GE

AF-650 GP™ General Purpose Drive

Programming Guide

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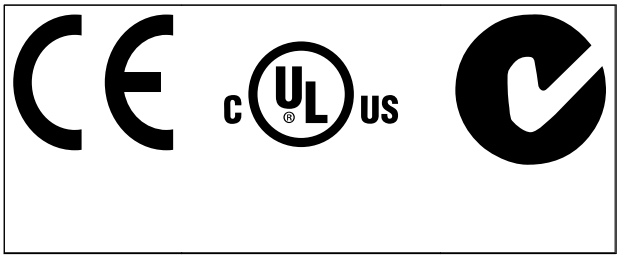
Contents

1 Introduction

Programming Guide
Software version: 2.14

This Programming Guide can be used for all AF-650 GP adjustable frequency drives with software version 2.14.
The software version number can be seen from *ID-43 Software Version*.

1.1.1 Approvals



1.1.2 Symbols

Symbols used in this guide.

NOTE!
Indicates something to be noted by the reader.

⚠CAUTION
Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or equipment damage.

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

* Indicates default setting

1.1.3 Abbreviations

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

1.1.4 Definitions

Drive:

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

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

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

Input:

Control command

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

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

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

Motor:

Motor Running

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

f_{JOG}

Motor frequency when the jog function is activated (via digital terminals).

f_M

Motor frequency.

f_{MAX}

Maximum motor frequency.

f_{MIN}

Minimum motor frequency.

$f_{M,N}$

Rated motor frequency (nameplate data).

I_M

Motor current (actual).

$I_{M,N}$

Rated motor current (nameplate data).

$n_{M,N}$

Rated motor speed (nameplate data).

n_s

Synchronous motor speed

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

$P_{M,N}$

Rated motor power (nameplate data in kW or HP).

$T_{M,N}$

Rated torque (motor).

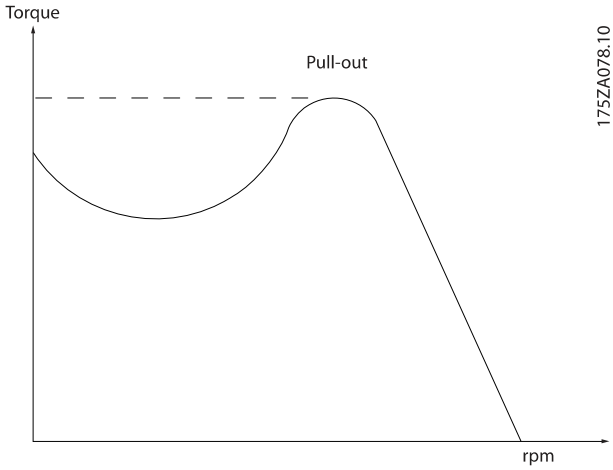
U_M

Instantaneous motor voltage.

$U_{M,N}$

Rated motor voltage (nameplate data).

Break-away torque



η_{DRIVE}

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

Start-disable command

A stop command belonging to the group 1 control commands - see this group.

Stop command

See Control commands.

References:

Advanced Vector Control

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

Analog Reference

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

Binary Reference

A signal transmitted to the serial communication port.

Preset Reference

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

Pulse Reference

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

Ref_{MAX}

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

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

Miscellaneous:

Analog Inputs
The analog inputs are used for controlling various functions of the drive.
There are two types of analog inputs:
Current input, 0-20 mA and 4-20 mA
Voltage input, 0-10 V DC
Voltage input, -10 - +10 V DC.

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

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

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

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

Digital Inputs
The digital inputs can be used for controlling various functions of the drive.

Digital Outputs
The drive features two solid state outputs that can supply a 24 V DC (max. 40 mA) signal.

DSP
Digital Signal Processor.

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

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 drive. The Keypad is detachable and can be installed up to 10 ft [3 m] from the drive, i.e., in a front panel with the optional Remote Keypad Mounting Kit (RMKYPDAC)..

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

lsb
Least significant bit.

msb
Most significant bit.

MCM
Short for Mille Circular Mil, an American measuring unit for cable cross-section. 1 MCM = 0.5067 mm^2.

Online/Offline Parameters
Changes to online parameters are activated immediately after the data value is changed. Changes to offline parameters are not activated until you enter [OK] on the Keypad.

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

PCD
Process Control Data

Power Cycle
Switch off line power until the display (Keypad) 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
You can save parameter settings in four set-ups. Change between the four parameter set-ups, and edit one set-up, while another set-up is active.

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

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

STW
Status Word

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

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

Trip
A state entered in fault situations, e.g., if the drive is subject to an over-temperature or when the drive is protecting the motor, process or mechanism. Restart is prevented until the cause of the fault has disappeared and the trip state is cancelled by activating reset or, in some cases, by being programmed to reset automatically. Trip may not be used for personal safety.

Trip Locked
A state entered in fault situations when the drive is protecting itself and requiring physical intervention, e.g., if the drive is subject to a short circuit on the output. A locked trip can only be canceled by cutting off line power, removing the cause of the fault, and reconnecting the drive. Restart is prevented until the trip state is cancelled by activating reset or, in some cases, by being programmed to reset automatically. Trip may not be used for personal safety.

VT Characteristics
Variable torque characteristics used for pumps and fans.

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

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

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

The power factor for 3-phase control:

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

The power factor indicates to which extent the drive imposes a load on the line power supply.
The lower the power factor, the higher the I_{RMS} for the same hp [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 adjustable frequency drive's built-in DC link reactor produce a high power factor, which minimizes the imposed load on the line power supply.

⚠WARNING

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

Safety Regulations

1. The line power supply to the drive must be disconnected whenever repair work is to be carried out. Make sure that the line power supply has been disconnected and that the necessary time has elapsed before removing motor and line power supply plugs.
2. The [OFF] button on the Keypad of the drive does not disconnect the line power supply and consequently it must not be used as a safety switch.
3. The equipment must be properly grounded, the user must be protected against supply voltage and the motor must be protected against overload in accordance with applicable national and local regulations.
4. The ground leakage current exceeds 3.5 mA.
5. Protection against motor overload is not included in the factory setting. If this function is desired, set *F-10 Electronic Overload* to data value Elec. OL trip 1 [4] or data value Elec. OL warning 1 [3].
6. Do not remove the plugs for the motor and line power supply while the drive is connected to line power. Make sure that the line power supply has been disconnected and that the necessary time has elapsed before removing motor and line power plugs.
7. Please note that the drive has more voltage sources than L1, L2 and L3, when load sharing (linking of DC intermediate circuit) or external 24 V DC are installed. Make sure that all voltage sources have been disconnected and that the necessary time has elapsed before commencing repair work.

Warning against unintended start

1. The motor can be brought to a stop by means of digital commands, bus commands, references or a local stop, while the drive is connected to line power. If personal safety considerations (e.g., risk of personal injury caused by contact with moving machine parts following an unintentional start) make it necessary to ensure that no unintended

start occurs, these stop functions are not sufficient. In such cases, the line power supply must be disconnected.

2. The motor may start while setting the parameters. If this means that personal safety may be compromised (e.g., personal injury caused by contact with moving machine parts), motor starting must be prevented by disconnection of the motor connection.

3. A motor that has been stopped with the line power supply connected may start if faults occur in the electronics of the drive through temporary overload or if a fault in the power supply grid or motor connection is remedied. If unintended start must be prevented for personal safety reasons (e.g., risk of injury caused by contact with moving machine parts), the normal stop functions of the drive are not sufficient. In such cases, the line power supply must be disconnected.

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

⚠WARNING

High Voltage

Touching the electrical parts may be fatal - even after the equipment has been disconnected from line power.
Also make sure that other voltage inputs have been disconnected, such as external 24V DC, load sharing (linkage of DC intermediate circuit), as well as the motor connection for kinetic backup.
Systems where adjustable frequency drives are installed must, if necessary, be equipped with additional monitoring and protective devices according to the valid safety regulations, e.g., law on mechanical tools, regulations for the prevention of accidents, etc. Modifications on the adjustable frequency drives by means of the operating software are allowed.

NOTE!

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

NOTE!

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

Protection Mode
Once a hardware limit on motor current or DC link voltage is exceeded, the drive will enter “Protection mode”. “Protection mode” means a change of the PWM modulation strategy and a low switching frequency to minimize losses. This continues 10 sec after the last fault and increases the reliability and the robustness of the drive while re-establishing full control of the motor.
The “protection mode” can be disabled by setting *SP-26 Trip Delay at Drive Fault* to zero which means that the drive will trip immediately if one of the hardware limits is exceeded.

1.1.5 Electrical Wiring - Control Cables

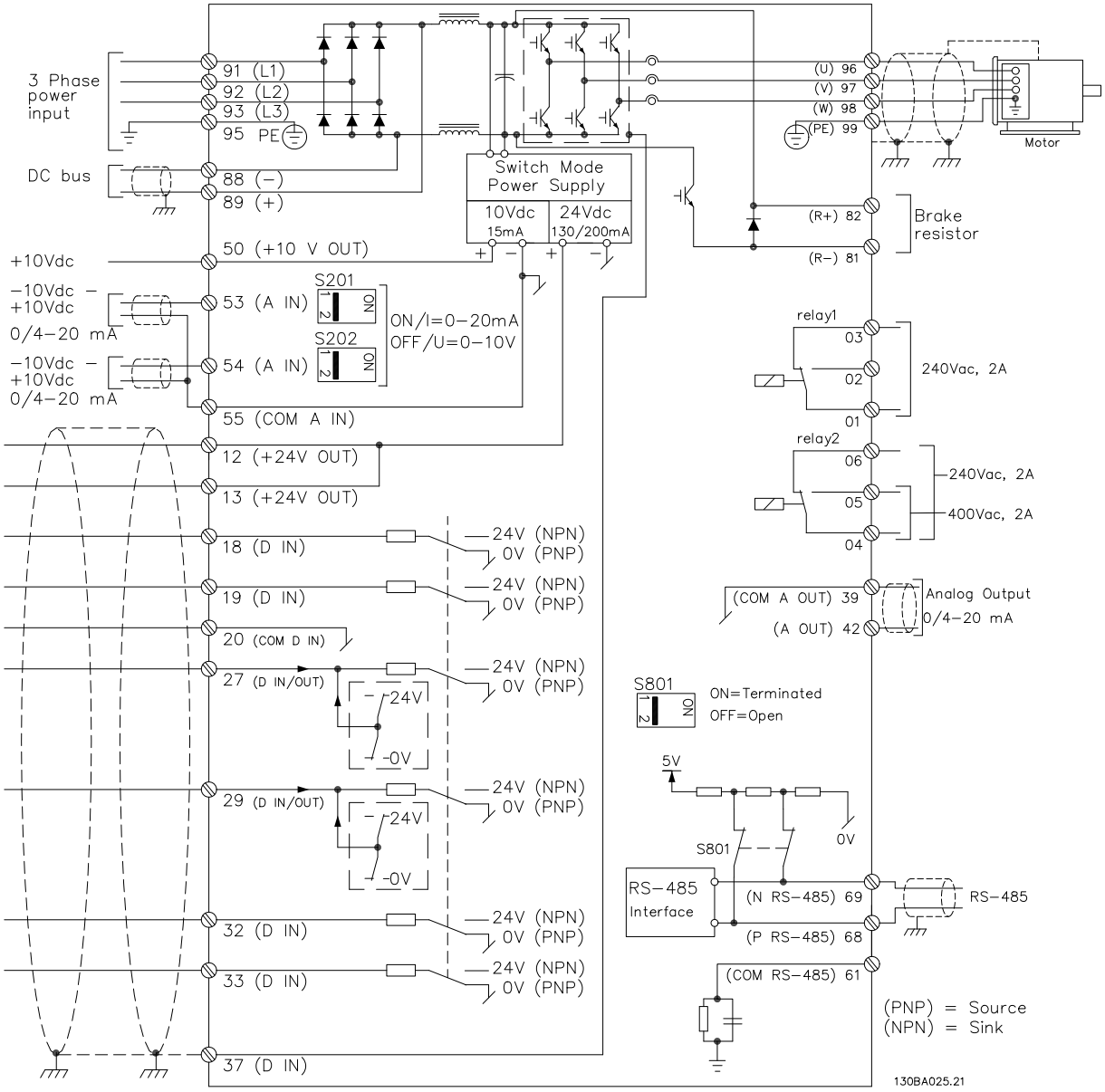


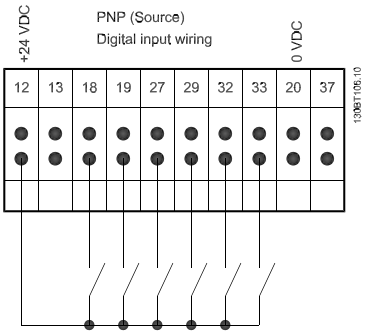
Figure 1.1 Diagram showing all electrical terminals without options.

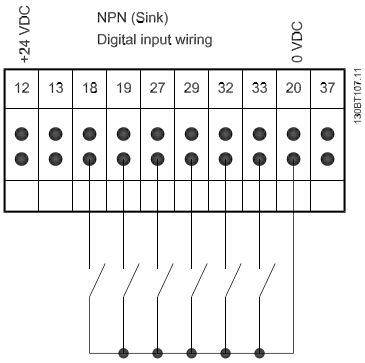
In rare cases, and depending on the installation, very long control cables and analog signals may result in 50/60 Hz ground loops due to noise from line power supply cables.

