GE
Industrial Solutions

AF-650 GP™
General Purpose Drive

Programming Guide

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Contents

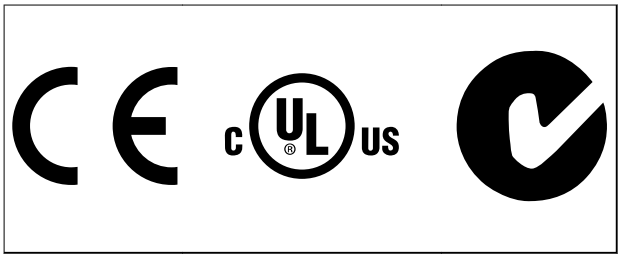
1 Introduction

1.1 Software Version

Programming Guide Software versions: 2.4x
This programming guide can be used for all General Purpose Drives AF-650 GP frequency converters with software versions 2.4x. The software version number can be read from *parameter ID-43 Software Version*.

Table 1.1 Software Version

1.2 Approvals



1.3 Definitions

1.3.1 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.

1.3.2 Input

Control command
Start and stop the connected motor with keypad and digital inputs.
Functions are divided into 2 groups.

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

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

Table 1.2 Function Groups

1.3.3 Motor

Motor running
Torque generated on output shaft and speed from 0 RPM to maximum 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).

$n_{M,N}$
Nominal 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
Instant motor voltage.

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

Break-away torque

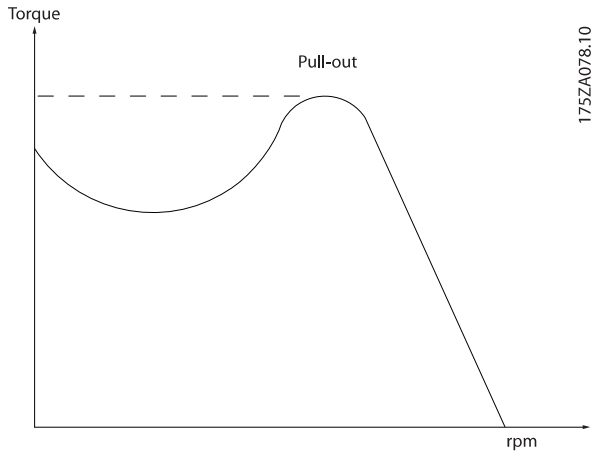


Illustration 1.1 Break-away Torque

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 Group 1 control commands - see *Table 1.2*.

Stop command
A stop command belonging to Group 1 control commands - see *Table 1.2*.

1.3.4 References

Advanced Vector Control
If compared with standard voltage/frequency ratio control, advanced 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 (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 8 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 is set in *parameter 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 is set in *parameter F-52 Minimum Reference*.

1.3.5 Miscellaneous

Analog inputs
The analog inputs are used for controlling various functions of the frequency converter.
There are 2 types of analog inputs:
Current input, 0–20 mA, and 4–20 mA
Voltage input, -10 V DC 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 2 solid-state outputs that can supply a 24 V DC (maximum 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 (10 ft) from the frequency converter, that is, 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=0.5067 mm^2.

Online/offline parameters
Changes to online 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, and so on, 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 4 set-ups. Change between the 4 parameter set-ups and edit 1 set-up, while another set-up is active.

SFAVM
Switching pattern called stator flux-oriented asynchronous vector modulation (*parameter 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 RS485 bus with the frequency converter protocol or MC protocol. See *parameter O-30 Protocol*.

Thermistor
A temperature-dependent resistor placed on the frequency converter or the motor.

Trip
A state entered in fault situations, for example if the frequency converter is subject to an overtemperature or when the frequency converter is protecting the motor, process, or mechanism. The frequency converter prevents a restart until the cause of the fault has disappeared. To cancel the trip state, restart the frequency converter. Do not use the trip state for personal safety.

Trip lock
The frequency converter enters this state in fault situations to protect itself. The frequency converter requires physical intervention, for example when there is a short circuit on the output. A trip lock can only be canceled by disconnecting mains, removing the cause of the fault, and reconnecting the frequency converter. Restart is prevented until the trip state is canceled by activating reset or, sometimes, by being programmed to reset automatically. Do not use the trip lock state for personal safety.

VT characteristics
Variable torque characteristics used for pumps and fans.

60° AVM
60° asynchronous vector modulation (*parameter F-37 Adv. Switching Pattern*).

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

$$Power\ factor = \frac{\sqrt{3}\ x\ U\ x\ I_1\ cos\phi}{\sqrt{3}\ x\ U\ x\ I_{RMS}}$$

The power factor for 3-phase control:

$$Power\ factor = \frac{I1\ x\ cos\phi 1}{I_{RMS}} = \frac{I_1}{I_{RMS}}\ since\ cos\phi 1 = 1$$

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 DC coils in the frequency converters produce a high-power factor, which minimizes the imposed load on the mains supply.

Target position
The final target position specified by positioning commands. The profile generator uses this position to calculate the speed profile.

Commanded position
The actual position reference calculated by the profile generator. The frequency converter uses the commanded position as setpoint for position PI.

Actual position
The actual position from an encoder, or a value that the motor control calculates in open loop. The frequency converter uses the actual position as feedback for position PI.

Position error
Position error is the difference between the actual position and the commanded position. The position error is the input for the position PI controller.

Position unit
The physical unit for position values.

1.4 Safety

⚠WARNING

HIGH VOLTAGE

Drives contain high voltage when connected to AC mains input, DC supply, or load sharing. Failure to perform installation, start-up, and maintenance by qualified personnel can result in death or serious injury.

- **Only qualified personnel must perform installation, start-up, and maintenance.**

Safety regulations

- Disconnect mains supply to the frequency converter 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. For information about the discharge time, see *Table 1.3*.
- [Off] does not disconnect the mains supply and must not be used as a safety switch.
- Ground the equipment properly, protect the user against supply voltage, and protect the motor against overload in accordance with applicable national and local regulations.
- The ground leakage current exceeds 3.5 mA. Ensure correct grounding of the equipment by a certified electrical installer.
- 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.
- 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 is installed. Check that all voltage sources have been disconnected and that the necessary time has elapsed before commencing repair work. For information about the discharge time, see *Table 1.3*.

⚠WARNING

UNINTENDED START

When the frequency converter is connected to AC mains, DC supply, or load sharing, the motor may start at any time. Unintended start during programming, service, or repair work can result in death, serious injury, or property damage. The motor can start via an external switch, a fieldbus command, an input reference signal from the keypad, or after a cleared fault condition.
To prevent unintended motor start:

- **Disconnect the frequency converter from the mains.**
- **Press [Off/Reset] on the keypad before programming parameters.**
- **Completely wire and assemble the frequency converter, motor, and any driven equipment before connecting the frequency converter to AC mains, DC supply, or load sharing.**

⚠WARNING

DISCHARGE TIME

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

1. **Stop the motor.**
2. **Disconnect AC mains, permanent magnet type motors, and remote DC-link supplies, including battery back-ups, UPS, and DC-link connections to other frequency converters.**
3. **Wait for the capacitors to discharge fully, before performing any service or repair work. The duration of waiting time is specified in *Table 1.3*.**

Voltage [V]	Power size [kW (hp)]	Minimum waiting time (minutes)
200–240	0.25–3.7 (1/3–5)	4
	5.5–37 (7.5–50)	15
380–500	0.37–7.5 (1/2–10)	4
	11–75 (15–100)	15
	90–250 (125–350)	20
	315–800 (450–1200)	40
525–600	0.75–7.5 (1–10)	4
	11–75 (15–100)	15
525–690	11–75 (15–100)	15
	90–315 (125–400)	20
	355–1200 (500–1350)	30

Table 1.3 Discharge Time

NOTICE

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, for example, when controlling the electromagnetic brake function of a hoist application, these control signals must not be relied on exclusively.

NOTICE

Hazardous situations must be identified by the machine builder/integrator who is responsible for considering the necessary preventive means. More monitoring and protective devices may be included, always according to valid national safety regulations, for example, law on mechanical tools and regulations for the prevention of accidents.

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, for example:

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 enters the protection mode. Protection mode means a change of the PWM modulation strategy and a low switching frequency to minimize losses. This continues for 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.

Protection mode can be disabled by setting *parameter SP-26 Trip Delay at Drive Fault* to 0, which means that the frequency converter trips immediately if 1 of the hardware limits is exceeded.

1.5 Electrical Wiring

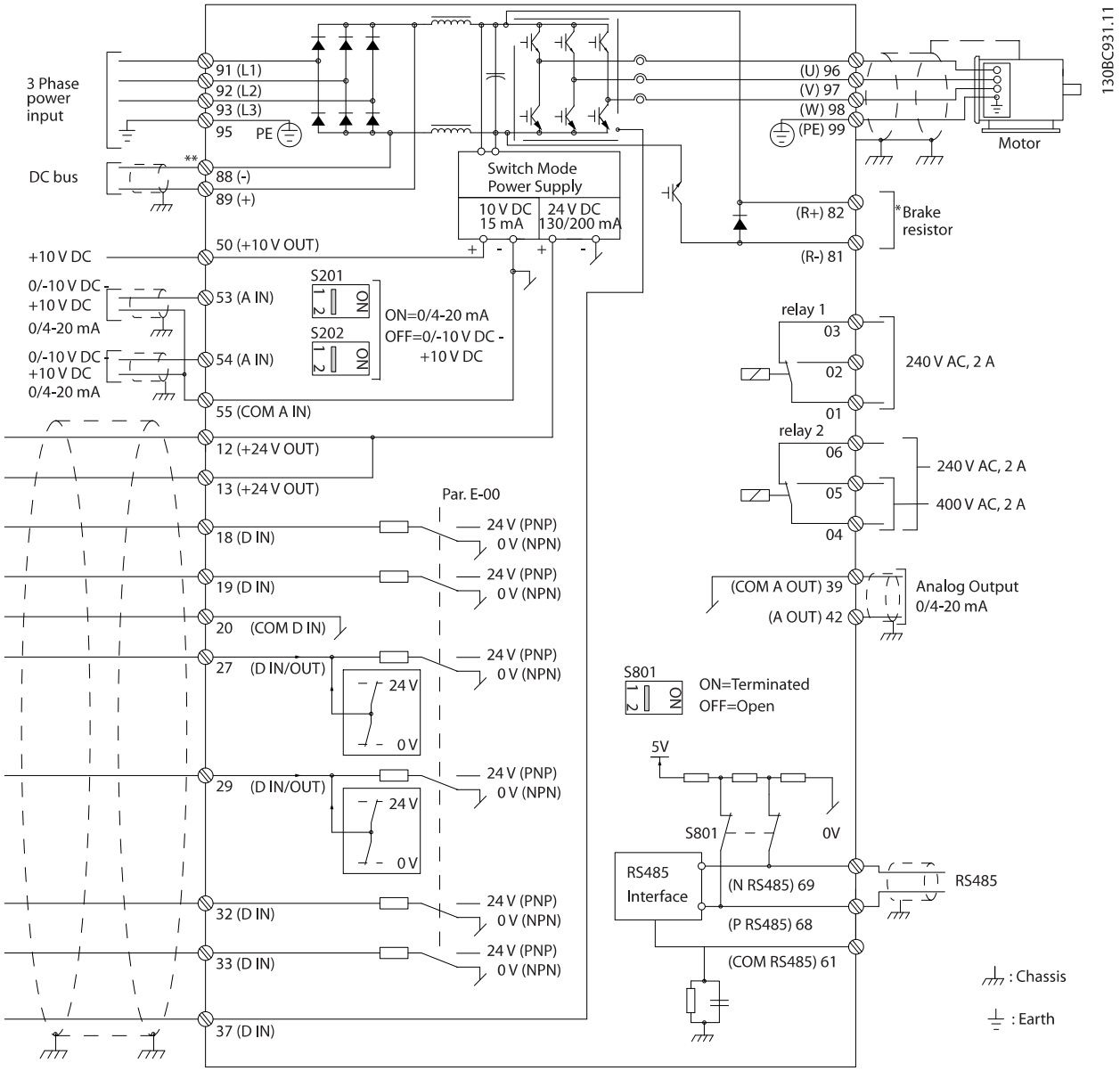


Illustration 1.2 Basic Wiring Schematic Drawing

A=Analog, D=Digital
Terminal 37 is used for Safe Torque Off. For Safe Torque Off installation instructions, refer to the Design and Installation Guide DET-767.
*The brake chopper factory option must be ordered to use dynamic brake 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 ground loops due to noise from mains supply cables.

If 50/60 Hz ground loops occur, consider breaking the shield or insert a 100 nF capacitor between shield and enclosure.

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

Input polarity of control terminals

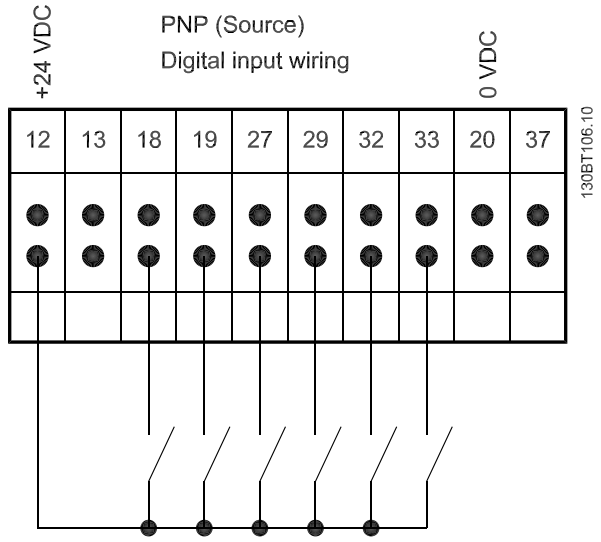


Illustration 1.3 PNP (Source)

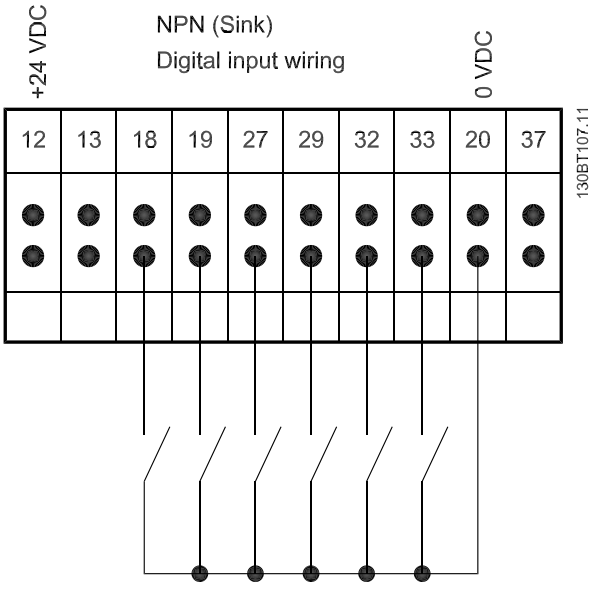


Illustration 1.4 NPN (Sink)

NOTICE

Control cables must be screened/armored.

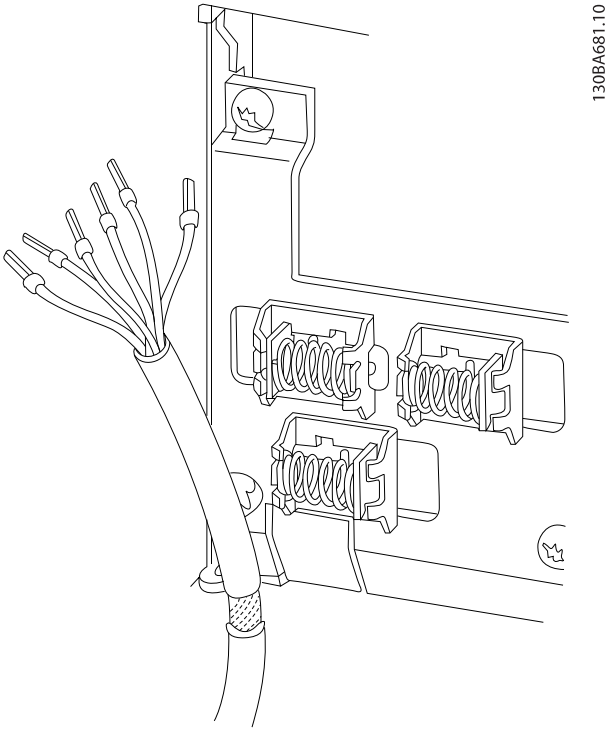
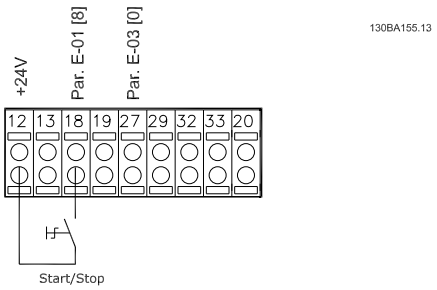


Illustration 1.5 Grounding of Shielded/Armored Control Cables

1.5.1 Start/Stop

Terminal 18 = *parameter E-01 Terminal 18 Digital Input [8] Start*.
Terminal 37 = Safe Torque Off (where available).



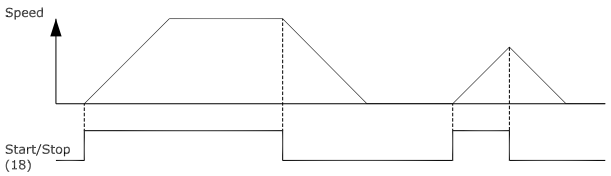


Illustration 1.6 Start/Stop

1.5.2 Pulse Start/Stop

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

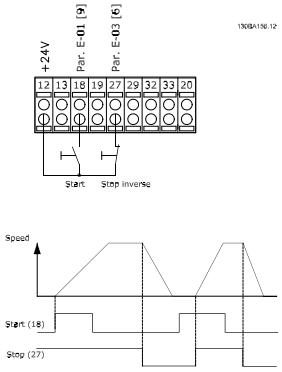


Illustration 1.7 Pulse Start/Stop

1.5.3 Speed Up/Down

Terminals 29/32 = Speed up/down

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

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

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

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

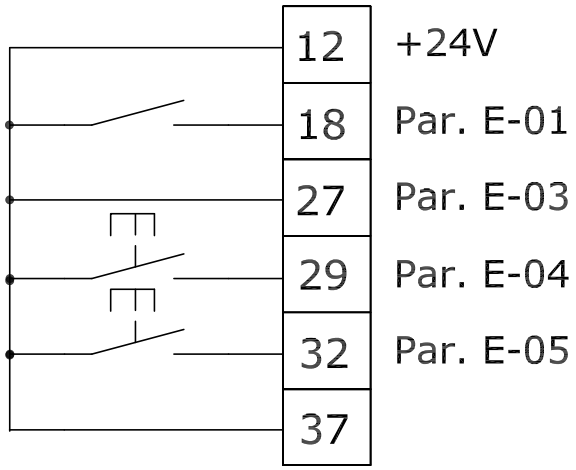


Illustration 1.8 Speed Up/Down

1.5.4 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 reference/feedback = 0 RPM.

Terminal 53, high reference/feedback = 1500 RPM.

Switch S201 = OFF (U)

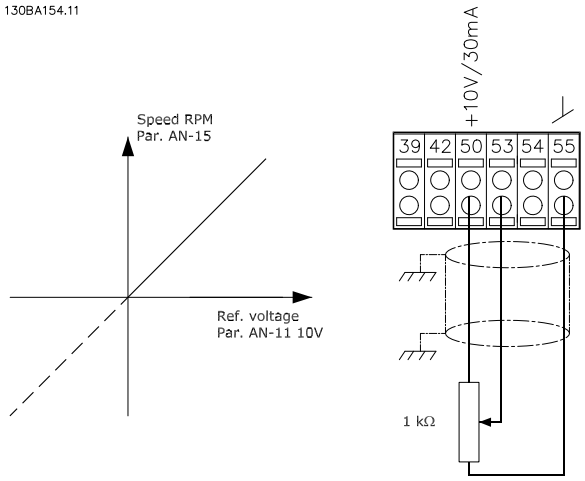


Illustration 1.9 Potentiometer Reference

2 How to Program

2

2.1 The Keypad

Easy programming of the frequency converter is performed by the keypad.

The keypad is divided into 4 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.
4. Operation keys and indicator lights.

The LCP display can show up to 5 items of operating data while showing *Status*.

Display lines:

a. **Status line:** Status messages showing icons and graphics.

b. **Line 1–2:** Operator data lines showing data defined or selected. Add up to 1 extra line by pressing [Status].

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

NOTICE

If start-up is delayed, the LCP shows the INITIALIZiNG message until it is ready. Adding or removing options may delay the start-up.

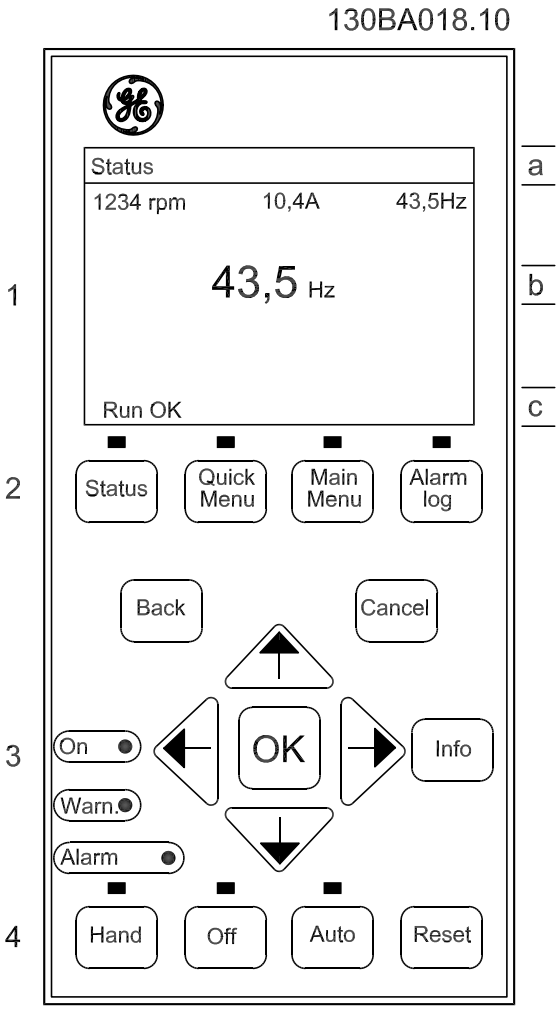


Illustration 2.1 Keypad

2.1.1 The LCD Display

The display has backlight and a total of 6 alpha-numeric lines. The display lines show the direction of rotation (arrow), the selected set-up and the programming set-up. The display is divided into 3 sections.

Top section
The 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
The bottom section always shows the state of the frequency converter in *Status* mode.

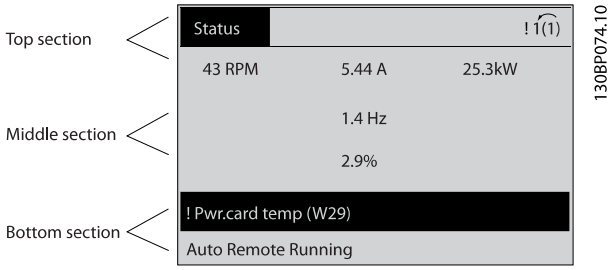


Illustration 2.2 Display

The active set-up (selected as the active set-up in *parameter 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 *parameter K-60 Main Menu Password* or via *parameter K-65 Quick Menu Password*.

Indicator lights
If certain threshold values are exceeded, the alarm and/or warning indicator lights up. A status and alarm text appear on the keypad.
The ON indicator light is activated when the frequency converter receives mains voltage or via a DC bus terminal or 24 V external supply option (OPC24VPS) supply. At the same time, the back indicator light is on.

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

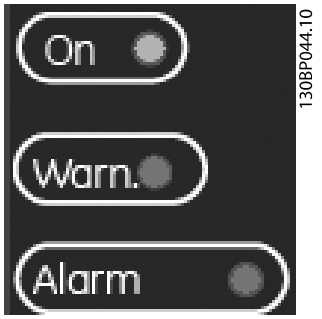


Illustration 2.3 Indicator Lights

Keypad keys
The control keys are divided into functions. The keys below the display and indicator lights are used for parameter set-up, including option of display indication during normal operation.

Illustration 2.4 LCP Keys

[Status]
Indicates the status of the frequency converter and/or the motor. Select between 3 different readouts by pressing [Status]: 5 line readouts, 4 line readouts, or logic controller. Press [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 the alarm mode. Also use [Status] to toggle single or double readout 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 s. The parameter shortcut allows direct access to any parameter.

2

[Alarm Log]
Shows an alarm list of the 5 latest alarms (numbered A1–A5). To obtain extra details about an alarm, press the navigation keys to maneuver to the alarm number and press [OK]. Information is shown about the condition of the frequency converter before it enters the alarm mode.

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

[Cancel]
Last change or command is canceled 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 4 navigation keys are used to navigate between the different options available in Quick Menu, Main Menu, and Alarm Log. Press the keys to move the cursor.

[OK]
Use for selecting a parameter marked by the cursor and for enabling the change of a parameter.

Local control keys
Local control keys are 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 with the navigation keys. The key can be selected as *[1] Enable* or *[0] Disable* via *parameter K-40 [Hand] Button on Keypad*
External stop signals activated with control signals or a fieldbus override a start command via the keypad.

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

- [Hand] - [Off] - [Auto].
- Reset.
- Coast 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 *parameter 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 starts. The key can be selected as *[1] Enable* or *[0] Disable* via *parameter K-42 [Auto] Button on Keypad*.

NOTICE

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 *parameter K-43 [Reset] Button on Keypad*.

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

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.

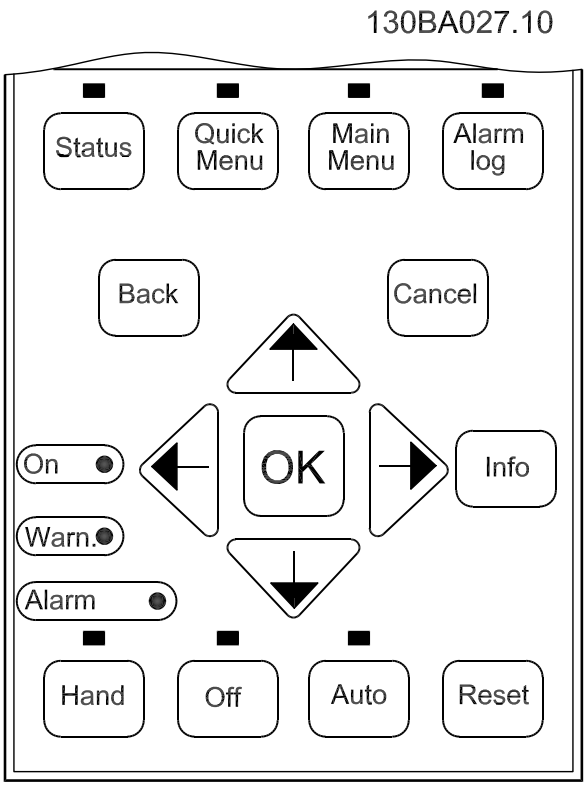


Illustration 2.9 Keypad

Data storage in keypad

NOTICE

Stop the motor before performing this operation.

To store the data in the LCP:

1. Go to *parameter K-50 Keypad Copy*.
2. Press the [OK] key.
3. Select *[1] 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

NOTICE

Stop the motor before performing this operation.

To transfer the data from the LCP to the frequency converter:

1. Go to *parameter K-50 Keypad Copy*.
2. Press the [OK] key.
3. Select *[2] 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 Readouts

It is possible to toggle between 3 status readout screens by pressing [Status].
Operating variables with different formatting are shown in each status view further in this section.

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

- *Parameter K-20 Display Line 1.1 Small*.
- *Parameter K-21 Display Line 1.2 Small*.
- *Parameter K-22 Display Line 1.3 Small*.
- *Parameter K-23 Display Line 2 Large*.
- *Parameter K-24 Display Line 3 Large*.

Each readout parameter selected in *parameter K-20 Display Line 1.1 Small* to *parameter K-24 Display Line 3 Large* has its own scale and digits after a possible decimal point. The larger the numeric value of a parameter is, the fewer digits are displayed after the decimal point.
Example: Current readout 5.25 A, 15.2 A, 105 A.

Operating variable	Unit
Parameter DR-00 Control Word	hex
Parameter DR-01 Reference [Unit]	[Unit]
Parameter DR-02 Reference [%]	%
Parameter DR-03 Status Word	hex
Parameter DR-05 Main Actual Value [%]	%
Parameter DR-10 Power [kW]	[kW]
Parameter DR-11 Power [hp]	[hp]
Parameter DR-12 Motor Voltage	[V]

2

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

Table 2.1 Units

Status view I

This readout state is standard after start-up or initialization. Press [Info] to obtain information about the units linked to the shown operating variables (1.1, 1.2, 1.3, 2 and 3). See the operating variables shown in *Illustration 2.10*.

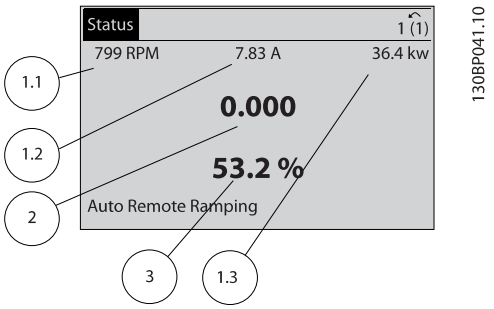


Illustration 2.10 Status View I

Status view 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 lines.

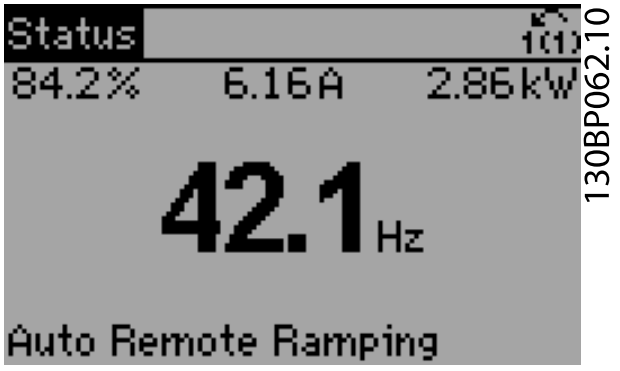


Illustration 2.11 Status View II

Status view III

This state shows the event and action of the Logic Controller. For further information, see *chapter 3.20 LC-## Logic Controller*.

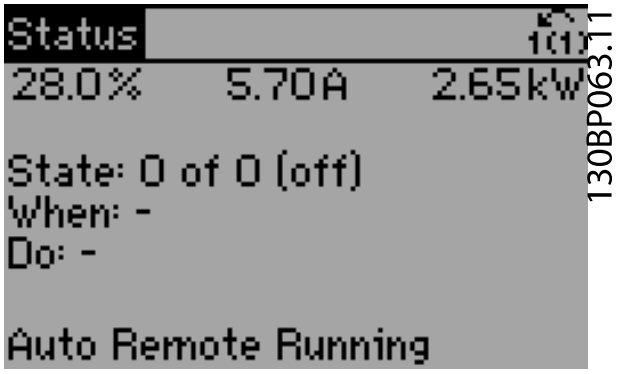


Illustration 2.12 Status View III

2.1.5 Parameter Set-up

The frequency converter can be used for practically all assignments. The frequency converter offers an option between 2 programming modes:

- Main menu mode.
- Quick menu mode.

Main menu provides access to all parameters. Quick menu 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.

2.1.6 Quick Menu Key Functions

Press [Quick Menu] to enter a list of different areas contained in the *Quick Menu*.

Illustration 2.13 Quick Menus

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

The parameter selection is effected with the navigation keys. The parameters in *Table 2.2* are accessible.

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

Table 2.2 Selection of Parameter

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 readouts. The information is shown as graphs.
Only parameters selected in *parameter K-20 Display Line 1.1 Small* and *parameter 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

2

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

Press				
Parameter P-04 Auto Tune	OK	Set desired auto tune function. Enable complete auto tune is recommended		

Table 2.3 Quick Set-up Procedure

2

2.1.8 Main Menu Mode

Press [Main Menu] to enter the main menu mode. The readout in *Illustration 2.14* appears on the display.
The middle and bottom sections in the display show a list of parameter groups, which can be selected by toggling the [▲] and [▼] keys.

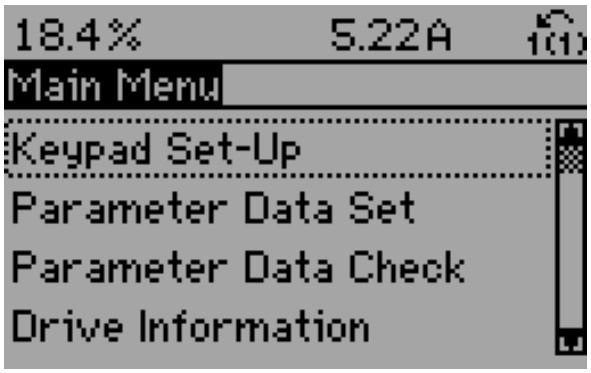


Illustration 2.14 Main Menu Mode

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 (*parameter H-40 Configuration Mode*), some parameters can be hidden. For example, 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, select a parameter with the navigation keys.
The middle section on the display shows the parameter number and name, and the selected parameter value.

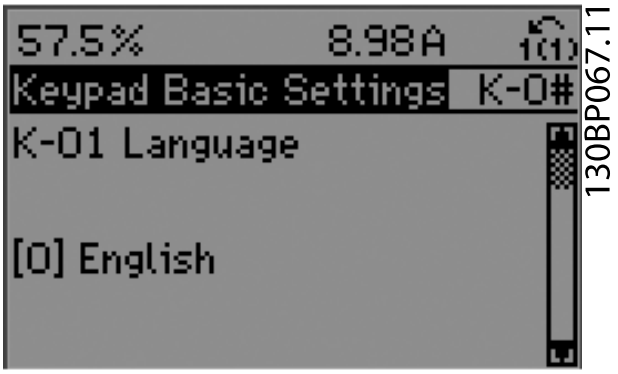


Illustration 2.15 Parameter Selection

2.1.10 Changing Data

The procedure for changing data is the same in the quick menu mode 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 numeric 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].

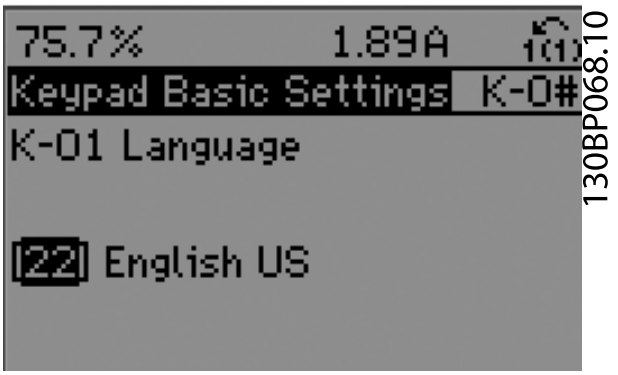


Illustration 2.16 Changing a Text Value

2.1.12 Changing a Data Value

If the selected parameter shows a numeric data value, change the selected data value with the [◄] [►] navigation keys and the [▲] [▼] navigation keys. Press [◄] [►] keys to move the cursor horizontally.

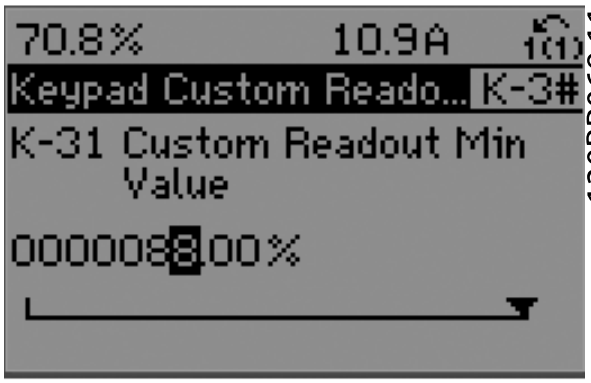


Illustration 2.17 Changing a Data Value

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 selected parameter shows a numeric data value, select a digit with [◄] [►].

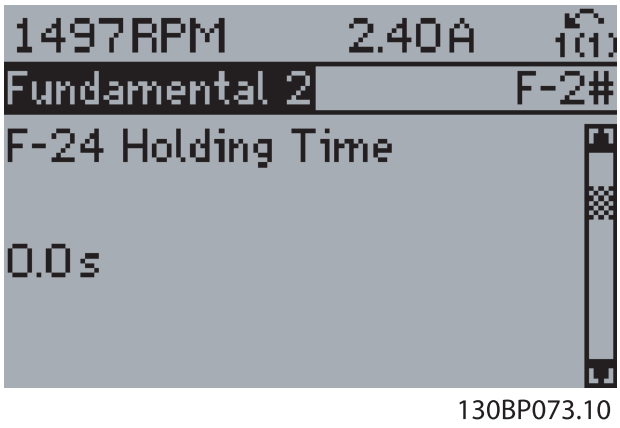


Illustration 2.19 Selecting a Digit

Change the selected digit infinitely variably with [▲] [▼]. The cursor indicates the selected digit. 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. This applies to:

- *Parameter P-07 Motor Power [kW].*
- *Parameter F-05 Motor Rated Voltage.*
- *Parameter F-04 Base Frequency.*

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

2

2.1.15 Readout and Programming of Indexed Parameters

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

For example, *parameter C-05 Multi-step Frequency 1 - 8* is changed as follows:

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

2.1.16 Local Control Keys

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

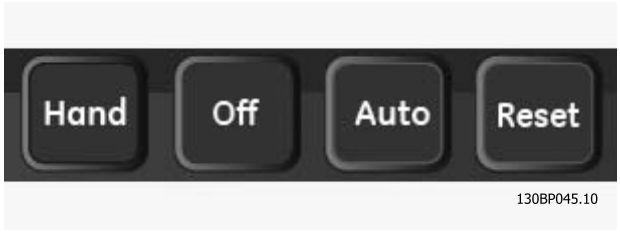


Illustration 2.20 Keypad Keys

[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 with the navigation keys. The key can be selected as *[1] Enable* or *[0] Disable* via *parameter K-40 [Hand] Button on Keypad*.
External stop signals activated with control signals, or a fieldbus, override a start command via the keypad.

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

- [Hand] - [Off] - [Auto].
- Reset.
- Coast 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 *parameter 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 control of the frequency converter 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 starts. The key can be selected as *[1] Enable* or *[0] Disable* via *parameter K-42 [Auto] Button on Keypad*.

NOTICE

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

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

2.1.17 Restoring Drive to Factory Settings

The drive can be restored to factory settings in 2 ways.

Recommended

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

Parameter H-03 Restore Factory Settings restores all except:

- *Parameter SP-50 RFI Filter*.
- *Parameter O-30 Protocol*.
- *Parameter O-31 Address*.
- *Parameter O-32 Drive Port Baud Rate*.
- *Parameter O-35 Minimum Response Delay*.
- *Parameter O-36 Max Response Delay*.
- *Parameter O-37 Max Inter-Char Delay*.
- *Parameter ID-00 Operating hours* to *parameter ID-05 Over Volt's*.
- *Parameter ID-20 Historic Log: Event* to *parameter ID-22 Historic Log: Time*.

