurs, the brake function is disabled and a warning is issued. The frequency converter is still operational but, since the brake transistor has short-circuited, substantial power is transmitted to the brake resistor, even if it is inactive.
Remove power to the frequency converter and remove the brake resistor.

High power drives: This alarm/warning could also occurs should the brake resistor overheat. Terminals 104 to 106 of FK102 are available as brake resistor temperature switch on the power card of high power drives. Unless used as an input, a jumper must be placed between terminals 104 and 106 of FK102.

WARNING/ALARM 28, Brake check failed
The brake resistor is not connected or not working. Check *B-15 Brake Check*.

ALARM 29, Heatsink temp
The maximum temperature of the heatsink has been exceeded. The temperature fault will not reset until the temperature falls below a defined heatsink temperature. The trip and reset points are different based on the frequency converter power size.

Troubleshooting
Check for the following conditions.

Ambient temperature too high.

Motor cable too long.

Incorrect airflow clearance above and below the frequency converter.

Blocked airflow around the frequency converter.

Damaged heatsink fan.

Dirty heatsink.

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

Remove power from the frequency converter and check motor phase U.

ALARM 31, Motor phase V missing
Motor phase V between the frequency converter and the motor is missing.

Remove power from the frequency converter and check motor phase V.

ALARM 32, Motor phase W missing
Motor phase W between the frequency converter and the motor is missing.

Remove power from the frequency converter and check motor phase W.

ALARM 33, Inrush fault
Too many power-ups have occurred within a short time period. Let the unit cool to operating temperature.

WARNING/ALARM 34, Fieldbus communication fault
The network on the communication option card is not working.

WARNING/ALARM 35, Option faultOut of frequency range
An option alarm is received. The alarm is option-specific. The most likely cause is a power-up or a communication fault.

WARNING/ALARM 36, Mains failure
This warning/alarm is only active if the supply voltage to the frequency converter is lost and *SP-10 Line failure* is NOT set to *[0] No Function*. Check the fuses to the frequency converter and mains power supply to the unit.

ALARM 37, Phase imbalance
There is a current imbalance between the power units

ALARM 38, Internal fault
When an internal fault occurs, a code number defined in *Table 5.4* is displayed.

Troubleshooting

Cycle power

Check that the option is properly installed

Check for loose or missing wiring

It may be necessary to contact your GE supplier or service department. Note the code number for further trouble-shooting directions.

No.	Text
0	Serial port cannot be restore. Contact your GE supplier or GE Service Department.
256-258	Power EEPROM data is defective or too old. Replace power card.
512-519	Internal fault. Contact your GE supplier or GE Service Department.
783	Parameter value outside of min/max limits
1024-1284	Internal fault. Contact your GE supplier or the GE Service Department.
1299	Option SW in slot A is too old
1300	Option SW in slot B is too old
1315	Option SW in slot A is not supported (not allowed)
1316	Option SW in slot B is not supported (not allowed)
1379-2819	Internal fault. Contact your GE supplier or GE Service Department.
2561	Replace control card
2820	Keypad stack overflow
2821	Serial port overflow
2822	USB port overflow
3072-5122	Parameter value is outside its limits
5123	Option in slot A: Hardware incompatible with control board hardware
5124	Option in slot B: Hardware incompatible with control board hardware
5376-6231	Internal fault. Contact your GE supplier or GE Service Department.

Table 5.4 Internal Fault Codes

ALARM 39, Heatsink sensor
No feedback from the heatsink temperature sensor.

The signal from the IGBT thermal sensor is not available on the power card. The problem could be on the power card, on the gate drive card, or the ribbon cable between the power card and gate drive card.

WARNING 40, Overload of digital output terminal 27
Check the load connected to terminal 27 or remove short-circuit connection. Check *E-00 Digital I/O Mode* and *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 *E-00 Digital I/O Mode* and *E-52 Terminal 29 Mode*.

WARNING 42, Overload of digital output on X30/6 or overload of digital output on X30/7
For X30/6, check the load connected to X30/6 or remove the short-circuit connection. Check *E-56 Term X30/6 Digi Out (OPCGPIO)*.

For X30/7, check the load connected to X30/7 or remove the short-circuit connection. Check *E-57 Term X30/7 Digi Out (OPCGPIO)*.

ALARM 45, Earth fault 2
Earth (ground) fault on start-up.

Troubleshooting

Check for proper earthing (grounding) and loose connections.

Check for proper wire size.

Check motor cables for short-circuits or leakage currents.

ALARM 46, Power card supply
The supply on the power card is out of range.

There are three power supplies generated by the switch mode power supply (SMPS) on the power card: 24 V, 5 V, ±18 V. When powered with three phase mains voltage, all three supplies are monitored.

Troubleshooting

Check for a defective power card.

Check for a defective control card.

Check for a defective option card.

If a 24 V DC power supply is used, verify proper supply power.

WARNING 47, 24 V supply low
The 24 V DC is measured on the control card. The external 24 V DC backup power supply may be overloaded, otherwise contact the GE supplier.

WARNING 48, 1.8 V supply low
The 1.8 V DC supply used on the control card is outside of allowable limits. The power supply is measured on the control card. Check for a defective control card. If an option card is present, check for an overvoltage condition.