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

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

Input polarity of control terminals

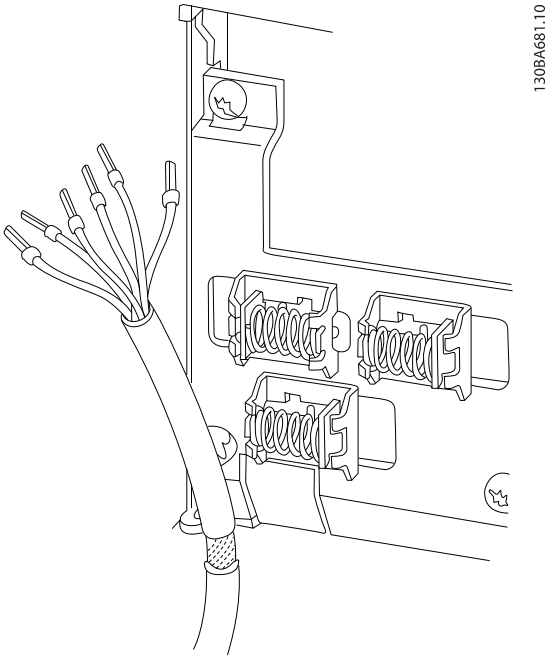




NOTE!

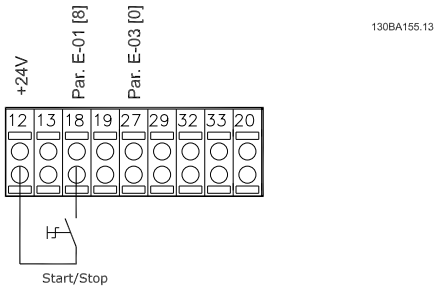
Control cables must be shielded/armored.

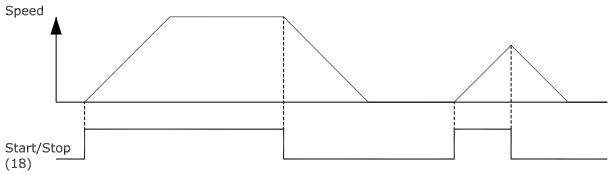
See section on grounding of shielded/armored control cables in the Design Guide for the correct termination of control cables.



1.1.6 Start/Stop

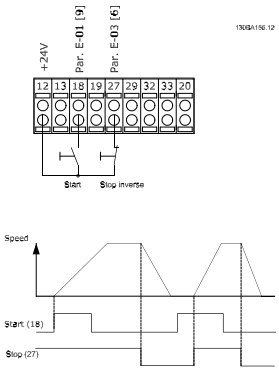
Terminal 18 = *E-01 Terminal 18 Digital Input* [8] *Start*





1.1.7 Pulse Start/Stop

Terminal 18 = *E-01 Terminal 18 Digital Input*Latched start, [9]
Terminal 27= *E-03 Terminal 27 Digital Input*Stop inverse, [6]



1.1.8 Speed Up/Down

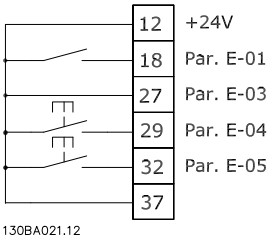
Terminals 29/32 = Speed up/down

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

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

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

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



1.1.9 Potentiometer Reference

Voltage reference via a potentiometer

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

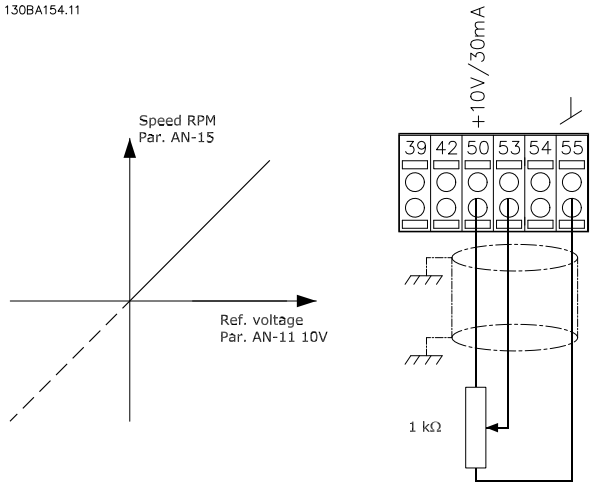
Terminal 53, Low Voltage = 0V

Terminal 53, High Voltage = 10V

Terminal 53, Low Ref./Feedback = 0 RPM

Terminal 53, High Ref./Feedback = 1500 RPM

Switch S201 = OFF (U)



1.1.10 External Hand Off Auto Example

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

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

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

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

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

External Hand-Off-Auto Selector Switch Wiring

Figure 1.2 GE 30 mm HOA Cat# (1) 104PSG34B & (3) CR104PXC1

2 How to Program

2.1 The Graphical Keypad

The easiest programming of the drive is performed by the Graphical Keypad.

2.1.1 How to Program on the Graphical Keypad

The following instructions are valid for the graphical Keypad

The keypad is divided into four functional groups.

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

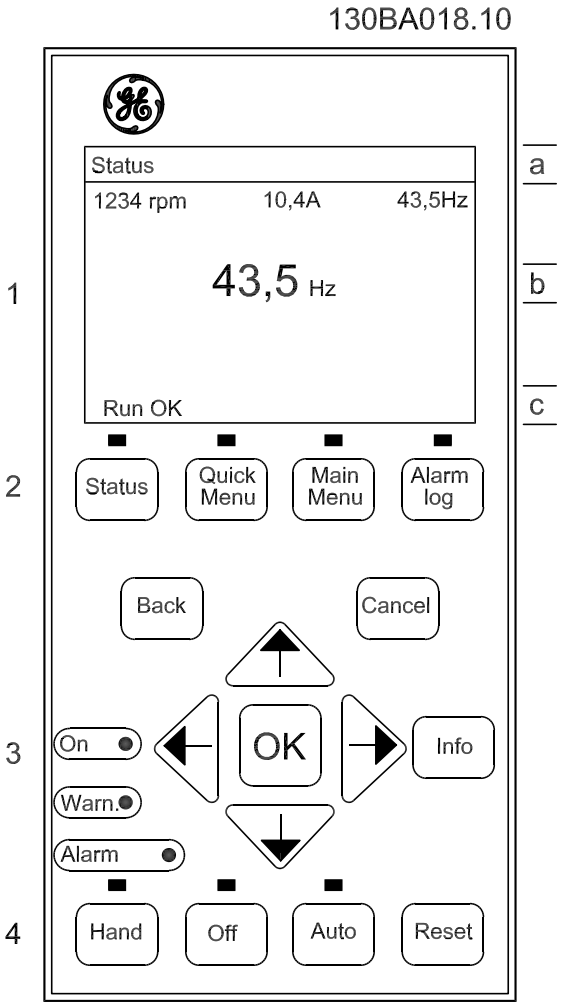
All data is displayed in the display, which can show up to five items of operating data while displaying [Status].

Display lines

a. **Status line:** Status messages displaying icons and graphic.

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

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



2

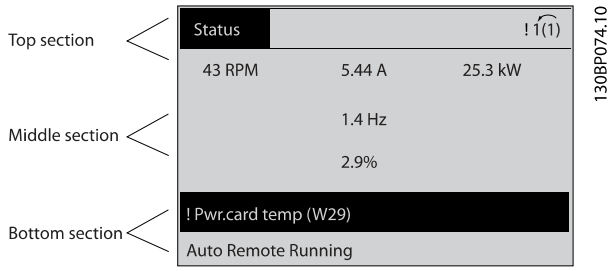
2.1.2 The LCD Display

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

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

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

The bottom section always shows the state of the drive in status mode.



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

Display Contrast Adjustment

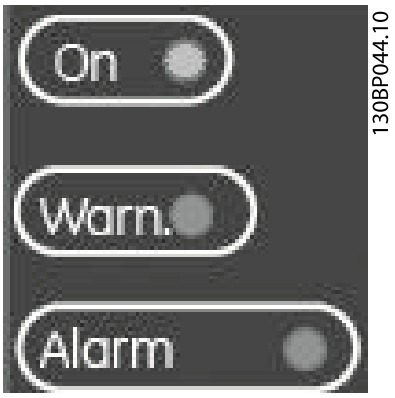
Press [status] and [▲] for darker display
Press [status] and [▼] for brighter display

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

LEDs

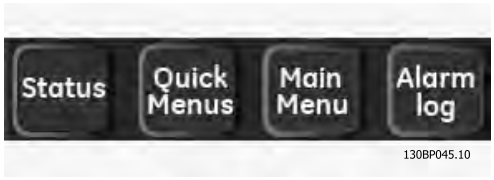
If certain threshold values are exceeded, the alarm and/or warning LED lights up. A status and alarm text appear on the Keypad.
The ON LED is activated when the drive receives AC line voltage or via a DC bus terminal or 24V external supply option (OPC24VPS) supply. At the same time, the back light is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

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



Keypad Keys

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



[Status] indicates the status of the drive and/or the motor. Choose between three different readouts by pressing the [Status] key: Five line readouts, four line readouts or Logic Controller.
Use **[Status]** for selecting the mode of display or for changing back to display mode from either the quick menu mode, the main menu mode or alarm mode. Also use the [Status] key to toggle single or double readout mode.

[Quick Menu] allows quick access to different quick menus such as

- Quick Start
- Parameter Data Check
- Trending

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

[Main Menu] is used for programming all parameters.
It is possible to switch directly between Main Menu mode and Quick Menu mode.
Parameter shortcut can be carried out by pressing down the **[Main Menu]** key for 3 seconds. The parameter shortcut allows direct access to any parameter.

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

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

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

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

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

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

Local Control Key for local control is found at the bottom of the Keypad.

[Hand] enables control of the drive via the Keypad.
[Hand] also starts the motor, and it is now possible to enter the motor speed data by means of the arrow keys.
The key can be selected as Enable [1] or Disable [0] via *K-40 [Hand] Button on Keypad*
External stop signals activated by means of control signals or a serial bus will override a "start" command via the Keypad.
The following control signals will still be active when [Hand] is activated.

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

[Off] stops the connected motor. The key can be selected as Enable [1] or Disable [0] via *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 drive 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 drive will start. The key can be selected as Enable [1] or Disable [0] via *K-42 [Auto] Button on Keypad*.

NOTE!

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

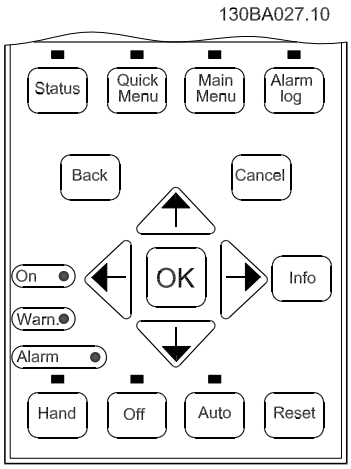
[Reset] is used for resetting the drive after an alarm (trip). It can be selected as *Enable* [1] or *Disable* [0] via *K-43 [Reset] Button on Keypad*.

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

2

2.1.3 Quick Transfer of Parameter Settings between Multiple Adjustable Frequency Drives

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



Data storage in Keypad

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

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

NOTE!

Stop the motor before performing this operation.

Connect the Keypad to another drive and copy the parameter settings to this drive as well.

Data transfer from Keypad to drive

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

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

NOTE!

Stop the motor before performing this operation.

2.1.4 Display Mode

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

2.1.5 Display Mode - Selection of Readouts

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

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

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

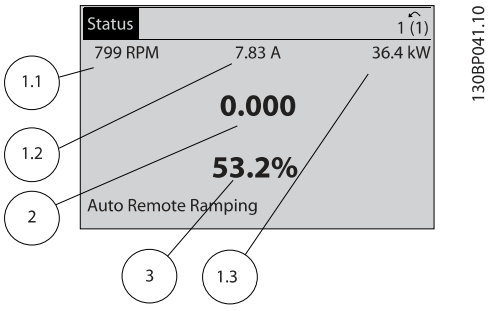
Operating variable:	Unit:
DR-00 Control Word	hex
DR-01 Reference [Unit]	[unit]
DR-02 Reference [%]	%
DR-03 Status Word	hex
DR-05 Main Actual Value [%]	%
DR-10 Power [kW]	[kW]
DR-11 Power [hp]	[HP]
DR-12 Motor Rated Voltage	[V]
DR-13 Frequency	[Hz]
DR-14 Motor Current	[A]
DR-16 Torque [Nm]	Nm
DR-17 Speed [RPM]	[RPM]
DR-18 Motor Thermal	%
DR-20 Motor Angle	
DR-30 DC Link Voltage	V
DR-32 Brake Power /s	kW
DR-33 Brake Power /2 min	kW
DR-34 Heatsink Temp.	C
DR-35 Drive Thermal	%
DR-36 Drive Nominal Current	A

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

Status screen I

This readout state is standard after start-up or initialization. Use [INFO] to obtain information about the measurement links to the displayed operating variables (1.1, 1.2, 1.3, 2 and 3).

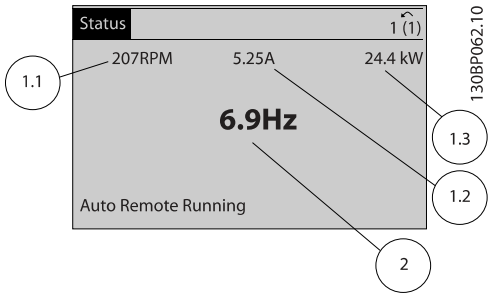
See the operating variables shown in the screen below.



Status screen II

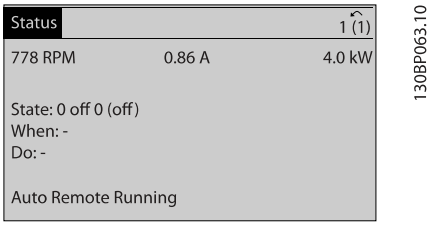
See the operating variables (1.1, 1.2, 1.3 and 2) shown in the screen below.