- *Parameter ID-30 Fault Log: Error Code* to *parameter 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] during power-up.
3. Release the keys after 5 s.
4. The frequency converter is now programmed according to default settings.

Manual restores all except:

- *Parameter ID-00 Operating hours*.
- *Parameter ID-03 Power Up's*.
- *Parameter ID-04 Over Temp's*.
- *Parameter ID-05 Over Volt's*.

NOTICE

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

3 Parameter Descriptions

3.1 Parameter Selection

3

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
LG-##	Logs & I/O Opt Status
LC-##	Logic Controller
B-##	Braking Functions
PI-##	PID Controls
SF-##	Special Features
IO-##	Programmable I/O Option

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.

3.2.1 K-0# Keypad Basic Settings

Parameters for configuring basic drives settings.

K-01 Language		
Option:		**Function:**
		Defines display language.
[0] *	English	
[1]	Deutsch	
[2]	Francais	
[4]	Spanish	
[5]	Italiano	
[10]	Chinese	
[12]	Bras.port	
[22]	English US	
[24]	Russian	

K-02 Motor Speed Unit		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** ***NOTICE*** **Changing the motor speed unit resets certain parameters to their initial value. Select the motor speed unit before modifying other parameters.**
[0]	RPM	Select to show motor speed variables and parameters using motor speed (RPM).
[1] *	Hz	Select to show motor speed variables and parameters using output frequency (Hz).

K-03 Regional Settings		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.**
[0]	Interna-tional	Activates *parameter P-07 Motor Power [kW]* for setting the motor power in kW and sets the default value of *parameter F-04 Base Frequency* to 50 Hz.
[1] *	US	Activates *parameter P-07 Motor Power [kW]* for setting the motor power in hp and sets the default value of *parameter 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 on mode.
[0]	Resume	Restarts the frequency converter, maintaining the start/stop settings (applied by [Hand On/ Off]) selected before the power-down of the frequency converter.
[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 *parameter 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 *parameter K-12 This Set-up Linked to* is programmed as required. Using *parameter 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 *parameter K-51 Set-up Copy* it is possible to copy parameter settings between the setups to enable quicker commis-

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sioning if similar parameter settings are required in different setups.

K-10 Active Set-up		
Option:		**Function:**
		Select the set-up to control the frequency converter functions.
[0]	Factory setup	Cannot be changed. It contains the GE data set and can be used as a data source when returning the other set-ups to a known state.
[1] *	Set-up 1	*[1] Set-up 1* to *[4] Set-up 4* are the 4 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 set-up selections using digital inputs and the serial communication port. This set-up uses the settings from *parameter K-12 This Set-up Linked to*. Stop the frequency converter before making changes to open and closed loop functions.

Use *parameter K-51 Set-up Copy* to copy a set-up to 1 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 2 different set-ups, link the set-ups together using *parameter K-12 This Set-up Linked to*. Parameters which are *not changeable during operation* are marked FALSE in the parameter lists in *chapter 4 Parameter Lists*.

K-11 Edit Set-up		
Option:		**Function:**
		Select the set-up to be edited (that is programmed) during operation; either the active set-up or 1 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 selected set-up from a range of sources: Keypad, Drive RS485, Drive USB, or up to 5 Network sites.

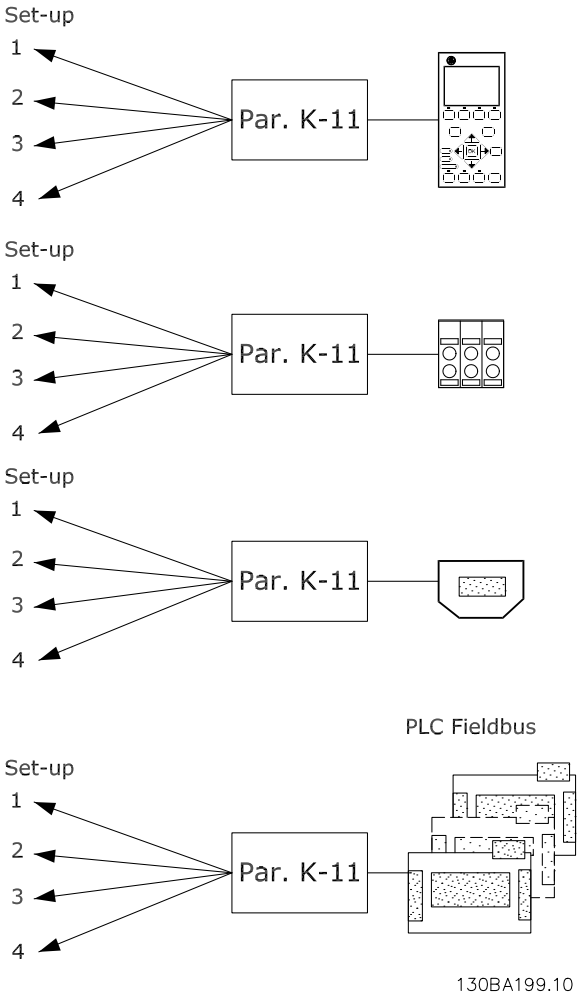
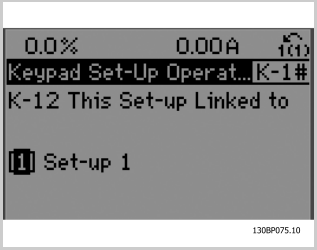
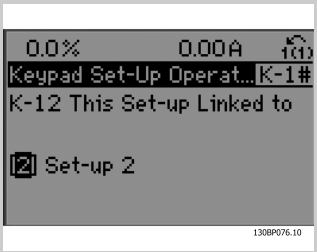


Illustration 3.1 Edit Set-up

K-12 This Set-up Linked to		
Option:		**Function:**
		To enable conflict-free changes from 1 set-up to another during operation, link set-ups containing parameters which are not changeable during operation. The link ensures synchronizing of the *not changeable during operation*-parameter values when moving from 1 set-up to another during operation. *Not changeable during operation*-parameters can be identified by the label FALSE in the parameter lists in *chapter 4 Parameter Lists*. *Parameter K-12 This Set-up Linked to* is used by *[9] Multi set-up* in *parameter K-10 Active Set-up*. Multi set-up is used to move from 1 set-up to another during operation (that is while the motor runs). Example: Use multi set-up to shift from set-up 1 to Set-up 2 while the motor runs. Program in set-up 1 first, then ensure that set-up 1 and set-up 2 are

K-12 This Set-up Linked to

Option:		Function:
		synchronized (or linked). Synchronization can be performed in 2 ways: 1. Change the edit set-up to *[2] Set-up 2* in *parameter K-11 Edit Set-up* and set *parameter K-12 This Set-up Linked to* to *[1] Set-up 1*. This starts the linking (synchronizing) process.  **Illustration 3.2 Set-up 1** OR 2. While still in set-up 1, copy set-up 1 to set-up 2. Then set *parameter K-12 This Set-up Linked to* to *[2] Set-up 2*. This starts the linking process.  **Illustration 3.3 Set-up 2** When completed, *parameter K-13 Readout: Linked Set-ups* reads {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, for example *parameter P-30 Stator Resistance (Rs)*, in set-up 2, they are also 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 *parameter K-12 This Set-up Linked to*. The parameter has 1 index for each parameter set-up. The value for each index shows which set-ups are linked to that parameter set-up.

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

Table 3.3 Set-up Link Example

K-14 Readout: Edit Set-ups / Channel

Range:		Function:
0*	[-2147483648 - 2147483647]	View the setting of *parameter K-11 Edit Set-up* for each of the 4 different communication channels. When the number is displayed as a hex number, as it is in the keypad, each number represents 1 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 the following: • The frequency converter received the setting set-up 2 via a fieldbus channel. This selection is reflected in *parameter K-11 Edit Set-up*. • A user selected set-up 1 via the keypad. • All other channels are using the active set-up.

K-15 Readout: Actual Set-up

Range:		Function:
0*	[0 - 255]	Makes it possible to read out the active set-up, also when [9] Multi set-up is selected in *parameter K-10 Active Set-up*.

3.2.3 K-2# Keypad Display

Define the variables displayed in the keypad.

3

NOTICE

Please refer to *parameter K-37 Display Text 1*, *parameter K-38 Display Text 2* and *parameter 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 *parameter 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 *parameter 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.
[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-24 Display Line 3 Large

Select a variable for display in line 3.

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 are 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 (for example 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 are 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 1 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 *parameter 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 *parameter K-30 Unit for Custom Readout*, *parameter K-31 Min Value of Custom Readout* (linear only), *parameter K-32 Max Value of Custom Readout*, *parameter F-17 Motor Speed High Limit [RPM]*, *parameter F-15 Motor Speed High Limit [Hz]* and actual speed.

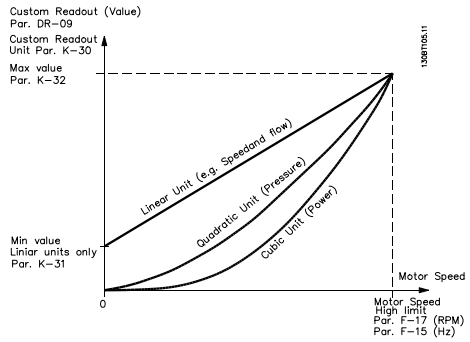


Illustration 3.4

The relation will depend on the type of unit selected in *parameter 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 3.4

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 has a linear, squared, or cubed relation to speed. This relation depends on the unit selected (see *Table 3.4*). The actual calculated value can be read in *parameter DR-09 Custom Readout*, and/or shown in the display by selecting *[DR-09] Custom Readout* in *parameter K-20 Display Line 1.1 Small* to *parameter 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	

K-30 Unit for Custom Readout

Option:		Function:
[32]	kg/h	
[33]	t/min	
[34]	t/h	
[40]	m/s	
[41]	m/min	
[45]	m	
[60]	°C	
[70]	mbar	
[71]	bar	
[72]	Pa	
[73]	kPa	
[74]	m WG	
[80]	kW	
[120]	GPM	
[121]	gal/s	
[122]	gal/min	
[123]	gal/h	
[124]	CFM	
[125]	ft^3/s	
[126]	ft^3/min	
[127]	ft^3/h	
[130]	lb/s	
[131]	lb/min	
[132]	lb/h	
[140]	ft/s	
[141]	ft/min	
[145]	ft	
[160]	°F	
[170]	psi	
[171]	lb/in^2	
[172]	in WG	
[173]	ft WG	
[176]	kpsi	
[177]	MPa	
[178]	kBar	
[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 when selecting a linear unit in *parameter K-30 Unit for Custom Readout*. For quadratic and cubic units, the minimum value is 0.

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

K-37 Display Text 1		
Range:		**Function:**
0*	[0 - 25]	Enter a text which can be viewed in the graphical display by selecting *[37] Display Text 1* in • *Parameter K-20 Display Line 1.1 Small*, • *Parameter K-21 Display Line 1.2 Small*, • *Parameter K-22 Display Line 1.3 Small*, • *Parameter K-23 Display Line 2 Large*, or • *Parameter K-24 Display Line 3 Large*.

K-38 Display Text 2		
Range:		**Function:**
0*	[0 - 25]	Enter a text which can be viewed in the graphical display by selecting *[38] Display Text 2* in • *parameter K-20 Display Line 1.1 Small*, • *parameter K-21 Display Line 1.2 Small*, • *parameter K-22 Display Line 1.3 Small*, • *parameter K-23 Display Line 2 Large*, or • *parameter K-24 Display Line 3 Large*.

K-39 Display Text 3		
Range:		**Function:**
0*	[0 - 25]	Enter a text which can be viewed in the graphical display by selecting *[39] Display Text 3* in • *parameter K-20 Display Line 1.1 Small*, • *parameter K-21 Display Line 1.2 Small*, • *parameter K-22 Display Line 1.3 Small*, • *parameter K-23 Display Line 2 Large*, or • *parameter 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	Select to disable the key.

K-40 [Hand] Button on Keypad		
Option:		**Function:**
[1] *	Enabled	[Hand] key enabled.
[2]	Password Protection	Avoid unauthorized start in hand-on mode. If *parameter K-40 [Hand] Button on Keypad* is included in *Quick Start Menu*, define the password in *parameter K-65 Quick Menu Password*. Otherwise, define the password in *parameter K-60 Main Menu Password*.

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

K-42 [Auto] Button on Keypad		
Option:		**Function:**
[0]	Disabled	Avoids accidental start of the frequency converter in *Auto On* mode.
[1] *	Enabled	[Auto] Key enabled
[2]	Password Protection	Avoids unauthorized start in *Auto On* mode. If *parameter K-42 [Auto] Button on Keypad* is included in the *Quick Menu*, then define the password in *parameter K-65 Quick Menu Password*.

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 unauthorized resetting. If *parameter K-43 [Reset] Button on Keypad* is included in the *Quick Menu*, then define the password in *parameter K-65 Quick Menu Password*.
[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 option *[2] Password*).

3

3.2.6 K-5# Copy/Save

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

K-50 Keypad Copy		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.**
[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.
[10]	Delete LCP copy data	Use to delete the copy after the transfer is complete.

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 *parameter 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 *parameter 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 *parameter 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 *parameter K-11 Edit Set-up*) to set-up 4.
[9]	Copy to all	Copies the parameters in the present set-up 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 *parameter K-61 Access to Main Menu w/o Password* is set to *[0] Full access*, this parameter is ignored.

K-61 Access to Main Menu w/o Password		
Option:		**Function:**
[0] *	Full access	Disables password defined in *parameter K-60 Main Menu Password*.
[1]	Keypad: Read only	Prevents unauthorized editing of *Main Menu* parameters.
[2]	Keypad: No access	Prevents 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, *parameter K-60 Main Menu Password*, *parameter K-65 Quick Menu Password*, and *parameter K-66 Access to Quick Menu w/o Password* are 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 *parameter K-66 Access to Quick Menu w/o Password* is set to *[0] Full access*, this parameter is ignored.

K-66 Access to Quick Menu w/o Password		
If *parameter K-61 Access to Main Menu w/o Password* is set to *[0] Full access* then this parameter is ignored.		
Option:		**Function:**
[0] *	Full access	Disables the password defined in *parameter 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.

K-66 Access to Quick Menu w/o Password		
If *parameter K-61 Access to Main Menu w/o Password* is set to *[0] Full access* then this parameter is ignored.		
Option:		**Function:**
[6]	All: No access	No access from keypad, Fieldbus or Drive standard bus is allowed.

K-67 Bus Password Access		
Range:		**Function:**
0*	[0 - 9999]	Use this parameter to unlock the frequency converter via network or 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. *Parameter F-01 Frequency Setting 1*, *parameter C-30 Frequency Command 2*, and *parameter C-34 Frequency Command 3* define up to 3 different reference signals. The sum of these reference signals defines the actual reference.
[0]	No function	
[1] *	Analog Input 53	
[2]	Analog Input 54	
[7]	Frequency input 29	
[8]	Frequency input 33	
[11]	Local bus reference	
[20]	Digital Potenti-ometer	
[21]	Analog input X30/11	OPCPRGIO
[22]	Analog input X30/12	OPCPRGIO
[26]	Analog Input X49/1	
[27]	Analog Input X49/3	
[28]	Analog Input X49/5	

F-02 Operation Method

Option:		Function:
		Select which reference site to activate.
[0] *	Linked to Hand / Auto	Use local reference when in hand-on mode, or remote reference when in auto-on mode.
[1]	Remote	Use remote reference in both hand-on mode and auto-on mode.
[2]	Local	Use local reference in both hand-on mode and auto-on mode. ***NOTICE*** **When set to *[2] Local*, the frequency converter starts with this setting again after a power-down.**

F-03 Max Output Frequency 1

Range:		Function:
100.0 Hz*	[1 - 590 Hz]	***NOTICE*** **This parameter cannot be adjusted while the motor is running.** ***NOTICE*** **Maximum output frequency cannot exceed 10% of the carrier frequency (*parameter F-26 Motor Noise (Carrier Freq)*).** Provides a final limit on the output frequency for improved safety in applications where overspeeding is to be avoided. This limit is final in all configurations (independent of the setting in *parameter H-40 Configuration Mode*).

F-04 Base Frequency

Range:		Function:
50 Hz*	[20 - 1000 Hz]	Minimum to maximum motor frequency: 20–590 Hz. Select the motor frequency value from the motor nameplate data. If a value other than 50 Hz or 60 Hz is selected, adapt the load-independent settings in *parameter H-50 Motor Magnetisation at Zero Speed* to *parameter H-53 Model Shift Frequency*. For 87 Hz operation with 230/400 V motors, set the nameplate data for 230 V/50 Hz. To run at 87 Hz, adapt *parameter F-17 Motor Speed High Limit [RPM]* and *parameter F-53 Maximum Reference*.

F-05 Motor Rated Voltage

Range:		Function:
500 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. Select a accel time which prevents the output current from exceeding the current limit in *parameter F-43 Current Limit* during ramping. The value 0.00 corresponds to 0.01 s in speed mode. See decel time in *parameter 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, i.e. the deceleration time from the synchronous motor speed n_s to 0 RPM. Select a decel time such that no overvoltage occurs in the inverter due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in *parameter F-43 Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See accel time in *parameter F-07 Accel Time 1*. $Par.\ F-08 = \frac{t_{dec}\,[s]\ x\ n_s\,[RPM]}{ref\ [RPM]}$

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	Changeover
0.25 - 7.5 kW	<10 Hz

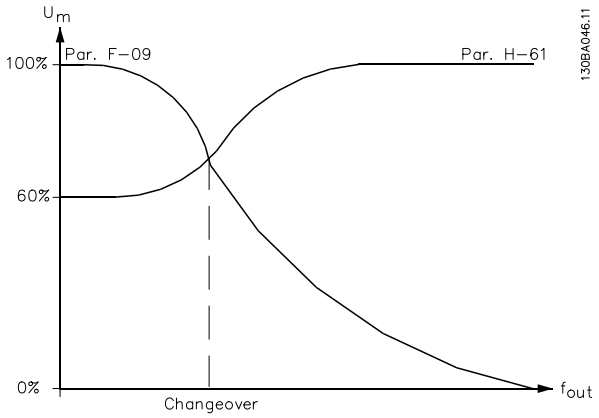


Illustration 3.5 Changeover

3.3.2 F-1# Fundamental 1

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

F-10 Electronic Overload		
Option:		**Function:**
		Motor thermal protection can be implemented using a range of techniques: • Via a PTC sensor in the motor windings connected to 1 of the analog or digital inputs (*parameter F-12 Motor Thermistor Input*). See *chapter 3.3.3.1 PTC Thermistor Connection*. • Via a KTY sensor in the motor winding connected to an analog input (*parameter H-96 KTY Thermistor Input*). See *chapter 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 *chapter 3.3.3.3 Electronic Thermal Overload*. • Via a mechanical thermal switch (Klixon type). See *chapter 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 overtemperature.
[2]	Thermistor trip	Stops (trips) the frequency converter when connected thermistor or KTY sensor in the motor reacts in the event of motor overtemperature. The thermistor cut-out value must be more than 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 1 of the digital outputs.
[4] *	Elec. OL Trip 1	Calculates the load when set-up 1 is active and stops (trips) the frequency converter when the motor is overloaded. Program a warning signal via 1 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	

3

F-10 Electronic Overload		
Option:		**Function:**
[6]	Elec. OL Trip 2	
[7]	Elec. OL Warning 3	
[8]	Elec. OL Trip 3	
[9]	Elec. OL Warning 4	
[10]	Elec. OL Trip 4	

3.3.3.1 PTC Thermistor Connection

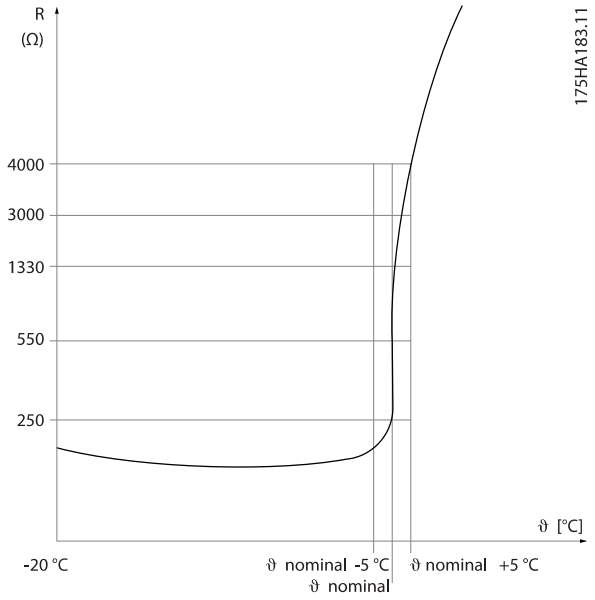


Illustration 3.6 PTC Profile

Using a digital input and 10 V as supply:
Example: The frequency converter trips when the motor temperature is too high.
Parameter set-up:

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

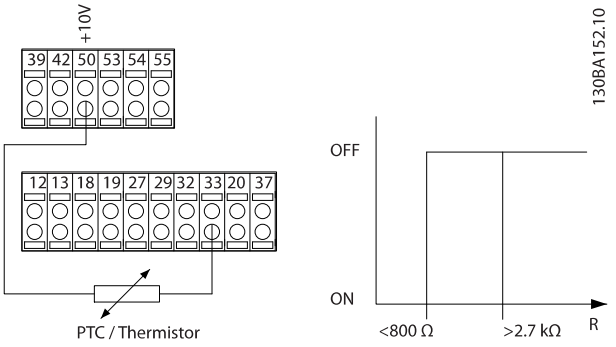


Illustration 3.7 PTC Thermistor Connection - Digital Input

Using an analog input and 10 V as supply:
Example: The frequency converter trips when the motor temperature is too high.
Parameter set-up:

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

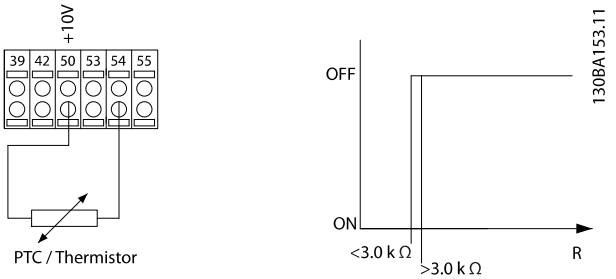


Illustration 3.8 PTC Thermistor Connection - Analog Input

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

Table 3.5 Threshold Cutout Values

NOTICE

Check that the selected 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 (*parameter P-30 Stator Resistance (Rs)*) for PM motors and also rotor resistance (*parameter 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 (*parameter H-97 KTY Threshold level*).
AF-650 GP can handle 3 types of KTY sensors, defined in *parameter H-95 KTY Sensor Type*. The actual sensor temperature can be read out from *parameter DR-19 KTY sensor temperature*.

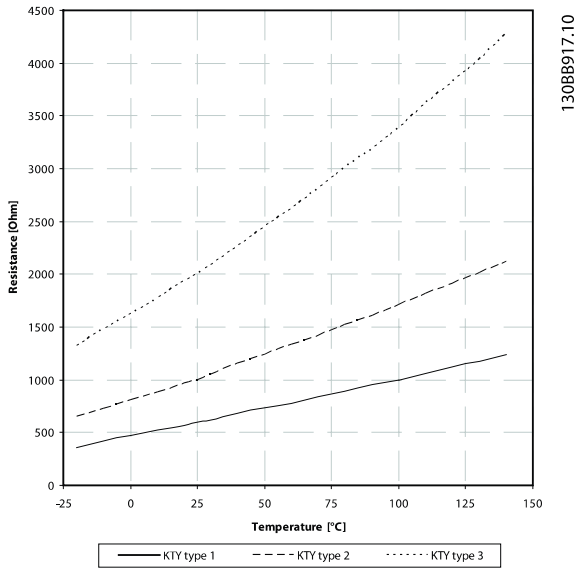


Illustration 3.9 KTY Type Selection

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

NOTICE

If the temperature of the motor is utilized through a thermistor or KTY sensor, the PELV is not complied with if there are short circuits between motor windings and the sensor. Put extra isolation on the sensor to comply with PELV.

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.

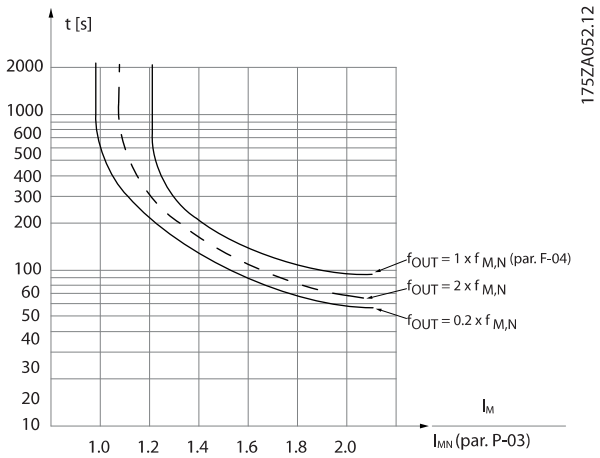


Illustration 3.10 Electronic Thermal Overload Profile

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

Parameter set-up:

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

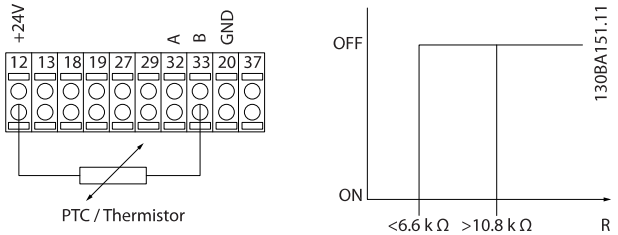


Illustration 3.11 Thermistor Connection

3

F-11 Motor External Fan		
Option:	**Function:**	
[0] *	No	No external fan on motor, that is 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 *Illustration 3.10* (f_{out} = 1 x $f_{M,N}$) is followed if the motor current is lower than nominal motor current (see *parameter P-03 Motor Current*). If the motor current exceeds nominal current, the operation time still decreases as if no fan was installed.

F-12 Motor Thermistor Input		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** ***NOTICE*** **Set digital input to *[0] PNP - Active at 24 V* in E-0#.** Select the input to which the thermistor (PTC sensor) should be connected. An analog input option *[1] Analog Input 53* or *[2] Analog Input 54* cannot be selected if the analog input is already in use as a reference source (selected in *parameter F-01 Frequency Setting 1*, *parameter C-30 Frequency Command 2* or *parameter 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	

F-15 Motor Speed High Limit [Hz]		
Range:		**Function:**
50.0 Hz*	[par. F-16 - par. F-03 Hz]	

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 *parameter 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 nominal motor speed. The motor speed high limit must exceed the setting in *parameter F-18 Motor Speed Low Limit [RPM]*.

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 *parameter 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 (for example conveyors, pumps, and non-wind milling fans).
[1] *	Parking	If the motor turns at a low speed (that is lower than 2–5% of the nominal speed), for example due to fans with windmilling, select *[1] Parking* and adjust *parameter B-06 Parking Current* and *parameter 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 *parameter 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 *parameter 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 the set value. Set the start function in *parameter 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 *parameter 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 *parameter 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 *parameter F-24 Holding Time*.
[0]	DC Hold/ delay time	Energizes motor with a DC hold current (*parameter B-00 DC Hold Current*) during the start delay time.
[1]	DC Brake/ delay time	Energizes motor with a DC brake current (*parameter 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 *parameter F-22 Start Speed [RPM]* and *parameter 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 *parameter F-22 Start Speed [RPM]* or *parameter F-23 Start Speed [Hz]*, and the output current corresponds to the setting of the start current in *parameter 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 *parameter F-22 Start Speed [RPM]* and *parameter F-29 Start Current* during the start delay time. The motor rotates in the reference direction. If the reference signal equals zero (0), *parameter 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 *parameter F-29 Start Current*.
[5]	Adv. Vector Control/Flux Clockwise	For the function described in *parameter 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 *parameter 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 (*parameter B-24 Stop Delay* to *parameter B-28 Gain Boost Factor*). This parameter is only active in flux control principle, in a mode with motor feedback or sensorless mode.
[7]	Adv. Vector Control/Flux Counter-cw	

F-26 Motor Noise (Carrier Freq)		
Select the carrier frequency. Changing the switching frequency reduces acoustic noise from the motor. Default values depend 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.

3

F-26 Motor Noise (Carrier Freq)		
Select the carrier frequency. Changing the switching frequency reduces acoustic noise from the motor. Default values depend on power size.		
Option:		**Function:**
[8]	6.0 kHz	
[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	Select to reduce the acoustic noise from the motor.

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, for example cone rotor motors, need extra current/starting speed to disengage the rotor. To obtain this boost, set the required current in *parameter F-29 Start Current*. Set *parameter F-22 Start Speed [RPM]*. Set *parameter F-25 Start Function* to *[3] Start speed cw* or *[4] Horizontal operation*, and set a start delay time in *parameter 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-33 Source for User-defined Readout		
Option:		**Function:**
[105]	Torq relate to rated	
[143]	PID Clamped Output 4-20mA	
[240] *	Default Source	

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 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 option when it is required that the output voltage is higher than 95% of the input voltage (typically when running over-synchronously). The output voltage is increased according to the degree of overmodulation. ***NOTICE*** **Overmodulation leads to increased torque ripple as harmonics increase.** Control in flux control principle provides an output current of up to 98% of the input current, regardless of *parameter F-38 Overmodulation*.

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 dependent]	This function limits the torque on the shaft to protect the mechanical installation.

NOTICE

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

NOTICE

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

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 synchronized 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 *parameter 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 *parameter H-40 Configuration Mode*.
[1] *	-Max - +Max	For both positive and negative values (both directions, relative to *parameter H-08 Reverse Lock*).

F-51 Reference/Feedback Unit		
Option:		**Function:**
		Select the unit to be used in process PID control references and feedbacks. *Parameter 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	

F-51 Reference/Feedback Unit		
Option:		**Function:**
[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		
Enter the minimum reference. The minimum reference is the lowest value obtainable by summing all references. Minimum reference is active only when *parameter F-50 Reference Range* is set to *[0] Min.- Max.* The minimum reference unit matches: • The configuration of *parameter H-40 Configuration Mode*: for *[1] Speed closed loop*, RPM; for *[2] Torque*, Nm. • The unit selected in *parameter F-51 Reference/Feedback Unit*.		
Range:		**Function:**
0 ReferenceFeedbackUnit*	[-999999.999 - par. F-53 ReferenceFeedbackUnit]	

3

F-53 Maximum Reference		
Enter the maximum reference. The maximum reference is the highest value obtainable by summing all references. The maximum reference unit matches: • The configuration selected in *parameter H-40 Configuration Mode*: For *[1] Speed closed loop*, RPM; for *[2] Torque*, Nm. • The unit selected in *parameter F-50 Reference Range*.		
Range:		**Function:**
1500.000 ReferenceFeedbackUnit*	[par. F-52 - 999999.999 ReferenceFeedbackUnit]	

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. If *catch up* is selected via 1 of the digital inputs (*parameter E-01 Terminal 18 Digital Input* to *parameter E-06 Terminal 33 Digital Input*), the percentage (relative) value is added to the total reference. If *slow down* is selected via 1 of the digital inputs (*parameter E-01 Terminal 18 Digital Input* to *parameter E-06 Terminal 33 Digital Input*), the percentage (relative) value is deducted from the total reference. Obtain extended functionality with the DigiPot function. See parameter group *F-9* Digital Potentiometer*.

F-64 Preset Relative Reference		
Range:		**Function:**
0 %*	[-100 - 100 %]	The actual reference, X, is increased or decreased with the percentage Y, set in *parameter F-64 Preset Relative Reference*. This results in the actual reference Z. Actual reference (X) is the sum of the inputs selected in:

F-64 Preset Relative Reference		
Range:		**Function:**
		• *Parameter F-01 Frequency Setting 1.* • *Parameter C-30 Frequency Command 2.* • *Parameter C-34 Frequency Command 3.* • *Parameter O-02 Control Word Source.*

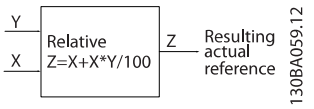


Illustration 3.12 Preset Relative Reference

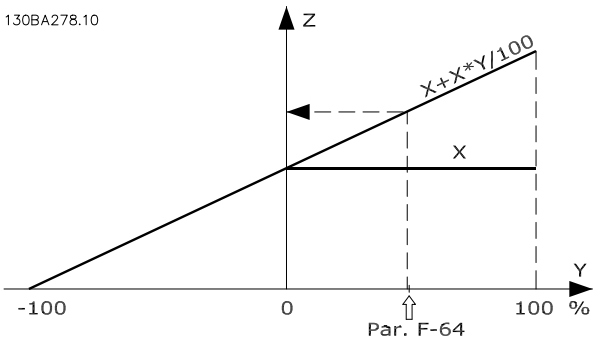
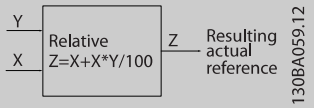


Illustration 3.13 Actual Reference

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

F-68 Relative Scaling Reference Resource		
Option:		**Function:**
[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 Potenti-ometer	
[21]	Analog input X30/11	
[22]	Analog input X30/12	
[26]	Analog Input X49/1	
[27]	Analog Input X49/3	
[28]	Analog Input X49/5	

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 is increased or decreased by the value set in this parameter.

F-91 Accel/Decel Time		
Range:		**Function:**
1 s*	[0 - 3600 s]	Enter the ramp time, that is the time for adjustment of the reference 0–100% of the specified digital potentiometer function (increase, decrease, or clear). If increase/decrease is activated for longer than the ramp delay period specified in *parameter F-95 Accel/Decel Ramp Delay*, the actual reference is 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 *parameter 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 resulting reference. This is recommended 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 resulting reference. This is recommended 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 when increase/decrease is activated. See also *parameter 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

Table 3.6 Functions for Digital Inputs

General Purpose Drives standard terminals are 18, 19, 27, 29, 32, and 33. OPCGPIO 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 *parameter 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 *parameter B-01 DC Brake Current* to *parameter B-03 DC Brake Cut In Speed [RPM]*. The function is only active when the value in *parameter 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 (*parameter F-08 Decel Time 1*, *parameter E-11 Decel Time 2*, *parameter E-13 Decel Time 3*, *parameter E-15 Decel Time 4*). ***NOTICE*** **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 *parameter 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 *parameter 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 *parameter 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

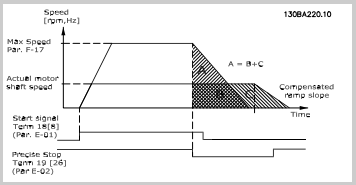
Preset ref. bit	2	1	0
Preset ref. 0	0	0	0
Preset ref. 1	0	0	1
Preset ref. 2	0	1	0
Preset ref. 3	0	1	1
Preset ref. 4	1	0	0
Preset ref. 5	1	0	1
Preset ref. 6	1	1	0
Preset ref. 7	1	1	1

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 (*parameter E-10 Accel Time 2* and *parameter E-11 Decel Time 2*) in the range 0 - *parameter 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 (*parameter E-10 Accel Time 2* and *parameter E-11 Decel Time 2*) in the range 0 - *parameter F-04 Base Frequency*. ***NOTICE*** **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 *parameter 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 *parameter 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 *parameter H-83 Precise Stop Function*.  **Illustration 3.15**
[28]	Catch up	Increases reference value by percentage (relative) set in *parameter F-62 Catch up/slow Down Value*.
[29]	Slow down	Reduces reference value by percentage (relative) set in *parameter F-62 Catch up/slow Down Value*.
[30]	Counter input	Precise stop function in *parameter 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 *parameter 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 Ramps

[36]	Mains failure inverse	Activates *parameter 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 *parameter 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

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.

NOTICE

Perform a power cycle to activate the parameter once it has been changed.

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.
[4]	PTC 1 Alarm	Coasts frequency converter when safe stop is activated. Manual reset from keypad, digital input or Network. Choice 4 is only available when the MCB 112 PTC Thermistor Card is connected.

NOTICE

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

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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 nominal motor speed n_s. Select a accel time such that the output current does not exceed the current limit in *parameter F-43 Current Limit* during ramping. The value 0.00 corresponds to 0.01 s in speed mode. See decel time in *parameter 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 nominal motor speed n_s to 0 RPM. Select a decel time such that no overvoltage occurs in the frequency converter due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in *parameter F-43 Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See accel time in *parameter 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 nominal motor speed n_s. Select a accel time such that the output current does not exceed the current limit in *parameter F-43 Current Limit* during ramping. The value 0.00 corresponds to 0.01 s in speed mode. See decel time in *parameter 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 nominal motor speed n_s to 0 RPM. Select a decel time such that no overvoltage occurs in the inverter due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in *parameter F-43 Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See accel time in *parameter 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. Select a accel time such that the output current does not exceed the current limit in *parameter F-43 Current Limit* during ramping. The value 0.00 corresponds to 0.01 s in speed mode. See decel time in *parameter 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 nominal motor speed n_s to 0 RPM. Select a decel time such that no overvoltage occurs in the inverter due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in *parameter F-43 Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See accel time in *parameter 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 *parameter E-51 Terminal 27 Mode*, and set the I/O function for terminal 29 in *parameter 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 *parameter 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 *parameter H-70 Warning Current Low* to *parameter 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 *parameter 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 *parameter F-43 Current Limit*.
[13]	Below current, low	Motor current is lower than set in *parameter H-70 Warning Current Low*.
[14]	Above current, high	Motor current is higher than set in *parameter H-71 Warning Current High*.
[15]	Out of range	Output frequency is outside the frequency range set in *parameter H-70 Warning Current Low* and *parameter H-71 Warning Current High*.
[16]	Below speed, low	Output speed is lower than the setting in *parameter H-72 Warning Speed Low*.
[17]	Above speed, high	Output speed is higher than the setting in *parameter H-73 Warning Speed High*.
[18]	Out of feedback range	Feedback is outside the range set in *parameter H-76 Warning Feedback Low* and *parameter H-77 Warning Feedback High*.
[19]	Below feedback low	Feedback is below the limit set in *parameter H-76 Warning Feedback Low*.
[20]	Above feedback high	Feedback is above the limit set in *parameter 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 *parameter 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 *parameter 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 *parameter 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.
[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 *parameter 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 *parameter 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 *parameter 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 *parameter 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 *parameter 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 *parameter 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 *parameter F-02 Operation Method* = [2] Local or when *parameter 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 *parameter 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 [20]

Range:		Function:
0.01 s*	[0.01 - 600 s]	Enter the delay of the relay cut in time. Select 1 of 2 internal mechanical relays in an array function. See *parameter E-24 Function Relay* for details.