WARNING 49, Speed limit
When the speed is not within the specified range in F-18 and F-17, the frequency converter shows a warning. When the speed is below the specified limit in *H-36 Trip Speed Low [RPM]* (except when starting or stopping) the frequency converter will trip.

ALARM 50, Auto tune calibration failed
Contact your GE supplier or GE Service Department.

ALARM 51, Auto tune check U_{nom} and I_{nom}
The settings for motor voltage, motor current and motor power are wrong. Check the settings in parameters P-02, P-03, P-06, P-07, F-04 and F-05.

ALARM 52, Auto tune low I_{nom}
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 operate.

ALARM 54, Auto tune motor too small
The motor is too small for the Auto tune to operate.

ALARM 55, Auto tune parameter out of range
The parameter values of the motor are outside of the acceptable range. Auto tune will not run.

ALARM 56, Auto tune interrupted by user
The user has interrupted the Auto tune.

ALARM 57, Auto tune internal fault
Try to restart Auto tune again. Repeated restarts can over heat the motor.

ALARM 58, Internal fault
Contact your GE supplier.

WARNING 59, Current limit
The current is higher than the value in *F-43 Current Limit*. Ensure that Motor data in parameters P-02, P-03, P-06, P-07, F-04 and F-05 are set correctly. Possibly increase the current limit. Be sure that the system can operate safely at a higher limit.

WARNING/ALARM 61, Feedback error
An error has been detected between calculated speed and speed measurement from feedback device. The function Warning/Alarm/Disabling setting is in *H-20 Motor Feedback Loss Function*. Accepted error setting in *H-21 Motor Feedback Speed Error* and the allowed time the error occur setting in *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 has reached the value set in *F-03 Max Output Frequency 1*. Check the application to determine the cause. Possibly increase the output frequency limit. Be sure the system can operate safely at a higher output frequency. The warning will clear when the output drops below the maximum limit.

ALARM 63, Mechanical brake low
The actual motor current has not exceeded the “release brake” current within the “Start delay” time window.

WARNING/ALARM 65, Control card over temperature
The cut-out temperature of the control card is 80 °C.

Troubleshooting

- Check that the ambient operating temperature is within limits
- Check for clogged filters
- Check fan operation
- Check the control card

WARNING 66, Heatsink temperature low
The frequency converter is too cold to operate. This warning is based on the temperature sensor in the IGBT module.
Increase the ambient temperature of the unit. Also, a trickle amount of current can be supplied to the frequency converter whenever the motor is stopped by setting *B-00 DC Hold Current* at 5% and *H-80 Function at Stop*

ALARM 67, Option module configuration has changed
One or more options have either been added or removed since the last power-down. Check that the configuration change is intentional and reset the unit.

ALARM 69, Power card temperature
The temperature sensor on the power card is either too hot or too cold.

Troubleshooting

Check that the ambient operating temperature is within limits.

Check for clogged filters.

Check fan operation.

Check the power card.

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

WARNING 76, Safe stop auto restart
The required number of power units does not match the detected number of active power units.

WARNING 77, Reduced power mode
This warning indicates that the frequency converter is operating in reduced power mode (i.e. less than the allowed number of inverter sections). This warning will be generated on power cycle when the frequency converter is set to run with fewer inverters and will remain on.

ALARM 78, Tracking error
The difference between set point value and actual value has exceeded the value in *H-25 Tracking Error*. Disable the function by *H-24 Tracking Error Function* or select an alarm/warning also in *H-24 Tracking Error Function*. Investigate the mechanics around the load and motor, Check feedback

connections from motor – encoder – to frequency converter. Select motor feedback function in *H-20 Motor Feedback Loss Function*. Adjust tracking error band in *H-25 Tracking Error* and *H-27 Tracking Error Ramping*.

ALARM 79, Illegal power section configuration
The scaling card is the incorrect part number or not installed. Also MK102 connector on the power card could not be installed.

ALARM 80, Drive initialised to default value
Parameter settings are restored to factory settings after a manual reset. Reset the unit to clear the alarm.

ALARM 83, Illegal option combination
The mounted options are not supported to work together.

WARNING 89, Mechanical brake sliding
The hoist brake monitor has detected a motor speed > 10 RPM.

ALARM 90, Feedback monitor
Check the connection to encoder/resolver option and eventually replace the OPCENC or OPCRES.

WARNING/ALARM 104, Mixing fan fault
The fan monitor checks that the fan is spinning at power-up or whenever the mixing fan is turned on. If the fan is not operating, then the fault is annunciated. The mixing-fan fault can be configured as a warning or an alarm trip by *SP-53 Fan Monitor*.

Troubleshooting Cycle power to the frequency converter to determine if the warning/alarm returns.

ALARM 246, Power card supply
This alarm is only for 6x unit size frequency converters. It is equivalent to Alarm 46. The report value in the alarm log indicates which power module generated the alarm:

1 = left most inverter module.

2 = middle inverter module in 62 or 64 frequency converter.

2 = right inverter module in 61 or 63 frequency converter.

3 = right inverter module in 62 or 64 frequency converter.

5 = rectifier module.

WARNING 250, New spare part
A component in the frequency converter has been replaced. Reset the frequency converter for normal operation.

WARNING 251, New typecode
The power card or other components have been replaced and the typecode changed. Reset to remove the warning and resume normal operation.

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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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