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



Status screen III

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



2.1.6 Parameter Set-up

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

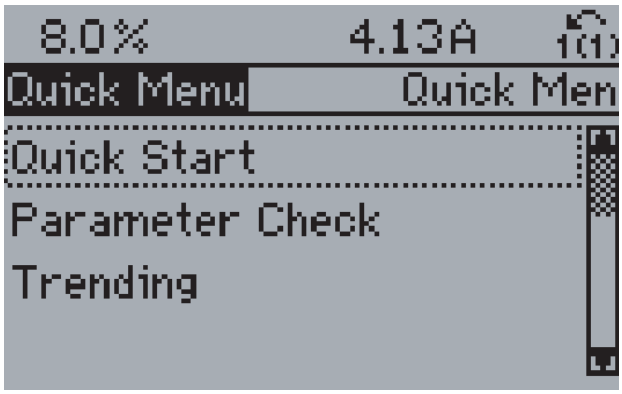
The former provides access to all parameters. The latter takes the user through a few parameters making it possible to start operating the drive.

Regardless of the mode of programming, you can change a parameter both in the main menu and quick menu modes.

2

2.1.7 Quick Menu Key Functions

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



130BP081.10

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

Parameters are selected by using the arrow keys. The parameters in the following table are accessible.

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

Parameter	Setting
P-04 Auto Tune	[1] Enable complete Auto Tune

Select *Changes made* to get information about:

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

Select *Trendings* to get information about the display line readouts. The information is shown as graphs.
Only display parameters selected in *K-20 Display Line 1.1 Small* and *K-24 Display Line 3 Large* can be viewed. It is possible to store up to 120 samples in the memory for later reference.

2.1.8 Initial Commissioning

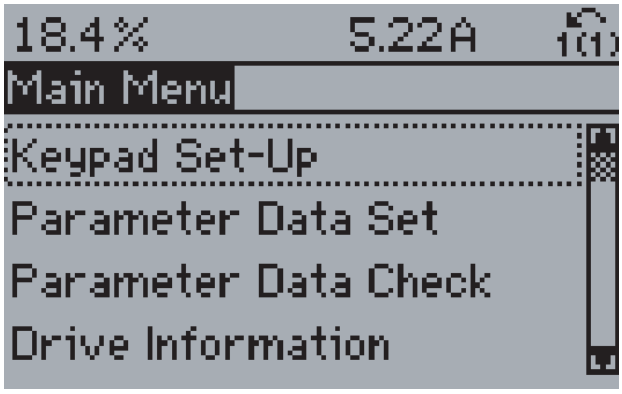
The easiest way of carrying out the initial commissioning is by using the quick menu button and follow the quick set-up procedure using Keypad (read table from left to right). The example applies to open-loop applications.

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

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

2.1.9 Main Menu Mode

Start main menu mode by pressing the [Main Menu] key. The readout shown to the right appears on the display. The middle and bottom sections on the display show a list of parameter groups which can be chosen by toggling the up and down buttons.



130BP066.10

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

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

2.1.10 Parameter Selection

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

After selecting a parameter group, choose a parameter by means of the navigation keys.
The middle section on the display shows the parameter number and name as well as the selected parameter value.

130BP067.10

2.1.11 Changing Data

The procedure for changing data is the same whether you select a parameter in the quick menu or the main menu mode. Press [OK] to change the selected parameter.
The procedure for changing data depends on whether the selected parameter represents a numerical data value or a text value.

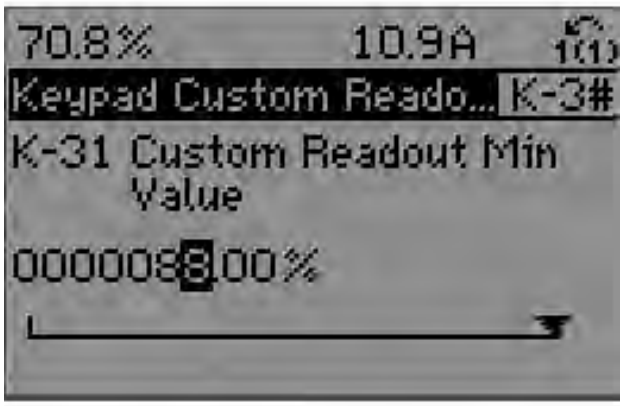
2.1.12 Changing a Text Value

If the selected parameter is a text value, change the text value with the [▲] [▼] navigation keys.
The up key increases the value, and the down key decreases the value. Place the cursor on the value you want to save and press [OK].

130BP068.10

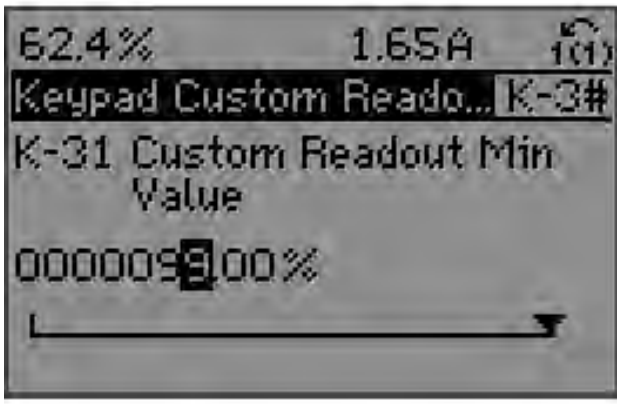
2.1.13 Changing a Group of Numeric Data Values

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



130BP069.10

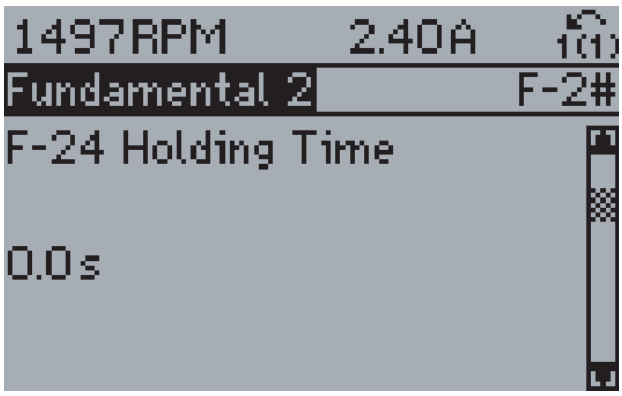
Use the [▲] [▼] navigation keys to change the data value. The up key enlarges the data value, and the down key reduces the data value. Place the cursor on the value you want to save and press [OK].



130BP070.10

2.1.14 Infinitely Variable Change of Numeric Data Value

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



130BP073.10

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

2.1.15 Value, Step-by-Step

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

2

2.1.16 Readout and Programming of Indexed Parameters

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

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

2.1.17 Keypad Keys

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

[Hand] enables control of the drive via the Keypad. [Hand] also starts the motor and it is now possible to enter the motor speed data by means of the arrow keys. The key can be selected as Enable [1] og Disable [0] via *K-40 [Hand] Button on Keypad*.
External stop signals activated by means of control signals or a serial bus will override a 'start' command via the Keypad.
The following control signals will still be active when [Hand] is activated:

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

[Off] stops the connected motor. The key can be selected as Enable [1] or Disable [0] via *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 drive 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 drive will start. The key can be selected as Enable [1] or Disable [0] via *K-42 [Auto] Button on Keypad*.

NOTE!

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

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

2.1.18 Restoring Drive to Factory Settings

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

Recommended

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

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

Manual Restore of Factory Settings

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

Manual restores all except:
ID-00 Operating Hours
ID-03 Power Ups
ID-04 Overtemps
ID-05 Overvolts

NOTE!

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

3 Parameter Descriptions

3.1 Parameter Selection

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

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

Table 3.2 Parameter groups

3

3.2 Keypad Set-Up

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

3.2.1 K-0# Keypad Basic Settings

Parameters for configuring basic drives settings.

K-01 Language		
Option:		**Function:**
		Defines the language to be used in the display. The adjustable frequency drive is delivered with 4 different languages.
[0] *	English	
[2]	Francais	
[4]	Spanish	
[10]	Chinese	
[22]	English US	
[52]	Hrvatski	

K-02 Motor Speed Unit		
Option:		**Function:**
		The display showing depends on settings in *K-02 Motor Speed Unit* and *K-03 Regional Settings*. The default setting of *K-02 Motor Speed Unit* and *K-03 Regional Settings* depends on which region of the world the drive is supplied to, but can be re-programmed as required. **NOTE!** **Changing the *Motor Speed Unit* will reset certain parameters to their initial value. It is recommended to select the motor speed unit first before modifying other parameters.**
[0]	RPM	Selects display of motor speed variables and parameters (i.e. references, feedbacks and limits) in terms of motor speed (RPM).
[1] *	Hz	Selects display of motor speed variables and parameters (i.e., references, feedbacks and limits) in terms of output frequency to the motor (Hz).

NOTE!

This parameter cannot be adjusted while the motor is running.

K-03 Regional Settings		
Option:		**Function:**
[0] *	Interna-tional	Activates *P-07 Motor Power [kW]* for setting the motor power in kW and sets the default value of *F-04 Base Frequency* to 50 Hz.
[1] *	US	Activates *P-07 Motor Power [kW]* for setting the motor power in HP and sets the default value of *F-04 Base Frequency* to 60 Hz.

NOTE!

This parameter cannot be adjusted while the motor is running.

K-04 Operating State at Power-up		
Option:		**Function:**
		Selects the operating mode upon reconnection of the drive to AC line voltage after power-down in hand (local) operation mode.
[0]	Resume	Restarts the drive maintaining the same local reference and the same start/stop settings (applied by [HAND/OFF]) as before the drive was powered down.
[1] *	Forced stop, ref=old	Restarts the drive with a saved local reference, after AC line voltage reappears and after pressing [HAND].
[2]	Forced stop, ref=0	Resets the local reference to 0 upon restarting the drive.

3.2.2 K-1# Keypad Set-up Operations

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

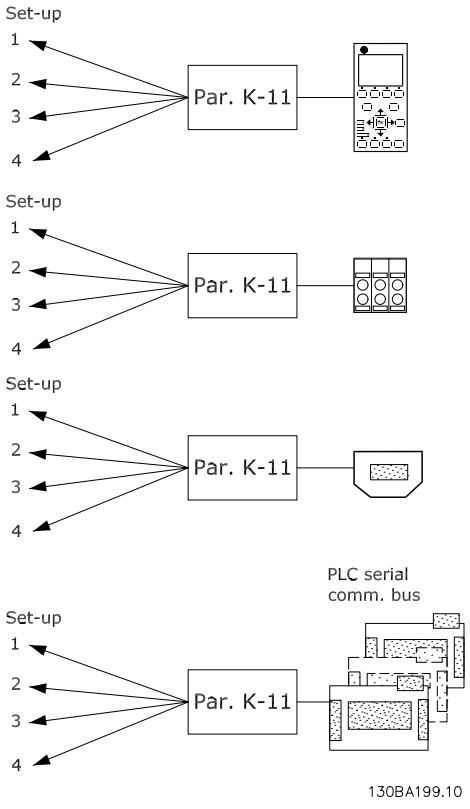
The active set-up (i.e., the set-up in which the adjustable frequency drive is currently operating) can be selected in *K-10 Active Set-up* and is displayed in the Keypad. Using Multi set-up, it is possible to switch between set-ups with the adjustable frequency drive running or stopped via digital input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

K-10 Active Set-up		
Option:		**Function:**
		Select the set-up to control the drive functions.
[0]	Factory set-up	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	*Set-up 1* [1] to *Set-up 4* [4] are the four separate parameter set-ups within which all parameters can be programmed.
[2]	Set-up 2	
[3]	Set-up 3	
[4]	Set-up 4	
[9]	Multi Set-up	Remote selection of set-ups using digital inputs and the serial communication port. This set-up uses the settings from *K-12 This Set-up Linked to*. Stop the drive before making changes to open-loop and closed-loop functions

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

K-11 Edit Set-up		
Option:		**Function:**
		Select the set-up to be edited (i.e., programmed) during operation: either the active set-up or one of the inactive set-ups.

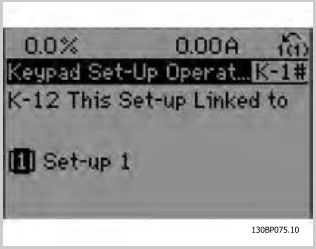
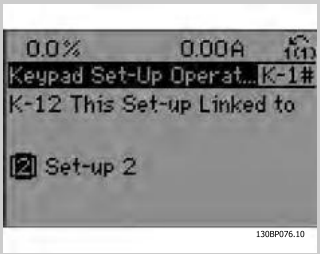
K-11 Edit Set-up		
Option:		**Function:**
[0]	Factory set-up	Cannot be edited, but it is useful as a data source for returning the other set-ups to a known state.
[1] *	Set-up 1	*Set-up 1* [1] to *Set-up 4* [4] can be edited freely during operation, independently of the active set-up.
[2]	Set-up 2	
[3]	Set-up 3	
[4]	Set-up 4	
[9]	Active Set-up	Can also be edited during operation. Edit the chosen set-up from a range of sources: Keypad, Drive RS-485, Drive USB or up to five Network sites.