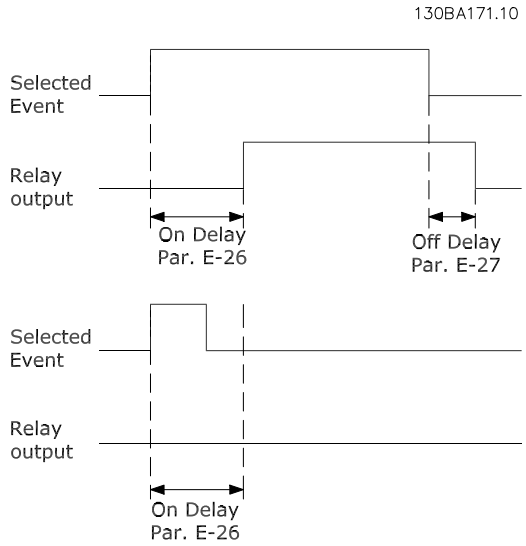

Illustration 3.16 On Delay, Relay

E-27 Off Delay, Relay		
Array[20]		
Range:		**Function:**
0.01 s*	[0.01 - 600 s]	Enter the delay of the relay cut out time. Select 1 of 2 internal mechanical relays in an array function. See *parameter E-24 Function Relay* for details. If the selected event condition changes before a delay timer expires, the relay output is unaffected.

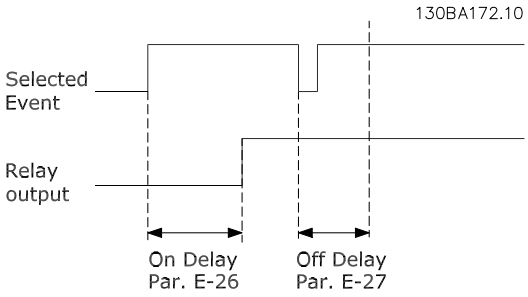

Illustration 3.17 Off Delay, Relay

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

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

E-51 Terminal 27 Mode		
Option:		**Function:**
[1]	Output	Defines terminal 27 as a digital output.

E-52 Terminal 29 Mode		
Option:		**Function:**
		NOTICE **This parameter is available for AF-650 GP only.**
[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 (that is low reference value) in *parameter E-62 Term. 29 Low Ref./Feedb. Value*. Refer to .

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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 (that is high reference value) in *parameter E-63 Term. 29 High Ref./Feedb. Value*.

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

E-63 Term. 29 High Ref./Feedb. Value		
Range:		**Function:**
1500.000 ReferenceFeedbackUnit*	[-999999.999 - 999999.999 ReferenceFeedbackUnit]	Enter the high reference value [RPM] for the motor shaft speed and the high feedback value, see also *parameter E-68 Term. 33 High Ref./Feedb. Value*. Select terminal 29 as a digital input (*parameter E-52 Terminal 29 Mode = [0] input* (default) and *parameter 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 (that is low reference value) in

E-65 Term. 33 Low Frequency		
Range:		**Function:**
		parameter 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 (that is high reference value) in *parameter 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 *parameter E-62 Term. 29 Low Ref./Feedb. Value*.

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

E-69 Pulse Filter Time Constant #33		
Range:		**Function:**
100 ms*	[1 - 1000 ms]	***NOTICE*** **This parameter cannot be adjusted while the motor is running.** Enter the pulse filter time constant. The low-pass filter reduces the influence, and dampens oscillations on the feedback signal from the control. This is an advantage if there is a great amount of 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 display output for terminal 27.
[45]	Bus ctrl.	
[48]	Bus ctrl., timeout	

E-70 Terminal 27 Pulse Output Variable		
Option:		**Function:**
[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 *parameter E-70 Terminal 27 Pulse Output Variable*.

E-73 Terminal 29 Pulse Output Variable		
Option:		**Function:**
[0] *	No operation	Select the 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	
[119]	Torque % lim	

E-75 Terminal X30/6 Pulse Output Variable		
Option:		**Function:**
[0] *	No operation	Select the variable for read-out on terminal X30/6. This parameter cannot be adjusted while the motor is running. This parameter is active when option module MCB 101 is installed in the frequency converter.
[45]	Bus ctrl.	
[48]	Bus ctrl., timeout	
[100]	Output frequency	
[101]	Reference	
[102]	Feedback	
[103]	Motor Current	

E-75 Terminal X30/6 Pulse Output Variable		
Option:		**Function:**
[104]	Torque rel to limit	
[105]	Torq relate to rated	
[106]	Power	
[107]	Speed	
[113]	Ext. Closed Loop 1	
[114]	Ext. Closed Loop 2	
[115]	Ext. Closed Loop 3	

E-76 Terminal X30/6 Pulse Output Variable		
Select the variable for readout on terminal X30/6. This parameter is active when General Purpose I/O 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]	***NOTICE*** **This parameter cannot be adjusted while the motor is running.** Select the maximum frequency on terminal X30/6 referring to the output variable in *parameter E-75 Terminal X30/6 Pulse Output Variable*. This parameter is active when General Purpose I/O OPCGPIO is installed in the frequency converter.

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.

3

E-81 Term 32/33 Encoder Direction		
Option:		**Function:**
		NOTICE **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 Bus-controlled Digital Outputs and Relays

E-93 Pulse Out #27 Bus Control		
Range:		**Function:**
0 %*	[0 - 100 %]	Set the output frequency transferred to output terminal 27 when the terminal is configured as *[45] Bus Controlled* in *parameter 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 output terminal 27 when the terminal is configured as *[48] Bus Ctrl Timeout* in *parameter E-70 Terminal 27 Pulse Output Variable* and a timeout is detected.

E-95 Pulse Out #29 Bus Control		
Range:		**Function:**
0 %*	[0 - 100 %]	Set the output frequency transferred to output terminal 29 when the terminal is configured as *[45] Bus Controlled* in *parameter 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 output terminal 29 when the terminal is configured as *[48] Bus Ctrl Timeout* in *parameter E-73 Terminal 29 Pulse Output Variable* and a timeout is detected.

E-97 Pulse Out #X30/6 Bus Control		
Range:		**Function:**
0 %*	[0 - 100 %]	Set the output frequency transferred to output terminal X30/6 when the terminal is configured as *[45] Bus ctrl.* in *parameter 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 output terminal X30/6 when the terminal is configured as *[48] Bus Ctrl Timeout* in *parameter E-76 Terminal X30/6 Pulse Output Variable* and a timeout 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 require that certain output frequencies or speeds are avoided 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 8 different preset references (0-7) in this parameter, using array programming. The preset reference is stated as a percentage of the value Ref_{MAX} (*parameter F-53 Maximum*

C-05 Multi-step Frequency 1 - 8

Array [8]
Range: 0-7

Range:		Function:
		Reference). If a Ref_{MIN} different from 0 (*parameter F-52 Minimum Reference*) is programmed, the preset reference is calculated as a percentage of the full reference range, that is 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 reference bit 0/1/2 [16], [17] or [18] for the corresponding digital inputs in parameter group *E-##*.

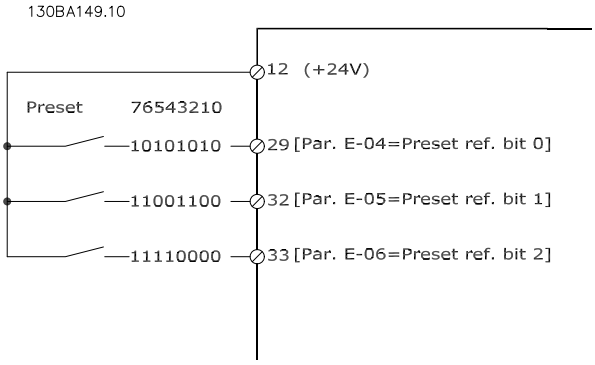

Illustration 3.18 Preset Reference

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 Reference Bits

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:
5.0 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 *parameter C-22 Jog Accel/Decel Time*.

3

C-21 Jog Speed [RPM]

Range:		Function:
150 RPM*	[0 - par. F-17 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 *parameter F-17 Motor Speed High Limit [RPM]*. See also *parameter 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 resulting output current required for the given jog ramp time does not exceed the current limit in *parameter F-43 Current Limit*. The jog ramp time starts after 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.

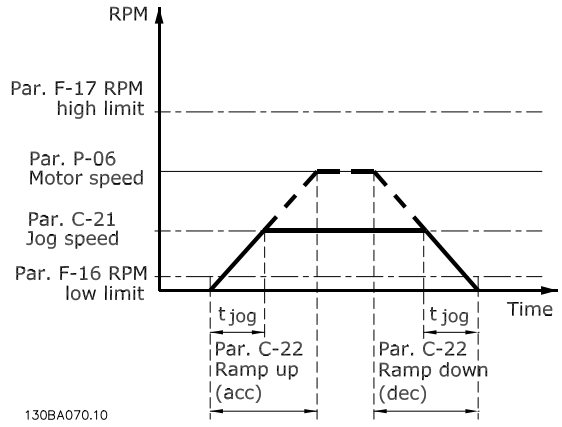

Illustration 3.19 Jog Ramp Time

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

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 resulting overvoltage occurs 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 *parameter F-43 Current Limit*). Quick stop is activated with 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 (*parameter 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 (*parameter 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 %]	

C-29 Ramp Lowpass Filter Time

Use this parameter to set how the smoothly the speed changes.

Range:		Function:
1 ms*	[1 - 200 ms]	

Parameters to configure Frequency Settings 2 and 3.

C-30 Frequency Command 2

Option:		Function:
		Select the reference input to be used for the 2nd reference signal. *Parameter F-01 Frequency Setting 1*, *parameter C-30 Frequency Command 2*, and *parameter C-34 Frequency Command 3* define up to 3 different reference signals. The sum of these reference signals defines the actual reference.
[0]	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[7]	Frequency input 29	
[8]	Frequency input 33	
[11]	Local bus reference	
[20] *	Digital Potentiometer	
[21]	Analog input X30/11	

C-30 Frequency Command 2		
Option:		**Function:**
[22]	Analog input X30/12	
[26]	Analog Input X49/1	
[27]	Analog Input X49/3	
[28]	Analog Input X49/5	

C-34 Frequency Command 3		
Option:		**Function:**
		Select the reference input to be used for the third reference signal. *Parameter F-01 Frequency Setting 1*, *parameter C-30 Frequency Command 2*, and *parameter C-34 Frequency Command 3* define up to 3 different reference signals. The sum of these reference signals defines the actual reference.
[0]	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[7]	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	
[26]	Analog Input X49/1	
[27]	Analog Input X49/3	
[28]	Analog Input X49/5	

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 Pole Number for Normal Speed Ranges

Table 3.13 shows the pole number 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 pole number, not pairs of poles. The frequency converter creates the initial setting of *parameter P-01 Motor Poles* based on *parameter F-04 Base Frequency* and *parameter 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 *parameter 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 overload protection, and so on.

P-04 Auto Tune		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** The Auto Tune function optimizes dynamic motor performance by automatically optimizing the advanced motor parameters (*parameter P-30 Stator Resistance (Rs)* to *parameter P-35 Main Reactance (Xh)*) at motor standstill. Activate the Auto Tune function by pressing [Hand] after selecting *Enable Complete AMA* or *[2] Reduced Auto Tune*. After a normal sequence, the display reads: *Press [OK] to finish Auto Tune*. After pressing [OK], 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. This option is available for standard asynchronous motors and non-salient PM motors.

NOTICE

- **For the best results run Auto Tune on a cold motor.**
- **Auto Tune cannot be performed while the motor is running.**
- **Auto Tune cannot run with a sine-wave filter connected.**

NOTICE

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. Perform an Auto Tune to achieve optimum dynamic motor performance. It may take up to 10 minutes, depending on the power rating of the motor.

NOTICE

Avoid generating external torque during Auto Tune.

NOTICE

If 1 of the settings in parameters F-04, F-05, or P-02 to P-08 is changed, *parameter P-30 Stator Resistance (Rs)* to *parameter P-01 Motor Poles*, the advanced motor parameters, return to default setting.

NOTICE

Auto Tune works problem-free on 1 motor size down, typically works on 2 motor sizes down, rarely works on 3 sizes down, and never work on 4 sizes down. Keep in mind that the accuracy of the measured motor data is 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 *parameter P-20 Motor Construction* is set to *[1] PM, non-salient SPM*, that is 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]	***NOTICE*** **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 frequency converter. This parameter is visible in the keypad if *parameter K-03 Regional Settings* is set to *[0] International*. ***NOTICE*** **4 sizes down, 1 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, that is on the basis of the nominal motor speed $n_{M,N}$. This function is not active when *parameter H-40 Configuration Mode* is set to *[1] Speed closed loop* or *[2] Torque* torque control with speed feedback or when

P-09 Slip Compensation		
Range:		**Function:**
		parameter 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]	***NOTICE*** ***Parameter P-10 Slip Compensation Time Constant* has no effect when *parameter P-20 Motor Construction = [1] PM, non-salient SPM.*** Enter the slip compensation reaction speed. A high value results in slow reaction, and a low value results in quick reaction. If low-frequency resonance problems arise, use a longer time setting.

3.6.2 P-2# Motor Selection

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

P-20 Motor Construction		
Option:		**Function:**
		Select the motor design type.
[0] *	Asynchron	Use for asynchronous motors.
[1]	PM, non salient SPM	Use for salient or non-salient PM motors. PM motors are divided into 2 groups, with either surface-mounted (SPM)/non-salient magnets or interior-mounted (IPM)/salient magnets. ***NOTICE*** **This option is valid for AF-650 GP only.**

P-24 Damping Gain		
Range:		**Function:**
140 %*	[0 - 250 %]	The damping gain stabilizes the PM machine to run smoothly and with stability. The value of damping gain controls the dynamic performance of the PM machine. High damping gain gives high dynamic performance and low damping gain gives 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 becomes unstable.

3

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 becomes 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 becomes 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 distort the calculated voltage and affect the stability of the system.

P-28 Min. Current at No Load		
Range:		**Function:**
0 %*	[0 - 50 %]	Adjust this parameter to achieve a smoother motor operation.

3.6.3 P-3# Adv. Motor Data

Parameters for advanced motor data. The motor data in *parameter P-30 Stator Resistance (Rs)* to *parameter 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 (*parameter P-36 Iron Loss Resistance (Rfe)*).

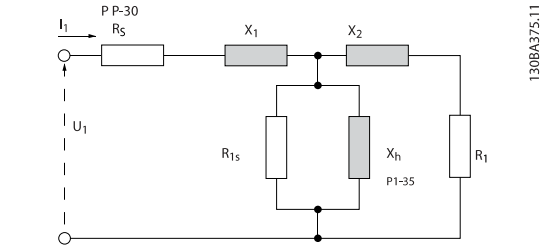

Illustration 3.20 Motor Equivalent Diagram for an Asynchronous Motor

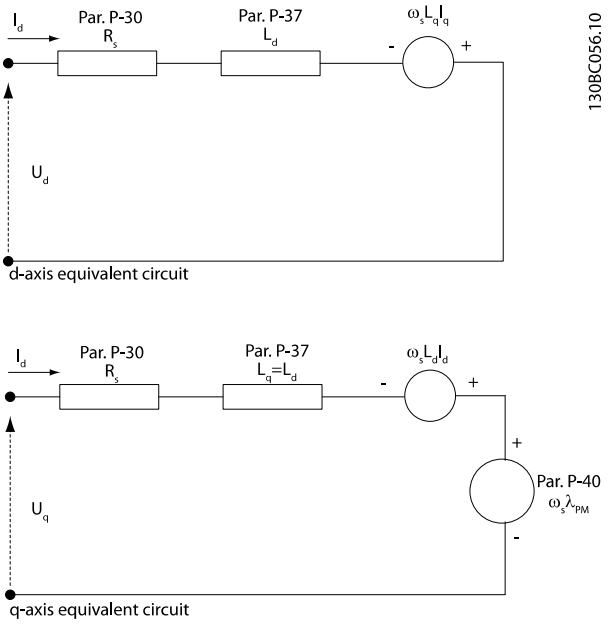

Illustration 3.21 Motor Equivalent Circuit Diagram for a PM Non Salient Motor

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 datasheet or perform an Auto Tune on a cold motor. ***NOTICE*** **For salient 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 (star point) 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-30 Stator Resistance (Rs)

Range:		Function:
		NOTICE **The parameter value is updated after each torque calibration if option *[3] 1st start with store* or option *[4] Every start with store* is selected in *parameter P-47 Torque Calibration*.**

P-31 Rotor Resistance (Rr)

Range:		Function:
1.0000 Ohm*	[0.0100 - 100.0000 Ohm]	***NOTICE*** ***Parameter P-31 Rotor Resistance (Rr)* does not have effect when *parameter P-20 Motor Construction* is set to *[1] PM, non-salient SPM*.** Set the rotor resistance value R_r to improve shaft performance using 1 of these methods. • Run an Auto Tune on a cold motor. The frequency converter measures the value from the motor. All compensations are reset to 100%. • Enter the R_r value manually. Obtain the value from the motor supplier. • Use the R_r default setting. The frequency converter establishes the setting based on the motor nameplate data.

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 1 of these methods: • Run an Auto Tune on a cold motor. The frequency converter measures the value from the motor. • Enter the X_1 value manually. Obtain the value from the motor supplier. • Use the X_1 default setting. The frequency converter establishes the setting based on the motor nameplate data. See *Illustration 3.20*.

P-33 Stator Leakage Reactance (X1)

Range:		Function:
		NOTICE **The parameter value is updated after each torque calibration if option *[3] 1st start with store* or option *[4] Every start with store* is selected in *parameter P-47 Torque Calibration*.** ***NOTICE*** **This parameter is only relevant for ASM.**

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 1 of these methods: • Run an Auto Tune on a cold motor. The frequency converter measures the value from the motor. • Enter the X_2 value manually. Obtain the value from the motor supplier. • Use the X_2 default setting. The frequency converter establishes the setting based on the motor nameplate data. See *Illustration 3.20*. ***NOTICE*** **The parameter value is updated after each torque calibration if option *[3] 1st start with store* or option *[4] Every start with store* is selected in *parameter P-47 Torque Calibration*.** ***NOTICE*** **This parameter is only relevant for ASM.**

P-35 Main Reactance (Xh)

Range:		Function:
100.0000 Ohm*	[1.0000 - 10000.0000 Ohm]	Set the main reactance of the motor using 1 of these methods: 1. Run an Auto Tune on a cold motor. The frequency

3

P-35 Main Reactance (Xh)		
Range:		**Function:**
		converter measures 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 based on the motor nameplate 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 *parameter 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 datasheet. The d-axis inductance cannot be found by performing an Auto Tune.

P-38 q-axis Inductance (Lq)		
Range:		**Function:**
0.000 mH*	[0.000 - 1000 mH]	Set the value of the q-axis inductance. See the motor datasheet.

P-44 d-axis Inductance Sat. (LdSat)		
Range:		**Function:**
0.0 mH*	[0 - 1000 mH]	This parameter corresponds to the inductance saturation of Ld. If the motor supplier provides an induction curve, enter the induction value at 200% of the nominal value.

P-45 q-axis Inductance Sat. (LqSat)		
Range:		**Function:**
0.0 mH*	[0 - 1000 mH]	This parameter corresponds to the inductance saturation of Lq. Ideally, this parameter has the same value as *parameter P-38 q-axis Inductance (Lq)*. If the

P-45 q-axis Inductance Sat. (LqSat)		
Range:		**Function:**
		motor supplier provides an induction curve, enter the induction value at 200% of the nominal value.

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.

P-47 Torque Calibration		
Option:		**Function:**
		Use this parameter to optimize the torque estimate in the full speed range. The estimated torque is based on the shaft power, $P_{shaft} = P_m - R_s \times I^2$. Make sure that the R_s value is correct. The R_s value in this formula is equal to the power loss in the motor, the cable, and the frequency converter. When this parameter is active, the frequency converter calculates the R_s value during power-up, ensuring the optimal torque estimate and optimal performance. Use this feature in cases when it is not possible to adjust *parameter P-30 Stator Resistance (Rs)* on each frequency converter to compensate for the cable length, frequency converter losses, and the temperature deviation on the motor.
[0] *	Off	
[1]	1st start after pwr-up	Calibrates at the first start-up after power-up and keeps this value until reset by a power cycle.
[2]	Every start	Calibrates at every start-up, compensating for a possible change in motor temperature since last start-up. The value is reset after a power cycle.
[3]	1st start with store	The frequency converter calibrates the torque at the first start-up after power-up. This option is used to update motor parameters: • *Parameter P-30 Stator Resistance (Rs).* • *Parameter P-33 Stator Leakage Reactance (X1).* • *Parameter P-34 Rotor Leakage Reactance (X2).*
[4]	Every start with store	The frequency converter calibrates the torque at every start-up, compensating for a possible change in motor temperature since last start-up. This option is used to update motor parameters:

P-47 Torque Calibration		
Option:		**Function:**
		• *Parameter P-30 Stator Resistance (Rs).* • *Parameter P-33 Stator Leakage Reactance (X1).* • *Parameter P-34 Rotor Leakage Reactance (X2).*

P-48 Inductance Sat. Point		
Range:		**Function:**
35 %*	[1 - 500 %]	Inductance saturation point.

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 behavior 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 frequency converter settings and is used when modifying the system configuration. This parameter setting returns to *[0] Protect Option Config.* after an option change.

H-03 Restore Factory Settings

Option:		Function:
		Use this parameter to specify normal operation, to perform tests, or to restore all parameters except: • *Parameter ID-03 Power Up's.* • *Parameter ID-04 Over Temp's.* • *Parameter 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	Normal operation of the frequency converter with the motor in the selected application.
[2]	Restore Factory Settings	*[2] Restore Factory Settings* Resets all parameter values to default settings, except for: • *Parameter ID-03 Power Up's.* • *Parameter ID-04 Over Temp's.* • *Parameter ID-05 Over Volt's.* The frequency converter resets during the next power-up. *Parameter H-03 Restore Factory Settings* also reverts 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.
[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.

NOTICE

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 *parameter 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 *parameter H-04 Auto-Reset (Times)* is set to *[1]–[13] Automatic reset.*

H-07 Accel/Decel Time 1 Type

Option:		Function:
		NOTICE **If *[1] S-ramp Const Jerk* is selected and the reference during ramping is changed, the ramp time may be prolonged to realize a jerk-free movement, which may result in a longer start or stop time.** **Extra 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. Select the ramp type, depending on requirements for acceleration/deceleration. A linear ramp gives constant acceleration during ramping. An S-ramp gives 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 *parameter F-07 Accel Time 1* and *parameter F-08 Decel Time 1*.

H-08 Reverse Lock

Option:		Function:
		NOTICE **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 *parameter H-40 Configuration Mode* is set to *[3] Process*, *parameter H-08 Reverse Lock* is set to *[0] Clockwise* as default. The setting in *parameter H-08 Reverse Lock* does not limit options for setting *parameter F-15 Motor Speed High Limit [Hz]* or *parameter F-17 Motor Speed High Limit [RPM]*.
[0] *	Clockwise	The reference is set to CW rotation. Reversing input (default terminal 19) must be open.
[1]	Counter clockwise	The reference is set to CCW rotation. Reversing input (default terminal 19) must be closed. If reversing is required with *reverse* input open, the motor direction can be changed by *parameter H-48 Clockwise Direction*
[2]	Both directions	Allows the motor to rotate in both directions.

H-09 Start Mode

Option:		Function:
		NOTICE **This parameter cannot be adjusted while the 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 *parameter H-09 Start Mode* is enabled, *parameter F-24 Holding Time* and *parameter F-25 Start Function* have no function. When *parameter H-09 Start Mode* is enabled, *parameter H-58 Flying Start Test Pulses Current* and *parameter H-59 Flying Start Test Pulses Frequency* are used to specify the conditions for the flying start.
[2]	Enabled Always	
[3]	Enabled Ref. Dir.	
[4]	Enab. Always Ref. Dir.	

NOTICE

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 consistency in feedback signal, that is 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 *parameter H-21 Motor Feedback Speed Error* for longer than the value set in *parameter 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 Feedback monitor is active as soon as the value in *parameter H-21 Motor Feedback Speed Error* is exceeded, regardless of the setting of *parameter 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 maximum allowed error in speed (output speed vs. feedback).

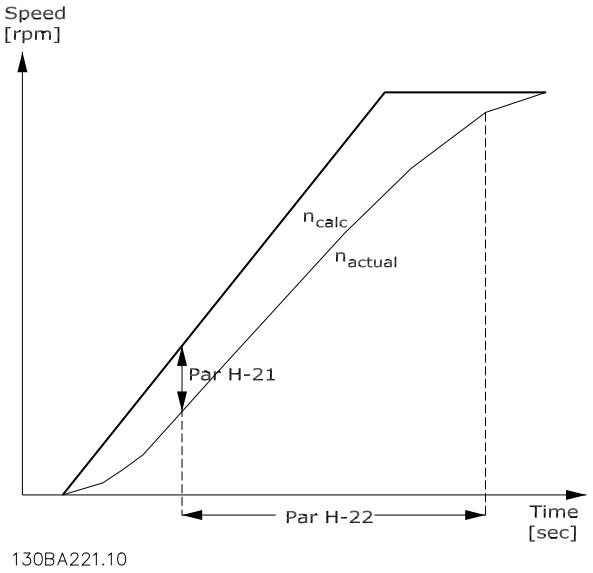

Illustration 3.23 Motor Feedback Speed Error

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

H-23 Motor Check At Start		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor runs.** ***NOTICE*** **Valid for AF-650 GP only** Use this parameter to detect the missing motor phase during motor stand-still. Shows *alarm 30, Motor phase U missing*, *alarm 31, Motor phase V missing*, or *alarm 32, Motor phase W missing* in the event of a missing motor phase during stand-still. Use this function before disengaging a mechanical brake. Enable this function to avoid motor damage.
[0] *	Off	**⚠CAUTION** **RISK OF MOTOR DAMAGE** **Using this option may lead to a motor damage.** The frequency converter does not issue a missing motor phase alarm.
[1]	On	Before each start, the frequency converter checks if all 3 motor phases are present. The check is performed

H-23 Motor Check At Start		
Option:	**Function:**	
		without any movement on ASM motors. For PM motors, the check is performed as part of the position detection.

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 (*parameter DR-13 Frequency*). The reaction is activated if the measured difference is more than the value specified in *parameter H-25 Tracking Error* for the time specified in *parameter 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 heavy loads.
[0] *	Disable	
[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 timeout period during which an error greater than the value set in *parameter 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

H-27 Tracking Error Ramping		
Range:		**Function:**
		and in closed loop, the encoder measures the speed.

H-28 Tracking Error Ramping Timeout		
Range:		**Function:**
1 s*	[0 - 60 s]	Enter the timeout period during which an error greater than the value set in *parameter 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 timeout period after ramping where *parameter H-27 Tracking Error Ramping* and *parameter H-28 Tracking Error Ramping Timeout* are still active.

3.7.3 H-3# Speed Monitor

H-30 Motor Speed Monitor Function		
Option:	**Function:**	
		NOTICE **This parameter is only available in the flux control principle.** Select how the frequency converter reacts when the motor speed monitor-function detects overspeed or wrong rotation direction. When the motor speed monitor is active, the frequency converter detects an error if the following conditions are true for a time period specified in *parameter H-32 Motor Speed Monitor Timeout*: • The actual speed differs from the reference speed in *parameter DR-48 Speed Ref. After Ramp [RPM]*. • The difference between the speeds exceeds the value in *parameter H-31 Motor Speed Monitor Max*. In speed closed loop, the actual speed is the feedback from the encoder measured during the time defined in *parameter PI-06 Speed PID Lowpass Filter Time*. In open loop, the actual speed is the estimated motor speed.

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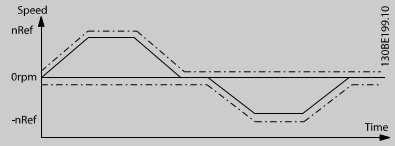
H-30 Motor Speed Monitor Function		
Option:		**Function:**
		 Solid line — *Parameter DR-48 Speed Ref. After Ramp [RPM]* Dotted line — *Parameter H-31 Motor Speed Monitor Max* **Illustration 3.24 Speed Reference and Maximum Allowed Speed Difference**
[0] *	Disabled	
[1]	Warning	The frequency converter reports *warning 101, Speed monitor* when the speed is outside the limit.
[2]	Trip	The frequency converter trips and reports *alarm 101, Speed monitor*.
[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	
[12]	Trip/ Warning	The frequency converter reports *alarm 101, Speed monitor* in running mode and *warning 101, Speed monitor* in stop or coast mode. This option is only available in closed-loop operation.
[13]	Trip/Catch	Select when there is a need to catch a load, for example when mechanical braking fails. This option is available in closed loop only. The frequency converter trips and reports *alarm 101, Speed monitor* in running mode. In stop mode, the frequency converter catches the flying load and reports *warning 101, Speed monitor*. In catch mode, the frequency converter applies holding torque to control the zero speed on a potentially malfunctioning brake (closed loop). To exit this mode, send a new start signal to the frequency converter. A coast or Safe Torque Off also terminates the function.

H-30 Motor Speed Monitor Function		
Option:		**Function:**
		start signal to the frequency converter. A coast or Safe Torque Off also terminates the function.

H-31 Motor Speed Monitor Max		
Range:		**Function:**
100 RPM*	[10 - 500 RPM]	

H-32 Motor Speed Monitor Timeout		
Range:		**Function:**
0.1 s*	[0 - 60 s]	

3.7.4 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 (that is via analog input or Network) is active. A remote reference can only be active when *parameter 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. Set the speed control parameters 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. Set the speed control parameters 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, *parameter H-41 Motor Control Principle*. ***NOTICE*** **This is valid for AF-650 GP only.**
[3]	Process	Enables the use of process control in the frequency converter. Set the process control parameters in parameter groups *PI-2#* and *PI-3#*.
[4]	Torque open loop	Enables the use of torque open loop in Adv. Vector Control mode (*parameter H-41 Motor*

H-40 Configuration Mode		
Option:		**Function:**
		Control Principle). Set the torque PID parameters in parameter group *PI-1#*.
[5]	Wobble	Enables the wobble functionality in *parameter SF-00 Wobble Mode* to *parameter 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:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** Select which motor control principle to employ.
[0]	U/f	Special motor mode, for parallel connected motors in special motor applications. When U/f is selected the characteristic of the control principle can be edited in *parameter H-55 U/f Characteristic - U* and *parameter H-56 U/f Characteristic - F*.
[1] *	Advanced Vector Control	Voltage vector control principle is 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. ***NOTICE*** **This is valid for AF-650 GP only.**
[3]	Flux w/ motor feedb	High accuracy speed and torque control, suitable for the most demanding applications. ***NOTICE*** **This is valid for AF-650 GP only.**

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

H-42 Flux Motor Feedback Source		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** Select the interface for which to receive feedback from the motor.
[1] *	24V encoder	A and B channel encoder, which can be connected to the digital input terminals 32/33 only. Program Terminals 32/33 to *No operation*.
[2]	OPCENC	Encoder module option, which can be configured in parameter group *EC-1#*. ***NOTICE*** **This is valid for AF-650 GP only.**
[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	

H-43 Torque Characteristics		
Option:		**Function:**
		NOTICE **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 *parameter SP-40 VT Level*.
[2]	Energy Savings CT	Automatically optimizes energy consumption by minimizing magnetization and frequency via *parameter SP-41 Energy Savings Min. Magnetization* and *parameter 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 generator mode. This is done to limit the power in generator mode that otherwise becomes considerably larger than in motor

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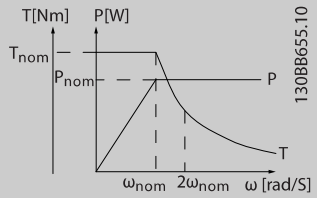
H-43 Torque Characteristics

Option:		Function:
		mode, due to the high DC-link voltage available in generator mode. $P_{shaft}[W] = \omega_{mech}[rad/s] \times T[Nm]$ This relationship with the constant power is illustrated in *Illustration 3.25*:  **Illustration 3.25 Constant Power**

H-44 Constant or Variable Torque OL

Option:		Function:
		NOTICE **This parameter cannot be adjusted while the motor is running.** Use this parameter to configure the frequency converter for either high or normal overload. When selecting the frequency converter size, always review the technical data in the *operating instructions* or the *design guide* to know the available output current.
[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 (*parameter H-40 Configuration Mode*), that is application control principle, to use when a local (keypad) reference is active. A local reference can be active only when *parameter F-02 Operation Method* is set to *[0] Linked to Hand/Auto* or *[2] Local*. By default the local reference is active in local 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 2 lines. If the value is not available for a motor speed of 1000 RPM, calculate the correct value as follows. If back EMF is for example 320 V at 1800 RPM, it can be calculated at 1000 RPM: **Example** Back EMF 320 V at 1800 RPM. Back EMF=(Voltage/ RPM)*1000=(320/1800)*1000=178. This parameter is only active when *parameter P-20 Motor Construction* is set to options that enable PM (permanent magnet) motors. ***NOTICE*** **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 x pi (radians). To obtain the offset angle value: After frequency converter start-up, apply DC hold and enter the value of *parameter DR-20 Motor Angle* into this parameter. This parameter is only active when *parameter P-20 Motor Construction* is set to *[1] PM, non-salient SPM* (Permanent Magnet Motor).

H-48 Clockwise Direction

Option:		Function:
		NOTICE **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	The motor shaft turns in clockwise direction when the frequency converter is connected U⇒U, V⇒V, and W⇒W to the motor.

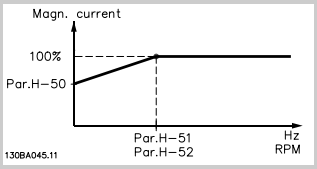
H-48 Clockwise Direction		
Option:		**Function:**
[1]	Inverse	Motor shaft turns in counterclockwise direction when the frequency converter is connected U⇒U, V⇒V, and W⇒W to the motor.

H-49 Motor Angle Offset Adjust		
Range:		**Function:**
		NOTICE **This parameter is only valid for AF-650 GP and only in combination with a PM motor with feedback.**
0*	[Manual]	The functionality of this option depends on the type of the feedback device. This option sets the frequency converter to use the motor angle offset entered in *parameter H-47 Motor Angle Offset*, if an absolute feedback device is used. If an incremental feedback device is selected, the frequency converter automatically adjusts the motor angle offset on the first start after power-up, or when the motor data is changed.
[1]	Auto	The frequency converter adjusts the motor angle offset automatically on the first start after power-up, or when the motor data is changed no matter what feedback device is selected. This means that options *Manual* and *Auto* are identical for the incremental encoder.
[2]	Auto Every Start	The frequency converter adjusts the motor angle offset automatically on every start, or when the motor data is changed.
[3]	Off	Selecting this option turns the automatic offset adjustment off.

3.7.5 H-5# Load Indep. Settings

Parameters to configure the load-independent motor settings.

H-50 Motor Magnetisation at Zero Speed		
This parameter is not visible on the LCP.		
Range:		**Function:**
100 %*	[0 - 300 %]	***NOTICE*** ***Parameter H-50 Motor Magnetisation at Zero Speed* has no effect when *parameter P-20 Motor Construction = [1] PM, non-salient SPM*.** Use this parameter along with *parameter H-51 Min Speed Normal Magnetising [RPM]* to obtain a different thermal load on the motor when running at low speed.

H-50 Motor Magnetisation at Zero Speed		
This parameter is not visible on the LCP.		
Range:		**Function:**
		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 3.26 Motor Magnetisation**

H-51 Min Speed Normal Magnetising [RPM]		
This parameter is not visible on the LCP.		
Range:		**Function:**
15 RPM*	[10 - 300 RPM]	***NOTICE*** ***Parameter H-51 Min Speed Normal Magnetising [RPM]* has no effect when *parameter P-20 Motor Construction=[1] PM, non-salient SPM*.** Set the required speed for normal magnetizing current. If the speed is set lower than the motor slip speed, *parameter H-50 Motor Magnetisation at Zero Speed* and *parameter H-51 Min Speed Normal Magnetising [RPM]* are of no significance. Use this parameter along with *parameter H-50 Motor Magnetisation at Zero Speed*. See *Table 3.13*.

H-52 Min Speed Normal Magnetising [Hz]		
Range:		**Function:**
12.5 Hz*	[0 - 250.0 Hz]	Set the required frequency for normal magnetizing current. If the frequency is set lower than the motor slip frequency, *parameter H-50 Motor Magnetisation at Zero Speed* is inactive. Use this parameter along with *parameter H-50 Motor Magnetisation at Zero Speed*. See *Illustration 3.26*.

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 *parameter H-40 Configuration Mode* and *parameter H-41 Motor Control Principle*. There are two options: shift between

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H-53 Model Shift Frequency

Range: **Function:**

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 *parameter H-40 Configuration Mode* is set to *[1] Speed closed loop* or *[2] Torque* and *parameter 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.

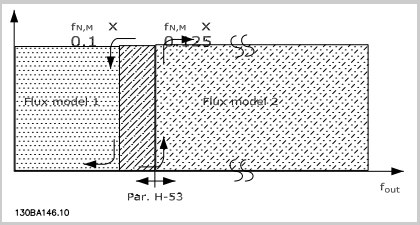

Illustration 3.29 H-40 = [1] Speed closed loop or [2] Torque and H-41 = [3] Flux w/motor feedback

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.

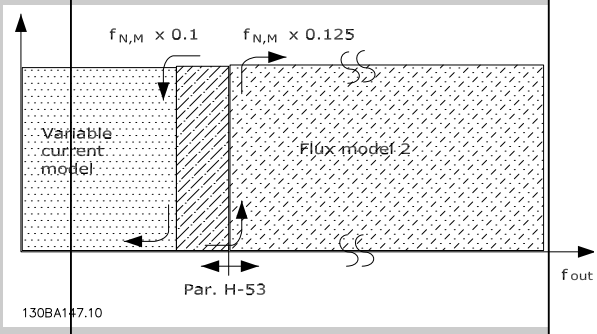

Illustration 3.30 H-40 = [0] Speed open loop, H-41 = [2] Flux sensorless

H-54 Voltage reduction in fieldweakening

Range:		Function:
0 V*	[0 - 100 V]	The value of this parameter reduces the maximal voltage available for the flux of the motor in field weakening, giving more voltage available for torque. An excessive value may cause stall problems at high speed.

H-55 U/f Characteristic - U

Array [6]

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 *parameter H-56 U/f Characteristic - F*. This parameter is an array parameter [0-5] and is only accessible when *parameter H-41 Motor Control Principle* is set to *[0] U/f*.

H-56 U/f Characteristic - F

Array [6]

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 *parameter H-55 U/f Characteristic - U*. This parameter is an array parameter [0–5] and is only accessible when *parameter H-41 Motor Control Principle* is set to *[0] U/f*.

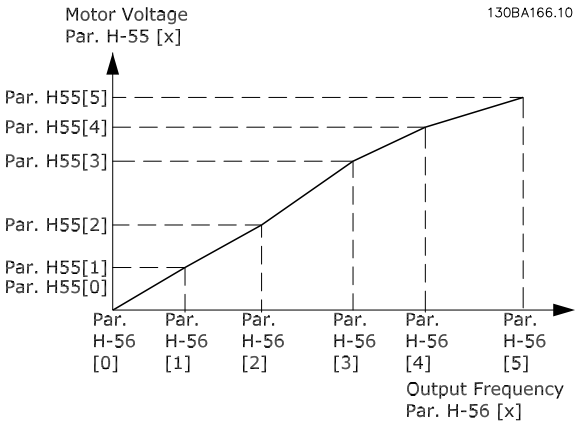

Illustration 3.31 U/f Characteristic

H-58 Flying Start Test Pulses Current		
Range:		**Function:**
30 %*	[0 - 200 %]	Sets the current level for the fly start 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 0 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 adjusting PM motors, the value tunes for back EMF and d-axis inductance of the motor.