K-12 This Set-up Linked to		
Option:		**Function:**
		To enable conflict-free changes from one set-up to another during operation, link set-ups containing parameters that are not changeable during operation. The link will ensure the proper synchronization of the 'not changeable during operation' parameter values when moving from one set-up to another during operation. 'Not changeable during operation'

3

K-12 This Set-up Linked to

Option:		Function:
		parameters can be identified by the label FALSE in the parameter lists in the section *Parameter Lists*. *K-12 This Set-up Linked to* is used by Multi set-up in *K-10 Active Set-up*. Multi set-up is used to move from one set-up to another during operation (i.e., while the motor is running). Example: Use Multi set-up to shift from Set-up 1 to Set-up 2 while the motor is running. Program in Set-up 1 first, then ensure that Set-up 1 and Set-up 2 are synchronized (or 'linked'). Synchronization can be performed in two ways: 1. Change the edit set-up to *Set-up 2* [2] in *K-11 Edit Set-up* and set *K-12 This Set-up Linked to* to *Set-up 1* [1]. This will start the linking (synchronizing) process.  OR 2. While still in Set-up 1, copy Set-up 1 to Set-up 2. Then set *K-12 This Set-up Linked to* to *Set-up 2* [2]. This will start the linking process.  After the link is complete, *K-13 Readout: Linked Set-ups* will read {1,2} to indicate that all 'not changeable during operation' parameters are now the same in Set-up 1 and Set-up 2. If there are changes to a "not changeable during operation" parameter, e.g., *P-30 Stator Resistance (Rs)* in Set-up 2, they will also be changed automatically in Set-up 1. A switch between Set-up 1 and Set-up 2 during operation is now possible.
[0] *	Not linked	

K-12 This Set-up Linked to

Option:		Function:
[1]	Set-up 1	
[2]	Set-up 2	
[3]	Set-up 3	
[4]	Set-up 4	

K-13 Readout: Linked Set-ups

Array [5]

Range:		Function:
0 *	[0 - 255]	View a list of all the set-ups linked by means of *K-12 This Set-up Linked to*. The parameter has one index for each parameter set-up. The parameter value displayed for each index represents which set-ups are linked to that parameter set-up.

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

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

K-14 Readout: Edit Set-ups / Channel

Range:		Function:
0 *	[-2147483648 - 2147483647]	View the setting of *K-11 Edit Set-up* for each of the four different communication channels. When the number is displayed in hex, as it is in the Keypad, each number represents one channel. Numbers 1-4 represent a set-up number; 'F' means factory setting; and 'A' means active set-up. The channels are, from right to left: Keypad , Drive bus, USB, HPFB1-5. Example: The number AAAAAA21h means that the Drive bus selected Set-up 2 in *K-11 Edit Set-up*, the Keypad selected Set-up 1 and all others used the active set-up.

3.2.3 K-2# Keypad Display

Define the variables displayed in the keypad.

NOTE!

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

		Select a variable for display in line 1, left position. The options are the same as listed for par. 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 adjustable frequency drive 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 adjustable frequency drive 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.
[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 adjustable frequency drive.
[1232]	BrakeEnergy/s	Present braking energy transferred to an external brake resistor. Stated as an instantaneous value.
[1233]	BrakeEnergy/2 min	Braking energy transferred to an external brake resistor. The mean power is calculated continuously for the most recent 120 seconds.
[1234]	Heatsink Temp.	Present heatsink temperature of the adjustable frequency drive. The cut-out limit is 203° ± 9°F [95±5±°C]; cutting back in occurs at 158° ± 9°F [70±5°C].
[1235]	Inverter Thermal	Percentage load of the inverters.
[1236]	Inv. Nom. Current	Nominal current of the adjustable frequency drive.
[1237]	Inv. Max. Current	Maximum current of the adjustable frequency drive.
[1238]	LC Control State	State of the event executed by the control.
[1239]	Control Card Temp.	Temperature of the control card.
[1250]	External Reference	Sum of the external reference as a percentage, i.e., the sum of analog/ pulse/bus.
[1251]	Pulse Reference	Frequency in Hz connected to the digital inputs (18, 19 or 32, 33).
[1252]	Feedback [Unit]	Reference value from programmed digital input(s).
[1253]	Digi Pot Reference	
[1260]	Digital Input	Signal states form the 6 digital terminals (18, 19, 27, 29, 32 and 33). Input 18 corresponds to the bit at the far left. Signal low = 0; Signal high = 1.
[1261]	Terminal 53 Switch Setting	Setting of input terminal 54. Current = 0; Voltage = 1.
[1262]	Analog Input 53	Actual value at input 53 either as a reference or protection value.
[1263]	Terminal 54 Switch Setting	Setting of input terminal 54. Current = 0; Voltage = 1.
[1264]	Analog Input 54	Actual value at input 54 either as reference or protection value.
[1265]	Analog Output 42 [mA]	Actual value at output 42 in mA. Use *AN-50 Terminal 42 Output* to select the value to be shown.
[1266]	Digital Output [bin]	Binary value of all digital outputs.

[1267]	Freq. Input #29 [Hz]	Actual value of the frequency applied at terminal 29 as an impulse input.
[1268]	Freq. Input #33 [Hz]	Actual value of the frequency applied at terminal 33 as an impulse input.
[1269]	Pulse Output #27 [Hz]	Actual value of impulses applied to terminal 27 in digital output mode.
[1270]	Pulse Output #29 [Hz]	Actual value of impulses applied to terminal 29 in digital output mode.
[1271]	Relay Output [bin]	
[1272]	Counter A	Application dependent (e.g., LC Control)
[1273]	Counter B	Application dependent (e.g., LC Control)
[1274]	Prec. Stop Counter	Display the actual counter value.
[1275]	Analog input X30/11	Actual value at input X30/11 either as reference or protection value.
[1276]	Analog input X30/12	Actual value at input X30/12 either as reference or protection value.
[1277]	Analog output X30/8 mA	Actual value at output X30/8 in mA. Use *AN-60 Terminal X30/8 Output* to select the value to be shown.
[1280]	Serial com. bus CTW 1	Control word (CTW) received from the bus master.
[1282]	Serial com. bus 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 par. 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 par. K-2#.

K-22 Display Line 1.3 Small

Option: Function:

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

K-23 Display Line 2 Large

Option: Function:

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

K-23 Display Line 2 Large

Option: Function:

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

K-25 Quick Start

Array [50]

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

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

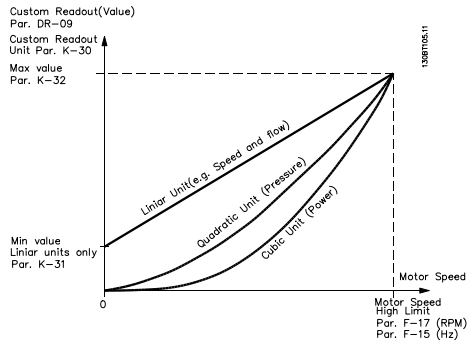
Range:		Function:
0 *	[0 - 9999]	

3.2.4 K-3# Keypad Custom Readout

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

Custom Readout

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



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

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

K-30 Unit for Custom Readout		
Option:		**Function:**
		It is possible to program a value to be shown in the display of the Keypad. The value will have a linear, squared or cubed relation to speed. This relation will depend on the unit selected (see table above). The actual calculated value can be read in *DR-09 Custom Readout*, and/or shown in the display by selecting Custom Readout [DR-09] in *K-20 Display Line 1.1 Small* to *K-24 Display Line 3 Large*.
[0] *	None	
[1]	%	
[5]	PPM	
[10]	1/min	
[11]	rpm	
[12]	Pulse/s	
[20]	l/s	
[21]	l/min	
[22]	l/h	
[23]	m^3/s	
[24]	m^3/min	
[25]	m^3/h	
[30]	kg/s	
[31]	kg/min	
[32]	kg/h	

K-30 Unit for Custom Readout		
Option:		**Function:**
[33]	t/min	
[34]	t/h	
[40]	m/s	
[41]	m/min	
[45]	m	
[60]	°C	
[70]	mbar	
[71]	bar	
[72]	Pa	
[73]	kPa	
[74]	m WG	
[80]	kW	
[120]	GPM	
[121]	gal/s	
[122]	gal/min	
[123]	gal/h	
[124]	CFM	
[125]	ft^3/s	
[126]	ft^3/min	
[127]	ft^3/h	
[130]	lb/s	
[131]	lb/min	
[132]	lb/h	
[140]	ft/s	
[141]	ft/min	
[145]	ft	
[160]	°F	
[170]	psi	
[171]	lb/in^2	
[172]	in WG	
[173]	ft WG	
[180]	HP	

K-31 Min Value of Custom Readout		
Range:		**Function:**
0.00 Custom-ReadoutUnit*	[-999999.99 - par. K-32 CustomRea-doutUnit]	This parameter sets the min. value of the custom defined readout (occurs at zero speed). Only possible to set different from 0 is when selecting a linear unit in *K-30 Unit for Custom Readout*. For quadratic and cubic units, the minimum value will be 0.

3

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

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

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

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

3.2.5 K-4# Keypad Buttons

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

K-40 [Hand] Button on Keypad		
Option:		**Function:**
[0]	Disabled	No function
[1] *	Enabled	[Hand] Key enabled
[2]	Passw. Protect.	Avoid unauthorized start in hand mode. If *K-40 [Hand] Button on Keypad*is included in the Quick Start Menu, then define the password in *K-65 Quick Menu Password*. Otherwise, define the password in *K-60 Main Menu Password*.

K-40 [Hand] Button on Keypad		
Option:		**Function:**
[3]		
[4]		
[5]		
[6]		

K-41 [Off] Button on Keypad		
Option:		**Function:**
[0] *	Disabled	Avoids accidental stop of the drive.
[1] *	Enabled	[Off] Key enabled
[2]	Passw. Protect.	Avoids unauthorized stop. If *K-41 [Off] Button on Keypad* is included in the Quick Menu, then define the password in *K-65 Quick Menu Password*.
[3]	Hand Off/On	
[4]	H off/on w. passw.	
[7]		
[8]		

K-42 [Auto] Button on Keypad		
Option:		**Function:**
[0] *	Disabled	Avoid accidental start of the drive in auto mode.
[1] *	Enabled	[Auto] Key enabled
[2]	Passw. Protect.	Avoids unauthorized start in auto mode. If *K-42 [Auto] Button on Keypad* is included in the Quick Menu, then define the password in *K-65 Quick Menu Password*.
[3]	Hand Off/On	
[4]	H off/on w. passw.	
[7]		
[8]		

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]	Passw. Protect.	Avoids unauthorized resetting. If *K-43 [Reset] Button on Keypad* is included in the Quick Menu, then define the password in *K-65 Quick Menu Password*.
[3]	Hand Off/On	
[4]	H off/on w. passw.	
[7]		Resets the drive without setting it in *Off* mode.

K-43 [Reset] Button on Keypad		
Option:		**Function:**
[8]		Resets the drive without setting it in *Off* mode. A password is required when pressing [Reset] (see [2]).

3.2.6 K-5# Copy/Save

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

K-50 Keypad Copy		
Option:		**Function:**
[0] *	No copy	
[1]	All to Keypad	Copies all parameters in all set-ups from the drive memory to the Keypad memory.
[2]	All from Keypad	Copies all parameters in all set-ups from the Keypad memory to the drive memory.
[3]	Size indep. of Keyp	Copy only the parameters that are independent of the motor size. The latter selection can be used to program several adjustable frequency drives with the same function without disturbing motor data.

NOTE!

This parameter cannot be adjusted while the motor is running.

K-51 Set-up Copy		
Option:		**Function:**
[0] *	No copy	No function
[1]	Copy to set-up 1	Copies all parameters in the present Programming Set-up (defined in *K-11 Edit Set-up*) to Set-up 1.
[2]	Copy to set-up 2	Copies all parameters in the present Programming Set-up (defined in *K-11 Edit Set-up*) to Set-up 2.
[3]	Copy to set-up 3	Copies all parameters in the present Programming Set-up (defined in *K-11 Edit Set-up*) to Set-up 3.
[4]	Copy to set-up 4	Copies all parameters in the present Programming Set-up (defined in *K-11 Edit Set-up*) to Set-up 4.
[9]	Copy to all	Copies the parameters in the present set-up over to each of the set-ups 1 to 4.

3.2.7 K-6# Password Protection

Parameters for setting the password protection for the drive parameters.

K-60 Main Menu Password		
Range:		**Function:**
100 *	[0 - 999]	Define the password for access to the main menu via the [Main Menu] key. If *K-61 Access to Main Menu w/o Password* is set to *Full access* [0], this parameter will be ignored.

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

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

NOTE!

More complex password protection is available for OEMs upon request.

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

K-66 Access to Quick Menu w/o Password		
Option:		**Function:**
[0] *	Full access	Disables the password defined in *K-65 Quick Menu Password*.
[1]	Keypad: Read only	Prevents unauthorized editing of quick menu parameters.
[2]	Keypad: No access	Prevents unauthorized viewing and editing of quick menu parameters.
[3]	Bus: Read only	Read only functions for quick menu parameters on network and/ or Drive standard bus.
[4]	Bus: No access	No access to quick menu parameters is allowed via network and/ or Drive standard bus.
[5]	All: Read only	read only function for quick menu parameters on Keypad, network or Drive standard bus.

K-66 Access to Quick Menu w/o Password		
Option:		**Function:**
[6]	All: No access	No access from Keypad, network or Drive standard bus is allowed.

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

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

3.3 Parameter Data Set

Parameter group related to the fundamental functions of the drive.

3.3.1 F-0# Fundamental 0

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

F-01 Frequency Setting 1

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

F-02 Operation Method

Option:		Function:
		Select which reference site to activate.
[0] *	Linked to Hand / Auto	Use local reference when in hand mode; or remote reference when in auto mode.
[1]	Remote	Use remote reference in both hand mode and auto mode.
[2]	Local	Use local reference in both hand mode and auto mode. **NOTE! When set to Local [2], the drive will start with this setting again following a 'power-down'.**

F-03 Max Output Frequency 1

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

NOTE!
This parameter cannot be adjusted while the motor is running.

NOTE!
Max. output frequency cannot exceed 10% of the carrier frequency (*F-26 Mtr Nois (Car Frq)*).

F-04 Base Frequency

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

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 Accl Time 1

Range:		Function:
3.00 s*	[0.01 - 3600.00 s]	Enter the accel time, i.e., the acceleration time from 0RPM to the synchronous motor speed n_S. Choose a accel time such that the output current does not exceed the current limit in *F-43 Current Limit* during ramping. The value 0.00 corresponds to 0.01 sec. in speed mode. See decel time in *F-08 Decl Time 1*. $Par.\ F-07 = \frac{t_{acc}[s] \times n_s[RPM]}{ref[RPM]}$

F-08 Decl Time 1

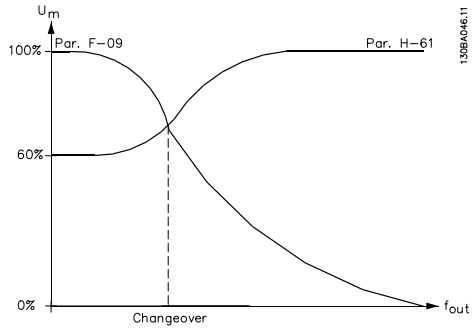
Range:		Function:
3.00 s*	[0.01 - 3600.00 s]	Enter the decel time, i.e., the deceleration time from the synchronous motor speed n_s to 0 RPM. Choose a decel time such that no

3

F-08 Decl Time 1		
Range:		**Function:**
		overvoltage arises in the inverter due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in *F-43 Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See accel time in *F-07 Accl Time 1*. $Par.\ F-08 = \frac{t_{dec}[s] \times n_s[RPM]}{ref[RPM]}$

F-09 Torque Boost		
Range:		**Function:**
100 %*	[0 - 300 %]	Enter the % value to compensate voltage in relation to load while the motor is running at low speed, and obtain the optimum U/f characteristic. The motor size determines the frequency range within which this parameter is active.

Motor size	Change-over
0.34–10 hp [0.25–7.5 kW]	< 10Hz



3.3.2 F-1# Fundamental 1

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

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

F-10 Electronic Overload		
Option:		Function:
[10]	Elec. OL Trip 4	

3.3.3.1 PTC Thermistor Connection

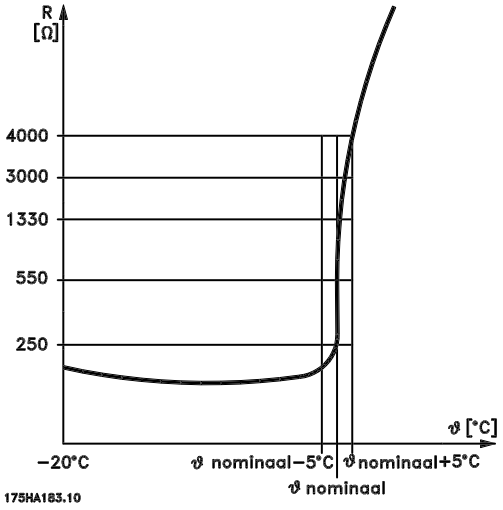
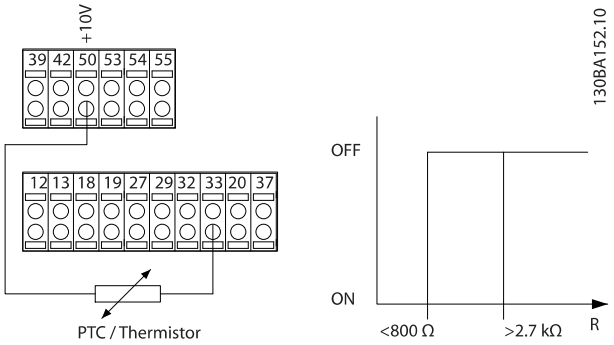
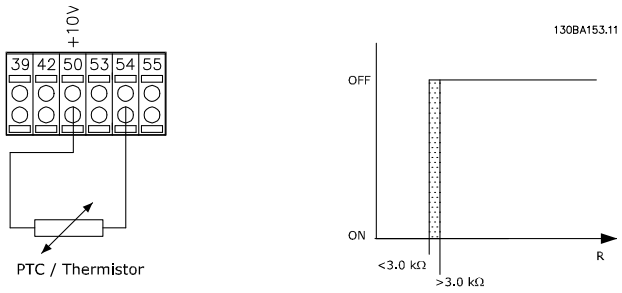


Figure 3.1 PTC profile

Using a digital input and 10 V as power supply:
Example: The drive trips when the motor temperature is too high.
Parameter set-up:
Set *F-10 Electronic Overload* to *Thermistor Trip* [2]
Set *F-12 Motor Thermistor Input* to *Digital Input* [6]



Using an analog input and 10 V as power supply:
Example: The drive trips when the motor temperature is too high.
Parameter set-up:
Set *F-10 Electronic Overload* to *Thermistor Trip* [2]
Set *F-12 Motor Thermistor Input* to *Analog Input 54* [2]



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

NOTE!

Ensure that the chosen supply voltage follows the specification of the thermistor element utilized.

3.3.3.2 KTY Sensor Connection

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

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

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

3

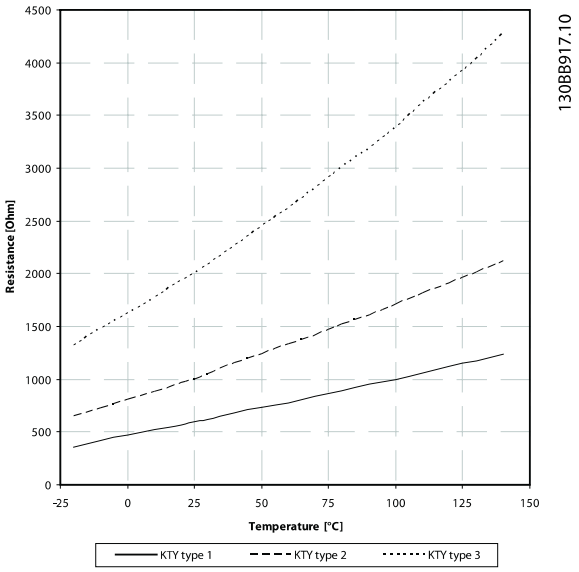


Figure 3.2 KTY type selection

KTY Sensor 1: KTY 84-1 with 1 kΩ at 212° F [100°C]
KTY Sensor 2: KTY 81-1, KTY 82-1 with 1 kΩ at 77 ° F [25°C]
KTY Sensor 3: KTY 81-2, KTY 82-2 with 2 kΩ at 77 °F [25°C]

NOTE!

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

3.3.3.3 Electronic Thermal Overload

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

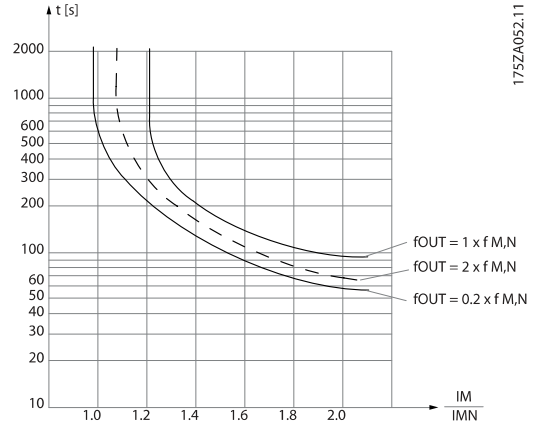
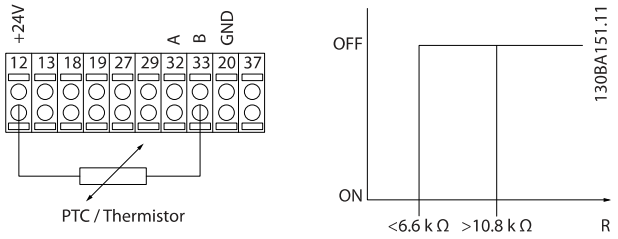


Figure 3.3 Electronic Thermal Overload profile

3.3.3.4 Klixon

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

Using a digital input and 24 V as power supply:
Example: The drive trips when the motor temperature is too high
Parameter set-up:
Set *F-10 Electronic Overload* to *Thermistor Trip* [2]
Set *F-12 Motor Thermistor Input* to *Digital Input* [6]



F-11 Motor External Fan		
Option:	**Function:**	
[0] *	No	No external fan on motor, i.e., the motor is derated at low speed.
[1]	Yes	Applies an external motor fan (external ventilation), so that no derating of the motor is required at low speed. The upper curve in graph above (fout = 1 x fM,N) is followed if the motor current is lower than nominal motor current (see *P-03 Motor Current*). If the motor current exceeds nominal current, the operation time still decreases as if no fan were installed.

F-12 Motor Thermistor Input		
Option:		Function:
		Select the input to which the thermistor (PTC sensor) should be connected. An analog input option [1] or [2] cannot be selected if the analog input is already in use as a reference source (selected in *F-01 Frequency Setting 1*, *C-30 Frequency Command 2* or *C-34 Frequency Command 3*).
[0] *	None	
[1]	Analog input 53	
[2]	Analog input 54	
[3]	Digital input 18	
[4]	Digital input 19	
[5]	Digital input 32	
[6]	Digital input 33	

NOTE!

This parameter cannot be adjusted while the motor is running.

NOTE!

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

F-15 Motor Speed High Limit [Hz]		
Range:		Function:
50/60.0 Hz*	[par. F-16 - par. F-03 Hz]	Enter the maximum limit for motor speed. The Motor Speed High Limit can be set to correspond to the manufacturer's recommended maximum of the motor shaft. The Motor Speed High Limit must exceed the in *F-16 Motor Speed Low Limit [Hz]*. Only *F-17 Motor Speed High Limit [RPM]* or *F-15 Motor Speed High Limit [Hz]* will be displayed, depending on other parameters in the main menu, and depending on default settings dependant on global location.

NOTE!

Max. output frequency cannot exceed 10% of the carrier frequency (*F-26 Mtr Nois (Car Frq)*).

F-16 Motor Speed Low Limit [Hz]		
Range:		Function:
0 Hz*	[0.0 - 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

F-16 Motor Speed Low Limit [Hz]		
Range:		Function:
		Speed Low Limit must not exceed the setting in *F-15 Motor Speed High Limit [Hz]*.

F-17 Motor Speed High Limit [RPM]		
Range:		Function:
3600. RPM*	[par. F-18 - 60000. RPM]	Enter the maximum limit for motor speed. The Motor Speed High Limit can be set to correspond to the manufacturer's maximum rated motor speed. The Motor Speed High Limit must exceed the setting in *F-18 Motor Speed Low Limit [RPM]*.

NOTE!

Max. output frequency cannot exceed 10% of the carrier frequency (*F-26 Mtr Nois (Car Frq)*).

F-18 Motor Speed Low Limit [RPM]		
Range:		Function:
0 RPM*	[0 - par. F-17 RPM]	Enter the minimum limit for motor speed. The Motor Speed Low Limit can be set to correspond to the manufacturer's recommended minimum motor speed. The Motor Speed Low Limit must not exceed the setting in *F-17 Motor Speed High Limit [RPM]*.

3.3.3 F-2# Fundamental 2

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

F-22 Start Speed [RPM]		
Range:		Function:
0 RPM*	[0 - 600 RPM]	Set a motor start speed. After the start signal, the output speed leaps to set value. Set the start function in *F-25 Start Function* to [3], [4] or [5], and set a start delay time in *F-24 Holding Time*.

F-23 Start Speed [Hz]		
Range:		Function:
0 Hz*	[0.0 - 500.0 Hz]	This parameter can be used for hoist applications (cone rotor). Set a motor start speed. After the start signal, the output speed leaps to set value. Set the start function in *F-25 Start Function* to [3], [4] or [5], and set a start delay time in *F-24 Holding Time*.

3

F-24 Holding Time		
Range:		**Function:**
0.0 s*	[0.0 - 10.0 s]	This parameter refers to the start function selected in *F-25 Start Function*. Enter the time delay required before commencing acceleration.

F-25 Start Function		
Option:		**Function:**
		Select the start function during start delay. This parameter is linked to *F-24 Holding Time*.
[0]	DC Hold/ delay time	Energizes motor with a DC holding current (*B-00 DC Hold Current*) during the start delay time.
[1]	DC Brake/ delay time	Energizes motor with a DC braking current (*B-01 DC Brake Current*) during the start delay time.
[2] *	Coast/delay time	Motor coasted during the start delay time (inverter off).
[3]	Start speed cw	Only possible with Advanced Vector Control. Connect the function described in *F-22 Start Speed [RPM]* and *F-29 Start Current* in the start delay time. Regardless of the value applied by the reference signal, the output speed applies the setting of the start speed in *F-22 Start Speed [RPM]* or *F-23 Start Speed [Hz]* and the output current corresponds to the setting of the start current in *F-29 Start Current*. This function is typically used in hoisting applications without counterweight, and especially in applications with a cone motor where the start is clockwise, followed by rotation in the reference direction.
[4]	Horizontal operation	Only possible with Advanced Vector Control. For obtaining the function described in *F-22 Start Speed [RPM]* and *F-29 Start Current* during the start delay time. The motor rotates in the reference direction. If the reference signal equals zero (0), *F-22 Start Speed [RPM]* is ignored and the output speed equals zero (0). The output current corresponds to the setting of the start current in *F-29 Start Current*.
[5]	Adv vctr ctrl/flx clkws	for the function described in *F-22 Start Speed [RPM]* only. The start current is calculated automatically. This function uses the start speed in the start delay time only. Regardless of the value set by the reference signal, the output speed equals the setting of the start speed in *F-22 Start Speed [RPM]*. *Start speed/ current clockwise* [3] and *Advanced Vector Control/Flux clockwise* [5] are typically used in hoisting applications. *Start speed/current in reference direction* [4] is particularly used in applications with counterweight and horizontal movement.
[6]	Hoist Mech Brake Rel	For utilizing mechanical brake control functions, *B-24 Stop Delay* to *B-28 Gain Boost Factor*. This parameter is only active when *H-41 Motor Control Principle* is set to [3] *Flux w/ motor feedback*.
[7]		

F-25 Start Function		
Option:		**Function:**
		current clockwise [3] and *Advanced Vector Control/Flux clockwise* [5] are typically used in hoisting applications. *Start speed/current in reference direction* [4] is particularly used in applications with counterweight and horizontal movement.
[6]	Hoist Mech Brake Rel	For utilizing mechanical brake control functions, *B-24 Stop Delay* to *B-28 Gain Boost Factor*. This parameter is only active when *H-41 Motor Control Principle* is set to [3] *Flux w/ motor feedback*.
[7]		

F-26 Mtr Nois (Car Frq)		
Select the carrier frequency. Changing the switching frequency can help to reduce acoustic noise from the motor. Default depend on power size.		
Option:		**Function:**
[0]	1.0 kHz	
[1]	1.5 kHz	Default switching frequency for 500–1,600 hp [355–1,200 kW], 690 V
[2]	2.0 kHz	Default switching frequency for 350–1,075 hp [250–800 kW], 400 V and 50–400 hp [37–315 kW], 690 V
[3]	2.5 kHz	
[4]	3.0 kHz	Default switching frequency for 25–50 hp [18.5–37 kW], 200 V and 50–300 hp [37–200 kW], 400 V
[5]	3.5 kHz	
[6]	4.0 kHz	Default switching frequency for 7.5–20 hp [5.5–15 kW], 200 V and 15–40 hp [11–30 kW], 400 V
[7] *	5.0 kHz	Default switching frequency for 0.34 - 4.96 kW hp [0.25–3.7 kW], 200 V and 0.496–10 hp [0.37–7.5 kW], 400 V
[8]	6.0 kHz	
[9]	7.0 kHz	
[10]	8.0 kHz	
[11]	10.0 kHz	
[12]	12.0 kHz	
[13]	14.0 kHz	
[14]	16.0 kHz	

NOTE!