H-59 Flying Start Test Pulses Frequency		
Range:		**Function:**
200 %*	[0 - 500 %]	Asynchronous motor: Set the frequency of the flying start test pulses that are used to detect the motor direction. For asynchronous motors, the value 100% means that the slip is doubled. Increase this value to reduce the generated torque. For synchronous motors, this value is the percentage nm,n of the free-running motor. Above this value, flying start is always performed. Below this value, the start mode is selected in *parameter F-20 PM Start Mode*

3.7.6 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	Changeover
0.25 - 7.5 kW	>10 Hz

Table 3.14 Changeover Frequency

H-62 Brake Check Limit Factor Source		
Select the input source for the function in *parameter B-15 Brake Check*. If several frequency converters are carrying out a brake check simultaneously, the resistance in the grid leads to a voltage drop on the mains or DC-link and a false brake check can occur. Use an external current sensor on every brake resistor. If an application requires a 100% valid brake check, connect the sensor to an analog input.		
Option:		**Function:**
[0] *	DC-link voltage	The frequency converter performs the brake check by monitoring the DC-link voltage. The frequency converter injects current in the brake resistor which lowers the DC-link voltage.
[1]	Analog Input 53	Select to use an external current sensor for brake monitoring.
[2]	Analog Input 54	Select to use an external current sensor for brake monitoring.

H-63 Brake Check Limit Factor		
Range:		**Function:**
98 %*	[0 - 100 %]	Enter the limit factor that *parameter B-15 Brake Check* uses when performing the brake check. The frequency converter uses the limit factor depending on the selection in *parameter H-62 Brake Check Limit Factor Source*: *[0] DC-link voltage* - the frequency converter applies the factor to the EEPROM data in the DC-link. *[1] Analog Input 53* or *[2] Analog Input 54* - the brake check fails if the input current on the analog input is lower than the maximum input current multiplied by the limit factor. For example, in the following configuration the brake check fails if the input current is lower than 16 mA: • A current transducer with a range of 4-20 mA is connected to analog input 53. • *Parameter H-63 Brake Check Limit Factor* is set to 80%.

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H-64 Resonance Dampening		
Range:		**Function:**
100 %*	[0 - 500 %]	***NOTICE*** ***Parameter H-64 Resonance Dampening* has no effect when *parameter P-20 Motor Construction=[1] PM*, non-salient SPM.** Enter the resonance damping value. Set *parameter H-64 Resonance Dampening* and *parameter H-65 Resonance Dampening Time Constant* to help eliminate high frequency resonance problems. To reduce resonance oscillation, increase the value of *parameter H-64 Resonance Dampening*.

H-65 Resonance Dampening Time Constant		
Range:		**Function:**
5 ms*	[5 - 50 ms]	***NOTICE*** ***Parameter H-65 Resonance Dampening Time Constant* has no effect when *parameter P-20 Motor Construction = [1] PM, non-salient SPM*.** Set *parameter H-64 Resonance Dampening* and *parameter H-65 Resonance Dampening Time Constant* to help eliminate high frequency resonance problems. Enter the time constant that provides the best dampening.

H-66 Min. Current at Low Speed		
Range:		**Function:**
100 %*	[1 - 200 %]	Enter the minimum motor current at low speed, see *parameter H-53 Model Shift Frequency*. Increasing this current improves motor torque at low speed. *Parameter H-66 Min. Current at Low Speed* is enabled when *parameter 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. *Parameter F-40 Torque Limiter (Driving)* and/or *parameter F-41 Torque Limiter (Braking)* automatically adjust *parameter H-66 Min. Current at Low Speed*. The parameter with the highest value adjusts *parameter H-66 Min. Current at Low Speed*. The current setting in *parameter H-66 Min. Current at Low Speed* is composed of the torque generating current and the magnetizing current. Example: Set *parameter F-40 Torque Limiter (Driving)* to 100% and set *parameter F-41 Torque Limiter (Braking)* to 60%. *Parameter H-66 Min. Current at Low Speed* automatically adjusts to about 127%, depending on the motor size.

H-67 Torque Limit Factor Source		
Option:		**Function:**
		Select an analog input for scaling the settings in *parameter F-40 Torque Limiter (Driving)* and *parameter F-41 Torque Limiter (Braking)* 0–100% (or inverse). The signal levels corresponding to 0% and 100% are defined in the analog input scaling, for example parameter group *AN-1#*. This parameter is only active when *parameter H-40 Configuration Mode* is in *Speed Open Loop* or *Speed Closed Loop*.
[0] *	No function	
[2]	Analog in 53	
[4]	Analog in 53 inv	
[6]	Analog in 54	
[8]	Analog in 54 inv	
[10]	Analog in X30-11	
[12]	Analog in X30-11 inv	
[14]	Analog in X30-12	
[16]	Analog in X30-12 inv	

H-68 Speed Limit Factor Source		
Option:		**Function:**
		Select an analog input for scaling the settings in *parameter F-03 Max Output Frequency 1* 0–100% (or the other way around). The signal levels corresponding to 0% and 100% are defined in the analog input scaling, for example parameter group *AN-1#*. This parameter is only active when *parameter H-40 Configuration Mode* is in *[4] Torque Open Loop*.
[0] *	No function	
[2]	Analog in 53	
[4]	Analog in 53 inv	
[6]	Analog in 54	
[8]	Analog in 54 inv	
[10]	Analog in X30-11	
[12]	Analog in X30-11 inv	
[14]	Analog in X30-12	
[16]	Analog in X30-12 inv	

3.7.7 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 readout via fieldbus in the extended status word.

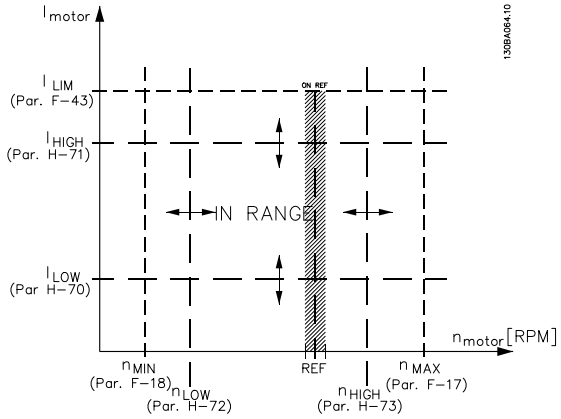

Illustration 3.32 Adjustable Warnings

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 3.32*.

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 3.32*.

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:**
3600 RPM*	[par. H-72 - 60000 RPM]	Enter the n_{HIGH} value. When the motor speed exceeds this value, the display reads *Speed high*. The signal outputs can be programmed to produce a status signal on terminals 27 or 29 and on relay outputs 01 or 02. Refer to *Illustration 3.32*.

H-74 Warning Reference Low		
Range:		**Function:**
-999999.999*	[-999999.999 - par. H-75]	Enter the lower reference limit. When the actual reference drops 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 ReferenceFeedbackUnit*	[-999999.999 - par. H-77 ReferenceFeedbackUnit]	Enter the lower feedback limit. When the feedback drops 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 ReferenceFeedbackUnit*	[par. H-76 - 999999.999 ReferenceFeedbackUnit]	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.

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H-78 Missing Motor Phase Function		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** Shows an alarm if motor phase is missing.
[0]	Disabled	No alarm is shown if a missing motor phase occurs.
[1]	Trip 100 ms	An alarm is shown if a missing motor phase occurs.
[2] *	Trip 1000 ms	
[3]	Trip 100 ms lim 3 phase detec.	
[5]	Motor Check	

3.7.8 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 deceled to the settings in *parameter 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 the motor with a DC hold current (see *parameter 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 premagnetizing function does not help the very first start command. Two different solutions are available to premagnetize the machine for the first start command: 1. Start the frequency converter with a 0 RPM reference and wait 2-4 rotor time constants before increasing the speed reference. 2. Set *parameter F-24 Holding Time* to the required premagnetizing time (2–4 rotor time constants. See the time constants description further in this section). 3. Set *parameter F-25 Start Function* to either *[0] DC hold* or *[1] DC Brake*. 4. Set the DC hold or DC brake current magnitude (*parameter B-00 DC Hold Current* or *parameter 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 *parameter H-55 U/f Characteristic - U* [0] defines the voltage at 0 Hz.
[5]	Coast at low reference	When the reference is below *parameter 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 *parameter 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 *parameter H-80 Function at Stop*.

H-83 Precise Stop Function		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor is running.** **Valid for AF-650 GP only.**
[0] *	Precise ramp stop	Only optimal when the operational speed, for example the operational speed of a conveyor belt is constant. This is an open-loop control. Achieves high repetitive precision at the stop 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, defined in

H-83 Precise Stop Function		
Option:		**Function:**
		parameter H-84 Precise Stop Counter Value, has been received at *terminal 29* or *terminal 33*. This is 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 *[2] Cnt stop with reset* but the number of pulses counted during decel to 0 RPM is deducted from the counter value entered in *parameter H-84 Precise Stop Counter Value*. This reset function can 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 *parameter 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. Make sure that the frequency converter has ramped up before activating the speed compensated stop.
[4]	Com cnt stop w/rst	Same as *Speed comp stop* 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 *Speed comp stop* but the number of pulses counted during decel to 0 RPM is deducted from the counter value entered in *parameter H-84 Precise Stop Counter Value*. This reset function can 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 using 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 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. Run a test 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:

- *Parameter F-08 Decel Time 1*.
- *Parameter E-11 Decel Time 2*.
- *Parameter E-13 Decel Time 3*.
- *Parameter E-15 Decel Time 4*.

The precise stop function is set up here and enabled from DI at *terminal 29* or *terminal 33*.

H-84 Precise Stop Counter Value		
Range:		**Function:**
100000*	[0 - 999999999]	Enter the counter value to be used in the integrated precise stop function, *parameter H-83 Precise Stop Function*. The maximum permissible frequency at terminal 29 or 33 is 110 kHz. **NOTICE** **Not used for selections *[0] Precise ramp stop* and *[3] Speed comp stop* in *parameter 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, and so on. for use in *parameter H-83 Precise Stop Function*. In speed compensated stop mode, the delay time at different frequencies has a major influence on the stop function. **NOTICE** **Not used for selections *[0] Precise ramp stop, [1] Cnt stop with reset*, and *[2] Cnt stop w/o reset* in *parameter H-83 Precise Stop Function*.**

H-87 Load Type		
This parameter is valid for AF-650 GP only.		
Option:		**Function:**
[0] *	Passive load	For conveyors, fan, and pump applications.
[1]	Active load	Use for hoisting applications. This option allows the frequency converter to ramp up at 0 RPM. When *[1] Active Load* is selected, set *parameter H-66 Min. Current at Low Speed* to a level which corresponds to maximum torque.

H-88 Motor Inertia		
Range:		**Function:**
0 kgm^2*	[0.0000 - 10000.0000 kgm^2]	Enter the motor inertia to obtain an improved torque readout and therefore a better estimate of the

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H-88 Motor Inertia		
Range:		**Function:**
		mechanical torque on the shaft. Available in flux control principle only.

H-89 System Inertia		
Range:		**Function:**
0.0048 kgm²*	[0000 - 10000.0000 kgm²]	***NOTICE*** **Valid for AF-650 GP only. 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.

3.7.9 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 (*parameter P-30 Stator Resistance (Rs)*) for PM motors and also rotor resistance (*parameter P-31 Rotor Resistance (Rr)*) for asynchronous motors, depending on winding temperature. The calculation is:

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

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

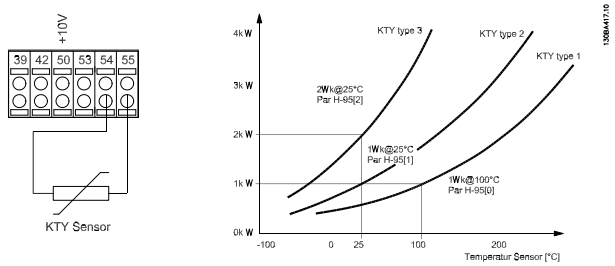


Illustration 3.33

NOTICE
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.

NOTICE
Valid for AF-650 GP only.

H-94 ATEX overload cur.lim. speed reduction		
Range:		**Function:**
0 %*	[0 - 100 %]	Only visible if *parameter F-10 Electronic Overload* is set to [20].

Configure the reaction for operating in Ex-e current limit.
0%: The frequency converter does not change anything besides issuing *warning 163, ATEX ETR cur.lim.warning.*
>0%: The frequency converter issues *warning 163, ATEX ETR cur.lim.warning* and reduces motor speed following ramp 2 (*parameter SP-76 Accel/Decel Time 2 Type*).

Example:
Actual reference = 50 RPM
Parameter H-94 ATEX overload cur.lim. speed reduction = 20%
Resulting reference = 40 RPM

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:**
		NOTICE **Valid for AF-650 GP only.** 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 *parameter F-01 Frequency Setting 1* to *parameter C-34 Frequency Command 3*). ***NOTICE*** **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.

H-98 ATEX overload interpol. points freq.		
Range:		**Function:**
0.0 Hz*	[0 - 1000.0 Hz]	***NOTICE*** **Valid for AF-650 GP only.** Only visible if *parameter F-10 Electronic Overload* is set to [20].

Enter the 4 frequency points [Hz] from the motor nameplate into this array. Together with *parameter H-99 ATEX overload interpol points current*, these can be presented in *Table 3.15*.

NOTICE

All frequency/current limit points from the motor nameplate or motor datasheet must be programmed.

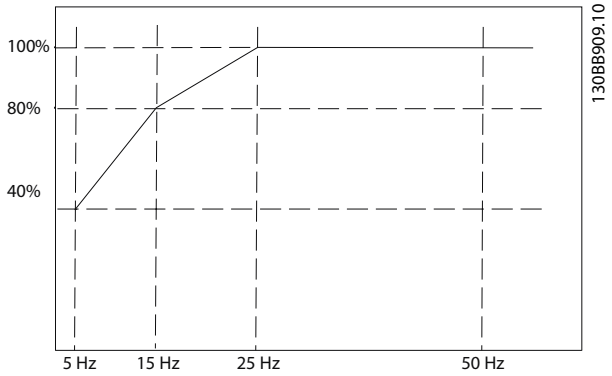


Illustration 3.34 Example of ATEX ETR Thermal Limitation Curve.
x-axis: f_m [Hz]
y-axis: $I_m/I_{m,n}$ x 100 [%]

Parameter H-98 ATEX overload interpol. points freq.	Parameter H-99 ATEX overload interpol points current
[0]=5 Hz	[0]=40%
[1]=15 Hz	[1]=80%
[2]=25 Hz	[2]=100%
[3]=50 Hz	[3]=100%

Table 3.15 Interpolation Points

All operating points underneath the curve are allowed continuously. Above the line, however, these are only allowed for a limited time calculated as a function of the overload. In the event of a machine current greater than 1.5 times the rated current, shut-down is immediate.

H-99 ATEX overload interpol points current		
Only visible if *parameter F-10 Electronic Overload* is set to [20] or [21].		
Range:		**Function:**
0 %*	[0 - 100 %]	***NOTICE*** **Valid for AF-650 GP only.** Definition of thermal limitation curve. For example, see *parameter H-98 ATEX overload interpol. points freq.*

Use the 4 current points [A] from the motor nameplate. Calculate the values as percentage of nominal motor current, $I_m/I_{m,n}$ x 100 [%], and enter into this array.

Together with *parameter H-98 ATEX overload interpol. points freq.*, these constitute a table (f [Hz],I [%]).

NOTICE

All frequency/current limit points from the motor nameplate or motor datasheet must be programmed.

3

3.8 AN-## Analog In/Out

Parameter group related to the Analog Inputs and Outputs.

3.8.1 AN-0# Analog I/O Mode

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

AN-00 Live Zero Timeout Time		
Range:		**Function:**
10 s*	[1 - 99 s]	Enter the live zero timeout in s. Live zero timeout time is active for analog inputs, that is, terminal 53 or terminal 54, used as reference or feedback sources. If the reference signal value associated with the selected current input drops below 50% of the value set in: • *Parameter AN-10 Terminal 53 Low Voltage*. • *Parameter AN-12 Terminal 53 Low Current*. • *Parameter AN-20 Terminal 54 Low Voltage*. • *Parameter AN-22 Terminal 54 Low Current*. For a time period longer than the time set in *parameter AN-00 Live Zero Timeout Time*, the function selected in *parameter AN-01 Live Zero Timeout Function* is activated.

AN-01 Live Zero Timeout Function		
Option:		**Function:**
		Select the timeout function. The function set in *parameter AN-01 Live Zero Timeout Function* is activated, if the input signal on terminal 53 or 54 is below 50% of the value in *parameter AN-10 Terminal 53 Low Voltage*, *parameter AN-12 Terminal 53 Low Current*, *parameter AN-20 Terminal 54 Low Voltage* or *parameter AN-22 Terminal 54 Low Current* for a time period defined in *parameter AN-00 Live Zero Timeout Time*. If several timeouts occur simultaneously, the frequency converter prioritizes the timeout functions as follows: 1. *Parameter AN-01 Live Zero Timeout Function*. 2. *Parameter 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 *parameter AN-14 Terminal 53 Low Ref./ Feedb. Value*.

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 *parameter 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 *parameter F-52 Minimum Reference*. Set the value to exceed 2 mA in order to activate the live zero timeout function in *parameter 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 *parameter 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 *parameter AN-10 Terminal 53 Low Voltage* and *parameter AN-12 Terminal 53 Low Current*.

AN-15 Terminal 53 High Ref./Feedb. Value		
Range:		**Function:**
1500.000 ReferenceFeed-backUnit*	[-999999.999 - 999999.999 ReferenceFeed-backUnit]	Enter the analog input scaling value that corresponds to the maximum reference feedback value set in *parameter AN-11 Terminal 53 High Voltage* and *parameter AN-13 Terminal 53 High Current*.

AN-16 Terminal 53 Filter Time Constant		
Range:		**Function:**
0.001 s*	[0.001 - 10 s]	***NOTICE*** **This parameter cannot be adjusted while the motor is running.** Enter the filter time constant. This constant is a first-order digital low-pass filter time for suppressing electrical noise in terminal 53. A high value improves dampening, but also increases the delay through the filter.

AN-17 Terminal 53 Live Zero		
Option:		**Function:**
		This parameter makes it possible to disable the live zero monitoring. For example, this is used if the analog outputs are used as part of a decentral I/O system (for example when not part of any control functions related to the frequency converter, but feeding an external control system with data).
[0]	Disabled	
[1] *	Enabled	

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 *parameter F-52 Minimum Reference*.

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 *parameter 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 *parameter F-52 Minimum Reference*. Enter the value that exceeds 2 mA to activate the live zero timeout function in *parameter 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 *parameter AN-25 Terminal 54 High Ref./ Feedb. Value*.

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

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

3

AN-26 Terminal 54 Filter Time Constant		
Range:		**Function:**
0.001 s*	[0.001 - 10 s]	***NOTICE*** **This parameter cannot be adjusted while the motor is running.** Enter the filter time constant. This is a first-order digital low-pass filter time constant for suppressing electrical noise in terminal 54. Increasing the value improves dampening but also increases the time delay through the filter.

AN-27 Terminal 54 Live Zero		
Option:		**Function:**
[0]	Disabled	
[1] *	Enabled	This parameter makes it possible to disable the live zero monitoring. For example, this is used if the analog outputs are used as part of a decentral I/O system (for example when not part of any control functions related to the frequency converter, but feeding an external control system with data).

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 *parameter 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 *parameter AN-35 Term. X30/11 High Ref./Feedb. Value*).

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 *parameter 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 *parameter AN-31 Terminal X30/11 High Voltage*).

AN-36 Term. X30/11 Filter Time Constant		
Range:		**Function:**
0.001 s*	[0.001 - 10 s]	***NOTICE*** **This parameter cannot be adjusted while the motor is running.** Enter the filter time constant. This constant is a first-order digital low-pass filter time for suppressing electrical noise in terminal X30/11. A high value improves dampening, but also increases the delay through the filter.

AN-37 Term. X30/11 Live Zero		
Option:		**Function:**
		This parameter makes it possible to disable the live zero monitoring. For example, this is used if the analog outputs are used as part of a decentral I/O system (for example when not part of any control functions related to the frequency converter, but feeding an external control system with data).
[0]	Disabled	
[1] *	Enabled	

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 *parameter 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 *parameter 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 *parameter 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 *parameter AN-41 Terminal X30/12 High Voltage*.

AN-46 Term. X30/12 Filter Time Constant		
Range:		**Function:**
0.001 s*	[0.001 - 10 s]	***NOTICE*** **This parameter cannot be adjusted while the motor is running.** Enter the filter time constant. This constant is a first-order digital low-pass filter time for suppressing electrical noise in terminal X30/12. A high value improves dampening, but also increases the delay through the filter.

AN-47 Term. X30/12 Live Zero		
Option:		**Function:**
		This parameter makes it possible to disable the live zero monitoring. For example, this is used if the analog outputs are used as part of a decentral I/O system (for example when not part of any control functions related to the frequency converter, but feeding an external control system with data).
[0]	Disabled	
[1] *	Enabled	

3.8.6 AN-5# Analog Output 42

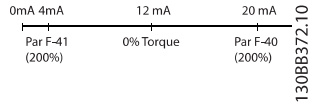
Parameters to configure the scaling and limits for Analog Output 1 (terminal 42)

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 the keypad in *parameter DR-65 Analog Output 42 [mA]*.
[0] *	No operation	Indicates no signal on the analog output.

AN-50 Terminal 42 Output		
Option:		**Function:**
[100]	Output frequency	0 Hz = 0 mA; 100 Hz = 20 mA.
[101]	Reference	*Parameter F-50 Reference Range* [Min - Max] 0% = 0 mA; 100% = 20 mA *Parameter F-50 Reference Range* [-Max - Max] -100% = 0 mA; 0% = 10 mA; +100% = 20 mA
[102]	Feedback	*Parameter F-50 Reference Range* [Min - Max] 0% = 0mA; 100% = 20mA *Parameter F-50 Reference Range* [-Max - Max] -100% = 0 mA; 0% = 10 mA; +100% = 20 mA
[103]	Motor Current	The value is taken from *parameter DR-37 Drive Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. Example: Inverter normal current (11 kW) is 24 A. 160 %=38.4 A. Motor normal current is 22 A, the readout is 11.46 mA. $\frac{20\ mA\ x\ 22\ A}{38.4\ A} = 11.46\ mA$ In case the normal motor current is equal to 20 mA, the output setting of *parameter AN-52 Terminal 42 Output Max Scale* is: $\frac{I_{DRIVE_{Max}}\ x\ 100}{I_{Motor_{Norm}}} = \frac{38.4\ x\ 100}{22} = 175\ \%$
[104]	Torque rel to limit	The torque setting is related to setting in *parameter F-40 Torque Limiter (Driving)*
[105]	Torq relate to rated	The torque is related to the motor torque setting.
[106]	Power	Taken from *parameter P-07 Motor Power [kW]*.
[107]	Speed	Taken from *parameter F-53 Maximum Reference*. 20 mA equals to value in *parameter F-53 Maximum Reference*.
[108]	Torque	Torque reference related to 160% torque.
[109]	Max Out Freq	0 Hz = 0 mA,*parameter F-03 Max Output Frequency 1* = 20 mA.
[113]	PID Clamped Output	
[117]	Shaft Power	
[118]	Shaft Power 4-20mA	
[119]	Torque % lim	Torque% lim: Torque reference. *parameter F-50 Reference Range* [Min - Max] 0% = 0mA; 100% = 20mA *parameter F-50 Reference Range* [-Max - Max] -100% = 0mA; 0% = 10mA; +100% = 20mA
[130]	Output freq. 4-20mA	0 Hz = 4 mA, 100 Hz = 20 mA

3

AN-50 Terminal 42 Output		
Option:		**Function:**
[131]	Reference 4-20mA	*Parameter F-50 Reference Range* [Min-Max] 0% = 4 mA; 100% = 20 mA *Parameter F-50 Reference Range* [-Max-Max] -100% = 4 mA; 0% = 12 mA; +100% = 20 mA
[132]	Feedback 4-20mA	Feedback 4-20mA: *parameter F-50 Reference Range* [Min-Max] 0% = 4 mA; 100% = 20 mA *Parameter F-50 Reference Range* [-Max-Max] -100% = 4 mA; 0% = 12 mA; +100% = 20 mA
[133]	Motor cur. 4-20mA	The value is taken from *parameter DR-37 Drive Max. Current*. The inverter maximum current (160% current) is equal to 20 mA. Example: Inverter normal current (11 kW) is 24 A. 160% = 38.4 A. Motor normal current is 22 A, the readout is 11.46 mA.
[134]	Torq.% lim 4-20 mA	The torque setting is related to setting in *parameter 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 *parameter P-07 Motor Power [kW]*.
[137]	Speed 4-20mA	Taken from *parameter F-53 Maximum Reference*. 20 mA = Value in *parameter 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 works independently of internal functions in the frequency converter.
[140]	Bus ctrl. 4-20 mA	An output value set from Network process data. The output works independently of internal functions in the frequency converter.
[141]	Bus ctrl 0-20mA t.o.	*Parameter H-74 Warning Reference Low* defines the behavior of the analog output in case of fieldbus timeout.
[142]	Bus ctrl 4-20mA t.o.	*Parameter H-74 Warning Reference Low* defines the behavior of the analog output in case of fieldbus timeout.
[147]	Main act val 0-20mA	
[148]	Main act val 4-20mA	
[149]	Torque % lim 4-20mA	Analog output at 0 torque is 12 mA. Motoring torque increases the output current to maximum torque limit 20 mA (set in *parameter F-40 Torque Limiter (Driving)*).

AN-50 Terminal 42 Output		
Option:		**Function:**
		Generating torque decreases the output to torque limit in generator mode (set in *parameter F-41 Torque Limiter (Braking)*) Example: *Parameter F-40 Torque Limiter (Driving)* = 200% and *parameter F-41 Torque Limiter (Braking)* = 200%. 20 mA = 200% motoring and 4 mA = 200% generating.  **Illustration 3.35 Torque Limit**
[150]	Max Out Fr 4-20mA	0 Hz = 0 mA, *parameter 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 mA or 4 mA) of the analog signal at terminal 42. Set the value to be the percentage of the full range of the variable selected in *parameter 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 required output current at a value 0–100% of the full-scale output, program the percentage value in the parameter, that is, 50% = 20 mA. If a current 4–20 mA is required at maximum output (100%), calculate the percentage value as follows:

$20\ mA / desired\ maximum\ current\ x\ 100\ \%$

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

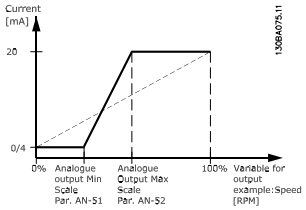


Illustration 3.36 Output Max. Scale

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. If a timeout function is selected in *parameter AN-50 Terminal 42 Output*, the output is preset to this level if a fieldbus timeout occurs.

AN-55 Terminal 42 Output Filter		
Option:		**Function:**
		The following readout parameters from selection in *parameter AN-50 Terminal 42 Output* have a filter selected when *parameter AN-55 Terminal 42 Output Filter* is 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 3.16 Readout Parameters

[0] *	Off	Filter off.
[1]	On	Filter on.

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, *parameter 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, that is 0 mA (or 0 Hz) is required at 25% of the maximum output value and 25% is programmed. The value can never exceed the corresponding setting in *parameter AN-62 Terminal X30/8 Max. Scale* if the value is below 100%. This parameter is active when General Purpose I/O OPCGPIO 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 required 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 required output current at a value between 0–100% of the full-scale output, program the percentage value in the parameter, that is, 50%=20 mA. If a current 4–20 mA is required 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. If there is a fieldbus timeout and a timeout function is selected in *parameter AN-60 Terminal X30/8 Output*, the output is 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.

3

SP-00 Fault Level

Use this parameter to customize fault levels.

Option:		Function:
[0]	Off	Use *[0] Off* with caution as it ignores all warnings and alarms for the selected source.
[1]	Warning	
[2]	Trip	Changing a fault level from default option *[3] Trip Lock* to *[2] Trip* leads to the automatic reset of the alarm. For alarms involving overcurrent, the frequency converter has a hardware protection that issues a 3 minute recovery after 2 consecutive overcurrent incidents. This hardware protection cannot be overruled.
[3] *	Trip Lock	
[4]	Trip w. delayed reset	This option adds a delay between automatic resets, otherwise it is the same as option *[2] Trip*. The delay prevents a situation where reset is attempted repeatedly for an overcurrent situation. Hardware protection of the frequency converter forces the 3 minute recovery time after 2 consecutive overcurrents (within a short time window).

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	–	–
Ground fault during ramping	14	–	–	D	X
Ground fault 2 during cont. operation	45	–	–	D	X
Torque limit	12	X	D	–	–
Overcurrent	13	–	–	X	D
Short circuit	16	–	–	X	D
Heat sink temperature	29	–	–	X	D
Heat sink sensor	39	–	–	X	D
Control card temperature	65	–	–	X	D
Power card temperature	69	–	1)	X	D
Heat sink temperature[1)]	244	–	–	X	D
Heat sink sensor[1)]	245	–	–	X	D
Power card temperature[1)]	247	–	–	–	–
Motor phase missing	30–32	–	–	X	D
Locked rotor	99	–	–	X	D

Table 3.17 Selection of Action when Selected Alarm Appears

D stands for the default setting.

X stands for a possible option.

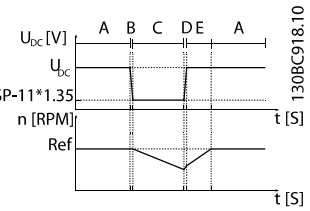
1) 2) Only frequency converters 125 hp and above. In all other products are just a warning.

3.9.1 SP-1# Line On/Off

Parameters to configure actions taken for Line Failures, Input Fault, and Imbalance.

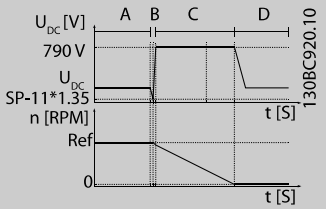
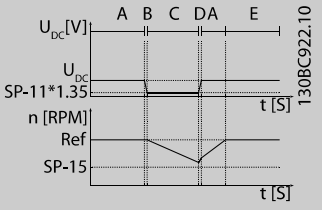
SP-10 Line failure

Options *[1] Ctrl. ramp-down*, *[2] Ctrl. ramp-down, trip*, *[5] Kinetic back-up, trip*, *[7] Kin. back-up, trip w recovery* are not active when the option *[2] Torque* is selected in *parameter H-40 Configuration Mode*.

Option:		Function:
		NOTICE ***Parameter SP-10 Line failure* cannot be changed while motor runs.** *Parameter 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 frequency converters, it only takes a few milliseconds before the DC level drops to about 373 V DC, and the IGBTs cut off and lose the control of the motor. When mains is restored, and the IGBTs start again, the output frequency and voltage vector do not correspond to the speed/ frequency of the motor, and the result is normally an overvoltage or overcurrent, mostly resulting in a trip lock. *Parameter SP-10 Line failure* can be programmed to avoid this situation. Select the function according to which the frequency converter must act when the threshold in *parameter SP-11 Line Voltage at Input Fault* is reached.
[0] *	No function	The frequency converter does not compensate for a mains interruption. The voltage on the DC link drops quickly and motor control is lost within milliseconds to seconds. Trip lock is the result.
[1]	Ctrl. Decel	Control of the motor remains with the frequency converter, and the frequency converter performs a controlled ramp down from *parameter SP-11 Line Voltage at Input Fault* level. If *parameter B-10 Brake Function* is *[0] Off* or *[2] AC brake*, the ramp follows the overvoltage ramping. If *parameter B-10 Brake Function* is *[1] Resistor Brake*, the ramp follows the setting in *parameter C-23 Quick Stop Decel Time*. This selection is useful in pump applications, where the inertia is low and the friction is high. When mains is restored, the output frequency ramps the motor up to the reference speed (if the mains interruption is prolonged, the controlled ramp down may bring the output frequency down to 0 RPM, and when the mains is restored, the application is ramped up from 0 RPM to the previous reference speed via the normal ramp up). If the energy in the DC link disappears before the motor is ramped to 0, the motor is coasted. **Limitation:** See the introduction text in *parameter SP-10 Line failure*.
[2]	Ctrl. Decel, trip	The functionality is the same as in option *[1] Ctrl. ramp-down*, except in this option a reset is necessary for starting up after power-up.
[3]	Coasting	Centrifuges can run for 1 hour without 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 maintaining control of the frequency converter 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 s. Many industry applications can extend controlled operation for many s, which is often enough time for the mains to return.  A Normal operation B Mains failure C Kinetic back-up D Mains return E Normal operation: ramping **Illustration 3.37 Kinetic Back-up** The DC level during *[4] Kinetic back-up* equals to *parameter SP-11 Line Voltage at Input Fault* * 1.35.

3

SP-10 Line failure		
Options *[1] Ctrl. ramp-down*, *[2] Ctrl. ramp-down, trip*, *[5] Kinetic back-up, trip*, *[7] Kin. back-up, trip w recovery* are not active when the option *[2] Torque* is selected in *parameter H-40 Configuration Mode*.		
Option:		**Function:**
		If the mains does 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 returns while in kinetic back-up mode, U_{DC} increases above *parameter SP-11 Line Voltage at Input Fault*x1.35. This is detected in 1 of the following ways. • If U_{DC} > *parameter SP-11 Line Voltage at Input Fault*x1.35x1.05. • If the speed is above the reference. This is relevant if the mains comes back at a lower level than before, for example, *parameter SP-11 Line Voltage at Input Fault*x1.35x1.02. This does not fulfil the criterion in point 1, and the frequency converter tries to reduce U_{DC} to *parameter SP-11 Line Voltage at Input Fault*x1.35 by increasing the speed. This cannot be done as the mains cannot be lowered. • If running mechanically. The same mechanism as in point 2 applies, but the inertia prevents the speed from going above the reference speed. This leads to the motor running mechanically until the speed is above the reference speed and the situation in point 2 occurs. Instead of waiting for that criterion, point 3 is introduced.
[5]	Kinetic back-up, trip	The difference between kinetic back-up with and without trip is that the latter always ramps down to 0 RPM and trips, regardless of whether mains returns or not. The function does not detect if mains returns. This is the reason for the relatively high level on the DC link during ramp down.

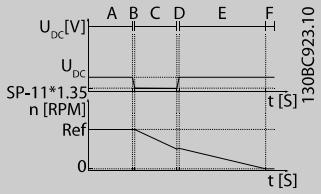
SP-10 Line failure		
Options *[1] Ctrl. ramp-down*, *[2] Ctrl. ramp-down, trip*, *[5] Kinetic back-up, trip*, *[7] Kin. back-up, trip w recovery* are not active when the option *[2] Torque* is selected in *parameter H-40 Configuration Mode*.		
Option:		**Function:**
		 A Normal operation B Mains failure C Kinetic back-up D Trip **Illustration 3.38 Kinetic Back-up Trip**
[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 *parameter SP-15 Kin. Backup Trip Recovery Level*. If mains does not return, the frequency converter ramps down to 0 RPM and trips. If mains returns while in kinetic back-up at a speed above the value in *parameter 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 *parameter SP-11 Line Voltage at Input Fault*x1.35.  A Normal operation. B Mains failure. C Kinetic back-up. D Mains return. E Normal operation: ramping. **Illustration 3.39 Kinetic Back-Up, Trip with Recovery where Mains Returns above *Parameter SP-15 Kin. Backup Trip Recovery Level***

SP-10 Line failure

Options *[1] Ctrl. ramp-down*, *[2] Ctrl. ramp-down, trip*, *[5] Kinetic back-up, trip*, *[7] Kin. back-up, trip w recovery* are not active when the option *[2] Torque* is selected in *parameter H-40 Configuration Mode*.

Option: **Function:**

If mains return while in kinetic back-up at a speed below *parameter 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 ramping down on its own, the ramping is done mechanically and U_{DC} is at the normal level ($U_{DC, m}$x1.35).



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

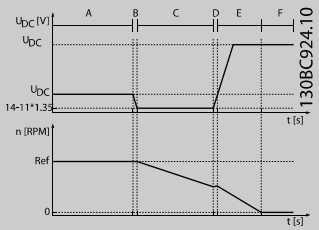
Illustration 3.40 Kinetic Back-Up, Trip with Recovery, Trip Slow Ramp where Mains Returns below *Parameter SP-15 Kin. Backup Trip Recovery Level*, in this Illustration a Slow Ramp is Used

If the ramp is quicker than the ramp down speed of the application, the ramping generates current. This results in a higher U_{DC} which is limited using the brake chopper/resistor brake.

SP-10 Line failure

Options *[1] Ctrl. ramp-down*, *[2] Ctrl. ramp-down, trip*, *[5] Kinetic back-up, trip*, *[7] Kin. back-up, trip w recovery* are not active when the option *[2] Torque* is selected in *parameter H-40 Configuration Mode*.

Option: **Function:**



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

Illustration 3.41 Kinetic Back-Up, Trip with Recovery where Mains Returns below *Parameter SP-15 Kin. Backup Trip Recovery Level*, in this Illustration a Quick Ramp is Used

SP-11 Line Voltage at Input Fault

Range:		Function:
198 V*	[180 - 600 V]	This parameter defines the threshold voltage at which the function in *parameter SP-10 Line failure* is activated. Select the detection level depending on the supply quality. For a supply of 380 V, set *parameter SP-11 Line Voltage at Input Fault* to 342 V. This results in a DC detection level of 462 V (*parameter SP-11 Line Voltage at Input Fault*x1.35).

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 (for example, a pump or a fan running near full speed).

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

3

SP-14 Kin. Backup Time Out		
Range:		**Function:**
60 s*	[0 - 60 s]	This parameter defines the kinetic back-up timeout in flux mode when running on low voltage grids. If the supply voltage does not exceed the value defined in *parameter SP-11 Line Voltage at Input Fault* +5% within the specified time, the frequency converter then automatically runs a controlled ramp-down profile before stop.

SP-15 Kin. Backup Trip Recovery Level		
Range:		**Function:**
60000.000 ReferenceFeedbackUnit*	[0 - 60000.000 ReferenceFeedbackUnit]	This parameter specifies the kinetic back-up trip recovery level. The unit is defined in *parameter K-02 Motor Speed Unit*.

SP-16 Kin. Backup Gain		
Range:		**Function:**
100 %*	[0 - 500 %]	Enter the kinetic back-up gain value in percent.

3.9.2 SP-2# Reset Functions

Parameters to configure the trip delay do to Torque Limit or Drive Fault.

For control card test and initialisation (factory reset of all parameters). Select function, press [OK], and toggle power to the frequency converter. Note, that the control card test needs special hardware to be attached to the inputs.

SP-23 Typecode Setting	
Option:	**Function:**

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 (*parameter 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 s. When the output torque reaches the torque limits (*parameter F-40 Torque Limiter (Driving)* and *parameter 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. Thermal monitoring of the frequency converter remains active.

SP-26 Trip Delay at Drive Fault		
Range:		**Function:**
1 s*	[0 - 35 s]	When the frequency converter detects an overvoltage in the set time, trip is effected after the set time. If value is 0, protection mode is disabled. ***NOTICE*** **Disable protection mode in hoisting applications.**

SP-29 Service Code		
Range:		**Function:**
0*	[-2147483647 - 2147483647]	For internal use 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 *parameter F-40 Torque Limiter (Driving)* and *parameter 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]	Controls the current limit control low-pass filter. This makes it possible to react to peak values or to average values. When selecting average values, it is sometimes possible to run with higher output current and instead trip on the

SP-32 Current Lim Ctrl, Filter Time		
Range:		**Function:**
		hardware limit for current. However, the control reacts slower as it does not react on immediate values.

SP-35 Stall Protection		
Option:		**Function:**
		Parameter 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.

SP-36 Fieldweakening Function		
Select the field weakening function mode in flux mode.		
Range:		**Function:**
0*	[Auto]	In this mode, the frequency converter calculates the optimal torque output. Measured DC-link voltage determines the phase-to-phase motor voltage. Magnetising reference is based on the actual voltage and utilises the information about the model of the motor.
1	[1/x]	The frequency converter reduces torque output. The frequency converter sets the magnetising reference inversely proportional to the speed using a static curve that shows the relationship between DC-link voltage and the speed.

SP-37 Fieldweakening Speed		
Range:		**Function:**
1420 RPM*	[10 - 60000 RPM]	

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 %]	***NOTICE*** **This parameter cannot be adjusted while the motor is running.** ***NOTICE*** **This parameter is not active when *parameter P-20 Motor Construction* is set to *[1] PM non-salient SPM*.** Enter the level of motor magnetization at low speed. Selection of a low value reduces energy loss in the motor, but also reduces load capability.

SP-41 Energy Savings Min. Magnetization		
Range:		**Function:**
40 %*	[40 - 200 %]	***NOTICE*** **This parameter is not active when *parameter P-20 Motor Construction* is set to *[1] PM non-salient SPM*.** Enter the minimum allowable magnetization for Automatic Energy Savings. Selection of a low value reduces energy loss in the motor, but can also reduce resistance to sudden load changes.

SP-42 Energy Savings Min. Frequency		
Range:		**Function:**
10 Hz*	[5 - 40 Hz]	***NOTICE*** **This parameter is not active when *parameter P-20 Motor Construction* is set to *[1] PM non-salient SPM*.** Enter the minimum frequency at which the automatic energy Savings is to be active.

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 enclosure 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.

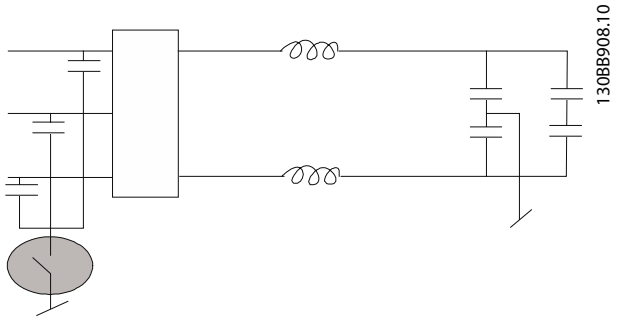


Illustration 3.42 RFI Filter

SP-51 DC Link Compensation

Option:		Function:
		The rectified AC-DC voltage in 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 in the DC link. In general, DC-link compensation is recommended for most applications, but pay attention 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	Disables 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	Enables 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 approximately 55 °C. Fan runs at low speed below 35 °C, and at full speed at approximately 55 °C.
[1]	On 50%	The fan always runs at 50% speed or above. The fan runs at 50% speed at 35 °C, and at full speed at approximately 55 °C.
[2]	On 75%	The fan always runs at 75% speed or above. The fan runs at 75% speed at 35 °C, and at full speed at approximately 55 °C.
[3]	On 100%	The fan always runs at 100% speed.
[4]	Auto (Low temp env.)	This option is the same as *[0] Auto*, but with special considerations around and below 0 °C. In option *[0] Auto* there is a risk that the fan starts running around 0 °C as the frequency converter detects a sensor fault and thus protect the frequency converter while reporting *warning 66, Heat sink Temperature Low*. Option *[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, Heat sink Temperature Low*.

SP-53 Fan Monitor

Option:		Function:
		Select the frequency converter action if a fan fault is detected.
[0]	Disabled	
[1] *	Warning	
[2]	Trip	

SP-54 AHF Cap Reconnect Delay

Range:		Function:
25 s*	[1 - 120 s]	Guarantees a minimum off-time for the capacitors. The timer starts once the AHF capacitor disconnects and needs to expire before the output is allowed to be on again. It only turns on again if the frequency converter power is 20–30%.

SP-55 Output Filter		
Option:	**Function:**	
		NOTICE **This parameter cannot be adjusted while the motor is running.** ***NOTICE*** **Reset the frequency converter after selecting *[2] Sine-Wave Filter Fixed*.** **⚠CAUTION** **OVERHEATING OF FREQUENCY CONVERTER** **Always set *parameter SP-55 Output Filter* to *[2] Sine-wave fixed* when using a sine-wave filter. Failure to do so can result in overheating of the frequency converter, which can result in personal injury and equipment damage.** 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 *parameter SP-56 Capacitance Output Filter* and *parameter SP-57 Inductance Output Filter* are programmed with the output filter capacitance and inductance. It does not limit the range of the switching frequency.
[2]	Sine-Wave Filter Fixed	This parameter sets a minimum allowed limit to the switching frequency and ensures that the filter is operated within the safe range of switching frequencies. Operation is possible with all control principles. For flux control principle, program *parameter SP-56 Capacitance Output Filter* and *parameter SP-57 Inductance Output Filter* (these parameters have no effect in Advanced Vector Control and U/f). The modulation pattern is set to SFAVM, which gives the lowest acoustic noise in the 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. ***NOTICE*** **This is required for correct compensation in Flux mode (*parameter 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. ***NOTICE*** **This is required for correct compensation in Flux mode (*parameter 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 (*parameter F-07 Accel Time 1*) in which the acceleration torque increases. The larger the percentage value, the greater the jerk

3

SP-71 Accel Time 1 S-ramp Ratio at Accel. Start		
Range:		**Function:**
		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 (*parameter 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 (*parameter 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 (*parameter 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 gives constant acceleration during ramping. An S-ramp gives 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 *parameter E-10 Accel Time 2* and *parameter E-11 Decel Time 2*.

NOTICE

If *[1] S-ramp Const Jerk* is selected and the reference during ramping is changed, the ramp time may be prolonged to realise 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 (*parameter 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 (*parameter 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 (*parameter 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 (*parameter 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 gives constant acceleration during ramping. An S-ramp gives 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 *parameter E-12 Accel Time 3* and *parameter E-13 Decel Time 3*.

NOTICE

If *[1] S-ramp Const Jerk* is selected and the reference during ramping is changed, the ramp time may be prolonged to realize a jerk-free movement, which may result in a longer start or stop time.
Extra 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 (*parameter 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 (*parameter 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 (*parameter 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 (*parameter 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 gives constant acceleration during ramping. An S-ramp gives non-linear acceleration, compensating for jerk in the application.
[0] *	Linear	
[1]	S-ramp Const Jerk	Accelerates with lowest possible jerk.

SP-92 Accel/Decel Ramp 4 Type		
Option:		**Function:**
[2]	S-ramp Const Time	S-ramp based on the values set in *parameter E-14 Accel Time 4* and *parameter E-15 Decel Time 4*.

NOTICE

If *[1] S-ramp Const Jerk* is selected and the reference during ramping is changed, the ramp time may be prolonged to realize a jerk-free movement, which may result in a longer start or stop time.
More adjustments 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 (*parameter 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 (*parameter 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 (*parameter 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 (*parameter E-15 Decel Time 4*) where the deceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

3.10 O-## Options/Comms

Parameter group related to communications and options.

3.10.1 O-0# General Settings

Parameters to configure the general settings for communications and options.

O-01 Control Site

Option:		Function:
		The setting in this parameter overrides the settings in *parameter O-50 Coasting Select* to *parameter 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:
		NOTICE **This parameter cannot be adjusted while the motor is running.** Select the source of the control word: 1 of 2 serial interfaces or 4 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. When the option is removed, the frequency converter detects a configuration change, sets *parameter O-02 Control Word Source* to default setting *[1] FC RS485*, and trips. If an option is installed after initial power-up, the setting of *parameter O-02 Control Word Source* does not change, but the frequency converter trips and shows: *Alarm 67, Option Changed*. When retrofitting a bus option into a frequency converter that did not have a bus option installed earlier, change the control to bus-based. This change is required for safety reasons to avoid an unintended change.
[0]	None	
[1] *	Drive RS485	
[2]	Drive USB	
[3]	Option A	
[4]	Option B	
[30]	External Can	

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 2 consecutive messages. If this time is exceeded, it indicates that the telegram communication has stopped. The function selected in *parameter O-04 Control Word Timeout Function* is then carried out. A valid control word triggers the timeout counter.

O-04 Control Word Timeout Function

Select the timeout function. The timeout function activates when the control word fails to be updated within the time period specified in *parameter O-03 Control Word Timeout Time*.

Option:		Function:
		NOTICE **To change the set-up after a timeout, configure as follows:** **1. Set *parameter K-10 Active Set-up* to *[9] Multi set-up*.** **2. Select the relevant link in *parameter K-12 This Set-up Linked to*.**
[0] *	Off	Resumes control via fieldbus (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]. • Via a digital input.
[7]	Select setup 1	Changes the set-up after a control word timeout. If communication resumes after a timeout, *parameter O-05 End-of-Timeout Function* either resumes the set-up used before the timeout, or retains the set-up endorsed by the timeout function.
[8]	Select setup 2	See *[7] Select set-up 1*.
[9]	Select setup 3	See *[7] Select set-up 1*.
[10]	Select setup 4	See *[7] Select set-up 1*.

O-04 Control Word Timeout Function

Select the timeout function. The timeout function activates when the control word fails to be updated within the time period specified in *parameter O-03 Control Word Timeout Time*.

Option:		Function:
[26]	Trip	

O-05 End-of-Timeout Function

Option:		Function:
		Select the action after receiving a valid control word following a timeout. This parameter is active only when *parameter O-04 Control Word Timeout Function* is set to: • *[7] Set-up 1.* • *[8] Set-up 2.* • *[9] Set-up 3.* • *[10] Set-up 4.*
[0]	Hold set-up	Retains the set-up selected in *parameter O-04 Control Word Timeout Function* and shows a warning until *parameter O-06 Reset Control Word Timeout* toggles. Then the frequency converter resumes its original set-up.
[1] *	Resume set-up	Resumes the set-up that was active before the timeout.

O-06 Reset Control Word Timeout

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

Option:		Function:
[0] *	Do not reset	Retains the set-up specified in *parameter O-04 Control Word Timeout Function*, following a control word timeout.
[1]	Do reset	Restores the frequency converter to the original set-up following a control word timeout. 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. ***NOTICE*** **This is only valid for Profibus.**

O-07 Diagnosis Trigger

Option:		Function:
		• *[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 *parameter DR-90 Alarm Word* or *parameter PB-53 Profibus Warning Word*. • *[2] Trigger alarms/warn.*: Send extended diagnosis data if one or more alarms or warnings appear in alarm *parameter DR-90 Alarm Word*, *parameter PB-53 Profibus Warning Word*, or warning *parameter DR-92 Warning Word*. The content of the extended diagnosis frame is as follows:
[0] *	Disable	
[1]	Trigger on alarms	

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	*parameter DR-92 Warning Word*	
14 - 17	*parameter DR-03 Status Word*	status word
18 - 21	*parameter DR-90 Alarm Word*	
22 - 23	*parameter PB-53 Profibus Warning Word*	Communication warning word (Profibus)

Table 3.18

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

3

O-07 Diagnosis Trigger		
Option:		**Function:**
[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.	Normal fieldbus readouts.
[1]	Motor Data LP-Filter	Filtered fieldbus readouts of the following parameters: • *Parameter DR-10 Power [kW].* • *Parameter DR-11 Power [hp].* • *Parameter DR-12 Motor Voltage.* • *Parameter DR-14 Motor current.* • *Parameter DR-16 Torque [Nm].* • *Parameter DR-17 Speed [RPM].* • *Parameter DR-22 Torque [%].* • *Parameter DR-25 Torque [Nm] High.*

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 are 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 more guidelines in the selection of *[1] PROFIdrive profile* and *[5] ODVA* , see the *installation guide* for the installed fieldbus.		
Option:		**Function:**
[0] *	Drive Profile	
[1]	PROFIdrive profile	
[5]	ODVA	
[7]	CANopen DSP 402	

O-13 Configurable Status Word STW		
Array [16]		
Option:		**Function:**
		This parameter enables configuration of bits 12–15 in the status word.
[0]	No function	
[1] *	Profile Default	The function corresponds to the profile default selected in *parameter O-10 Control Word Profile.*

O-13 Configurable Status Word STW		
Array [16]		
Option:		**Function:**
[2]	Alarm 68 Only	Only set if *alarm 68, Safe stop* occurs.
[3]	Trip excl Alarm 68	Set if a trip occurs, except if *alarm 68, Safe stop* executes the trip.
[10]	T18 DI status	
[11]	T19 DI status	The bit indicates the status of terminal 19. 0 indicates that the terminal is low. 1 indicates that the terminal is high.
[12]	T27 DI status	The bit indicates the status of terminal 27. 0 indicates that the terminal is low. 1 indicates that the terminal is high.
[13]	T29 DI status	The bit indicates the status of terminal 29. 0 indicates that the terminal is low. 1 indicates that the terminal is high.
[14]	T32 DI status	The bit indicates the status of terminal 32. 0 indicates that the terminal is low. 1 indicates that the terminal is high.
[15]	T33 DI status	The bit indicates the status of terminal 33. 0 indicates that the terminal is low. 1 indicates that the terminal is 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.
[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.
[40]	Out of ref range	
[49]	Derate active	
[60]	Comparator 0	See *parameter group LC-1# Comparators*. If comparator 0 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[61]	Comparator 1	See *parameter group LC-1# Comparators*. If comparator 1 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[62]	Comparator 2	See *parameter group LC-1# Comparators*. If comparator 2 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[63]	Comparator 3	See *parameter group LC-1# Comparators*. If comparator 3 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[64]	Comparator 4	See *parameter group LC-1# Comparators*. If comparator 4 is evaluated as TRUE, the output goes high. Otherwise, it is low.

O-13 Configurable Status Word STW		
Array [16]		
Option:		**Function:**
[65]	Comparator 5	See *parameter group LC-1# Comparators*. If comparator 5 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[70]	Logic Rule 0	See *parameter group LC-4# Logic Rules*. If logic rule 0 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[71]	Logic Rule 1	See *parameter group LC-4# Logic Rules*. If logic rule 1 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[72]	Logic Rule 2	See *parameter group LC-4# Logic Rules*. If logic rule 2 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[73]	Logic Rule 3	See *parameter group LC-4# Logic Rules*. If logic rule 3 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[74]	Logic Rule 4	See *parameter group LC-4# Logic Rules*. If logic rule 4 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[75]	Logic Rule 5	See *parameter group LC-4# Logic Rules*. If logic rule 5 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[80]	SL digital out A	See *parameter LC-52 Logic Controller Action*. The output goes high whenever the smart logic action *[38] Set digital out A high* is executed. The output goes low whenever the smart logic action *[32] Set digital out A low* is executed.
[81]	SL digital out B	See *parameter LC-52 Logic Controller Action*. The input goes high whenever the smart logic action *[39] Set digital out B high* is executed. The input goes low whenever the smart logic action *[33] Set digital out B low* is executed.
[82]	SL digital out C	See *parameter LC-52 Logic Controller Action*. The input goes high whenever the smart logic action *[40] Set digital out C high* is executed. The input goes low whenever the smart logic action *[34] Set digital out C low* is executed.
[83]	SL digital out D	See *parameter LC-52 Logic Controller Action*. The input goes high whenever the smart logic action *[41] Set digital out D high* is executed. The input goes low whenever the smart logic action *[35] Set digital out D low* is executed.
[84]	SL digital out E	See *parameter LC-52 Logic Controller Action*. The input goes high whenever the smart logic action *[42] Set digital out E high* is executed. The input goes low whenever the

O-13 Configurable Status Word STW		
Array [16]		
Option:		**Function:**
		smart logic action *[36] Set digital out E low* is executed.
[85]	SL digital out F	See *parameter LC-52 Logic Controller Action*. The input goes high whenever the smart logic action *[43] Set digital out F high* is executed. The input goes low whenever the smart logic action *[37] Set digital out F low* is executed.
[86]	ATEX ETR cur. alarm	
[87]	ATEX ETR freq. alarm	
[88]	ATEX ETR cur. warning	
[89]	ATEX ETR freq. warning	

O-14 Configurable Control Word CTW		
Array [15]		
Option:		**Function:**
		This parameter is not valid in software versions before 4.93.
[0]	None	The frequency converter ignores the information in this bit.
[1] *	Profile default	The functionality of the bit is depending on the selection *parameter O-10 Control Word Profile*.
[2]	CTW Valid, active low	If set to 1, the frequency converter ignores the remaining bits of the control word.
[4]	PID error inverse	Inverts the resulting error from the process PID controller. Available only if *parameter H-40 Configuration Mode* is set to *[6] Surface Winder*, *[7] Extended PID Speed OL*, or *[8] Extended PID Speed CL*.
[5]	PID reset I part	Resets the I-part of the process PID controller. Equivalent to *parameter PI-40 Process PID I-part Reset*. Available only if *parameter H-40 Configuration Mode* is set to *[6] Surface Winder*, *[7] Extended PID Speed OL*, or *[8] Extended PID Speed CL*.
[6]	PID enable	Enables the extended process PID controller. Equivalent to *parameter PI-50 Process PID Extended PID*. Available only if *parameter H-40 Configuration Mode* is set to *[6] Surface Winder*, *[7] Extended PID Speed OL*, or *[8] Extended PID Speed CL*.

3

O-16 Store Data Values

Option:		Function:
[0] *	Off	
[1]	Store edit setup	
[2]	Store all setups	

O-17 Configurable Alarm and Warningword

The configurable alarm and warning word has 16 bits (0-15). Each of those bits can be configured to any of the following options.

Option:		Function:
[0] *	Off	
[1]	10 Volts low warning	
[2]	Live zero warning	
[3]	No motor warning	
[4]	Mains phase loss warning	
[5]	DC link voltage high warning	
[6]	DC link voltage low warning	
[7]	DC overvoltage warning	
[8]	DC undervoltage warning	
[9]	Inverter overloaded warning	
[10]	Motor ETR overtemp warning	
[11]	Motor thermistor overtemp warning	
[12]	Torque limit warning	
[13]	Over current warning	
[14]	Earth fault warning	
[17]	Controlword timeout warning	
[19]	Discharge temp high warning	
[22]	Hoist mech brake warning	
[23]	Internal fans warning	
[24]	External fans warning	
[25]	Brake resistor short circuit warning	
[26]	Brake powerlimit warning	
[27]	Brake chopper short circuit warning	
[28]	Brake check warning	
[29]	Heatsink temperature warning	
[30]	Motor phase U warning	
[31]	Motor phase V warning	
[32]	Motor phase W warning	
[34]	Fieldbus communication warning	
[36]	Mains failure warning	
[40]	T27 overload warning	
[41]	T29 overload warning	
[45]	Earth fault 2 warning	
[47]	24V supply low warning	
[58]	AMA internal fault warning	
[59]	Current limit warning	
[60]	External interlock warning	
[61]	Feedback error warning	
[62]	Frequency max warning	
[64]	Voltage limit warning	
[65]	Controlboard overtemp warning	
[66]	Heatsink temp low warning	
[68]	Safe stop warning	

O-17 Configurable Alarm and Warningword

The configurable alarm and warning word has 16 bits (0-15). Each of those bits can be configured to any of the following options.

Option:		Function:
[73]	Safe stop autorestart warning	
[76]	Power unit setup warning	
[77]	Reduced powermode warning	
[78]	Tracking error warning	
[89]	Mech brake sliding warning	
[163]	ATEX ETR cur limit warning	
[165]	ATEX ETR freq limit warning	
[10002]	Live zero error alarm	
[10004]	Mains phase loss alarm	
[10007]	DC overvoltage alarm	
[10008]	DC undervoltage alarm	
[10009]	Inverter overload alarm	
[10010]	ETR overtemperature alarm	
[10011]	Thermistor overtemp alarm	
[10012]	Torque limit alarm	
[10013]	Overcurrent alarm	
[10014]	Earth fault alarm	
[10016]	Short circuit alarm	
[10017]	CTW timeout alarm	
[10022]	Hoist brake alarm	
[10026]	Brake powerlimit alarm	
[10027]	Brakechopper shortcircuit alarm	
[10028]	Brake check alarm	
[10029]	Heatsink temp alarm	
[10030]	Phase U missing alarm	
[10031]	Phase V missing alarm	
[10032]	Phase W missing alarm	
[10033]	Inrush fault alarm	
[10034]	Fieldbus com faul alarm	
[10036]	Mains failure alarm	
[10037]	Phase imbalance alarm	
[10038]	Internal fault	
[10039]	Heatsink sensor alarm	
[10045]	Earth fault 2 alarm	
[10046]	Powercard supply alarm	
[10047]	24V supply low alarm	
[10048]	1.8V supply low alarm	
[10049]	Speed limit alarm	
[10060]	Ext interlock alarm	
[10061]	Feedback error alarm	
[10063]	Mech brake low alarm	
[10065]	Controlboard overtemp alarm	
[10067]	Option config changed alarm	
[10068]	Safe stop alarm	
[10069]	Powercard temp alarm	
[10073]	Safestop auto restart alarm	
[10074]	PTC thermistor alarm	
[10078]	Tracking error alarm	
[10079]	Illegal PS config alarm	

O-17 Configurable Alarm and Warningword		
The configurable alarm and warning word has 16 bits (0-15). Each of those bits can be configured to any of the following options.		
Option:		**Function:**
[10081]	CSIV corrupt alarm	
[10082]	CSIV param error alarm	
[10090]	Feedback monitor alarm	
[10091]	AI54 settings alarm	
[10164]	ATEX ETR current lim alarm	
[10166]	ATEX ETR freq limit alarm	

O-19 Product Code		
Range:		**Function:**
0*	[0 - 2147483647]	Select 0 to read out the actual fieldbus product code according to the mounted fieldbus option. Select 1 to read out the actual vendor ID.

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 *parameter 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 due to overload or bad frames. This parameter specifies the time between 2 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 is 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 2 bytes. This parameter activates timeout if transmission is interrupted. This parameter is active only when *parameter 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.

3

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 *parameter O-42 PCD Write Configuration* and *parameter 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	
[163]	Term. 29 High Ref./Feedb. Value	
[168]	Term. 33 High Ref./Feedb. Value	
[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 Set-up	
[615]	Terminal 53 High Ref./Feedb. Value	
[625]	Terminal 54 High Ref./Feedb. Value	

O-41 Parameters for Signals		
Option:		**Function:**
[653]	Terminal 42 Output Bus Control	
[663]	Terminal X30/8 Bus Control	
[890]	Bus Jog 1 Speed	
[891]	Bus Jog 2 Speed	
[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]	Torque [Nm]	
[1213]	Frequency	
[1214]	Motor current	
[1215]	Frequency [%]	
[1217]	Speed [RPM]	
[1218]	Motor Thermal	
[1219]	KTY sensor temperature	
[1220]	Motor Angle	
[1221]	Torque [%] High Res.	
[1222]	Torque [%]	
[1223]	Motor Shaft Power [kW]	
[1224]	Calibrated Stator Resistance	
[1225]	Torque [Nm] High	
[1230]	DC Link Voltage	
[1232]	Brake Energy /s	
[1233]	Brake Energy Average	
[1234]	Heatsink Temp.	
[1235]	Drive Thermal	
[1238]	Logic Controller State	
[1239]	Control Card Temp.	
[1245]	Motor Phase U Current	
[1246]	Motor Phase V Current	
[1247]	Motor Phase W Current	
[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]	

O-41 Parameters for Signals		
Option:		**Function:**
[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	
[1286]	Drive Port REF 1	
[1287]	Bus Readout Alarm/Warning	
[1289]	Configurable Alarm/Warning Word	
[1290]	Alarm Word	
[1291]	Alarm Word 2	
[1292]	Warning Word	
[1293]	Warning Word 2	
[1294]	Ext. Status Word	
[1295]	Ext. Status Word 2	
[1340]	Analog Input X49/1	
[1341]	Analog Input X49/3	
[1342]	Analog Input X49/5	
[1343]	Analog Out X49/7	
[1344]	Analog Out X49/9	
[1345]	Analog Out X49/11	
[1346]	X49 Digital Output [bin]	
[1500]	Operating hours	
[1501]	Running Hours	
[1502]	kWh Counter	
[2348]	PCD Feed Forward	
[3644]	Terminal X49/7 Bus Control	
[3654]	Terminal X49/9 Bus Control	
[3664]	Terminal X49/11 Bus Control	

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)	
[41]	Torque Limiter (Braking)	
[52]	Minimum Reference	
[53]	Maximum Reference	
[62]	Catch up/slow Down Value	
[110]	Accel Time 2	
[111]	Decel Time 2	
[163]	Term. 29 High Ref./Feedb. Value	

O-42 PCD Write Configuration		
Range:		**Function:**
[168]	Term. 33 High Ref./Feedb. Value	
[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	
[615]	Terminal 53 High Ref./Feedb. Value	
[625]	Terminal 54 High Ref./Feedb. Value	
[653]	Terminal 42 Output Bus Control	
[663]	Terminal X30/8 Bus Control	
[890]	Bus Jog 1 Speed	
[891]	Bus Jog 2 Speed	
[1280]	Fieldbus CTW 1	
[1282]	Fieldbus REF 1	
[1285]	Drive Port CTW 1	
[1286]	Drive Port REF 1	
[2348]	PCD Feed Forward	
[3644]	Terminal X49/7 Bus Control	
[3654]	Terminal X49/9 Bus Control	
[3664]	Terminal X49/11 Bus Control	

O-43 PCD Read Configuration		
Range:		**Function:**
[0] *	None	
[515]	Readout: Actual Set-up	
[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]	Torque [Nm]	
[1213]	Frequency	
[1214]	Motor current	
[1215]	Frequency [%]	
[1217]	Speed [RPM]	
[1218]	Motor Thermal	
[1219]	KTY sensor temperature	
[1220]	Motor Angle	
[1221]	Torque [%] High Res.	
[1222]	Torque [%]	
[1223]	Motor Shaft Power [kW]	
[1224]	Calibrated Stator Resistance	
[1225]	Torque [Nm] High	
[1230]	DC Link Voltage	
[1232]	Brake Energy /s	
[1233]	Brake Energy Average	
[1234]	Heatsink Temp.	
[1235]	Drive Thermal	

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O-43 PCD Read Configuration		
Range:		**Function:**
[1238]	Logic Controller State	
[1239]	Control Card Temp.	
[1245]	Motor Phase U Current	
[1246]	Motor Phase V Current	
[1247]	Motor Phase W Current	
[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	
[1289]	Configurable Alarm/Warning Word	
[1290]	Alarm Word	
[1291]	Alarm Word 2	
[1292]	Warning Word	
[1293]	Warning Word 2	
[1294]	Ext. Status Word	
[1295]	Ext. Status Word 2	
[1340]	Analog Input X49/1	
[1341]	Analog Input X49/3	
[1342]	Analog Input X49/5	
[1343]	Analog Out X49/7	
[1344]	Analog Out X49/9	
[1345]	Analog Out X49/11	
[1346]	X49 Digital Output [bin]	
[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 1 extra digital input.
[3] *	Logic OR	Activates Coast command via the network/serial communication port or via 1 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. ***NOTICE*** **When *parameter P-20 Motor Construction* is set to *[1] PM non-salient SPM*, only selection *[0] Digital input* is available.**
[0]	Digital input	Activates a DC Brake command via a digital input.
[1]	Bus	Activates a DC Brake command via the serial communication port or network option module.
[2]	Logic AND	Activates a DC Brake command via the network/ serial communication port, and also via 1 of the digital inputs.
[3] *	Logic OR	Activates a DC Brake command via the network/ serial communication port, or via 1 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.

O-53 Start Select		
Option:		**Function:**
[0]	Digital input	Activates a start command via a digital input.
[1]	Bus	Activates a start command via the serial communication port or network option module.
[2]	Logic AND	Activates a start command via the network/ serial communication port and also via 1 of the digital inputs.
[3] *	Logic OR	Activates a start command via the network/ serial communication port or via 1 of the digital inputs.

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 also via 1 of the digital inputs.
[3] *	Logic OR	Activates the reverse command via the fieldbus/serial communication port or via 1 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 via 1 of the digital inputs.
[3] *	Logic OR	Activates the set-up selection via the network/ serial communication port or via 1 of the digital inputs.

O-56 Preset Reference Select		
Option:		**Function:**
		Select control of the preset reference selection via the terminals (digital input) and/or via the network.
[0]	Digital input	Activates preset reference selection via a digital input.

O-56 Preset Reference Select		
Option:		**Function:**
[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 via 1 of the digital inputs.
[3] *	Logic OR	Activates the preset reference selection via the network/serial communication port or via 1 of the digital inputs.

O-57 Profidrive OFF2 Select

Select control of the frequency converter OFF2 selection via the terminals (digital input) and/or via the fieldbus. This parameter is active only when *parameter O-01 Control Site* is set to *[0] Digital and ctrl. word,* and *parameter O-10 Control Word Profile* is set to *[1] Profidrive profile*.

Option:		**Function:**
[0]	Digital input	
[1]	Bus	
[2]	Logic AND	
[3] *	Logic OR	

O-58 Profidrive OFF3 Select

Select control of the frequency converter OFF3 selection via the terminals (digital input) and/or via the fieldbus. This parameter is active only when *parameter O-01 Control Site* is set to *[0] Digital and ctrl. word,* and *parameter O-10 Control Word Profile* is set to *[1] Profidrive profile*.

Option:		**Function:**
[0]	Digital input	
[1]	Bus	
[2]	Logic AND	
[3] *	Logic OR	

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

Array [6]

Range:		**Function:**
0*	[0 - 0]	This parameter shows the number of messages with faults (for example 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:
		NOTICE **The options depend on the installed option.**
[1] *	DeviceNet	View the active CAN protocol.

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 depend on the setting of *parameter O-10 Control Word Profile*. When *parameter O-10 Control Word Profile* is set to *[0] Drive protocol*, *parameter DN-10 Process Data Type Selection* options *[0] INSTANCE 100/150* and *[1] INSTANCE 101/151* are available. When *parameter O-10 Control Word Profile* is set to *[5] ODVA*, *parameter 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 motor profiles. For guidelines in message selection, refer to the *DeviceNet MCA 104 Installation Guide*. ***NOTICE*** **A change to this parameter is 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	

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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:
[62]	Catch up/slow Down Value	
[110]	Accel Time 2	
[111]	Decel Time 2	
[163]	Term. 29 High Ref./Feedb. Value	
[168]	Term. 33 High Ref./Feedb. Value	
[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	
[615]	Terminal 53 High Ref./Feedb. Value	
[625]	Terminal 54 High Ref./Feedb. Value	
[653]	Terminal 42 Output Bus Control	
[663]	Terminal X30/8 Bus Control	
[890]	Bus Jog 1 Speed	
[891]	Bus Jog 2 Speed	
[1280]	Fieldbus CTW 1	
[1282]	Fieldbus REF 1	
[1285]	Drive Port CTW 1	
[1286]	Drive Port REF 1	
[2348]	PCD Feed Forward	

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 Set-up	
[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]	Torque [Nm]	
[1213]	Frequency	
[1214]	Motor current	
[1215]	Frequency [%]	
[1217]	Speed [RPM]	
[1218]	Motor Thermal	

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:
[1219]	KTY sensor temperature	
[1220]	Motor Angle	
[1221]	Torque [%] High Res.	
[1222]	Torque [%]	
[1223]	Motor Shaft Power [kW]	
[1224]	Calibrated Stator Resistance	
[1225]	Torque [Nm] High	
[1230]	DC Link Voltage	
[1232]	Brake Energy /s	
[1233]	Brake Energy Average	
[1234]	Heatsink Temp.	
[1235]	Drive Thermal	
[1238]	Logic Controller State	
[1239]	Control Card Temp.	
[1245]	Motor Phase U Current	
[1246]	Motor Phase V Current	
[1247]	Motor Phase W Current	
[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	
[1289]	Configurable Alarm/Warning Word	
[1290]	Alarm Word	
[1291]	Alarm Word 2	
[1292]	Warning Word	
[1293]	Warning Word 2	

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:
[1294]	Ext. Status Word	
[1295]	Ext. Status Word 2	
[1340]	Analog Input X49/1	
[1341]	Analog Input X49/3	
[1342]	Analog Input X49/5	
[1343]	Analog Out X49/7	
[1344]	Analog Out X49/9	
[1345]	Analog Out X49/11	
[1346]	X49 Digital Output [bin]	
[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 3.21

DN-14 Net Reference

Read only from keypad.

Option:		Function:
		Select the reference source in instances 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 instances 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.

3

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 are 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:**
1*	[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 MCA 104 in EEPROM non-volatile memory as default.

DN-34 DeviceNet Product Code		
Range:		**Function:**
200*	[0 - 65535]	

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 MCA 104 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 3–10 of the messages. The number of available PCDs depend on the message type. The values in PCD 3–10 are then written to the selected parameters as data values. Alternatively, specify a standard PROFIBUS message in *parameter 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	
[163]	Term. 29 High Ref./ Feedb. Value	
[168]	Term. 33 High Ref./ Feedb. Value	
[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	
[615]	Terminal 53 High Ref./ Feedb. Value	
[625]	Terminal 54 High Ref./ Feedb. Value	
[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	
[1285]	Drive Port CTW 1	
[1286]	Drive Port REF 1	

PB-15 PCD Write Configuration		
Array [10]		
Option:		**Function:**
[168]	Term. 33 High Ref./ Feedb. Value	
[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	
[615]	Terminal 53 High Ref./ Feedb. Value	
[625]	Terminal 54 High Ref./ Feedb. Value	
[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	
[1285]	Drive Port CTW 1	
[1286]	Drive Port REF 1	

PB-16 PCD Read Configuration		
[10] Array		
Option:		**Function:**
		Select the parameters to be assigned to PCD 3–10 of the messages. The number of available PCDs depend on the message type. PCDs 3–10 contain the actual data values of the selected parameters. For standard PROFIBUS messages, see *parameter PB-22 Telegram Selection*.
[0] *	None	
[515]	Readout: Actual Set-up	
[1200]	Control Word	
[1201]	Reference [Unit]	
[1202]	Reference %	
[1203]	Status Word	
[1205]	Main Actual Value [%]	
[1209]	Custom Readout	
[1210]	Power [kW]	
[1211]	Power [hp]	

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PB-16 PCD Read Configuration		
[10] Array		
Option:		**Function:**
[1212]	Torque [Nm]	
[1213]	Frequency	
[1214]	Motor current	
[1215]	Frequency [%]	
[1217]	Speed [RPM]	
[1218]	Motor Thermal	
[1219]	KTY sensor temperature	
[1220]	Motor Angle	
[1221]	Torque [%] High Res.	
[1222]	Torque [%]	
[1223]	Motor Shaft Power [kW]	
[1224]	Calibrated Stator Resistance	
[1225]	Torque [Nm] High	
[1230]	DC Link Voltage	
[1232]	Brake Energy /s	
[1233]	Brake Energy Average	
[1234]	Heatsink Temp.	
[1235]	Drive Thermal	
[1238]	Logic Controller State	
[1239]	Control Card Temp.	
[1245]	Motor Phase U Current	
[1246]	Motor Phase V Current	
[1247]	Motor Phase W Current	
[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	

PB-16 PCD Read Configuration		
[10] Array		
Option:		**Function:**
[1289]	Configurable Alarm/ Warning Word	
[1290]	Alarm Word	
[1291]	Alarm Word 2	
[1292]	Warning Word	
[1293]	Warning Word 2	
[1294]	Ext. Status Word	
[1295]	Ext. Status Word 2	
[1340]	Analog Input X49/1	
[1341]	Analog Input X49/3	
[1342]	Analog Input X49/5	
[1343]	Analog Out X49/7	
[1344]	Analog Out X49/9	
[1345]	Analog Out X49/11	
[1346]	X49 Digital Output [bin]	
[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. To adjust the station address in *parameter PB-18 Node Address*, set the hardware switch to 126 or 127 (all switches set to ON). Otherwise, this parameter shows the actual setting of the switch.

PB-22 Telegram Selection		
Displays the Profibus message configuration.		
Option:		**Function:**
[1]	Standard telegram 1	
[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	Read only.

PB-23 Parameters for Signals		
Array [1000]		
Read only		
Option:		**Function:**
		This parameter contains a list of signals available for selection in *parameter PB-15 PCD Write Configuration* and *parameter PB-16 PCD Read Configuration*.

PB-27 Parameter Edit

Option:		Function:
		Edit parameters via: • PROFIBUS. • The standard RS485 interface. • 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 *parameter O-50 Coasting Select* to *parameter O-56 Preset Reference Select*.
[0]	Disable	Disables process control via PROFIBUS master class 1 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 *parameter PB-45 Fault Code* and *parameter PB-47 Fault Number*. The maximum buffer capacity is eight error events. The buffer and counter are set to 0 upon reset or power-up.

PB-45 Fault Code

Range:		Function:
0*	[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

Read only

Range:		Function:
0*	[0 - 65535]	This parameter shows PROFIBUS communication warnings. Refer to the *AF-650 GP & AF-600 FP PROFIBUS DP Operating Instructions, DET-624* for further information.

Bit	Description
0	Connection with DP-master is not OK.
1	Not used.
2	NDL (Network data link layer) is not OK.
3	Clear data command received.
4	Actual value is not updated.
5	Baud rate 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 fault occurred.
13	Not configured.
14	Timeout active.
15	*Warning 34, Fieldbus fault* active.

Table 3.22 PROFIBUS Warning Word

PB-63 Actual Baud Rate

Option:		Function:
		This parameter shows 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	

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PB-64 Device Identification

Range:		Function:
0*	[0 - 0]	This parameter shows the device identification. Refer to the *AF-650 GP & AF-600 FP PROFIBUS DP Operating Instructions, DET-624* 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.

PB-67 Control Word 1

Range:		Function:
0*	[0 - 65535]	This parameter accepts the Control Word from a Master Class 2 in the same format as PCD 1.