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

NOTE!

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

F-27 Motor Tone Random		
Option:	**Function:**	
[0] *	Off	No change of the acoustic motor switching noise.
[1]	On	Transforms the acoustic motor switching noise from a clear ringing tone to a less noticeable 'white' noise. This is achieved by slightly and randomly altering the synchronism of the pulse width modulated output phases.

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

F-29 Start Current		
Range:		**Function:**
0.00 A*	[0.00 - par. P-03 A]	Some motors, e.g., cone rotor motors, need extra current/starting speed to disengage the rotor. To obtain this boost, set the required current in *F-29 Start Current*. Set *F-22 Start Speed [RPM]*. Set *F-25 Start Function* to [3] or [4], and set a start delay time in *F-24 Holding Time*. This parameter can be used for hoist applications (cone rotor).

3.3.4 F-3# Fundamental 3

Parameters to configure drive Advanced Switching Pattern and Overmodulation.

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

F-38 Overmodulation		
Option:	**Function:**	
[0]		Select *Off* [0] for no overmodulation of the output voltage, in order to avoid torque ripple on the motor shaft. This feature may be useful for applications such as grinding machines.
[1] *		Select On [1] to enable the overmodulation function for the output voltage. This is the right choice when it is required that the output voltage is higher than 95% of the input voltage (typical when running oversynchronously). The output voltage is increased according to the degree of overmodulation. **NOTE!** **Overmodulation leads to increased torque ripple as harmonics are increased.** Control in FLUX mode provides an output current of up to 98% of the input current, regardless of *F-38 Overmodulation*.

3.3.5 F-4# Fundamental 4

Parameters to configure drive torque and current limits.

F-40 Torque Limiter (Driving)		
Range:		**Function:**
160.0 %*	[0.0 - 1000.0 %]	This function limits the torque on the shaft to protect the mechanical installation.

NOTE!

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

NOTE!

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

F-41 Torque Limiter (Braking)		
Range:		**Function:**
100.0 %*	[0.0 - 1000.0 %]	This function limits the torque on the shaft to protect the mechanical installation.

NOTE!

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

3

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.

3.3.6 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 *Speed closed-loop* [1] control or *Process [3]* is selected in *H-40 Configuration Mode*.
[0]	Min. - Max.	Select the range of the reference signal and the feedback signal. Signal values can be positive only, or positive and negative. The minimum limit may have a negative value, unless *Speed closed-loop* [1] control or *Process [3]* is selected in *H-40 Configuration Mode*.
[1] *	-Max - +Max	For both positive and negative values (both directions, relative to *H-08 Reverse Lock*).

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

F-51 Reference/Feedback Unit		
Option:		**Function:**
[25]	m^3/h	
[30]	kg/s	
[31]	kg/min	
[32]	kg/h	
[33]	t/min	
[34]	t/h	
[40]	m/s	
[41]	m/min	
[45]	m	
[60]	°C	
[70]	mbar	
[71]	bar	
[72]	Pa	
[73]	kPa	
[74]	m WG	
[80]	kW	
[120]	GPM	
[121]	gal/s	
[122]	gal/min	
[123]	gal/h	
[124]	CFM	
[125]	ft^3/s	
[126]	ft^3/min	
[127]	ft^3/h	
[130]	lb/s	
[131]	lb/min	
[132]	lb/h	
[140]	ft/s	
[141]	ft/min	
[145]	ft	
[150]	lb ft	
[160]	°F	
[170]	psi	
[171]	lb/in^2	
[172]	in WG	
[173]	ft WG	
[180]	HP	

F-52 Minimum Reference		
Range:		**Function:**
0 ReferenceFeedbackUnit*	[-999999.999 - par. F-53 ReferenceFeedbackUnit]	Enter the Minimum Reference. The Minimum Reference is the lowest value obtainable by summing all references. Minimum Reference is active only when *F-50 Reference Range* is set to *Min.- Max.* [0].

F-52 Minimum Reference		
Range:		**Function:**
		The minimum reference unit matches: • The choice of configuration in *H-40 Configuration Mode Configuration Mode*: for *Speed closed-loop* [1], RPM; for *Torque* [2], Nm. • The unit selected in *F-51 Reference/ Feedback Unit*.

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

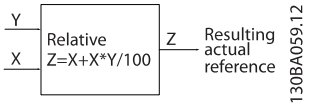
F-54 Reference Function		
Option:		**Function:**
[0] *	Sum	Sums both external and preset reference sources.
[1]	External/Preset	Use either the preset or the external reference source. Shift between external and preset via a command on a digital input.

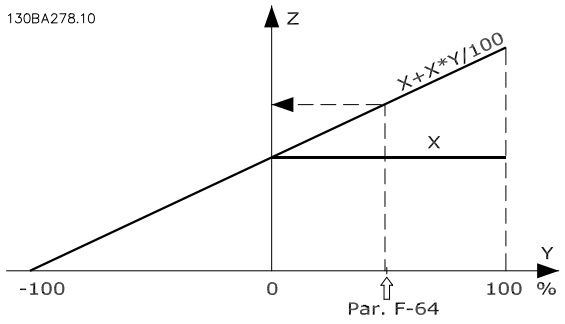
3.3.7 F-6# References

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

F-62 Catch up/speed down value		
Range:		**Function:**
0.00 %*	[0.00 - 100.00 %]	Enter a percentage (relative) value to be either added or deducted from the actual reference for catch up or slow-down, respectively. If *Catch up* is selected via one of the digital inputs (*E-01 Terminal 18 Digital Input* to *E-06 Terminal 33 Digital Input*), the percentage (relative) value is added to the total reference. If *Slow-down* is selected via one of the digital inputs (*E-01 Terminal 18 Digital Input* to *E-06 Terminal 33 Digital Input*), the percentage (relative) value is deducted from the total reference. Obtain extended functionality with the DigiPot function. See parameter group F-9# *Digital Pot-Meter*.

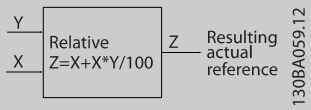
F-64 Preset Relative Reference		
Range:		**Function:**
0.00 %*	[-100.00 - 100.00 %]	The actual reference, X, is increased or decreased with the percentage Y, set in *F-64 Preset Relative Reference*. This results in the actual reference Z. Actual reference (X) is the sum of the inputs selected in *F-01 Frequency Setting 1*, *C-30 Frequency Command 2*, *C-34 Frequency Command 3* and *O-02 Control Word Source*.





F-68 Relative Scaling Reference Resource		
Option:		**Function:**
		Select a variable value to be added to the fixed value (defined in *F-64 Preset Relative Reference*). The sum of the fixed and variable values (labeled Y in the figure below) is multiplied by the actual reference (labeled X in the figure below).

3

F-68 Relative Scaling Reference Resource		
Option:		Function:
		The result is then added to the actual reference (X+X*Y/100) to give the resulting 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]	Digi. Potentiomtre	
[21]	Analog input X30-11	
[22]	Analog input X30-12	

NOTE!

This parameter cannot be adjusted while the motor is running.

3.3.8 F-9# Digital Potentiometer

Parameters to configure drive digital pot-meter function.

F-90 Step Size		
Range:		Function:
0.10 %*	[0.01 - 200.00 %]	Enter the increment size required for INCREASE/DECREASE, as a percentage of the synchronous motor speed, n_s. If INCREASE/DECREASE is activated, the resulting reference will be increased/ decreased by the amount set in this parameter.

F-91 Accel/Decel Time		
Range:		Function:
1.00 s*	[0.00 - 3600.00 s]	Enter the ramp time, i.e., the time for adjustment of the reference from 0% to 100% of the specified digital potentiometer function (Increase, Decrease or Clear). If Increase/Decrease is activated for longer than the ramp delay period specified in

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

F-92 Power Restore		
Option:		Function:
[0] *	Off	Resets the Digital Pot-Meter reference to 0% after power-up.
[1]	On	Restores the most recent Digital Pot-Meter reference at power-up.

F-93 Maximum Limit		
Range:		Function:
100 %*	[-200 - 200 %]	Set the maximum permissible value for the resultant reference. This is advisable if the Digital Pot-Meter is used for fine tuning of the resulting reference.

F-94 Minimum Limit		
Range:		Function:
-100 %*	[-200 - 200 %]	Set the minimum permissible value for the resultant reference. This is advisable if the Digital Pot-Meter is used for fine tuning of the resulting reference.

F-95 Accel/Decel Ramp Delay		
Range:		Function:
0 *	[0 - 0]	Enter the delay required from activation of the digital pot-meter function until the drive starts to ramp the reference. With a delay of 0 ms, the reference starts to ramp as soon as INCREASE/ DECREASE is activated. See also *F-91 Accel/Decel Time*.

3.4 E-## Digital In/Out

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

3.4.1 E-0# Digital Inputs

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 adjustable frequency drive. All digital inputs can be set to the following functions:

Digital input function	Select	Terminal
No operation	[0]	All *term 32, 33
Reset	[1]	All
Coast inverse	[2]	All *term 27
Coast and reset inverse	[3]	All
Quick stop inverse	[4]	All
DC brake inverse	[5]	All
Stop inverse	[6]	All
Start	[8]	All *term 18
Latched start	[9]	All
Reversing	[10]	All *term 19
Start reversing	[11]	All
Enable start forward	[12]	All
Enable start reverse	[13]	All
Jog	[14]	All *term 29
Preset reference on	[15]	All
Preset ref bit 0	[16]	All
Preset ref bit 1	[17]	All
Preset ref bit 2	[18]	All
Freeze reference	[19]	All
Freeze output	[20]	All
Speed up	[21]	All
Slow	[22]	All
Set-up select bit 0	[23]	All
Set-up select bit 1	[24]	All
Precise stop inverse	[26]	18, 19
Precise 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
Line failure inverse	[36]	All
Latched precise start	[40]	18, 19
Latched precise stop inverse	[41]	18, 19
DigiPot Increase	[55]	All
DigiPot Decrease	[56]	All
DigiPot Clear	[57]	All
Counter A (up)	[60]	29, 33

Counter A (down)	[61]	29, 33
Reset Counter A	[62]	All
Counter B (up)	[63]	29, 33
Counter B (down)	[64]	29, 33
Reset Counter B	[65]	All
Mech. Brake Feedb.	[70]	All
Mech. Brake Feedb. Inv.	[71]	All
PTC Card 1	[80]	All

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

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

All digital inputs can be programmed to these functions:

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

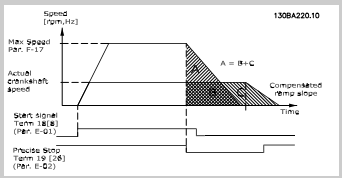
[16]	Preset ref bit 0	Preset ref. bit 0,1, and 2 enables a choice between one of the eight preset references according to the table below.
[17]	Preset ref bit 1	Same as Preset ref bit 0 [16].
[18]	Preset ref bit 2	Same as Preset ref bit 0 [16].

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

[19]	Freeze ref	Freezes the actual reference, which is now the point of enable/condition for Speed up and Slow to be used. If Speed up/down is used, the speed change always follows ramp 2 (*E-10 Accl Time 2* and *E-11 Decl Time 2*) in the range 0 - *F-53 Maximum Reference*.
[20]	Freeze output	Freezes the actual motor frequency (Hz), which is now the point of enable/condition for Speed up and Slow to be used. If Speed up/down is used, the speed change always follows ramp 2 (*E-10 Accl Time 2* and *E-11 Decl Time 2*) in the range 0 - *F-04 Base Frequency*. **NOTE!** **When freeze output is active, the adjustable frequency drive cannot be stopped via a low 'start [8]' signal. Stop the adjustable frequency drive via a terminal programmed for Coast inverse [2] or Coast and reset inv.**
[21]	Speed up	Select Speed up and Slow if digital control of the up/down speed is desired (motor potentiometer). Activate this function by selecting either Freeze reference or Freeze output. When Speed up/down is activated for less than 400 msec, the resulting reference will be increased/decreased by 0.1%. If Speed up/down is activated for more than 400 msec., the resulting reference will follow the setting in accel/decel parameters.