PB-68 Status Word 1

Range:		Function:
0*	[0 - 65535]	This parameter delivers the Status Word for a Master Class 2 in the same format as PCD 2.

PB-70 Edit Set-up

Option:		Function:
[0]	Factory setup	
[1] *	Set-up 1	
[2]	Set-up 2	
[3]	Set-up 3	
[4]	Set-up 4	
[9]	Active Set-up	

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

PB-72 ProfibusDriveReset

Option:		Function:
[0] *	No action	
[1]	Power-on reset	Resets the frequency converter after power-up, as for power-cycle.
[2]	Power-on reset prep	
[3]	Comm option reset	Resets the PROFIBUS DP option only. This is useful after changing certain settings in parameter group PB-##, for example, *parameter PB-18 Node Address*. When reset, the frequency converter disappears from the Network, which may cause a communication error from the master.

PB-75 DO Identification

Range:		Function:
0*	[0 - 65535]	Provides information about the DO (Drive Object).

PB-80 Defined Parameters (1)

Array [116]
No keypad access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows 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 shows 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 shows 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 shows 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-85 Defined Parameters (6)

Range:		Function:
0*	[0 - 9999]	

PB-90 Changed Parameters (1)

Array [116]
No keypad access
Read only

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

PB-93 Changed Parameters (4)

Range:		Function:
0*	[0 - 9999]	

PB-94 Changed Parameters (5)

Array [116]
No keypad Address
Read only

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

PB-99 Profibus Revision Counter

Range:		Function:
0*	[0 - 65535]	

3.13 EN-## Ethernet

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

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EN-00 IP Address Assignment

Option:		Function:
		Selects the IP Address assignment method.
[0] *	Manual	Set the IP-address in *parameter 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:
0*	[0 - 4294967295]	Configure the IP address of the option. Read-only if *parameter EN-00 IP Address Assignment* is set to DHCP or BOOTP.

EN-02 Subnet Mask

Range:		Function:
0*	[0 - 4244635647]	Configure the IP subnet mask of the option. Read-only if *parameter EN-00 IP Address Assignment* is set to DHCP or BOOTP.

EN-03 Default Gateway

Range:		Function:
0*	[0 - 2147483647]	Configure the IP subnet mask of the option. Read-only if *parameter EN-00 IP Address Assignment* is set to DHCP or BOOTP.

EN-04 DHCP Server

Range:		Function:
0*	[0 - 2147483647]	***NOTICE*** **A power-cycle is necessary after setting the IP parameters manually.** Read only. Displays the IP address of the found DHCP or BOOTP server.

EN-05 Lease Expires

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

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 - 48]	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 - 17]	Read-only. Shows the physical (MAC) address of the option.

3.13.1 EN-1# Ethernet Link Parameters

Applies for the whole parameter group.

Index [0] is used for port 1, and index [1] is used for port 2.

EN-10 Link Status

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

EN-11 Link Duration

Range:		Function:
0*	[0 - 0]	Read-only. Shows 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 *parameter EN-13 Link Speed* and *parameter 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 *parameter EN-12 Auto Negotiation* is set to *[1] 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 *parameter 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-23 Process Data Config Write Size

Range:		Function:
16*	[8 - 32]	Sets the number of bits being sent from the frequency converter as process data. The setting counts from right (LSB). The value 1 means that only the least significant bit of the signal is transferred from the frequency converter.

EN-24 Process Data Config Read Size

Range:		Function:
16*	[8 - 32]	Sets the number of bits being sent to the frequency converter as process data. The setting counts from right (LSB). The value 1 means that only the least significant bit of the signal is transferred to the frequency converter. The preceding bits are set to zero.

EN-27 Primary Master

Range:		Function:
0*	[0 - 4294967295]	Controls the Master's access to the process data. The value zero (0.0.0.0) means that other masters can take control of the drive immediately if the connection is lost or closed. Setting an IP number means that only a master with this value can establish a connection for controlling the drive. In systems with backup masters, this parameter should be left to the value zero (0.0.0.0).

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 [0] Off.
[0] *	Off	The store function is inactive.
[1]	Store All set-ups	All parameter values are stored in the non-volatile memory, in all 5 set-ups.

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 3.23 Bit Description

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.

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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:
201*	[0 - 65535]	Read-only. Shows the CIP product code.

EN-35 EDS Parameter

Range:		Function:
0*	[0 - 0]	

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 ms, 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 PCDs can be filtered in/out.

EN-40 Status Parameter

Range:		Function:
0*	[0 - 0]	***NOTICE*** **This parameter is for Modbus TCP only**

EN-41 Slave Message Count

Range:		Function:
0*	[0 - 0]	***NOTICE*** **This parameter is for Modbus TCP only**

EN-42 Slave Exception Message Count

Range:		Function:
0*	[0 - 0]	***NOTICE*** **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 Transparent Socket Channel Port

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

EN-90 Cable Diagnostic

Option:		Function:
		NOTICE **The cable diagnostics function is only issued on ports where there is no link (see *parameter EN-10 Link Status, Link Status*)** Enables/disables advanced cable diagnosis function. If enabled, the distance to cable errors can be read out in *parameter EN-93 Cable Error Length*. The parameter resumes to the default setting of disable after the diagnostics have finished.
[0] *	Disabled	
[1]	Enabled	

EN-91 Auto Cross-Over

Option:		Function:
[0]	Disable	Disables the auto cross-over function.
[1] *	Enable	Enables the auto cross-over function. ***NOTICE*** **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 *parameter 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 shown in meters with an accuracy of ±2 m. The value 0 means that no errors are 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: 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 are blocked.
-1 %*	[-1 - 20 %]	

EN-95 Broadcast Storm Filter

Option:		Function:
		Applies to *parameter 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.

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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 datasheet.
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, that is, the number of pulses or periods per revolution.

3.14.2 EC-2# Abs. Enc. Interface

EC-20 Protocol Selection

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

EC-21 Resolution (Positions/Rev)

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

EC-24 SSI Data Length

Range:		Function:
13*	[13 - 25]	Set the number of bits for the SSI telegram. Select 13 bits for single-turn encoders and 25 bits for multi-turn encoders.

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.

EC-34 HIPERFACE Baudrate

Option:		Function:
		NOTICE **This parameter cannot be adjusted while the motor runs.** Select the baud rate of the attached encoder. The parameter is only accessible when *parameter 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:
		NOTICE **This parameter cannot be adjusted while the motor runs.** 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 *parameter EC-61 Feedback Signal Monitoring* is an electrical check of the hardware circuit in the encoder system.

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

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

Option:		Function:
[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	
[12]	Trip/Warning	
[13]	Trip/Catch	

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3.15 RS-## Resolver Interface

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

RS-56 Encoder Sim. Resolution

Set the resolution and activate the encoder emulation function (generation of encoder signals from the measured position from a resolver). Use this function to transfer the speed or position information from 1 frequency converter to another. To disable the function, select *[0] Disabled*.

Option:		**Function:**
[0] *	Disabled	
[1]	512	
[2]	1024	
[3]	2048	
[4]	4096	

RS-59 Resolver Interface

Activate the OPCRES when the resolver parameters are selected. To avoid damage to resolvers, adjust *parameter RS-50 Poles* and *parameter RS-53 Transformation Ratio* before enabling 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 *parameter 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]	Registers the power consumption of the motor as an average value over 1 hour. Reset the counter in *parameter 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.

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

ID-06 Reset kWh Counter		
Option:		**Function:**
[0] *	Do not reset	No reset of the kWh counter is required.
[1]	Reset counter	Press [OK] to reset the kWh counter to 0 (see *parameter ID-02 kWh Counter*).

ID-07 Reset Running Hours Counter		
Option:		**Function:**
[0] *	Do not reset	
[1]	Reset counter	To reset the running hours counter to 0, select *[1] Reset* and press [OK] (see *parameter ID-01 Running Hours*). This parameter cannot be selected via the serial port, RS485. Select *[0] Do not reset* if no reset of the running-hours counter is required.

3.17.2 ID-1# Data Trending Settings

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

ID-10 Trending Source		
Option:		**Function:**
		Select which variables are to be logged.
[0] *	None	
[515]	Readout: Actual Set-up	
[1200]	Control Word	
[1201]	Reference [Unit]	
[1202]	Reference %	
[1203]	Status Word	
[1210]	Power [kW]	
[1211]	Power [hp]	
[1212]	Torque [Nm]	
[1213]	Frequency	
[1214]	Motor current	
[1217]	Speed [RPM]	
[1218]	Motor Thermal	
[1221]	Torque [%] High Res.	
[1222]	Torque [%]	
[1224]	Calibrated Stator Resistance	
[1225]	Torque [Nm] High	
[1230]	DC Link Voltage	
[1232]	Brake Energy /s	
[1233]	Brake Energy Average	
[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	

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ID-10 Trending Source		
Option:		**Function:**
[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]	
[1289]	Configurable Alarm/Warning Word	
[1290]	Alarm Word	
[1292]	Warning Word	
[1294]	Ext. Status Word	
[1295]	Ext. Status Word 2	
[1340]	Analog Input X49/1	
[1341]	Analog Input X49/3	
[1342]	Analog Input X49/5	
[1343]	Analog Out X49/7	
[1344]	Analog Out X49/9	
[1345]	Analog Out X49/11	
[1346]	X49 Digital Output [bin]	

ID-11 Trending Interval		
Array [4]		
Range:		**Function:**
0.000*	[0.000 - 0.000]	Enter the interval in ms 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 then retains a specified percentage of samples before the occurrence of the trigger event (*parameter ID-14 Samples Before Trigger*). Options are described under E-## Digital Output.		
Option:		**Function:**
[0] *	False	
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current Limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Line voltage out of range	
[18]	Reversing	
[19]	Warning	

ID-12 Trigger Event		
Select the trigger event. When the trigger event occurs, a window is applied to freeze the log. The log then retains a specified percentage of samples before the occurrence of the trigger event (*parameter ID-14 Samples Before Trigger*). Options are described under E-## Digital Output.		
Option:		**Function:**
[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 *parameter ID-12 Trigger Event* and *parameter ID-14 Samples Before Trigger*.

ID-14 Samples Before Trigger		
Range:		**Function:**
50*	[0 - 100]	Before a trigger event, enter the percentage of all samples which should be retained in the log. See also *parameter ID-12 Trigger Event* and *parameter 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 *Table 3.24*:

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

Table 3.24 Logged Events

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 maximum value corresponds to approximately 24 days, which means that the count restarts at 0 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

Range:		Function:
0*	[0 - 255]	View the fault code and look up its meaning in *chapter 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 s 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 - 6]	View the frequency converter type.

ID-41 Power Section

Range:		Function:
0*	[0 - 20]	View the power section.

ID-42 Voltage

Range:		Function:
0*	[0 - 20]	View the voltage.

ID-43 Software Version

Range:		Function:
0*	[0 - 5]	View the SW version

ID-44 GE Model Number

Range:		Function:
0*	[0 - 40]	View the model number string used for reordering the frequency converter in its original configuration.

3

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

ID-46 GE Product No.		
Range:		**Function:**
0*	[0 - 8]	View the 8-digit number. To restore the ordering number after the power card exchange, see *parameter SP-29 Service Code*.

ID-47 GE Power Card Model No		
Range:		**Function:**
0*	[0 - 8]	View the power card model number.

ID-48 Keypad ID Number		
Range:		**Function:**
0*	[0 - 20]	View the keypad ID number.

ID-49 SW ID Control Card		
Range:		**Function:**
0*	[0 - 20]	View the control card software version number.

ID-50 SW ID Power Card		
Range:		**Function:**
0*	[0 - 20]	View the power card software version number.

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

ID-53 Power Card Serial Number		
Range:		**Function:**
0*	[0 - 19]	View the power card serial number.

ID-59 Filename		
Range:		**Function:**
0*	[0 - 16]	Shows the currently used customer-specific initial values (CSIV) filename.

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 - 30]	View the installed option type.

ID-61 Option SW Version		
Array [8]		
Range:		**Function:**
0*	[0 - 20]	View the installed option software version.

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

ID-63 Option Serial No		
Array [8]		
Range:		**Function:**
0*	[0 - 18]	View the installed option serial number.

ID-70 Option in Slot A		
Range:		**Function:**
0*	[0 - 30]	View the model number string for the option installed in slot A, and a translation of the model number string. for example, for model number string *AX*, the translation is *No option*.

ID-71 Slot A Option SW Version		
Range:		**Function:**
0*	[0 - 20]	View the software version for the option installed in slot A.

ID-72 Option in Slot B		
Range:		**Function:**
0*	[0 - 30]	View the model number string for the option installed in slot B, and a translation of the model number string. For example, for model number string *BX*, the translation is *No option*.

ID-73 Slot B Option SW Version		
Range:		**Function:**
0*	[0 - 20]	View the software version for the option installed in slot B.

ID-74 Option in Slot C1		
Range:		**Function:**
0*	[0 - 30]	View the model number string for the option installed in slot C, and a translation of the model number string. For example, for model number string *CXXXX*, the translation is *No option*.

ID-75 Slot C0 Option SW Version		
Range:		**Function:**
0*	[0 - 20]	View the software version for the option installed in slot C.

ID-76 Option in Slot C2		
Range:		**Function:**
0*	[0 - 30]	Shows the model number string for the option in slot C1 (CXXXX if no option) and the translation, that is *No option*.

ID-77 Slot C1 Option SW Version		
Range:		**Function:**
0*	[0 - 20]	Shows the software version for the installed option in option slot C.

ID-80 Fan Running Hours		
Range:		**Function:**
0 h*	[0 - 2147483647 h]	View how many hours the heat sink fan has run (increments for each hour). The value is saved when the frequency converter is turned off.

ID-81 Preset Fan Running Hours		
Range:		**Function:**
0 h*	[0 - 99999 h]	Enter value to preset the fan running hours counter, see *parameter ID-80 Fan Running Hours*. This parameter cannot be selected via the serial port, RS485.

3.17.7 ID-9# Parameter Info

Parameters to view defined parameters and modified parameters.

ID-92 Defined Parameters		
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		
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-98 Drive Identification		
Range:		**Function:**
0*	[0 - 40]	This parameter contains data that is used by the DCT-10.

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

3

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 *parameter 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 2-byte word sent with the status word to the fieldbus master reporting the main actual value.

DR-09 Custom Readout

Range:		Function:
0 CustomReadoutUnit*	[0 - 0 CustomReadoutUnit]	View the value of custom readout from *parameter K-30 Unit for Custom Readout* to *parameter 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]	Shows motor power in kW. The value shown is calculated based on the actual motor voltage and motor current. The value is filtered, and therefore approximately 1.3 s may pass from when an input value changes to when the data readout values change. The resolution of readout 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 based on the actual motor voltage and motor current. The value is filtered, and therefore approximately 1.3 ms may pass from when an input value changes to when the data readout 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 damping.

DR-14 Motor current

Range:		Function:
0 A*	[0 - 10000 A]	View the motor current measured as an average value, I_{RMS}. The value is filtered, and thus approximately 1.3 s may pass from when an input value changes to when the data readout values change.

DR-15 Frequency [%]

Range:		Function:
0 %*	[-100 - 100 %]	View a 2 byte word reporting the actual motor frequency (without resonance damping) as a percentage (scale 0000–4000 hex) of *parameter F-03 Max Output Frequency 1*. Set *parameter PB-16 PCD Read Configuration* index 1 to send it with the status word instead of the MAV.

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. Therefore, the minimum value and the maximum value depend on the maximum motor current and the motor used. The value is filtered, and thus approximately 30 ms may pass from when an input changes value to when the data readout values change. In flux control principle, this readout is compensated for in*parameter H-88 Motor Inertia* for improved accuracy.

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 *parameter F-10 Electronic Overload*.

DR-19 KTY sensor temperature		
Range:		**Function:**
0 °C*	[0 - 0 °C]	Returning the actual temperature on KTY sensor built into the motor. See parameter group *chapter 3.7.9 H-9# Motor Temperature*.

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 0–2xpi (radian).

DR-21 Torque [%] High Res.		
Range:		**Function:**
0 %*	[-200 - 200 %]	The value shown is the torque in percent of nominal torque, with sign and 0.1% resolution, applied to the motor shaft.

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-23 Motor Shaft Power [kW]		
Range:		**Function:**
0 kW*	[0 - 10000 kW]	Readout of the mechanical power applied to the motor shaft.

DR-24 Calibrated Stator Resistance		
Range:		**Function:**
0.0000 Ohm*	[0.0000 - 100.0000 Ohm]	Shows the calibrated stator resistance.

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. Therefore, the minimum value and the maximum value depend on the maximum 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 *parameter 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 a 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 instant value.

DR-33 Brake Energy Average		
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 level based on the selected time period within *parameter B-13 Braking Thermal Overload*.

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DR-34 Heatsink Temp.		
Range:		**Function:**
0 °C*	[0 - 255 °C]	View the frequency converter heat sink temperature. The cut-out limit is 90 ±5 °C (194 ±9 °F), and the motor cuts back in at 60 ±5 °C (140 ±9 °F).

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 must match the nameplate data on the connected motor. The data is used for calculation of torque, motor overload protection, and so on.

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

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 *chapter 3.17.2 ID-1# Data Trending Settings*). The logging buffer is never full when *parameter ID-13 Trending Mode* is set to *[0] Log always*.
[0] *	No	
[1]	Yes	

DR-45 Motor Phase U Current		
Range:		**Function:**
0 A*	[0 - 10000 A]	Shows the motor phase U_{RMS} current. Facilitates monitoring of imbalance in the motor currents, detection of weak motor cables or imbalance in motor windings.

DR-46 Motor Phase V Current		
Range:		**Function:**
0 A*	[0 - 10000 A]	Shows the motor phase V_{RMS} current. Facilitates monitoring of imbalance in the motor currents, detection of weak motor cables or imbalance in motor windings.

DR-47 Motor Phase W Current		
Range:		**Function:**
0 A*	[0 - 10000 A]	Shows the motor phase W_{RMS} current. Facilitates monitoring of imbalance in the motor currents, detection of weak motor cables or imbalance in motor windings.

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, overcurrent, and imbalance of supply voltage (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, fieldbus, 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 inputs. The readout can also reflect the impulses from an incremental encoder.

DR-52 Feedback[Unit]		
Range:		**Function:**
0 Reference-FeedbackUnit*	[-999999.999 - 999999.999 ReferenceFeed-backUnit]	View the feedback unit resulting from the selection of unit and scaling in *parameter F-50 Reference Range*, *parameter F-51 Reference/*

DR-52 Feedback[Unit]		
Range:		**Function:**
		Feedback Unit, *parameter F-52 Minimum Reference*, and *parameter 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]	Readout parameter where the actual motor RPM from the feedback source can be read in both closed loop and open loop. The feedback source is selected by *parameter PI-00 Speed PID Feedback Source*.

3.18.5 DR-6# Inputs/Outputs

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

DR-60 Digital Input		
Range:		**Function:**
0*	[0 - 1023]	View the signal states from the active digital inputs. Example: Input 18 corresponds to bit number 5, 0 = no signal, 1 = connected signal.

Bit 0	Digital input terminal 33.
Bit 1	Digital input terminal 32.
Bit 2	Digital input terminal 29.
Bit 3	Digital input terminal 27.
Bit 4	Digital input terminal 19.
Bit 5	Digital input terminal 18.
Bit 6	Digital input terminal 37.
Bit 7	Digital input General Purpose I/O OPCGPIO terminal X30/4 (OPCGPIO).
Bit 8	Digital input General Purpose I/O OPCGPIO terminal X30/3 (OPCGPIO).
Bit 9	Digital input General Purpose I/O OPCGPIO terminal X30/2 (OPCGPIO).
Bit 10–63	Reserved for future terminals.

Table 3.25 Active Digital Inputs

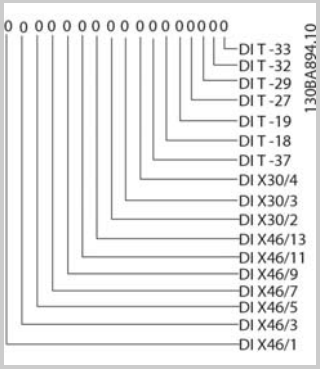
DR-60 Digital Input		
Range:		**Function:**
		

Illustration 3.43 Relay Settings

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

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	

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 *parameter 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.

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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]	***NOTICE*** **This parameter is available for AF-650 GP only.** 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.

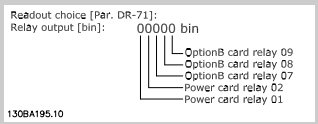

Illustration 3.44 Relay Settings

DR-72 Counter A		
Range:		**Function:**
0*	[-2147483648 - 2147483647]	View the present value of counter A. Counters are useful as comparator operands, see *parameter LC-10 Comparator Operand*. Reset or change the value either via digital inputs (parameter group *E-0# Digital Inputs*) or by using an LC action (*parameter 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 (*parameter LC-10 Comparator Operand*). Reset or change the value either via digital inputs (parameter group *E-1# Digital Inputs*) or by using an Logic Controller action (*parameter LC-52 Logic Controller Action*).

DR-74 Prec. Stop Counter		
Range:		**Function:**
0*	[0 - 2147483647]	Returns the actual counter value of precise counter (*parameter 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 General Purpose I/O OPCGPIO.

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

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 2-byte control word (CTW) received from the fieldbus master. Interpretation of the control word depends on the fieldbus option installed and the control word profile selected in *parameter 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 2-byte word sent with the control word from the fieldbus 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 communication option status word.

DR-85 Drive Port CTW 1		
Range:		**Function:**
0*	[0 - 65535]	View the 2-byte control word (CTW) received from the fieldbus master. Interpretation of the control word depends on the fieldbus option installed and the control word profile selected in *parameter O-10 Control Word Profile.*

DR-86 Drive Port REF 1		
Range:		**Function:**
0*	[-200 - 200]	View the 2-byte status word (STW) sent to the fieldbus master. Interpretation of the status word depends on the network option installed and the control word profile selected in *parameter O-10 Control Word Profile*.

DR-87 Bus Readout Alarm/Warning		
Range:		**Function:**
0*	[0 - 65535]	Alarm and warning numbers in hex as showed in the alarm log. The high byte contains the alarm, the low byte the warning. The alarm number is the first one that occurred after the last reset.

DR-89 Configurable Alarm/Warning Word		
Range:		**Function:**
0*	[0 - 65535]	This alarm/warning word is configured in *parameter O-17 Configurable Alarm and Warningword* to match the actual requirements.

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.

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

DR-95 Ext. Status Word 2		
Range:		**Function:**
0*	[0 - 4294967295]	Shows the extended status word 2 sent via the serial communication port in hex code.

3

3.19 LG-## Logs & I/O Opt Status

3.19.1 LG-4# PGIO Data Readouts

Parameters for configuring the readout of OPCPRGIO.

3

LG-40 Analog Input X49/1		
Range:		**Function:**
0*	[-20 - 20]	

LG-41 Analog Input X49/3		
Range:		**Function:**
0*	[-20 - 20]	

LG-42 Analog Input X49/5		
Range:		**Function:**
0*	[-20 - 20]	

LG-43 Analog Out X49/7		
Shows the actual value at output of terminal X49/7 in V or mA. The value reflects the selection in *parameter IO-40 Terminal X49/7 Analogue Output*.		
Range:		**Function:**
0*	[0 - 30]	

LG-44 Analog Out X49/9		
Shows the actual value at output of terminal X49/9 in V or mA. The value reflects the selection in *parameter IO-50 Terminal X49/9 Analogue Output*.		
Range:		**Function:**
0*	[0 - 30]	

LG-45 Analog Out X49/11		
Shows the actual value at output of terminal X49/11 in V or mA. The value reflects the selection in *parameter IO-60 Terminal X49/11 Analogue Output*.		
Range:		**Function:**
0*	[0 - 30]	

LG-46 X49 Digital Output [bin]		
Range:		**Function:**
0*	[0 - 15]	

3.20 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 *parameter LC-52 Logic Controller Action*) that are executed when the corresponding user-defined events are met.

3.20.1 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 runs.
[3]	In range	The motor runs within the programmed current and speed ranges set in *parameter H-70 Warning Current Low* to *parameter H-73 Warning Speed High*.
[4]	On reference	The motor runs on reference.
[5]	Torque limit	The torque limit set in *parameter F-40 Torque Limiter (Driving)* or *parameter F-41 Torque Limiter (Braking)* is exceeded.
[6]	Current Limit	The motor current limit set in *parameter F-43 Current Limit* is exceeded.
[7]	Out of current range	The motor current is outside the range set in *parameter F-43 Current Limit*.
[8]	Below I low	The motor current is lower than set in *parameter H-70 Warning Current Low*.
[9]	Above I high	The motor current is higher than set in *parameter H-71 Warning Current High*.
[10]	Out of speed range	The speed is outside the range set in *parameter H-72 Warning Speed Low* and *parameter H-73 Warning Speed High*.
[11]	Below speed low	The output speed is lower than the setting in *parameter H-72 Warning Speed Low*.

LC-01 Start Event

Select the boolean (true or false) input to activate Logic Controller.

Option:		Function:
[12]	Above speed high	The output speed is higher than the setting in *parameter H-73 Warning Speed High*.
[13]	Out of feedb. range	The feedback is outside the range set in *parameter H-76 Warning Feedback Low* and *parameter H-77 Warning Feedback High*.
[14]	Below feedb. low	The feedback is below the limit set in *parameter H-76 Warning Feedback Low*.
[15]	Above feedb. high	The feedback is above the limit set in *parameter 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 counterclockwise (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.

LC-01 Start Event		
Select the boolean (true or false) input to activate Logic Controller.		
Option:		**Function:**
[40]	Drive stopped	A stop command (jog, stop, quick stop, 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. Only available on the graphical LCP.
[44]	Reset key	[Reset] is pressed. Only available on the graphical LCP.
[45]	Left key	[◄] is pressed. Only available on the graphical LCP.
[46]	Right key	[►] is pressed. Only available on the graphical LCP.
[47]	Up key	[▲] is pressed. Only available on the graphical LCP.
[48]	Down key	[▼] is pressed. Only available on the graphical LCP.
[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.
[76]	Digital input x30 2	Use the value of x30/2 (General Purpose I/O OPCGPIO).
[77]	Digital input x30 3	Use the value of x30/3 (General Purpose I/O OPCGPIO).
[78]	Digital input x30 4	Use the value of x30/4 (General Purpose I/O OPCGPIO).
[94]	RS Flipflop 0	See *chapter 3.20.2 LC-1# Comparators*.
[95]	RS Flipflop 1	See *chapter 3.20.2 LC-1# Comparators*.
[96]	RS Flipflop 2	See *chapter 3.20.2 LC-1# Comparators*.
[97]	RS Flipflop 3	See *chapter 3.20.2 LC-1# Comparators*.
[98]	RS Flipflop 4	See *chapter 3.20.2 LC-1# Comparators*.
[99]	RS Flipflop 5	See *chapter 3.20.2 LC-1# Comparators*.
[100]	RS Flipflop 6	See *chapter 3.20.2 LC-1# Comparators*.
[101]	RS Flipflop 7	See *chapter 3.20.2 LC-1# Comparators*.

LC-02 Stop Event		
Select the boolean (true or false) input to deactivate Logic Controller.		
Option:		**Function:**
[0]	False	For descriptions of options *[0] False–[61] Logic rule 5*, see *parameter LC-01 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	
[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-02 Stop Event		
Select the boolean (true or false) input to deactivate Logic Controller.		
Option:		**Function:**
[43]	Ok key	[OK] is pressed. Only available on the graphical LCP.
[44]	Reset key	[Reset] is pressed. Only available on the graphical LCP.
[45]	Left key	[◄] is pressed. Only available on the graphical LCP.
[46]	Right key	[►] is pressed. Only available on the graphical LCP.
[47]	Up key	[▲] is pressed. Only available on the graphical LCP.
[48]	Down key	[▼] is pressed. Only available on the graphical LCP.
[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.
[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	
[90]	ATEX OL cur. warning	Available, if *parameter F-10 Electronic Overload* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If the *alarm 164, ATEX ETR cur.lim.alarm* is active, the output is 1.
[91]	ATEX OL cur. alarm	Available, if *parameter F-10 Electronic Overload* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 166, ATEX ETR freq.lim.alarm* is active, the output is 1.
[92]	ATEX OL freq. warning	Available, if *parameter F-10 Electronic Overload* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *alarm 163, ATEX ETR cur.lim.warning* is active, the output is 1.
[93]	ATEX OL freq. alarm	Available, if *parameter F-10 Electronic Overload* is set to *[20] ATEX ETR* or *[21] Advanced ETR*. If *warning 165, ATEX ETR freq.lim.warning* is active, the output is 1.
[94]	RS Flipflop 0	See *chapter 3.20.2 LC-1# Comparators*.
[95]	RS Flipflop 1	See *chapter 3.20.2 LC-1# Comparators*.
[96]	RS Flipflop 2	See *chapter 3.20.2 LC-1# Comparators*.
[97]	RS Flipflop 3	See *chapter 3.20.2 LC-1# Comparators*.
[98]	RS Flipflop 4	See *chapter 3.20.2 LC-1# Comparators*.
[99]	RS Flipflop 5	See *chapter 3.20.2 LC-1# Comparators*.
[100]	RS Flipflop 6	See *chapter 3.20.2 LC-1# Comparators*.
[101]	RS Flipflop 7	See *chapter 3.20.2 LC-1# Comparators*.
[102]	Relay 1	
[103]	Relay 2	
[108]	Relay 7	X34/Relay Option OPCRLY
[109]	Relay 8	X34/Relay Option OPCRLY
[110]	Relay 9	X34/Relay Option OPCRLY

LC-03 Reset Logic Controller		
Option:		**Function:**
[0] *	Do not reset Logic Controller	Retains programmed settings in *LC-## Logic Controller* .
[1]	Reset Logic Controller	Resets all parameters in *LC-## Logic Controller* to default settings.

3.20.2 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		
Option:		**Function:**
		Options *[1] Reference %* to *[31] Counter B* are variables which are compared based on their values. Options *[50] FALSE* to *[186] Drive in auto mode* are digital values (true/false) where the comparison is based on the amount of time during which they are set to true or false. See *parameter 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 in percent.
[2]	Feedback %	[RPM] or [Hz], as set in *parameter K-02 Motor Speed Unit*.
[3]	Motor speed	[RPM] or [Hz], as set in *parameter K-02 Motor Speed Unit*.
[4]	Motor Current	
[5]	Motor torque	
[6]	Motor power	
[7]	Motor Rated Voltage	
[8]	DC-link voltage	
[9]	Motor Thermal	Value is in percent.
[10]	Drive thermal	Value is in percent.
[11]	Heat sink temp.	Value is in percent.
[12]	Analog input AI53	Value is in percent.
[13]	Analog input AI54	Value is in percent.
[14]	Analog input AIFB10	AIFB10 is internal 10 V supply.
[15]	Analog input AIS24V	AIS24V is a 24 V switch mode power supply.
[17]	Analog input AICCT	Value is in [°]. AICCT is control card temperature.
[18]	Pulse input FI29	Value is in percent.
[19]	Pulse input FI33	Value is in percent.
[20]	Alarm number	The number or registered alarms.
[21]	Warning number	
[22]	Analog input x30 11	
[23]	Analog input x30 12	
[30]	Counter A	
[31]	Counter B	
[32]	Process PID Error	Value of the PID error (*parameter PI-60 Process PID Error*).

LC-10 Comparator Operand		
Option:		**Function:**
[33]	Process PID Output	Value of the PID output (*parameter PI-61 Process PID Output*).
[43]	Analog input X49/1	
[44]	Analog input X49/3	
[45]	Analog input X49/5	
[50]	FALSE	Use to enter the fixed value of false in the comparator.
[51]	TRUE	Use to enter the fixed value of true in the comparator.
[52]	Control ready	Use to enter the control board receives supply voltage.
[53]	Drive ready	The frequency converter is ready for operation and applies a signal on the control board.
[54]	Running	The motor runs.
[55]	Reversing	The output is active when the frequency converter runs counterclockwise (the logical product of the status bits running AND reverse).
[56]	In range	The motor runs within the programmed current and speed ranges set in *parameter H-70 Warning Current Low* to *parameter H-73 Warning Speed High*.
[60]	On reference	The motor runs on reference.
[61]	Below reference, low	The motor runs at a reference which is less than the value in *parameter H-74 Warning Reference Low*.
[62]	Above ref, high	The motor runs at a reference which exceeds the value in *parameter H-75 Warning Reference High*.
[65]	Torque limit	The torque exceeds the value in *parameter F-40 Torque Limiter (Driving)* or *parameter F-41 Torque Limiter (Braking)*.
[66]	Current Limit	The motor current exceeds the value in *parameter F-43 Current Limit*.
[67]	Out of current range	The motor current is outside the range set in *parameter F-43 Current Limit*.
[68]	Below I low	The motor current is lower than the value in *parameter H-70 Warning Current Low*.
[69]	Above I high	The motor current is higher than the value in *parameter H-71 Warning Current High*.

LC-10 Comparator Operand		
Option:		**Function:**
[70]	Out of speed range	The speed is outside the range set in *parameter H-72 Warning Speed Low* and *parameter H-73 Warning Speed High*.
[71]	Below speed low	The output speed is lower than the value in *parameter H-72 Warning Speed Low*.
[72]	Above speed high	The output speed is higher than the value in *parameter H-73 Warning Speed High*.
[75]	Out of feedback range	The feedback is outside the range set in *parameter H-76 Warning Feedback Low* and *parameter H-77 Warning Feedback High*.
[76]	Below feedback low	The feedback is lower than the limit set in *parameter H-76 Warning Feedback Low*.
[77]	Above feedback high	The feedback exceeds the limit set in *parameter H-77 Warning Feedback High*.
[80]	Thermal warning	This operand becomes true when the frequency converter detects any thermal warning, for instance 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	If a warning is triggered, this operand gets the warning number.
[86]	Alarm (trip)	A trip alarm is active.
[87]	Alarm (trip lock)	A trip lock alarm is active.
[90]	Bus OK	Active communication (no timeout) 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.

LC-10 Comparator Operand		
Option:		**Function:**
[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).
[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.
[166]	Relay 7	
[167]	Relay 8	
[168]	Relay 9	
[180]	Local referecnce active	Active when *parameter F-02 Operation Method* is *[2] Local* or when

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LC-10 Comparator Operand		
Option:		**Function:**
		parameter 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	Active when *parameter F-02 Operation Method* is *[1] Remote* or *[0] Linked to hand/auto*, while the keypad is in auto mode.
[182]	Start command	Active 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	Active when the frequency converter is in hand on mode.
[186]	Drive in auto mode	Active 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 *parameter LC-10 Comparator Operand* is smaller than the fixed value in *parameter LC-12 Comparator Value*. The result is FALSE, if the variable selected in *parameter LC-10 Comparator Operand* is greater than the fixed value in *parameter LC-12 Comparator Value*.
[1] *	≈ (equal)	Select *[1]* ≈ for the result of the evaluation to be TRUE, when the variable selected in *parameter LC-10 Comparator Operand* is approximately equal to the fixed value in *parameter LC-12 Comparator Value*.
[2]	>	Select *[2]* > for the inverse logic of option *[0]* <.
[5]	TRUE longer than..	
[6]	FALSE longer than..	

LC-11 Comparator Operator		
Array [6]		
Option:		**Function:**
[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 comparator. This is an array parameter containing comparator values 0–5.

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	
[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	

LC-15 RS-FF Operand S		
Option:		**Function:**
[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	[OK] is pressed. Only available on the graphical LCP.
[44]	Reset key	[Reset] is pressed. Only available on the graphical LCP.
[45]	Left key	[◄] is pressed. Only available on the graphical LCP.
[46]	Right key	[►] is pressed. Only available on the graphical LCP.
[47]	Up key	[▲] is pressed. Only available on the graphical LCP.
[48]	Down key	[▼] is pressed. Only available on the graphical LCP.
[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	
[102]	Relay 1	
[103]	Relay 2	
[108]	Relay 7	X34/Relay Option OPCRLY.

LC-15 RS-FF Operand S		
Option:		**Function:**
[109]	Relay 8	X34/Relay Option OPCRLY.
[110]	Relay 9	X34/Relay Option OPCRLY.

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	
[43]	Ok key	[OK] is pressed. Only available on the graphical LCP.

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LC-16 RS-FF Operand R		
Option:		**Function:**
[44]	Reset key	[Reset] is pressed. Only available on the graphical LCP.
[45]	Left key	[◄] is pressed. Only available on the graphical LCP.
[46]	Right key	[►] is pressed. Only available on the graphical LCP.
[47]	Up key	[▲] is pressed. Only available on the graphical LCP.
[48]	Down key	[▼] is pressed. Only available on the graphical LCP.
[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	
[102]	Relay 1	
[103]	Relay 2	
[108]	Relay 7	X34/Relay Option OPCRLY.
[109]	Relay 8	X34/Relay Option OPCRLY.
[110]	Relay 9	X34/Relay Option OPCRLY.

3.20.3 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*	[0 - 0]	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 (that is, *[29] Start timer 1*) and until the given timer value has elapsed.

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

LC-41 Logic Rule Operator 1

Array [6]

Option:		**Function:**
		Select the 1st logical operator to use on the boolean inputs from *parameter LC-40 Logic Rule Boolean 1* and *parameter LC-42 Logic Rule Boolean 2*. Parameter numbers in square brackets stand for the boolean inputs of parameters in *LC-## Logic Controller* .
[0] *	DISABLED	Ignores: • *Parameter LC-42 Logic Rule Boolean 2*. • *Parameter LC-43 Logic Rule Operator 2*. • *Parameter 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 *parameter LC-01 Start Event* ([0] - [61]) and *parameter LC-02 Stop Event* ([70] - [75]) for further description.

LC-43 Logic Rule Operator 2

Array [6]

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

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

LC-52 Logic Controller Action

Option:		Function:
		Select the action corresponding to the LC event. Actions are executed when the corresponding event (defined in *parameter LC-51 Logic Controller Event*) is evaluated as true.
[0] *	DISABLED	
[1]	No action	
[2]	Select set-up 1	Changes the active set-up (*parameter K-10 Active Set-up*) to 1. If the set-up is changed, it merges 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 *parameter K-10 Active Set-up*) to 2. If the set-up is changed, it merges 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 (*parameter K-10 Active Set-up*) to 3. If the set-up is changed, it merges 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 (*parameter K-10 Active Set-up*) to 4. If the set-up is changed, it merges 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 merges 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 merges with other preset reference commands coming from either the digital inputs or via a Network.

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LC-52 Logic Controller Action		
Option:		**Function:**
[12]	Select preset ref 2	Selects preset reference 2. If the active preset reference is changed, it merges 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 merges with other preset reference commands coming from either the digital inputs or via a Network.
[14]	Select preset ref 4	Selects preset reference 4. If the active preset reference is changed, it merges 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 merges 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 merges 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 merges 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 *parameter LC-20 Logic Controller Timer* for further description.
[30]	Start timer 1	Starts timer 1, see *parameter LC-20 Logic Controller Timer* for further description.
[31]	Start timer 2	Starts timer 2, see *parameter LC-20 Logic Controller Timer* for further description.
[32]	Set digital out A low	Any output with LC output A is low.
[33]	Set digital out B low	Any output with LC output B is low.
[34]	Set digital out C low	Any output with LC output C is low.
[35]	Set digital out D low	Any output with LC output D is low.
[36]	Set digital out E low	Any output with LC output E is low.
[37]	Set digital out F low	Any output with LC output F is low.
[38]	Set digital out A high	Any output with LC output A is high.
[39]	Set digital out B high	Any output with LC output B is high.
[40]	Set digital out C high	Any output with LC output C is high.
[41]	Set digital out D high	Any output with LC output D is high.
[42]	Set digital out E high	Any output with LC output E is high.
[43]	Set digital out F high	Any output with LC output F is high.
[60]	Reset Counter A	Resets counter A to 0.
[61]	Reset Counter B	Resets counter B to 0.
[70]	Start timer 3	Start timer 3, see *parameter LC-20 Logic Controller Timer* for further description.
[71]	Start timer 4	Start timer 4, see *parameter LC-20 Logic Controller Timer* for further description.
[72]	Start timer 5	Start timer 5, see *parameter LC-20 Logic Controller Timer* for further description.
[73]	Start timer 6	Start timer 6, see *parameter LC-20 Logic Controller Timer* for further description.
[74]	Start timer 7	Start timer 7, see *parameter LC-20 Logic Controller Timer* for further description.

3.21 B-## Brakes

Parameter group related to the brake features in the drive.

3.21.1 B-0# DC Brake

Parameters to configure the DC brake and DC hold functions.

B-00 DC Hold Current

Range:		Function:
50 %*	[0 - 160 %]	***NOTICE*** **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 produce larger than expected currents with larger motor power sizes. This error increases as the motor power increases.** Enter a value for holding current as a percentage of the rated motor current $I_{M,N}$ set in *parameter P-03 Motor Current*. 100% DC hold 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 *parameter F-25 Start Function [0]* or *parameter H-80 Function at Stop [1]*.

B-01 DC Brake Current

Range:		Function:
50 %*	[0 - 1000 %]	***NOTICE*** **The maximum value depends on the rated motor current. Avoid 100% current for too long. It may damage the motor.** Enter a value for current as a percentage of the rated motor current $I_{M,N}$, see *parameter P-03 Motor Current*. 100% DC brake 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 *parameter 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 *parameter B-02 DC Braking Time*.

B-02 DC Braking Time

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

B-03 DC Brake Cut In Speed [RPM]

Range:		Function:
0 RPM*	[0 - par. F-17 RPM]	Set the DC brake cut-in speed for activation of the DC brake current set in *parameter B-01 DC Brake Current*, upon a stop command.

B-04 DC Brake Cut In Speed [Hz]

Range:		Function:
0.0 Hz*	[0 - par. F-15 Hz]	Set the DC brake cut-in speed for activation of the DC braking current set in *parameter B-01 DC Brake Current*, upon a stop command.

B-05 Maximum Reference

Range:		Function:
par. F-53 Reference-FeedbackUnit*	[par. F-52 - 999999.999 ReferenceFeedbackUnit]	

B-06 Parking Current

Range:		Function:
50 %*	[0 - 1000 %]	Set current as percentage of rated motor current, *parameter P-03 Motor Current*. Is used when enabled in *parameter 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 *parameter B-06 Parking Current*, once activated.

3.21.2 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.

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B-10 Brake Function		
Option:		**Function:**
[2]	AC brake	Is selected to improve braking without using a brake resistor. This parameter controls an overmagnetisation 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 overvoltage limit. ***NOTICE*** **The AC brake is not as efficient as dynamic braking with resistor.** **AC brake is for VVC+ 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 Ω. This value is used for monitoring the power to the brake resistor in *parameter 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 2 decimals, use *parameter B-11 Brake Resistor (ohm)*.

B-12 Brake Power Limit (kW)		
Range:		**Function:**
5.000 kW*	[0.001 - 2000.000 kW]	*Parameter 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 *parameter DR-33 Brake Energy Average* and thereby specifies when a warning/alarm is to be given. To calculate *parameter B-12 Brake Power Limit (kW)*, the following formula can be used. $P_{\mathrm{br,avg}}[W] = \frac{U_{\mathrm{br}}^2[V] \times t_{\mathrm{br}}[s]}{R_{\mathrm{br}}[\Omega] \times T_{\mathrm{br}}[s]}$ $P_{br,avg}$ 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 380–500 V: 810 V 525–600 V: 943 V 525–690 V: 1099 V

B-12 Brake Power Limit (kW)		
Range:		**Function:**
		NOTICE **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 *parameter DR-33 Brake Energy Average* and then enter this + 20% in *parameter B-12 Brake Power Limit (kW)*.**

B-13 Braking Thermal Overload		
Option:		**Function:**
		This parameter is only active in frequency converters with a brake. This parameter enables monitoring of the power to the brake resistor. The power is calculated based on the resistance (*parameter 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 during the duty time exceeds 100% of the monitoring limit (*parameter B-12 Brake Power Limit (kW)*. The warning disappears when the transmitted power drops below 80% of the monitoring limit.
[2]	Trip	Trips the 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.
[4]	Warning 30s	

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 output. 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:**
		Parameter B-15 Brake Check is only active in frequency converters with an integral dynamic brake. Select type of test and monitoring function to check the connection to the brake resistor, or

B-15 Brake Check		
Option:		**Function:**
		whether a brake resistor is present, and then show a warning or an alarm in the event of a fault. ***NOTICE*** **The brake resistor disconnection function is tested during power-up. However, the brake IGBT test is performed when there is no braking. A warning or trip disconnects the brake function.** The testing sequence is as follows: 1. The DC link ripple amplitude is measured for 300 ms without braking. 2. The DC link ripple amplitude is measured for 300 ms with the brake turned on. 3. If the DC link ripple amplitude while braking is lower than the DC link ripple amplitude before braking + 1%: *Brake check has failed by returning a warning or alarm.* 4. If the DC link ripple amplitude while braking is higher than the DC link ripple amplitude before braking + 1%: *Brake check is OK.*
[0] *	Off	Monitors brake resistor and brake IGBT for a short circuit during operation. If a short circuit occurs, *Warning 25 Brake resistor short-circuited* 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 showing an alarm (trip lock).
[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 shown (for example, warning 25, 27, or 28).

NOTICE

Remove a warning arising 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.

B-16 AC brake Max. Current		
Range:		**Function:**
100 %*	[0 - 1000.0 %]	Enter the maximum permissible current when using AC braking to avoid overheating of motor windings.

NOTICE

Parameter B-16 AC brake Max. Current* has no effect when *parameter P-20 Motor Construction=[1] PM, non salient SPM.

B-17 Over-voltage Control		
Option:		**Function:**
		Overvoltage control (OVC) reduces the risk of the frequency converter tripping due to an overvoltage 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.

NOTICE

Do not enable OVC in hoisting applications.

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

B-19 Over-voltage Gain		
Range:		**Function:**
100 %*	[10 - 200 %]	Select overvoltage gain.

3.21.3 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 *parameter E-24 Function Relay*, *parameter E-20 Terminal 27 Digital Output*, or *parameter 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 *parameter B-20 Release Brake Current*. During stop, the mechanical brake activates when the speed falls below the level specified in *parameter 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.

NOTICE

Protection mode and trip delay features (*parameter SP-25 Trip Delay at Torque Limit* and *parameter 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.

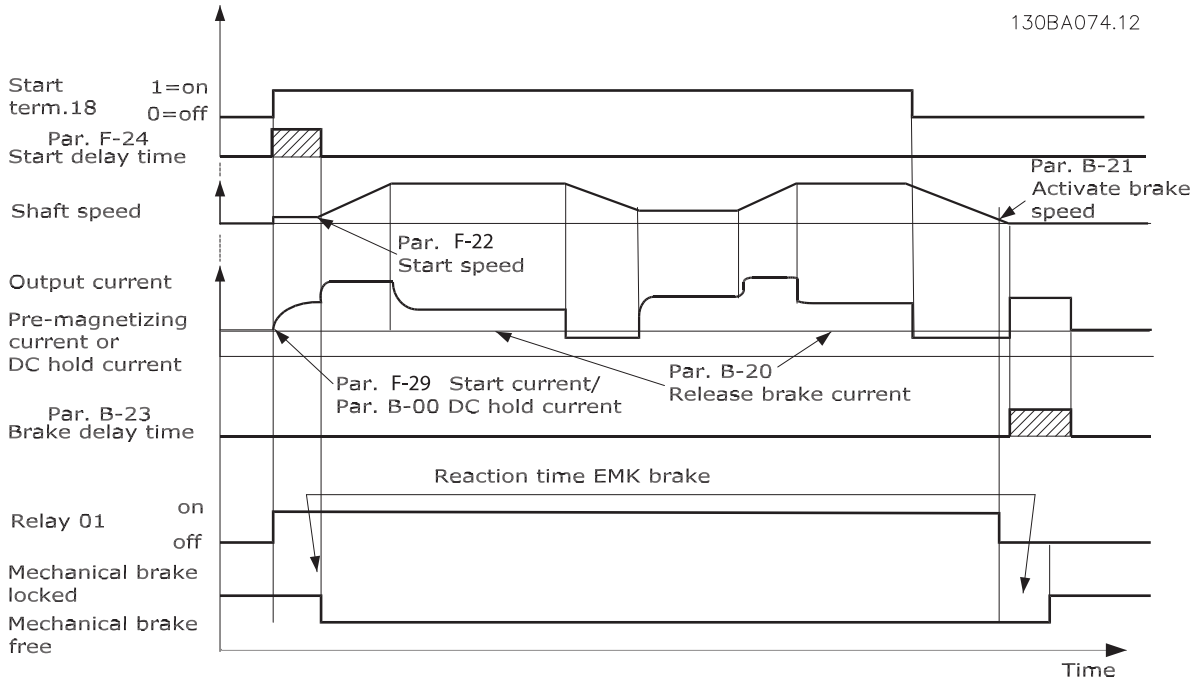

Illustration 3.45

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 braking 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 *parameter DR-37 Drive Max. Current*.

NOTICE

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

B-21 Activate Brake Speed [RPM]

Range:		Function:
300 RPM*	[0 - par. H-73 RPM]	Set the motor speed for activation of the mechanical brake, when a stop condition is present. The upper speed limit is specified in *parameter 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 braking has locked the load before the motor enters coast mode. To adjust transition of the load to the mechanical braking, set *parameter B-23 Activate Brake Delay* and *parameter B-24 Stop Delay*. Setting of brake delay parameters does not affect the torque. The frequency converter does not register that mechanical braking is holding the load.

B-23 Activate Brake Delay

Range:		Function:
		After setting *parameter B-23 Activate Brake Delay*, the torque drops to 0 after a 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 %*	[-300 - 300 %]	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* (*parameter 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.

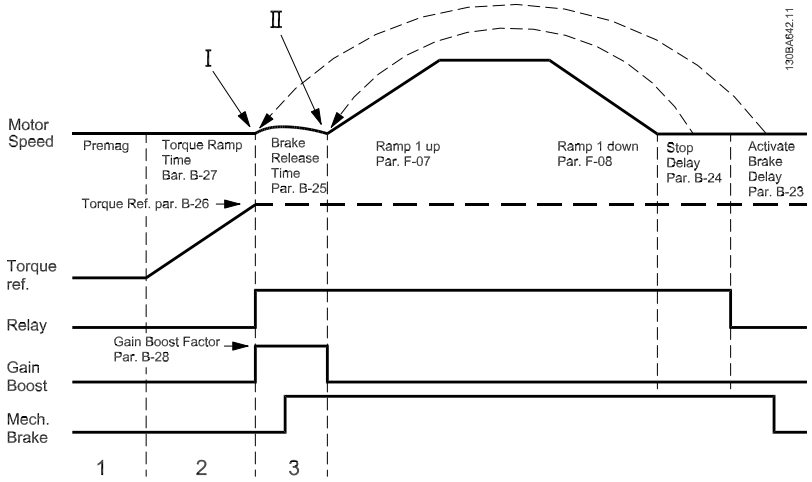

Illustration 3.46 Brake release sequence for hoist mechanical brake control

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 *parameter B-24 Stop Delay*, the frequency converter starts without applying the mechanical brake (e.g. reversing).

3.22 PI-## PID Controls

Parameter group related to PID Controls

3.22.1 PI-0# Speed PID Control

Parameters to configure the Speed PID Control.

PI-00 Speed PID Feedback Source

Option:		Function:
		NOTICE **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 *parameter 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-01 Speed PID Droop

The droop function allows the frequency converter to decrease the motor speed proportional to the load. The droop value is directly proportional to the load value. Use the droop function when several motors are mechanically connected and the load on motors can differ.
Ensure that *parameter P-09 Slip Compensation* has a default setting.

Range:		Function:
0 RPM*	[0 - 200 RPM]	Enter the droop value at 100% load.

PI-02 Speed PID Proportional Gain

Range:		Function:
0.015*	[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 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 long to regulate errors. This parameter is used with *[0] Speed open loop* and *[1] Speed closed loop* control, set in *parameter 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 *parameter 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. Consider limiting the gain at higher frequencies. For example, set up a pure D-link at low frequencies and a constant D-link at higher frequencies. This parameter is used with *parameter H-40 Configuration Mode [1] Speed closed loop* control.

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PI-06 Speed PID Lowpass Filter Time		
Range:		**Function:**
10 ms*	[0.1 - 100 ms]	***NOTICE*** **Severe filtering can be detrimental to dynamic performance.** **This parameter is used with *parameter H-40 Configuration Mode [1] Speed closed loop* and *[2] Torque* control.** **Adjust the filter time in flux sensorless to 3–5 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 of noise in the system, see *Illustration 3.47*. For example, if a time constant (τ) of 100 ms is programmed, the cut-off frequency for the low-pass filter is 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 *parameter PI-06 Speed PID Lowpass Filter Time* taken from the number of pulses per revolutions from encoder:

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

Table 3.26 Speed PID Lowpass Filter Time

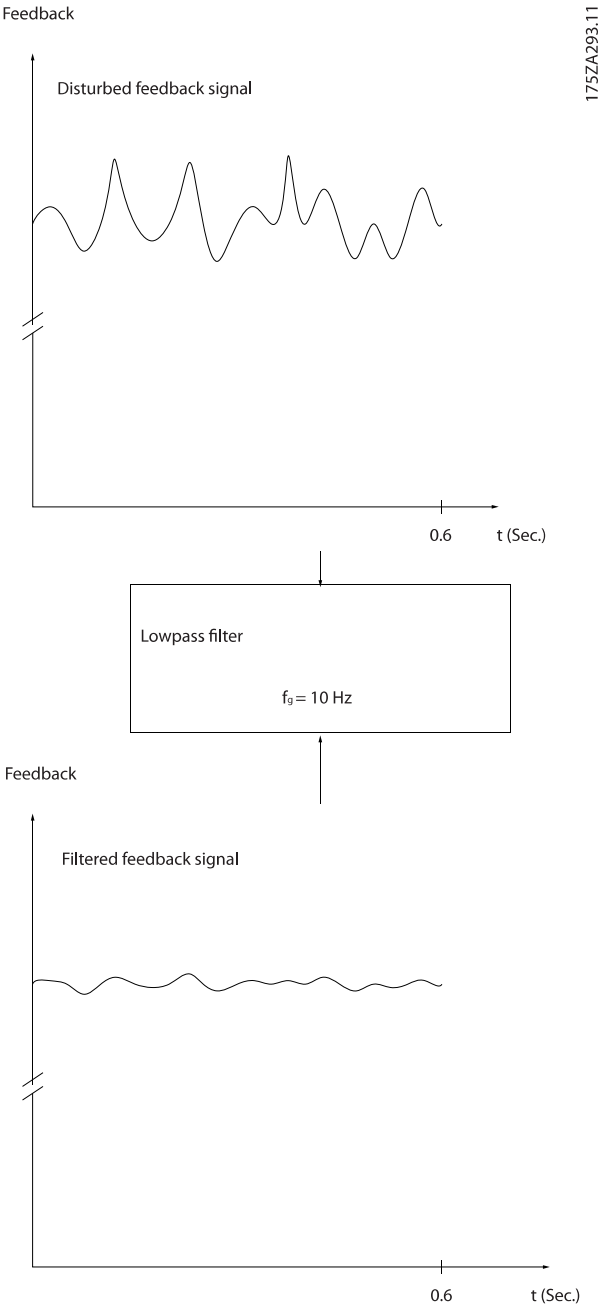

Illustration 3.47 Feedback Signal

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

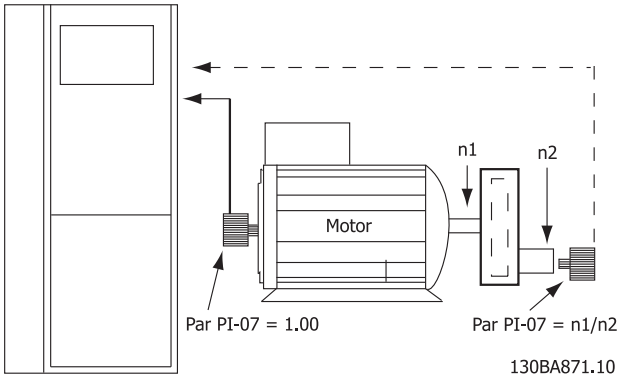

Illustration 3.48

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.

PI-09 Speed PID Error Correction w/ Ramp		
Range:		**Function:**
300 RPM*	[10 - 100000 RPM]	The speed error between ramp and actual speed is held up against the setting in this parameter. If the speed error exceeds this parameter entry, the speed error is corrected via ramping in a controlled way.

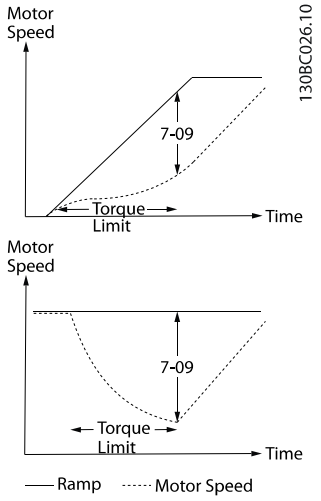

Illustration 3.49 Speed Error between Ramp and Actual Speed

PI-10 Torque PI Feedback Source		
Select the feedback source for the torque controller.		
Option:		**Function:**
[0] *	Controller Off	Select to operate in open loop.
[1]	Analog Input 53	Select to use torque feedback from the analog input.
[2]	Analog Input 54	Select to use torque feedback from the analog input.
[3]	Estimed Torque	Select to use the torque feedback estimated by the frequency converter.

3.22.2 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 controller instability.

PI-16 Torque PI Lowpass Filter Time		
Enter the time constant for the torque control lowpass filter.		
Range:		**Function:**
5 ms*	[0.1 - 100 ms]	

PI-18 Torque PI Feed Forward Factor		
Enter the torque feed forward factor value. The reference signal bypasses the torque controller by this value.		
Range:		**Function:**
0 %*	[0 - 100 %]	

PI-19 Current Controller Rise Time		
Range:		**Function:**
100 %*	[15 - 100 %]	Enter the value for the rise time of the current controller as a percentage of the control period.

3.22.3 PI-2# Proces PID Feedback

Parameters to configure the feedback sources for the Process PID Control.

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PI-20 Process CL Feedback 1 Resource		
Option:		**Function:**
		The effective feedback signal is made up of the sum of up to 2 different input signals. Select which frequency converter input should be treated as the source of the first of these signals. The second input signal is defined in *parameter 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)
[12]	Analog Input X49/1	
[13]	Analog Input X49/3	
[14]	Analog Input X49/5	

PI-22 Process CL Feedback 2 Resource		
Option:		**Function:**
		The effective feedback signal is made up of the sum of up to 2 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 *parameter 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)
[12]	Analog Input X49/1	
[13]	Analog Input X49/3	
[14]	Analog Input X49/5	

3.22.4 PI-3# Process PID Control

Parameters to configure the Process PID Controls.

PI-30 Process PID Normal/ Inverse Control		
Option:		**Function:**
		Normal and inverse controls 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 decrease 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 starts to ramp and then operates under speed open-loop control. When the process PID start speed is reached, the frequency converter changes to process PID control.

PI-33 Process PID Proportional Gain		
Range:		**Function:**
0.10*	[0 - 10]	Enter the PID proportional gain. The proportional gain multiplies the error between the setpoint 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 setpoint 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. If there is no limit, the differentiator gain increases when there are fast changes. To obtain a pure differentiator gain at slow changes and a constant differentiator gain where fast changes occur, limit the differentiator gain.

PI-38 Process PID Feed Forward Factor

Range:		Function:
0 %*	[0 - 200 %]	Enter the PID feed forward factor. The 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 affects the motor speed. When the feed forward factor is activated, it provides less overshoot and high dynamics when changing the set-point. *Parameter PI-38 Process PID Feed Forward Factor* is active when *parameter 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 value of this parameter, the on-reference status bit is 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 automatically returns to *[0] No*. Resetting the I-part makes it possible to start from a well-defined point after changing something in the process, for example 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 is adjusted linearly between the scale at minimum reference (*parameter PI-43 Process PID Gain Scale at Min. Ref.*) and the scale at maximum reference (*parameter 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 is adjusted linearly between the scale at minimum reference (*parameter PI-43 Process PID Gain Scale at Min. Ref.*) and the scale at maximum reference (*parameter PI-44 Process PID Gain Scale at Max. Ref.*).

PI-45 Process PID Feed Fwd Resource

Option:		Function:
[0] *	No function	Select which frequency converter input should be used as the feed forward factor. The factor is added 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 Potentiometer	
[21]	Analog input X30/11	
[22]	Analog input X30/12	
[32]	Bus PCD	Selects a fieldbus reference configured by *parameter O-02 Control Word Source*. Change *parameter O-42 PCD Write Configuration* for the bus used to make the feed-forward available in *parameter PI-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.

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

PI-48 PCD Feed Forward		
Range:		**Function:**
0*	[0 - 65535]	This parameter contains the value of *parameter PI-45 Process PID Feed Fwd Resource [32] Bus PCD.*

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.

3.22.5 PI-5# Ext. Process PID Ctrl.

This parameter group is only used if *parameter 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.

PI-51 Process PID Feed Fwd Gain		
Range:		**Function:**
1*	[0 - 100]	The feed forward is used to obtain the required level, based on a well-known signal available. The PID controller then only takes care of the smaller part of the control, necessary because of unknown characters. The standard feed forward factor in *parameter PI-38 Process PID Feed Forward Factor* is always related to the reference, whereas *parameter PI-51 Process PID Feed Fwd Gain* has more options. In winder applications, the feed forward factor is typically 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 %]	Gives the present error value used by the process PID controller.

PI-61 Process PID Output		
Range:		**Function:**
0 %*	[-200 - 200 %]	Gives the present raw output value from the process PID controller.

PI-62 Process PID Clamped Output		
Range:		**Function:**
0 %*	[-200 - 200 %]	Gives the present output value from the process PID controller after the clamp limits have been observed.

PI-63 Process PID Gain Scaled Output		
Range:		**Function:**
0 %*	[-200 - 200 %]	Gives the present output value from the process PID controller after the clamp limits have been observed and the resulting value has been gain scaled.

3.23 SF-# Special Functions

3.23.1 SF-## Wobble Function

The wobble function is primarily used for synthetic yarn winding applications. The wobble option is installed in the frequency converter controlling the traverse frequency converter. The yarn moves back and forth in a diamond pattern across the surface of the yarn package. To prevent a build-up 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. Suitable for elastic yarn applications, the option features a randomized wobble ratio.

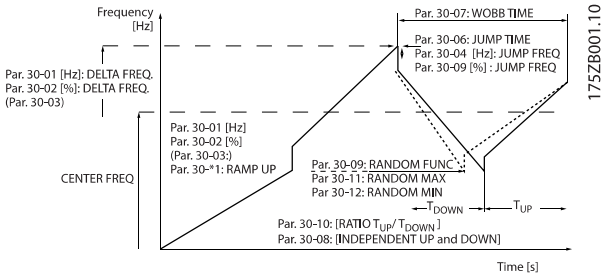

Illustration 3.50 Wobble Function

SF-00 Wobble Mode		
Option:		**Function:**
		NOTICE **This parameter cannot be adjusted while the motor runs.** The standard speed open-loop mode in *parameter 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. Set the parameters as absolute values (direct frequencies) or as relative values (percentage of other parameter). Set the wobble cycle time as an absolute value 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	

3.23.2 Center Frequency

Use parameter group to set the center frequency.

SF-01 Wobble Delta Frequency [Hz]		
Range:		**Function:**
5 Hz*	[0 - 25 Hz]	The delta frequency determines the magnitude of the wobble frequency. The delta frequency is superimposed on the center frequency. *Parameter SF-01 Wobble Delta Frequency [Hz]* contains both the positive and negative delta frequency. The setting of *parameter SF-01 Wobble Delta Frequency [Hz]* must thus not exceed the setting of the center frequency. The initial ramp-up time from standstill until the wobble sequence runs 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 *parameter SF-01 Wobble Delta Frequency [Hz]*.

SF-03 Wobble Delta Freq. Scaling Resource		
Option:		**Function:**
		Select which frequency converter 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	
[12]	Analog Input X49/1	
[13]	Analog Input X49/3	
[14]	Analog Input X49/5	

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 at the boundaries of the wobble sequence, the frequency jump is set in this parameter. If the traverse system has a very high inertia, a high

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SF-04 Wobble Jump Frequency [Hz]		
Range:		**Function:**
		jump frequency may create a torque limit warning or trip or an overvoltage warning or trip. 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 *parameter 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.

3.23.3 SF-2# Adv. Start Adjust

SF-20 High Starting Torque Time [s]		
Range:		**Function:**
0.0 s*	[0 - 60 s]	***NOTICE*** **This parameter is available for AF-650 GP only.** High starting torque time for PM motor in flux control principle without feedback.

SF-21 High Starting Torque Current [%]		
Range:		**Function:**
100.0 %*	[0 - 200.0 %]	***NOTICE*** **This parameter is available for AF-650 GP only.** High starting torque current for PM motor in advanced vector control and flux mode without feedback.

SF-22 Locked Rotor Protection		
Option:		**Function:**
		NOTICE **This parameter is available for AF-650 GP only.** Available for PM motors only, in flux sensorless mode and VVC+ open-loop mode.
[0] *	Off	
[1]	On	Protects the motor from the locked rotor condition. The control algorithm detects a possible locked rotor condition in the motor and trips the frequency converter to protect the motor.

SF-23 Locked Rotor Detection Time [s]		
Range:		**Function:**
0.10 s*	[0.05 - 1 s]	Time period for detecting the locked rotor condition. A low parameter value leads to faster detection.

SF-24 Locked Rotor Detection Speed Error [%]		
Range:		**Function:**
25 %*	[0 - 100 %]	

SF-25 Light Load Delay [s]

Use this parameter when the light load detection is active. Enter the delay before the frequency converter activates the light load detection when the motor speed reaches the reference in *parameter SF-27 Light Load Speed [%]*.

Range:		Function:
0.000 s*	[0.000 - 10.000 s]	

SF-26 Light Load Current [%]

Use this parameter when the light load detection is active. Enter the reference current, which is used to determine if the motion of the lift is obstructed and if the direction is to be changed. The value is a percentage of nominal motor current in *parameter P-03 Motor Current*.

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

SF-27 Light Load Speed [%]

Use this parameter when the light load detection is active. Enter the reference speed during the light load detection. The value is a percentage of nominal motor speed in *parameter P-06 Base Speed*. For standard asynchronous motors, the synchronous speed is used instead of *parameter P-06 Base Speed* due to slip.

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

3.23.4 SF-3# Miscellaneous

Parameter group for extra settings.

SF-30 External Interlock Delay

Range:		Function:
0 s*	[0 - 600 s]	Set the time for delaying the external interlock command.

SF-84 Process PID Proportional Gain

Range:		Function:
0.10*	[0 - 10]	Enter the process controller proportional gain. Quick control is obtained at high amplification. However, if amplification is too great, the process may become unstable.

3

3.24 IO-## I/O Mode

3.24.1 IO-0# I/O Mode

OPCPRGIO has 3 analog inputs and 3 configurable analog outputs. Use the parameters in this group to configure the mode of the analog outputs.
Terminals can be programmed to provide voltage, current, or digital output.

IO-03 Terminal X49/7 Mode

Select the output mode of analog terminal X49/7.

Option:		Function:
[0] *	Voltage 0-10V	
[1]	Voltage 2-10V	
[2]	Current 0-20mA	
[3]	Current 4-20mA	
[4]	Digital	

IO-04 Terminal X49/9 Mode

Select the output mode of analog terminal X49/9.

Option:		Function:
[0] *	Voltage 0-10V	
[1]	Voltage 2-10V	
[2]	Current 0-20mA	
[3]	Current 4-20mA	
[4]	Digital	

IO-05 Terminal X49/11 Mode

Select the output mode of analog terminal X49/11.

Option:		Function:
[0] *	Voltage 0-10V	
[1]	Voltage 2-10V	
[2]	Current 0-20mA	
[3]	Current 4-20mA	
[4]	Digital	

3.24.2 IO-1# Analog Input X49/1

IO-10 Terminal X49/1 Low Voltage

Range:		Function:
0.07 V*	[0 - par. IO-12 V]	Enter the voltage (V) that corresponds to the low reference value (set in *parameter IO-14 Term. X49/1 Low Ref./ Feedb. Value*).

IO-11 Terminal X49/1 Low Current

Range:		Function:
4 mA*	[0 - par. IO-13 mA]	Enter the voltage (mA) that corresponds to the low reference value (set in *parameter IO-14 Term. X49/1 Low Ref./ Feedb. Value*).

IO-12 Terminal X49/1 High Voltage

Range:		Function:
10 V*	[par. IO-10 - 10 V]	Enter the voltage (V) that corresponds to the low reference value (set in *parameter IO-15 Term. X49/1 High Ref./ Feedb. Value*).

IO-13 Terminal X49/1 High Current

Range:		Function:
20 mA*	[par. IO-11 - 20 mA]	Enter the voltage (V) that corresponds to the low reference value (set in *parameter IO-15 Term. X49/1 High Ref./ Feedb. Value*).

IO-14 Term. X49/1 Low Ref./Feedb. Value

Range:		Function:
0*	[-999999.999 - 999999.999]	Enter the reference or feedback value (in RPM, Hz, bar, etc.) that corresponds to the voltage or current set in *parameter IO-10 Terminal X49/1 Low Voltage/parameter IO-11 Terminal X49/1 Low Current*.

IO-15 Term. X49/1 High Ref./Feedb. Value

Range:		Function:
100*	[-999999.999 - 999999.999]	Enter the reference or feedback value (in RPM, Hz, bar, etc.) that corresponds to the voltage or current set in *parameter IO-12 Terminal X49/1 High Voltage/parameter IO-13 Terminal X49/1 High Current*.

IO-16 Term. X49/1 Filter Time Constant

Range:		Function:
0.001 s*	[0.001 - 10 s]	Enter the filter time constant. This is a first-order digital low pass filter time constant for suppressing electrical noise in terminal X49/1. A high time constant value improves dampening but also increases the delay through the filter.

IO-17 Term. X49/1 Live Zero

This parameter gives the possibility of disabling live zero monitoring. E.g. for use as decentral I/O.

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

3.24.3 IO-2# Analog Input X49/3

IO-20 Terminal X49/3 Low Voltage

Range:		Function:
0.07 V*	[0 - par. IO-22 V]	Enter the voltage (V) that corresponds to the low reference value (set in *parameter IO-24 Term. X49/3 Low Ref./ Feedb. Value*).

IO-21 Terminal X49/3 Low Current

Range:		Function:
4 mA*	[0 - par. IO-23 mA]	Enter the current (mA) that corresponds to the low reference value (set in *parameter IO-24 Term. X49/3 Low Ref./ Feedb. Value*).

IO-22 Terminal X49/3 High Voltage

Range:		Function:
10 V*	[par. IO-20 - 10 V]	Enter the voltage (V) that corresponds to the high reference value (set in *parameter IO-25 Term. X49/3 High Ref./ Feedb. Value*).

IO-23 Terminal X49/3 High Current

Range:		Function:
20 mA*	[par. IO-21 - 20 mA]	Enter the current (mA) that corresponds to the high reference value (set in *parameter IO-25 Term. X49/3 High Ref./ Feedb. Value*).

IO-24 Term. X49/3 Low Ref./Feedb. Value

Range:		Function:
0*	[-999999.999 - 999999.999]	Enter the reference or feedback value (in RPM, Hz, bar, etc.) that corresponds to the voltage or current set in *parameter IO-20 Terminal X49/3 Low Voltage/parameter IO-21 Terminal X49/3 Low Current*.

IO-25 Term. X49/3 High Ref./Feedb. Value

Range:		Function:
100*	[-999999.999 - 999999.999]	Enter the reference or feedback value (in RPM, Hz, bar, etc.) that corresponds to the voltage or current set in *parameter IO-22 Terminal X49/3 High Voltage/parameter IO-23 Terminal X49/3 High Current*.

IO-26 Term. X49/3 Filter Time Constant

Range:		Function:
0.001 s*	[0.001 - 10 s]	Enter the filter time constant. This is a first-order digital low pass filter time constant for suppressing electrical noise in terminal X49/3. A high time constant value improves dampening but also increases the delay through the filter.

IO-26 Term. X49/3 Filter Time Constant

Range:		Function:
		value improves dampening but also increases the delay through the filter.

IO-27 Term. X49/3 Live Zero

This parameter gives the possibility of disabling live zero monitoring. E.g. for use as decentral I/O.

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

3.24.4 IO-3# Analog Input X49/5

IO-30 Terminal X49/5 Low Voltage

Range:		Function:
0.07 V*	[0 - par. IO-32 V]	Enter the voltage (V) that corresponds to the low reference value (set in *parameter IO-34 Term. X49/5 Low Ref./ Feedb. Value*).

IO-31 Terminal X49/5 Low Current

Range:		Function:
4 mA*	[0 - par. IO-33 mA]	Enter the current (mA) that corresponds to the low reference value (set in *parameter IO-34 Term. X49/5 Low Ref./ Feedb. Value*).

IO-32 Terminal X49/5 High Voltage

Range:		Function:
10 V*	[par. IO-30 - 10 V]	Enter the voltage (V) that corresponds to the high reference value (set in *parameter IO-35 Term. X49/5 High Ref./ Feedb. Value*).

IO-33 Terminal X49/5 High Current

Range:		Function:
20 mA*	[par. IO-31 - 20 mA]	Enter the current (mA) that corresponds to the high reference value (set in *parameter IO-35 Term. X49/5 High Ref./ Feedb. Value*).

IO-34 Term. X49/5 Low Ref./Feedb. Value

Range:		Function:
0*	[-999999.999 - 999999.999]	Enter the reference or feedback value (in RPM, Hz, bar, etc.) that corresponds to the voltage or current set in *parameter IO-20 Terminal X49/3 Low Voltage/parameter IO-21 Terminal X49/3 Low Current*.

3

IO-35 Term. X49/5 High Ref./Feedb. Value		
Range:		**Function:**
100*	[-999999.999 - 999999.999]	Enter the reference or feedback value (in RPM, Hz, bar, etc.) that corresponds to the voltage or current set in *parameter IO-32 Terminal X49/5 High Voltage/parameter IO-33 Terminal X49/5 High Current*.

IO-36 Term. X49/5 Filter Time Constant		
Range:		**Function:**
0.001 s*	[0.001 - 10 s]	Enter the filter time constant. This is a first-order digital low pass filter time constant for suppressing electrical noise in terminal X49/5. A high time constant value improves dampening but also increases the delay through the filter.

IO-37 Term. X49/5 Live Zero		
Option:		**Function:**
[0]	Disabled	This parameter gives the possibility of disabling live zero monitoring. E.g. for use as decentral I/O.
[1] *	Enabled	

3.24.5 IO-4# Output X49/7

OPCPRGIO has 3 analog inputs and 3 configurable analog outputs. Use the parameters in this group to configure the mode of the analog outputs.

Select the functionality of terminal X49/7.

IO-40 Terminal X49/7 Analogue Output		
Option:		**Function:**
[0] *	No operation	
[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	
[139]	Bus ctrl. 0-20 mA	
[141]	Bus ctrl 0-20mA t.o.	

IO-42 Terminal X49/7 Min. Scale

Match the minimum output of terminal X49/7 with a required value. The required value is defined as a percentage of the value selected in *parameter IO-40 Terminal X49/7 Analogue Output*. To know more about how this parameter works, see *parameter AN-52 Terminal 42 Output Max Scale*.

The following example describes how the frequency converter uses this parameter.

Example

Parameter IO-03 Terminal X49/7 Mode=[0] Voltage 0-10 V

Parameter IO-40 Terminal X49/7 Analogue Output=[100] Output frequency

Parameter F-03 Max Output Frequency 1=200 Hz

Application requirement: If the output frequency is lower than 20 Hz, the output of terminal X49/7 should be 0 V. To fulfil the example requirement, enter 10% in *parameter IO-42 Terminal X49/7 Min. Scale*.

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

IO-43 Terminal X49/7 Max. Scale		
Range:		**Function:**
100 %*	[0 - 200 %]	

IO-44 Terminal X49/7 Bus Control

This parameter contains the output level of terminal X49/7 if the terminal is controlled by a fieldbus.

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

IO-45 Terminal X49/7 Timeout Preset

The frequency converter sends the value of this parameter to the output terminal when the terminal is controlled by a fieldbus and a timeout is detected.

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

3.24.6 IO-5# Output X49/9

OPCPRGIO has 3 analog inputs and 3 configurable analog outputs. Use the parameters in this group to configure the mode of the analog outputs.

IO-50 Terminal X49/9 Analogue Output		
Select the functionality of terminal X49/9.		
Option:		**Function:**
[0] *	No operation	
[100]	Output frequency	
[101]	Reference	
[102]	Feedback	
[103]	Motor Current	
[104]	Torque rel to limit	
[105]	Torq relate to rated	
[106]	Power	
[107]	Speed	

IO-50 Terminal X49/9 Analogue Output

Select the functionality of terminal X49/9.

Option:		Function:
[108]	Torque	
[109]	Max Out Freq	
[139]	Bus ctrl. 0-20 mA	
[141]	Bus ctrl 0-20mA t.o.	

IO-52 Terminal X49/9 Min. Scale

Match the minimum output of terminal X49/9 with a required value. For more information, see *parameter IO-42 Terminal X49/7 Min. Scale*.

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

IO-53 Terminal X49/9 Max. Scale

Scale the maximum output of terminal X49/9. For more information, see *parameter IO-43 Terminal X49/7 Max. Scale*.

Range:		Function:
100 %*	[0 - 200 %]	

IO-54 Terminal X49/9 Bus Control

This parameter contains the output level of terminal X49/9 if the terminal is controlled by a fieldbus.

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

IO-55 Terminal X49/9 Timeout Preset

The frequency converter sends the value of this parameter to the output terminal when the terminal is controlled by a fieldbus and a timeout is detected.