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

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

[23]	Set-up select bit 0	Select Set-up select bit 0 or Select Set-up select bit 1 to select one of the four set-ups. Set *K-10 Active Set-up* to Multi Set-up.
[24]	Set-up select bit 1	(Default Digital input 32): Same as Set-up select bit 0 [23].
[26]	Precise stop inv.	Prolongs stop signal to give a precise stop independent of speed. Sends an inverted stop signal when the precise stop function is activated in *H-83 Precise Stop Function*. Precise stop inverse function is available for terminals 18 or 19.
[27]	Precise start, stop	Use when Precise ramp stop [0] is selected in *H-83 Precise Stop Function*. 
[28]	Catch up	Increases reference value by percentage (relative) set in *F-62 Catch up/speed down value*.
[29]	Slow-down	Reduces reference value by percentage (relative) set in *F-62 Catch up/speed down value*.
[30]	Counter input	Precise stop function in *H-83 Precise Stop Function* acts as counter stop or speed compensated counter stop with or without reset. The counter value must be set in *H-84 Precise Stop Counter Value*.
[32]	Pulse input	Use pulse sequence as either reference or feedback. Scaling is done in par. group E-6#.
[34]	Ramp bit 0	Enables a choice between one of the four ramps available, according to the table below.
[35]	Ramp bit 1	Same as Ramp bit 0.

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

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

E-00 Digital I/O Mode

Option:		Function:
		Digital inputs and programmed digital outputs are pre-programmable for operation either in PNP or NPN systems.
[0] *	PNP	Action on positive directional pulses (↕). PNP systems are pulled down to GND.
[1]	NPN	Action on negative directional pulses (↕). NPN systems are pulled up to + 24V, internally in the drive.

NOTE!

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

E-01 Terminal 18 Digital Input

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

E-02 Terminal 19 Digital Input

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

E-03 Terminal 27 Digital Input

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

E-04 Terminal 29 Digital Input

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

E-05 Terminal 32 Digital Input

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

E-06 Terminal 33 Digital Input

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

E-07 Terminal 37 Safe Stop

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

NOTE!

When Auto Reset/ Warning is selected, the adjustable frequency drive opens up for automatic restart.

Overview of functions, alarms and warnings

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

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

3.4.2 E-1# Additional Accel/Decel Ramps

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

E-10 Accl Time 2

Range:		Function:
3.00 s*	[0.01 - 3600.00 s]	Enter the accel time from 0 RPM to the rated motor speed n_s. Choose a accel time such that the output current does not exceed the current limit in *F-43 Current Limit* during ramping. The value 0.00 corresponds to 0.01 sec. in speed mode. See decel time in *E-11 Decl Time 2*. $Par.\ E-10 = \frac{t_{acc}[s] \times n_s[RPM]}{ref[RPM]}$

E-11 Decl Time 2

Range:		Function:
3.00 s*	[0.01 - 3600.00 s]	Enter the decel time from the rated motor speed n_s to 0 RPM. Choose a decel time such that no overvoltage arises in the inverter due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in *F-43 Current Limit*. The value 0.00 corresponds to 0.01 sec. in speed mode. See accel time in *E-10 Accl Time 2*. $Par.\ E-11 = \frac{t_{dec}[s] \times n_s[RPM]}{ref[RPM]}$

E-12 Accl Time 3

Range:		Function:
3.00 s*	[0.01 - 3600.00 s]	Enter the accel time from 0 RPM to the rated motor speed n_s. Choose a accel time such that the output current does not exceed the current limit in *F-43 Current Limit* during ramping. The value 0.00 corresponds to 0.01 sec. in speed mode. See decel time in *E-13 Decl Time 3*.

E-13 Decl Time 3

Range:		Function:
3.00 s*	[0.01 - 3600.00 s]	Enter the decel time from the rated motor speed n_s to 0 RPM. Choose a decel time such that no overvoltage arises in the inverter due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in *F-43 Current Limit*. The value 0.00 corresponds to 0.01 sec. in speed mode. See accel time in *E-12 Accl Time 3*. $Par.\ E-13 = \frac{t_{dec}[s] \times n_s[RPM]}{ref[RPM]}$

E-14 Accl Time 4

Range:		Function:
3.00 s*	[0.01 - 3600.00 s]	Enter the accel time from 0 RPM to the rated motor speed n_s. Choose a accel time such that the output current does not exceed the current limit in *F-43 Current Limit* during ramping. The value 0.00 corresponds to 0.01 sec. in speed mode. See decel time in *E-15 Decl Time 4*. $Par.\ E-14 = \frac{t_{acc}[s] \times n_s[RPM]}{ref[RPM]}$

E-15 Decl Time 4

Range:		Function:
3.00 s*	[0.01 - 3600.00 s]	Enter the decel time from the rated motor speed n_s to 0 RPM. Choose a decel time such that no overvoltage arises in the inverter due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in *F-43 Current Limit*. The value 0.00 corresponds to 0.01 sec. in speed mode. See accel time in *E-14 Accl Time 4*. $Par.\ E-15 = \frac{t_{dec}[s] \times n_s[RPM]}{ref[RPM]}$

3.4.3 E-2# Digital Output

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

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

[0]	No operation	*Default for all digital outputs and relay outputs*
[1]	Control ready	The control board receives supply voltage.
[2]	Drive ready	The adjustable frequency drive is ready for operation and applies a supply signal on the control board.
[3]	Drive ready / remote control	The adjustable frequency drive 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.

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[6]	Running / no warning	Output speed is higher than the speed set in *H-81 Min Speed for Function at Stop [RPM]*. The motor is running and there are no warnings.
[7]	Run in range/no warning	Motor is running within the programmed current and speed ranges set in *H-70 Warning Current Low* to *H-73 Warning Speed High*. There are no warnings.
[8]	Run on reference / no warning	Motor runs at reference speed.
[9]	Alarm	An alarm activates the output. There are no warnings.
[10]	Alarm or warning	An alarm or a warning activates the output.
[11]	At torque limit	The torque limit set in *F-40 Torque Limiter (Driving)* or F-41 has been exceeded.
[12]	Out of current range	The motor current is outside the range set in *F-43 Current Limit*.
[13]	Below current, low	Motor current is lower than set in *H-70 Warning Current Low*.
[14]	Above current, high	Motor current is higher than set in *H-71 Warning Current High*.
[15]	Out of speed range	Output frequency is outside the frequency ranges set in *H-70 Warning Current Low* and *H-71 Warning Current High*.
[16]	Below speed, low	Output speed is lower than the setting in *H-72 Warning Speed Low*.
[17]	Above speed, high	Output speed is higher than the setting in *H-73 Warning Speed High*.
[18]	Out of feedback range	Feedback is outside the range set in *H-76 Warning Feedback Low* and *H-77 Warning Feedback High*.
[19]	Below feedback low	Feedback is below the limit set in *H-76 Warning Feedback Low*.
[20]	Above feedback high	Feedback is above the limit set in *H-77 Warning Feedback High*.
[21]	Thermal warning	The thermal warning turns on when the temperature exceeds the limit in the motor, the adjustable frequency drive, the brake resistor, or the thermistor.
[22]	Ready, no thermal warning	The adjustable frequency drive is ready for operation and there is no overtemperature warning.
[23]	Remote, ready, no thermal warning	The adjustable frequency drive is ready for operation and is in auto mode. There is no overtemperature warning.
[24]	Ready, no over/ undervoltage	The adjustable frequency drive is ready for operation, and the AC line voltage is within the specified voltage range (see *General Specifications* section).
[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 timeout) via the serial communication port.
[27]	Torque limit and stop	Use in performing a coasting stop and in torque limit condition. If the adjustable frequency drive 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 adjustable frequency drive if there is a fault on the brake modules. Use the output/relay to cut out the main voltage from the adjustable frequency drive.
[31]	Relay 123	Relay is activated when Control Word [0] is selected in parameter group O-##.
[32]	Mechanical brake control	Enables control of an external mechanical brake, see description in the section *Control of Mechanical Brake*, and par. group B-2#
[40]	Out of ref range	
[41]	Below reference low	
[42]	Above reference high	
[45]	Bus Ctrl	Controls output via bus. The state of the output is set in *E-90 Digital & Relay Bus Control*. The output state is retained in the event of bus timeout.
[46]	Bus Ctrl On at timeout	Controls output via bus. The state of the output is set in *E-90 Digital & Relay Bus Control*. In the event of a bus timeout, the output state is set high (On).
[47]	Bus Ctrl Off at timeout	Controls output via bus. The state of the output is set in *E-90 Digital & Relay Bus Control*. In the event of a bus timeout, the output state is set low (Off).
[55]	Pulse output	
[60]	Comparator 0	See par. group LC-1#. If Comparator 0 is evaluated as TRUE, the output will go high. Otherwise, it will be low.

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

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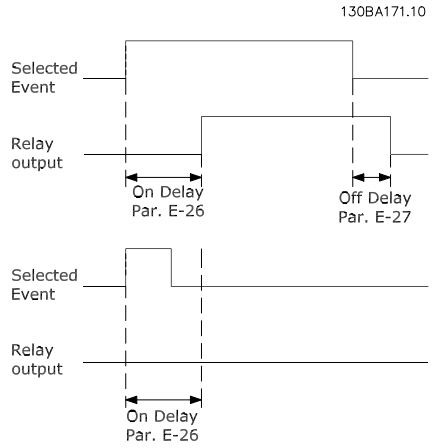
Choices are described under E-2#

E-26 On Delay, Relay

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

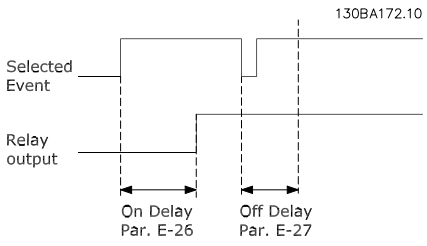
Range:		Function:
0.01 s*	[0.01 - 600.00 s]	Enter the delay of the relay cut-in time. Select one of available mechanical relays and OPCRLY Relay Option Module in an array function. See *E-24 Function Relay*.



E-27 Off Delay, Relay

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

Range:		Function:
0.01 s*	[0.01 - 600.00 s]	Enter the delay of the relay cut-out time. Select one of available mechanical relays and OPCRLY Relay Option Module in an array function. See *E-24 Function Relay*.



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

E-51 Terminal 27 Mode

Option:		Function:
[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:
[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 par. E-5#.

E-54 Terminal X30/3 Digital Input

Option:		Function:
		The options are the same as listed for par. E-5#.

E-55 Terminal X30/4 Digital Input

Option:		Function:
		The options are the same as listed for par. E-5#.

E-56 Term X30/6 Digi Out (OPCGPIO)

This parameter is active when OPCGPIO General Purpose I/O Option Module is mounted in the frequency converter. Functions are described under E-2# *Digital Outputs*.

E-57 Term X30/7 Digi Out (OPCGPIO)

This parameter is active when OPCGPIO General Purpose I/O Option Module is mounted in the frequency converter. Functions are described under E-2# *Digital Outputs*.

3.4.4 E-6# Pulse Input

Parameters to configure terminal 29 and 33 as pulse train inputs.

E-60 Term. 29 Low Frequency

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

E-61 Term. 29 High Frequency

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

E-62 Term. 29 Low Ref./Feedb. Value		
Range:		**Function:**
0.000 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 *E-67 Term. 33 Low Ref./Feedb. Value*. Set terminal 29 to digital input (*E-52 Terminal 29 Mode =input* [0] (default) and *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 *E-68 Term. 33 High Ref./Feedb. Value*. Select terminal 29 as a digital input (*E-52 Terminal 29 Mode =input* [0] (default) and *E-04 Terminal 29 Digital Input* = applicable value).

E-64 Pulse Filter Time Constant #29		
Range:		**Function:**
100 ms*	[1 - 1000 ms]	Enter the pulse filter time constant. The pulse filter dampens oscillations of the feedback signal, which is an advantage if there is a lot of noise in the system. A high time constant value results in better damping, but also increases the time delay through the filter. This parameter cannot be adjusted while the motor is running.

E-65 Term. 33 Low Frequency		
Range:		**Function:**
100 Hz*	[0 - 110000 Hz]	Enter the low frequency corresponding to the low motor shaft speed (i.e., low reference value) in *E-67 Term. 33 Low Ref./Feedb. Value*.

E-66 Term. 33 High Frequency		
Range:		**Function:**
100 Hz*	[0 - 110000 Hz]	Enter the high frequency corresponding to the high motor shaft speed (i.e., high reference value) in *E-68 Term. 33 High Ref./Feedb. Value*.

E-67 Term. 33 Low Ref./Feedb. Value		
Range:		**Function:**
0.000 *	[-999999.999 - 999999.999]	Enter the low reference value [RPM] for the motor shaft speed. This is also the low feedback value, see also *E-62 Term. 29 Low Ref./Feedb. Value*.

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

E-69 Pulse Filter Time Constant #33		
Range:		**Function:**
100 ms*	[1 - 1000 ms]	Enter the pulse filter time constant. The low-pass filter reduces the influence on, and dampens oscillations in, the feedback signal from the control. This is an advantage, if, for example, there is a great amount of noise in the system.

NOTE!

This parameter cannot be adjusted while the motor is running.

3.4.5 E-7# Pulse Output

Parameters to configure terminal 27 and 29 as pulse train outputs and to configure encoder input terminals 32 and 33.