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

3.24.7 IO-6# Output X49/11

OPCPRGIO has 3 analog inputs and 3 configurable analog outputs. Use the parameters in this group to configure the mode of the analog outputs.

IO-60 Terminal X49/11 Analogue Output

Select the functionality of terminal X49/11.

Option:		Function:
[0] *	No operation	
[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	

IO-60 Terminal X49/11 Analogue Output

Select the functionality of terminal X49/11.

Option:		Function:
[139]	Bus ctrl. 0-20 mA	
[141]	Bus ctrl 0-20mA t.o.	

IO-62 Terminal X49/11 Min. Scale

Match the minimum output of terminal X49/11 with a required value. For more information, see *parameter IO-42 Terminal X49/7 Min. Scale*.

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

IO-63 Terminal X49/11 Max. Scale

Scale the maximum output of terminal X49/11. For more information, see *parameter IO-43 Terminal X49/7 Max. Scale*.

Range:		Function:
100 %*	[0 - 200 %]	

IO-64 Terminal X49/11 Bus Control

This parameter contains the output level of terminal X49/11 if the terminal is controlled by a fieldbus.

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

IO-65 Terminal X49/11 Timeout Preset

The frequency converter sends the value of this parameter to the output terminal when the terminal is controlled by a fieldbus and a timeout is detected.

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

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. 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 4 set-ups, for example, 1 single parameter can have 4 different data values.
1 set-up: The data value is 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	Normalised value 2 bytes	N2
35	Bit sequence of 16 boolean variables	V2
54	Time difference w/o date	TimD

Table 4.1 Data Type

4.1.2 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	ExpressionLimit	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 Set-up	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
F-03	Max Output Frequency 1	ExpressionLimit	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	ExpressionLimit	All set-ups	TRUE	-	Uint8
F-11	Motor External Fan	ExpressionLimit	All set-ups	TRUE	-	Uint8
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-33	Source for User-defined Readout	[240] Default Source	All set-ups	TRUE	-	Uint8
F-37	Adv. Switching Pattern	[1] SFAVM	All set-ups	TRUE	-	Uint8
F-38	Overmodulation	ExpressionLimit	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

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

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
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
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-29	Ramp Lowpass Filter Time	1 ms	All set-ups	TRUE	-4	Uint16
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	Conversion index	Type
P-0#						
P-01	Motor Poles	ExpressionLimit	All set-ups	FALSE	0	Uint8
P-02	Motor Power [HP]	ExpressionLimit	All set-ups	FALSE	-2	Uint32
P-03	Motor Current	ExpressionLimit	All set-ups	FALSE	-2	Uint32
P-04	Auto Tune	[0] Off	All set-ups	FALSE	-	Uint8
P-05	Motor Cont. Rated Torque	ExpressionLimit	All set-ups	FALSE	-1	Uint32
P-06	Base Speed	ExpressionLimit	All set-ups	FALSE	67	Uint16
P-07	Motor Power [kW]	ExpressionLimit	All set-ups	FALSE	1	Uint32
P-09	Slip Compensation	100 %	All set-ups	TRUE	0	Int16
P-1#						
P-10	Slip Compensation Time Constant	ExpressionLimit	All set-ups	TRUE	-2	Uint16
P-2#						
P-20	Motor Construction	[0] Asynchron	All set-ups	FALSE	-	Uint8
P-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-28	Min. Current at No Load	0 %	All set-ups	TRUE	0	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-38	q-axis Inductance (Lq)	ExpressionLimit	All set-ups	FALSE	-6	Int32
P-4#						
P-44	d-axis Inductance Sat. (LdSat)	ExpressionLimit	All set-ups	FALSE	-6	Int32
P-45	q-axis Inductance Sat. (LqSat)	ExpressionLimit	All set-ups	FALSE	-6	Int32
P-46	Position Detection Gain	100 %	All set-ups	TRUE	0	Uint16
P-47	Torque Calibration	ExpressionLimit	All set-ups	TRUE	-	Uint8
P-48	Inductance Sat. Point	ExpressionLimit	All set-ups	TRUE	0	Int16

4.1.7 H-## High Perf Parameters

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
H-0#						
H-01	Option Detection	[0] Protect Option Config.	1 set-up	TRUE	-	Uint8
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	ExpressionLimit	All set-ups	TRUE	-	Uint8

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
H-21	Motor Feedback Speed Error	300 RPM	All set-ups	TRUE	67	Uint16
H-22	Motor Feedback Loss Timeout	ExpressionLimit	All set-ups	TRUE	-2	Uint16
H-23	Motor Check At Start	[0] Off	All set-ups	TRUE	-	Uint8
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-3#						
H-30	Motor Speed Monitor Function	[0] Disabled	All set-ups	TRUE	-	Uint8
H-31	Motor Speed Monitor Max	100 RPM	All set-ups	TRUE	67	Uint16
H-32	Motor Speed Monitor Timeout	0.1 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
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	Flying Start Test Pulses Current	ExpressionLimit	All set-ups	FALSE	0	Uint16
H-59	Flying Start 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-62	Brake Check Limit Factor Source	[0] DC-link voltage	All set-ups	TRUE	-	Uint8
H-63	Brake Check Limit Factor	98 %	All set-ups	TRUE	0	Uint8
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	Imax (DR-37)	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	ExpressionLimit	All set-ups	TRUE	-3	Int32

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
H-77	Warning Feedback High	ExpressionLimit	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	Motor Inertia	0 kgm^2	All set-ups	FALSE	-4	Uint32
H-89	System Inertia	ExpressionLimit	All set-ups	FALSE	-4	Uint32
H-9#						
H-94	ATEX overload cur.lim. speed reduction	0 %	2 set-ups	TRUE	-1	Uint16
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
H-98	ATEX overload interpol. points freq.	ExpressionLimit	1 set-up	TRUE	-1	Uint16
H-99	ATEX overload interpol points current	ExpressionLimit	2 set-ups	TRUE	0	Uint16

4.1.8 AN-## Analog In / Out

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
AN-0#						
AN-00	Live Zero Timeout Time	10 s	All set-ups	TRUE	0	Uint8
AN-01	Live Zero Timeout Function	[0] Off	All set-ups	TRUE	-	Uint8
AN-1#						
AN-10	Terminal 53 Low Voltage	ExpressionLimit	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-17	Terminal 53 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
AN-2#						
AN-20	Terminal 54 Low Voltage	ExpressionLimit	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	ExpressionLimit	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-27	Terminal 54 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
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

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
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-37	Term. X30/11 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
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-47	Term. X30/12 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
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	Conversion 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-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-16	Kin. Backup Gain	100 %	All set-ups	TRUE	0	Uint32
SP-2#						
SP-23	Typecode Setting	ExpressionLimit	2 set-ups	FALSE	-	Uint16
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-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-36	Fieldweakening Function	[0] Auto	All set-ups	TRUE	-	Uint8
SP-37	Fieldweakening Speed	ExpressionLimit	All set-ups	TRUE	67	Uint16

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
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	ExpressionLimit	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	All set-ups	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-54	AHF Cap Reconnect Delay	25 s	2 set-ups	TRUE	0	Uint16
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
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	Conversion 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

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
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	[1] Profile Default	All set-ups	TRUE	-	Uint8
O-14	Configurable Control Word CTW	[1] Profile default	All set-ups	TRUE	-	Uint8
O-16	Store Data Values	[0] Off	All set-ups	TRUE	-	Uint8
O-17	Configurable Alarm and Warningword	[0] Off	All set-ups	TRUE	-	Uint16
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	ExpressionLimit	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
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	ExpressionLimit	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	Conversion index	Type
DN-0#						
DN-00	DeviceNet Protocol	[1] DeviceNet	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-18	internal_process_data_config_write	ExpressionLimit	All set-ups	TRUE	0	Uint16
DN-19	internal_process_data_config_read	ExpressionLimit	All set-ups	TRUE	0	Uint16
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

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
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-85	Defined Parameters (6)	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	ExpressionLimit	2 set-ups	TRUE	-	Uint8
EN-13	Link Speed	[0] None	2 set-ups	TRUE	-	Uint8

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

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	2 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#						

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
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	Uint16
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	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]
ID-74	Option in Slot C1	0 N/A	All set-ups	FALSE	0	VisStr[30]
ID-75	Slot C0 Option SW Version	0 N/A	All set-ups	FALSE	0	VisStr[20]
ID-76	Option in Slot C2	0 N/A	All set-ups	FALSE	0	VisStr[30]
ID-77	Slot C1 Option SW Version	0 N/A	All set-ups	FALSE	0	VisStr[20]
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

4.1.17 DR-## Data Readouts

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
DR-0#						
DR-00	Control Word	0 N/A	All set-ups	FALSE	0	V2
DR-01	Reference [Unit]	0 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-23	Motor Shaft Power [kW]	0 kW	All set-ups	TRUE	1	Int32
DR-24	Calibrated Stator Resistance	0.0000 Ohm	All set-ups	TRUE	-4	Uint32
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 Average	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-45	Motor Phase U Current	0 A	All set-ups	TRUE	-2	Int32
DR-46	Motor Phase V Current	0 A	All set-ups	TRUE	-2	Int32
DR-47	Motor Phase W Current	0 A	All set-ups	TRUE	-2	Int32
DR-48	Speed Ref. After Ramp [RPM]	0 RPM	All set-ups	FALSE	67	Int32
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#						

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
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-89	Configurable Alarm/Warning Word	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
DR-95	Ext. Status Word 2	0 N/A	All set-ups	FALSE	0	Uint32

4.1.18 LG-## Logs & I/O Opt Status

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
LG-0#						
LG-00	Maintenance Log: Item	0 N/A	All set-ups	FALSE	0	Uint8
LG-01	Maintenance Log: Action	0 N/A	All set-ups	FALSE	0	Uint8
LG-02	Maintenance Log: Time	0 s	All set-ups	FALSE	0	Uint32
LG-03	Maintenance Log: Date and Time	ExpressionLimit	All set-ups	FALSE	0	TimeOfDay
LG-1#						
LG-10	FireMode Log:Event	0 N/A	All set-ups	FALSE	0	Uint8
LG-11	Fire Mode Log: Time	0 s	All set-ups	FALSE	0	Uint32
LG-12	Fire Mode Log: Date and Time	ExpressionLimit	All set-ups	FALSE	0	TimeOfDay
LG-3#						
LG-30	Analog Input X42/1	0 N/A	All set-ups	FALSE	-3	Int32
LG-31	Analog Input X42/3	0 N/A	All set-ups	FALSE	-3	Int32

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
LG-32	Analog Input X42/5	0 N/A	All set-ups	FALSE	-3	Int32
LG-33	Analog Out X42/7 [V]	0 N/A	All set-ups	FALSE	-3	Int16
LG-34	Analog Out X42/9 [V]	0 N/A	All set-ups	FALSE	-3	Int16
LG-35	Analog Out X42/11 [V]	0 N/A	All set-ups	FALSE	-3	Int16

4.1.19 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	2 set-ups	TRUE	-	Uint8
LC-16	RS-FF Operand R	ExpressionLimit	2 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

4.1.20 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	MaxReference (F-5)	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

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
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	Imax (DR-37)	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

4.1.21 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-01	Speed PID Droop	0 RPM	All set-ups	TRUE	67	Uint16
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	ExpressionLimit	All set-ups	TRUE	67	Uint32
PI-1#						
PI-10	Torque PI Feedback Source	[0] Controller Off	All set-ups	TRUE	-	Uint8
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-16	Torque PI Lowpass Filter Time	5 ms	All set-ups	TRUE	-4	Uint16
PI-18	Torque PI Feed Forward Factor	0 %	All set-ups	TRUE	0	Uint16
PI-19	Current Controller Rise Time	ExpressionLimit	All set-ups	TRUE	0	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	ExpressionLimit	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#						

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
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-48	PCD Feed Forward	0 N/A	All set-ups	TRUE	0	Uint16
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

4.1.22 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	ExpressionLimit	All set-ups	TRUE	-	Uint8
SF-23	Locked Rotor Detection Time [s]	ExpressionLimit	All set-ups	TRUE	-2	Uint8
SF-24	Locked Rotor Detection Speed Error [%]	25 %	All set-ups	TRUE	-1	Uint32
SF-25	Light Load Delay [s]	0.000 s	All set-ups	TRUE	-3	Uint32
SF-26	Light Load Current [%]	0 %	All set-ups	TRUE	0	Uint16
SF-27	Light Load Speed [%]	0 %	All set-ups	TRUE	0	Uint16
SF-3#						
SF-30	External Interlock Delay	0 s	All set-ups	TRUE	0	Uint16
SF-8#						
SF-84	Process PID Proportional Gain	ExpressionLimit	All set-ups	TRUE	-3	Uint16

4.1.23 IO-## Programmable I/O Option

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
IO-0#						
IO-00	Terminal X49/1 Mode	[1] Voltage	All set-ups	TRUE	-	Uint8
IO-01	Terminal X49/3 Mode	[1] Voltage	All set-ups	TRUE	-	Uint8
IO-02	Terminal X49/5 Mode	[1] Voltage	All set-ups	TRUE	-	Uint8
IO-03	Terminal X49/7 Mode	[0] Voltage 0-10V	All set-ups	TRUE	-	Uint8
IO-04	Terminal X49/9 Mode	[0] Voltage 0-10V	All set-ups	TRUE	-	Uint8
IO-05	Terminal X49/11 Mode	[0] Voltage 0-10V	All set-ups	TRUE	-	Uint8
IO-1#						
IO-10	Terminal X49/1 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
IO-11	Terminal X49/1 Low Current	4 mA	All set-ups	TRUE	-5	Int16
IO-12	Terminal X49/1 High Voltage	10 V	All set-ups	TRUE	-2	Int16
IO-13	Terminal X49/1 High Current	20 mA	All set-ups	TRUE	-5	Int16
IO-14	Term. X49/1 Low Ref./Feedb. Value	0 N/A	All set-ups	TRUE	-3	Int32
IO-15	Term. X49/1 High Ref./Feedb. Value	100 N/A	All set-ups	TRUE	-3	Int32
IO-16	Term. X49/1 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
IO-17	Term. X49/1 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
IO-2#						
IO-20	Terminal X49/3 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
IO-21	Terminal X49/3 Low Current	4 mA	All set-ups	TRUE	-5	Int16
IO-22	Terminal X49/3 High Voltage	10 V	All set-ups	TRUE	-2	Int16
IO-23	Terminal X49/3 High Current	20 mA	All set-ups	TRUE	-5	Int16
IO-24	Term. X49/3 Low Ref./Feedb. Value	0 N/A	All set-ups	TRUE	-3	Int32
IO-25	Term. X49/3 High Ref./Feedb. Value	100 N/A	All set-ups	TRUE	-3	Int32
IO-26	Term. X49/3 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
IO-27	Term. X49/3 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
IO-3#						
IO-30	Terminal X49/5 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
IO-31	Terminal X49/5 Low Current	4 mA	All set-ups	TRUE	-5	Int16
IO-32	Terminal X49/5 High Voltage	10 V	All set-ups	TRUE	-2	Int16
IO-33	Terminal X49/5 High Current	20 mA	All set-ups	TRUE	-5	Int16
IO-34	Term. X49/5 Low Ref./Feedb. Value	0 N/A	All set-ups	TRUE	-3	Int32
IO-35	Term. X49/5 High Ref./Feedb. Value	100 N/A	All set-ups	TRUE	-3	Int32
IO-36	Term. X49/5 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
IO-37	Term. X49/5 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
IO-4#						
IO-40	Terminal X49/7 Analogue Output	[0] No operation	All set-ups	TRUE	-	Uint8
IO-41	Terminal X49/7 Digital Output	[0] No operation	All set-ups	TRUE	-	Uint8
IO-42	Terminal X49/7 Min. Scale	0 %	All set-ups	TRUE	-2	Int16
IO-43	Terminal X49/7 Max. Scale	100 %	All set-ups	TRUE	-2	Int16
IO-44	Terminal X49/7 Bus Control	0 %	All set-ups	TRUE	-2	N2
IO-45	Terminal X49/7 Timeout Preset	0 %	1 set-up	TRUE	-2	Uint16
IO-5#						
IO-50	Terminal X49/9 Analogue Output	[0] No operation	All set-ups	TRUE	-	Uint8
IO-51	Terminal X49/9 Digital Output	[0] No operation	All set-ups	TRUE	-	Uint8
IO-52	Terminal X49/9 Min. Scale	0 %	All set-ups	TRUE	-2	Int16
IO-53	Terminal X49/9 Max. Scale	100 %	All set-ups	TRUE	-2	Int16
IO-54	Terminal X49/9 Bus Control	0 %	All set-ups	TRUE	-2	N2
IO-55	Terminal X49/9 Timeout Preset	0 %	1 set-up	TRUE	-2	Uint16
IO-6#						
IO-60	Terminal X49/11 Analogue Output	[0] No operation	All set-ups	TRUE	-	Uint8
IO-61	Terminal X49/11 Digital Output	[0] No operation	All set-ups	TRUE	-	Uint8
IO-62	Terminal X49/11 Min. Scale	0 %	All set-ups	TRUE	-2	Int16
IO-63	Terminal X49/11 Max. Scale	100 %	All set-ups	TRUE	-2	Int16
IO-64	Terminal X49/11 Bus Control	0 %	All set-ups	TRUE	-2	N2
IO-65	Terminal X49/11 Timeout Preset	0 %	1 set-up	TRUE	-2	Uint16

5 Troubleshooting

5.1 Status Messages

5.1.1 Warnings/Alarm Messages

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

A warning remains active until its cause is no longer present. Under certain circumstances, operation of the motor may still 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.

3 ways to reset:

- Press [Reset].
- Via a digital input with the reset function.
- Via serial communication/optional network.

NOTICE

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 extra protection, meaning that the mains supply must be switched off before the alarm can be reset. After being switched back on, the frequency converter is no longer blocked and can be reset once the cause has been rectified.

Alarms that are not trip locked can also be reset using the automatic reset function in *parameter 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 it is possible to specify whether a warning or an alarm should be shown for a given fault.

This is possible, for instance, in *parameter 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.

NOTICE

No missing motor phase detection and no stall detection are active when *parameter P-20 Motor Construction* is set to *[1] PM non-salient SPM*.

Number	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
1	10 Volts low	X	–	–	
2	Live zero error	(X)	(X)	–	Parameter AN-01 Live Zero Timeout Function
3	No motor	(X)	–	–	Parameter H-80 Function at Stop
4	Mains phase loss	(X)	(X)	(X)	Parameter SP-12 Function at Line Imbalance
5	DC-link voltage high	X	–	–	–
6	DC-link voltage low	X	–	–	–
7	DC overvoltage	X	X	–	–
8	DC undervoltage	X	X	–	–
9	Inverter overloaded	X	X	–	–
10	Motor Electronic OL overtemperature	(X)	(X)	–	Parameter F-10 Electronic Overload
11	Motor thermistor overtemperature	(X)	(X)	–	Parameter F-10 Electronic Overload
12	Torque limit	X	X	–	–
13	Overcurrent	X	X	X	–
14	Ground fault	X	X	–	–

Number	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
15	Hardware mismatch		X	X	–
16	Short Circuit		X	X	–
17	Control word timeout	(X)	(X)	–	Parameter 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)	–	Parameter B-13 Braking Thermal Overload
27	Brake chopper short-circuited	X	X	–	
28	Brake check	(X)	(X)	–	Parameter B-15 Brake Check
29	Heat sink temp	X	X	X	
30	Motor phase U missing	(X)	(X)	(X)	Parameter H-78 Missing Motor Phase Function
31	Motor phase V missing	(X)	(X)	(X)	Parameter H-78 Missing Motor Phase Function
32	Motor phase W missing	(X)	(X)	(X)	Parameter 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	Imbalance of supply voltage	–	X	–	–
38	Internal Fault	–	X	X	–
39	Heat sink sensor	–	X	X	–
40	Overload of Digital Output Terminal 27	(X)	–	–	Parameter E-00 Digital I/O Mode, parameter E-51 Termina l 27 Mode
41	Overload of Digital Output Terminal 29	(X)	–	–	Parameter E-00 Digital I/O Mode, parameter E-52 Termina l 29 Mode
42	Ovrld X30/6-7	(X)	–	–	–
43	Ext. Supply (option)		–	–	–
45	Ground 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	–	parameter 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	–	–

Number	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
58	Auto Tune internal fault	X	X	–	–
59	Current limit	X		–	–
61	Feedback Error	(X)	(X)	–	Parameter H-20 Motor Feedback Loss Function
62	Output Frequency at Maximum Limit	X	–	–	–
64	Voltage Limit	X	–	–	–
65	Control board overtemperature	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	–	–	Parameter SP-59 Actual Number of Inverter Units
78	Tracking Error	(X)	(X)	–	Parameter H-24 Tracking Error Function
79	Illegal PS config	–	X	X	–
80	Frequency converter 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 parameter 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#). The original event that caused an alarm cannot damage the frequency converter or cause dangerous conditions. A trip lock is an action when an alarm occurs, which 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 Indicator Light

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)	Reserved	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
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	24 V Supply Low (W47)	Reserved	Unused
24	01000000	16777216	Mains Failure (A36)	Reserved	Mains Failure (W36)	Reserved	Unused
25	02000000	33554432	1.8 V Supply Low (A48)	Reserved	Current Limit (W59)	Reserved	Unused
26	04000000	67108864	Brake Resistor (A25)	Reserved	Low Temp (W66)	Reserved	Unused

Bit	Hex	Dec	Alarm Word	Alarm Word 2	Warning Word	Warning Word 2	Extended Status Word
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 a serial bus or optional network for diagnostics. See also *parameter DR-94 Ext. Status Word*.

WARNING 1, 10 Volts low
The control card voltage is less than 10 V from terminal 50. Remove some of the load from terminal 50, as the 10 V supply is overloaded. Maximum 15 mA or minimum 590 Ω.

A short circuit in a connected potentiometer or incorrect wiring of the potentiometer can cause this condition.

Troubleshooting

- Remove the wiring from terminal 50. If the warning clears, the problem is with the wiring. If the warning does not clear, replace the control card.

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

Troubleshooting

- Check connections on all analog mains 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, and 5 for signals, terminals 2, 4, and 6 common.
- Check that the frequency converter programming and switch settings match the analog signal type.
- Perform an input terminal signal test.

WARNING/ALARM 3, No motor
No motor is 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. Options are programmed in *parameter 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 DC-link voltage (DC) is higher than the high-voltage warning limit. The limit depends on the frequency converter voltage rating. The unit is still active.

WARNING 6, DC link voltage low
The DC-link voltage (DC) is lower than the low voltage warning limit. The limit depends on the frequency converter voltage rating. The unit is still active.

WARNING/ALARM 7, DC overvoltage
If the DC-link voltage exceeds the limit, the frequency converter trips after a certain time.

Troubleshooting

- Extend the ramp time.
- Change the ramp type.
- Activate the functions in *parameter B-10 Brake Function*.
- Increase *parameter SP-26 Trip Delay at Drive Fault*.
- If the alarm/warning occurs during a power sag, use kinetic back-up (*parameter SP-10 Line failure*).

WARNING/ALARM 8, DC under voltage
If the DC-link voltage drops below the undervoltage limit, the frequency converter checks for 24 V DC back-up supply. If no 24 V DC back-up 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 an input voltage test.
- Perform a soft-charge circuit test.

WARNING/ALARM 9, Inverter overload
The frequency converter has run with more than 100% overload for too long and is about to cut out. The counter for electronic thermal inverter protection issues a warning at 98% and trips at 100% with an alarm. The frequency converter cannot be reset until the counter is below 90%.

Troubleshooting

- Compare the output current shown on the keypad with the frequency converter rated current.
- Compare the output current shown on the keypad with the measured motor current.
- Show the thermal frequency converter 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 is >90% if *parameter F-10 Electronic Overload* is set to warning options, or whether the frequency converter trips when the counter reaches 100% if *parameter F-10 Electronic Overload* is set to trip options. 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 *parameter P-03 Motor Current* is correct.
- Ensure that the 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 that it is selected in *parameter F-11 Motor External Fan*.
- Running Auto tune in *parameter 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 *parameter 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 that *parameter F-12 Motor Thermistor Input* selects terminal 53 or 54.
- When using terminal 18, 19, 31, 32, or 33 (digital inputs), check that the thermistor is connected correctly between the digital input terminal used (digital input PNP only) and terminal 50. Select the terminal to use in *parameter F-12 Motor Thermistor Input*.

WARNING/ALARM 12, Torque limit
The torque has exceeded the value in *parameter F-40 Torque Limiter (Driving)* or the value in *parameter F-41 Torque Limiter (Braking)*. *Parameter SP-25 Trip Delay at Torque Limit* can change this warning 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, 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 approximately 1.5 s, then the frequency converter trips and issues an alarm. Shock loading or quick acceleration with high-inertia loads can cause this fault. If the acceleration during ramp-up is quick, the fault can also appear after kinetic back-up. If extended mechanical brake control is selected, a trip can be reset externally.

Troubleshooting

- Remove the power and check if the motor shaft can be turned.
- Check that the motor size matches the frequency converter.
- Check that the motor data is correct in *parameters* P-02, P-03, P-06, P-07, F-04, and F-05.

ALARM 14, Earth (ground) fault
There is current from the output phase to ground, either in the cable between the frequency converter and the motor, or in the motor itself. Ground fault is detected by the current transducers that measure current going out from the frequency converter and current going into the frequency converter from the motor. Ground fault is issued if the deviation of the 2 currents is too large (the current going out of the frequency converter should be the same as the current going into the frequency converter).

Troubleshooting

- Remove power to the frequency converter and repair the ground fault.
- Check for ground faults in the motor by measuring the resistance to ground of the motor cables and the motor with a megohmmeter.
- Reset any potential individual offset in the 3 current transducers in AF-650 GP. Perform the manual initialization or perform a complete AMA. This method is most relevant after changing the power card.

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 GE:

- *Parameter ID-40 Drive Type*.
- *Parameter ID-41 Power Section*.
- *Parameter ID-42 Voltage*.
- *Parameter ID-43 Software Version*.
- *Parameter ID-45 Actual Typecode String*.
- *Parameter ID-49 SW ID Control Card*.
- *Parameter ID-50 SW ID Power Card*.
- *Parameter ID-60 Option Mounted*.
- *Parameter ID-61 Option SW Version* (for each option slot).

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

Troubleshooting

- Remove the 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 *parameter O-04 Control Word Timeout Function* is NOT set to *[0] Off*.
If *parameter O-04 Control Word Timeout Function* is set to *[5] Stop and Trip*, a warning appears, and the frequency converter ramps down to a stop and shows an alarm.

Troubleshooting

- Check the connections on the serial communication cable.
- Increase *parameter O-03 Control Word Timeout Time*.
- Check the operation of the communication equipment.
- Verify that proper EMC installation was performed.

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.

Troubleshooting

- Set the affected parameter to a valid value.

WARNING/ALARM 22, Hoist mechanical brake
The value of this warning/alarm shows the type of warning/alarm.
0 = The torque reference was not reached before timeout (*parameter B-27 Torque Ramp Time*).
1 = Expected brake feedback not received before timeout (*parameter B-23 Activate Brake Delay*, *parameter B-25 Brake Release Time*).

WARNING 23, Internal fan fault
The fan warning function is a protective function that checks if the fan is running/mounted. The fan warning can be disabled in *parameter SP-53 Fan Monitor* (*[0] Disabled*).

For frequency converters with DC fans, there is a feedback sensor mounted in the fan. If the fan is commanded to run and there is no feedback from the sensor, this alarm appears. For frequency converters with AC fans, the voltage to the fan is monitored.

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 control card.

WARNING 24, External fan fault
The fan warning function is a protective function that checks if the fan is running/mounted. The fan warning can be disabled in *parameter SP-53 Fan Monitor* (*[0] Disabled*).

For frequency converters with DC fans, there is a feedback sensor mounted in the fan. If the fan is commanded to run and there is no feedback from the sensor, this alarm appears. For frequency converters with AC fans, the voltage to the fan is monitored.

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 heat sink.

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.

Troubleshooting

- Remove the power to the frequency converter and replace the brake resistor (refer to *parameter 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 s of run time. The calculation is based on the DC-link voltage and the brake resistor value set in *parameter B-16 AC brake Max. Current*. The warning is active when the dissipated braking power is higher than 90% of the brake resistor power. If option *[2] Trip* is selected in *parameter 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.

Troubleshooting

- Remove power to the frequency converter and remove the brake resistor.

High-power drives: This alarm/warning also occurs if the brake resistor overheat. Terminals 104–106 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.

Troubleshooting

- Check *parameter B-15 Brake Check*.

ALARM 29, Heatsink temp
The maximum temperature of the heat sink is exceeded. The temperature fault is not reset until the temperature drops below a defined heat sink temperature. The trip and reset points are different based on the frequency converter power size.

Troubleshooting
Check for the following conditions.

- The ambient temperature is too high.
- The motor cables are too long.
- Incorrect airflow clearance above and below the frequency converter.
- Blocked airflow around the frequency converter.
- Damaged heat sink fan.
- Dirty heat sink.

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

Troubleshooting

- Remove the 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.

Troubleshooting

- Remove the 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.

Troubleshooting

- Remove the 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.

Troubleshooting

- 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 *parameter SP-10 Line failure* is not set to *[0] No Function*.

Troubleshooting

- Check the fuses to the frequency converter and mains 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 shown.

Troubleshooting

- Cycle power.
- Check that the option is properly installed.
- Check for loose or missing wiring.

It may be necessary to contact the GE supplier or service department. Note the code number for further trouble-shooting directions.

Number	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.

Number	Text
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 heat sink 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 gatedrive card, or the ribbon cable between the power card and gatedrive card.

WARNING 40, Overload of digital output terminal 27
Check the load connected to terminal 27 or remove the short circuit connection. Check *parameter E-00 Digital I/O Mode* and *parameter E-51 Terminal 27 Mode*.

WARNING 41, Overload of digital output terminal 29
Check the load connected to terminal 29 or remove the short circuit connection. Also check *parameter E-00 Digital I/O Mode* and *parameter E-52 Terminal 29 Mode*.

WARNING 42, Overload of digital output on X30/6 or overload of digital output on X30/7
For terminal X30/6, check the load connected to terminal X30/6 or remove the short circuit connection. Also check *parameter E-56 Term X30/6 Digi Out (OPCGPIO)* (General Purpose I/O OPCGPIO).

For terminal X30/7, check the load connected to terminal X30/7 or remove the short circuit connection. Check *parameter E-57 Term X30/7 Digi Out (OPCGPIO)* (General Purpose I/O OPCGPIO).

ALARM 43, Ext. supply
The Extended Relay Option is mounted without external 24 V DC. Either connect a 24 V DC external supply or specify that no external supply is used via *parameter 14-80 Option Supplied by External 24VDC*, *[0] No*. A change in *parameter 14-80 Option Supplied by External 24VDC* requires a power cycle.

ALARM 45, Earth fault 2
Ground fault.

Troubleshooting
- Check for proper grounding and loose connections.
- Check for proper wire size.
- Check the 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 3 supplies generated by the switch mode supply (SMPS) on the power card:
- 24 V.
- 5 V.
- ±18 V.

When powered with 3-phase mains voltage, all 3 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 supply is used, verify proper supply power.

WARNING 47, 24 V supply low
The supply on the power card is out of range.

There are 3 supplies generated by the switch mode supply (SMPS) on the power card:
- 24 V.
- 5 V.
- ±18 V.

Troubleshooting
- Check for a defective power card.

WARNING 48, 1.8 V supply low
The 1.8 V DC supply used on the control card is outside of the allowable limits. The supply is measured on the control card.

Troubleshooting
- Check for a defective control card.
- If an option card is present, check for overvoltage.

WARNING 49, Speed limit
The warning is shown when the speed is outside of the specified range in F-18 and F-17. When the speed is below the specified limit in *parameter H-36 Trip Speed Low [RPM]* (except when starting or stopping), the frequency converter trips.

ALARM 50, Auto tune calibration failed
Contact the 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.

Troubleshooting

- 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.

Troubleshooting

- Check the settings in *parameter P-03 Motor Current*.

ALARM 53, Auto tune motor too big
The motor is too large 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
Auto tune cannot run because the parameter values of the motor are outside of the acceptable range.

ALARM 56, Auto tune interrupted by user
The AMA is manually interrupted.

ALARM 57, Auto tune internal fault
Try to restart Auto tune. Repeated restarts can overheat the motor.

ALARM 58, Internal fault
Contact the GE supplier.

WARNING 59, Current limit
The current is higher than the value in *parameter F-43 Current Limit*. Ensure that motor data in *parameters* P-02, P-03, P-06, P-07, F-04, and F-05 is set correctly. Increase the current limit if necessary. Ensure that the system can operate safely at a higher limit.

WARNING 60, External interlock
A digital input signal indicates a fault condition external to the frequency converter. An external interlock has commanded the frequency converter to trip. Clear the external fault condition. To resume normal operation, apply 24 V DC to the terminal programmed for external interlock, and reset the frequency converter.

WARNING/ALARM 61, Feedback error
An error has been detected between calculated speed and speed measurement from feedback device.

Troubleshooting

- Check the settings for warning/alarm/disabling in *parameter H-20 Motor Feedback Loss Function*.
- Set the tolerable error in *parameter H-21 Motor Feedback Speed Error*.
- Set the tolerable feedback loss time in *parameter H-22 Motor Feedback Loss Timeout*.

WARNING 62, Output frequency at maximum limit
The output frequency has reached the value set in *parameter F-03 Max Output Frequency 1*. Check the application for possible causes. Possibly increase the output frequency limit. Be sure that the system can operate safely at a higher output frequency. The warning clears 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 64, Voltage limit
The combination of load and speed requires a motor voltage higher than what can be provided due to the actual DC-link voltage.

WARNING/ALARM 65, Control card over temperature
The cut-out temperature of the control card is 85 °C.

Troubleshooting

- Check that the ambient operating temperature is within the limits.
- Check for clogged filters.
- Check the 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 *parameter B-00 DC Hold Current* to 5% and *parameter 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 68, Safe Stop activated
Safe Torque Off (STO) has been activated. To resume normal operation, apply 24 V DC to terminal 37, then send a reset signal (via bus, digital I/O, or by pressing [Reset]).

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. To check compatibility, contact the GE supplier with the model number from the unit nameplate and the part numbers of the cards.

ALARM 71, PTC 1 safe stop
STO has been activated from external source. Normal operation can be resumed when 24 V DC is applied to terminal # 37. When that happens, send a reset signal (via bus or digital I/O, or press [Reset]).

ALARM 72, Dangerous failure

STO with trip lock. An unexpected combination of STO commands has occurred:

- OPCPTC enables X44/10, but STO is not enabled.
- OPCPTC is the only device using STO (specified through selection *[4] PTC 1 Alarm* or *[5] PTC 1 Warning* in *parameter E-07 Terminal 37 Safe Stop*), STO is activated, and X44/10 is not activated.

WARNING 73, Safe stop auto restart
STO activated. With automatic restart enabled, the motor can start when the fault is cleared.

ALARM 74, PTC Thermistor
Alarm related to PTC Thermistor Card OPCPTC. The PTC is not working.

ALARM 75, Illegal profile sel.
Do not write the parameter value while the motor runs. Stop the motor before writing the MCO profile to *parameter O-10 Control Word Profile*.

WARNING 76, Power Unit Setup
The required number of power units does not match the detected number of active power units.

Troubleshooting

- Confirm that the spare part and its power card are the correct part number.

WARNING 77, Reduced power mode
The frequency converter is operating in reduced power mode (less than the allowed number of inverter sections). This warning is generated on power cycle when the frequency converter is set to run with fewer inverters and remains on.

ALARM 78, Tracking error
The difference between setpoint value and actual value exceeds the value in *parameter H-25 Tracking Error*.

Troubleshooting

- Disable the function or select an alarm/warning in *parameter 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 *parameter H-20 Motor Feedback Loss Function*.
- Adjust tracking error band in *parameter H-25 Tracking Error* and *parameter H-27 Tracking Error Ramping*.

ALARM 79, Illegal power section configuration
The scaling card has an incorrect part number or is not installed. The 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. To clear the alarm, reset the unit.

ALARM 81, CSIV corrupt
CSIV file has syntax errors.

ALARM 82, CSIV parameter error
CSIV failed to initialize a parameter.

ALARM 83, Illegal option combination
The mounted options are incompatible.

ALARM 88, Option detection
A change in the option layout is detected.
Parameter H-01 Option Detection is set to *[0] Frozen configuration* and the option layout has been changed.

- To apply the change, enable option layout changes in *parameter H-01 Option Detection*.
- Alternatively, restore the correct option configuration.

WARNING 89, Mechanical brake sliding
The hoist brake monitor detects a motor speed exceeding 10 RPM.

ALARM 90, Feedback monitor
Check the connection to encoder/resolver option and, if necessary, replace OPCENC or OPCRES.

ALARM 91, Analog input 54 wrong settings
Set switch S202 in position OFF (voltage input) when a KTY sensor is connected to analog input terminal 54.

ALARM 99, Locked rotor
Rotor is blocked.

WARNING/ALARM 101, Speed monitor
The motor speed monitor value is outside range. See *parameter H-30 Motor Speed Monitor Function*.

WARNING/ALARM 104, Mixing fan fault
The fan is not operating. The fan monitor checks that the fan is spinning at power-up or whenever the mixing fan is turned on. The mixing-fan fault can be configured as a warning or an alarm trip in *parameter SP-53 Fan Monitor*.

Troubleshooting

- Cycle power to the frequency converter to determine if the warning/alarm returns.

WARNING/ALARM 122, Mot. rotat. unexp.
The frequency converter performs a function that requires the motor to be at standstill, for example DC hold for PM motors.

WARNING 123, Motor Mod. Changed
The motor selected in *parameter P-20 Motor Construction* is not correct. Check the motor model.

WARNING 220, Configuration file version not supported
The frequency converter does not support the current configuration file version. Customization is aborted.

ALARM 246, Power card supply
This alarm is only for enclosure size F 6x unit size frequency converters. It is equivalent to *alarm 46, Power card supply*.

The report value in the alarm log indicates which power module generated the alarm:

1 = Inverter module to the far left.

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 249, Rect. low temperature
The temperature of the rectifier heat sink is lower than expected.

Troubleshooting

- Check the temperature sensor.

WARNING 250, New spare part
The power or switch mode supply has been exchanged. Restore the frequency converter type code in the EEPROM. Select the correct type code in *parameter SP-23 Typecode Setting* according to the label on the frequency converter. Remember to select Save to EEPROM at the end.

WARNING 251, New typecode
The power card or other components are replaced and the type code has changed.

WARNING 253, Digital output X49/9 overload
Digital output X49/9 is overloaded.

WARNING 254, Digital output X49/11 overload
Digital output X49/11 is overloaded.

WARNING 255, Digital output X49/7 overload
Digital output X49/7 is overloaded.

ALARM 430, PWM Disabled
The PWM on the power card is disabled.

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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.

GE
41 Woodford Avenue
Plainville, CT 06062

www.geindustrial.com/drives

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DET-618D