E-70 Terminal 27 Pulse Output Variable		
Option:		**Function:**
[0]	No operation	Select the desired display output for terminal 27.
[45]	Bus ctrl.	
[48]	Bus ctrl, timeout	
[100]	Output frequency	
[101]	Reference	

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

E-73 Terminal 29 Pulse Output Variable		
Option:		**Function:**
[0] *	No operation	Select the desired display output for terminal 29.
[45]	Bus ctrl.	
[48]	Bus ctrl, timeout	
[100]	Output frequency	
[101]	Reference	
[102]	Feedback	
[103]	Motor Current	
[104]	Torque rel to limit	
[105]	Torq relate to rated	
[106]	Power	
[107]	Speed	
[108]	Torque	
[109]	Max Out Freq	
[119]	Torque % lim	

E-76 Terminal X30/6 Pulse Output Variable		
Select the variable for read-out on terminal X30/6. This parameter is active when the General Purpose I/O Option Module (OPCGPIO) is installed in the drive.		
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		
Select the maximum frequency on terminal X30/6 referring to the output variable in *E-75 Terminal X30/6 Pulse Output Variable*. This parameter cannot be adjusted while the motor is running. This parameter is active when the General Purpose I/O Option Module (OPCGPIO) is mounted in the drive.		
Range:		**Function:**
5000. Hz*	[0 - 32000 Hz]	

3.4.6 E-8# 24V 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. This parameter cannot be adjusted while the motor is running.

NOTE!

This parameter cannot be adjusted while the motor is running.

E-81 Term 32/33 Encoder Direction		
Option:		**Function:**
		Change the detected encoder rotation direction without changing the wiring to the encoder.
[0] *	Clockwise	Sets channel A 90° (electrical degrees) behind channel B upon clockwise rotation of the encoder shaft.
[1]	Counter-clockwise	Sets channel A 90° (electrical degrees) ahead of channel B upon clockwise rotation of the encoder shaft.

NOTE!

This parameter cannot be adjusted while the motor is running.

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

E-93 Pulse Out #27 Bus Control

Range:		Function:
0.00 %*	[0.00 - 100.00 %]	Set the output frequency transferred to the output terminal 27 when the terminal is configured as 'Bus Controlled' in *E-70 Terminal 27 Pulse Output Variable* [45].

E-94 Pulse Out #27 Time-out Preset

Range:		Function:
0.00 %*	[0.00 - 100.00 %]	Set the output frequency transferred to the output terminal 27 when the terminal is configured as 'Bus Ctrl Timeout' in *E-70 Terminal 27 Pulse Output Variable* [48]. And a timeout is detected.

E-95 Pulse Out #29 Bus Control

Range:		Function:
0.00 %*	[0.00 - 100.00 %]	Set the output frequency transferred to the output terminal 29 when the terminal is configured as 'Bus Controlled' in *E-73 Terminal 29 Pulse Output Variable* [45].

E-96 Pulse Out #29 Time-out Preset

Range:		Function:
0.00 %*	[0.00 - 100.00 %]	Set the output frequency transferred to the output terminal 29 when the terminal is configured as 'Bus Ctrl Timeout' in *E-73 Terminal 29 Pulse Output Variable* [48]. And a timeout is detected.

E-97 Pulse Out #X30/6 Bus Control

Range:		Function:
0.00 %*	[0.00 - 100.00 %]	Set the output frequency transferred to the output terminal X30/6 when the terminal is configured as 'Bus Controlled' in *E-76 Terminal X30/6 Pulse Output Variable*, Terminal X30/6 Pulse Output Variable [45].

E-98 Pulse Out #X30/6 Timeout Preset

Range:		Function:
0.00 %*	[0.00 - 100.00 %]	Set the output frequency transferred to the output terminal X30/6 when the terminal is configured as 'Bus Ctrl Timeout' in *E-76 Terminal X30/6 Pulse Output Variable* [48]. And a timeout is detected.

3

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*	[0.0 - par. F-15 Hz]	Some systems call for avoiding certain output speeds due to resonance problems in the system. Enter the lower limits of the speeds to be avoided.

C-02 Jump Speed From [RPM]

Array [4]

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

C-03 Jump Speed To [RPM]

Array [4]

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

C-04 Jump Frequency To [Hz]

Array [4]

Range:		Function:
0 Hz*	[0.0 - 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

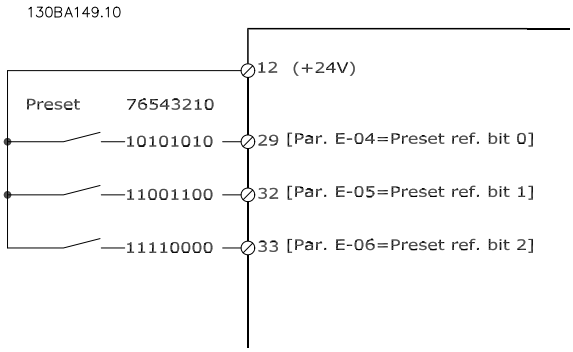
Array [8]
Range: 0-7

Range:		Function:
0.00 %*	[-100.00 - 100.00 %]	Enter up to eight different preset references (0-7) in this parameter, using

C-05 Multi-step Frequency 1 - 8

Array [8]
Range: 0-7

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



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

3.5.2 C-2# Jog Set-Up

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

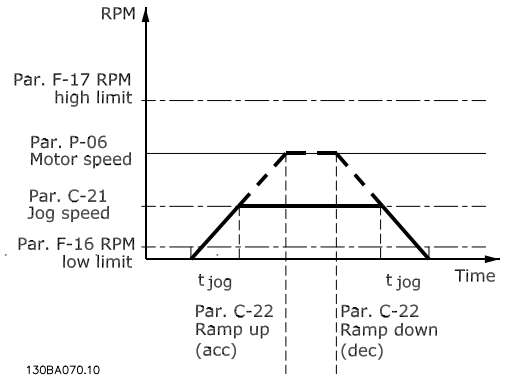
C-20 Jog Speed [Hz]

Range:		Function:
0 Hz*	[0.0 - par. F-15 Hz]	The jog speed is a fixed output speed at which the drive is running when the jog function is activated. See also *C-22 Jog Accel/Decel Time*.

3

C-21 Jog Speed [RPM]		
Range:		**Function:**
150. RPM*	[0 - par. F-17 RPM]	Enter a value for the jog speed n_{JOG}, which is a fixed output speed. The drive runs at this speed when the jog function is activated. The maximum limit is defined in *F-17 Motor Speed High Limit [RPM]*. See also *C-22 Jog Accel/Decel Time*.

C-22 Jog Accel/Decel Time		
Range:		**Function:**
3.00 s*	[0.01 - 3600.00 s]	Enter the jog ramp time, i.e., the acceleration/deceleration time between 0 RPM and the rated motor frequency n_s. Ensure that the resultant output current required for the given jog ramp time does not exceed the current limit in *F-43 Current Limit*. The jog ramp time starts upon activation of a jog signal via the Keypad, a selected digital input, or the serial communication port. When jog state is disabled, the normal ramping times are valid.



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

C-23 Quick Stop Decel Time		
Range:		**Function:**
3.00 s*	[0.01 - 3600.00 s]	Enter the quick stop decel time from the synchronous motor speed to 0 RPM. Ensure that no resultant overvoltage will arise in the inverter due to regenerative operation of the motor required to achieve the given decel time. Ensure also that the generated current required to achieve the given decel time does not exceed the current limit (set in *F-43 Current Limit*). Quick stop is activated by means of a signal on a selected digital input, or via the serial communication port.

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

C-24 Quick Stop Ramp Type		
Option:		**Function:**
[0] *	Linear	
[1]	S-ramp Const Jerk	
[2]	S-ramp Const Time	

C-25 Quick Stop S-ramp Ratio at Decel. Start		
Range:		**Function:**
50 %*	[1 - 99. %]	

C-26 Quick Stop S-ramp Ratio at Decel. End		
Range:		**Function:**
50 %*	[1 - 99. %]	

Parameters to configure Frequency Settings 2 and 3.

C-30 Frequency Command 2		
Option:		**Function:**
		Select the reference input to be used for the second reference signal. *F-01 Frequency Setting 1*, *C-30 Frequency Command 2* and *C-34 Frequency Command 3* define up to three different reference signals. The sum of these reference signals defines the actual reference.
[0]	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[7]	Frequency input 29	
[8]	Frequency input 33	
[11]	Local bus reference	
[20] *	Digi. Potentiomtre	
[21]	Analog input X30-11	
[22]	Analog input X30-12	

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

C-34 Frequency Command 3		
Option:		**Function:**
[20]	Digi. Potentiomtre	
[21]	Analog input X30-11	
[22]	Analog input X30-12	

3.6 P-## Motor Data

Parameter group related to setting motor data in the drive.

3.6.1 P-0# Motor Data

Parameters to configure Motor, Auto Tuning and Slip Compensation.

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

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

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

P-02 Motor Power [HP]		
Range:		**Function:**
4.00 hp*	[0.09 - 3000.00 hp]	Enter the nominal motor power in HP according to the motor nameplate data. The default value corresponds to the nominal rated output of the unit. This parameter is visible in Keypad if *K-03 Regional Settings* is *US* [1]

P-03 Motor Current		
Range:		**Function:**
7.20 A*	[0.10 - 10000.00 A]	Enter the nominal motor current value from the motor nameplate data. The data are used for calculating torque, motor protection, etc.

P-04 Auto Tune		
Option:		**Function:**
		The Auto Tune function optimizes dynamic motor performance by automatically optimizing the advanced motor parameters (*P-30 Stator Resistance (Rs)* to *P-35 Main Reactance (Xh)*) at motor standstill. Activate the Auto Tune function by pressing [Hand] after selecting [1] or [2]. See also the section *Auto Tuning* in the AF-650 GP Design Guide. After a normal sequence, the display will read: "Press [OK] to finish Auto Tune". After pressing the [OK] key, the drive is ready for operation. This parameter cannot be adjusted while the motor is running.
[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 drive and the motor. AF-650 GP: The Full Auto Tune does not include X_h measurement for AF-650 GP. Instead, the X_h value is determined from the motor database. R_S is the best adjustment method (see *P-3# Adv. Motor Data*). Drives rated at 460 V 350 HP and above and at 575 V 125 HP and above will only run a Reduced Auto Tune when Full Auto Tune is selected. It is recommended to obtain the Advanced Motor Data from the motor manufacturer to enter into par. P-31 through P-36 for best performance.
[2]	Reduced Auto Tune	Performs a reduced Auto Tune of the stator resistance R_s in the system only.

Note:

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

NOTE!

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

NOTE!

Avoid generating external torque during Auto Tune.

3

NOTE!

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

NOTE!

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

P-05 Motor Cont. Rated Torque		
Range:		**Function:**
0 Nm*	[0.1 - 10000.0 Nm]	Enter the value from the motor nameplate data. The default value corresponds to the nominal rated output. This parameter is available when *P-20 Motor Construction* is set to *PM, non salient SPM* [1], i.e., the parameter is valid for PM and non-salient SPM motors only.

P-06 Base Speed		
Range:		**Function:**
1420. RPM*	[10 - 60000 RPM]	Enter the nominal motor speed value from the motor nameplate data. The data are used for calculating motor compensations.

P-07 Motor Power [kW]		
Range:		**Function:**
4.00 kW*	[0.09 - 3000.00 kW]	Enter the nominal motor power in kW according to the motor nameplate data. The default value corresponds to the nominal rated output of the unit. This parameter cannot be adjusted while the motor is running. This parameter is visible in Keypad if *K-03 Regional Settings* is *International* [0]. **NOTE! Four sizes down, one size up from nominal unit rating.**

P-09 Slip Compensation		
Range:		**Function:**
100. %*	[-500 - 500 %]	Enter the % value for slip compensation to compensate for tolerances in the value of $n_{M,N}$. Slip compensation is calculated automatically, i.e., on the basis of the rated motor speed $n_{M,N}$. This function is not active when *H-40 Configuration Mode* is set to *Speed closed-loop* [1] or *Torque* [2] Torque control with speed feedback or when *H-41 Motor Control Principle* is set to *U/f* [0] special motor mode.

P-10 Slip Compensation Time Constant		
Range:		**Function:**
0.10 s*	[0.05 - 5.00 s]	Enter the slip compensation reaction speed. A high value results in slow reaction, and a low value results in quick reaction. If low-frequency resonance problems arise, use a longer time setting.

NOTE!

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

3.6.2 P-2# Motor Selection

Parameters to configure the drive to work with asynchronous AC motors or permanent magnet motors

P-20 Motor Construction		
Option:		**Function:**
		Select the motor construction type.
[0] *	Asynchron	For asynchronous motors.
[1]	PM, non salient SPM	For permanent magnet (PM) motors. Note that PM motors are divided into two groups, with either surface mounted (non-salient) or interior (salient) magnets.

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

3.6.3 P-3# Adv. Motor Data

Parameters to configure advanced motor data to the drive.

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

P-31 Rotor Resistance (Rr)

Range:		Function:
1.0000 Ohm*	[0.0100 - 100.0000 Ohm]	Fine-tuning R_r will improve shaft performance. Set the rotor resistance value using one of these methods: 1. Run an Auto Tune on a cold motor. The drive will measure the value from the motor. All compensations are reset to 100%. 2. Enter the R_r value manually. Obtain the value from the motor supplier. 3. Use the R_r default setting. The drive establishes the setting on the basis of 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 one of these methods: 1. Run an Auto Tune on a cold motor. The drive will measure the value from the motor. 2. Enter the X_1 value manually. Obtain the value from the motor supplier. 3. Use the X_1 default setting. The drive establishes the setting on the basis of the motor nameplate data.

P-34 Rotor Leakage Reactance (X2)

Range:		Function:
4.0000 Ohm*	[0.0400 - 400.0000 Ohm]	Set the rotor leakage reactance of the motor using one of these methods: 1. Run an Auto Tune on a cold motor. The drive will measure the value from the motor. 2. Enter the X_2 value manually. Obtain the value from the motor supplier. 3. Use the X_2 default setting. The drive establishes the setting on the basis of the motor nameplate data.

P-35 Main Reactance (Xh)

Range:		Function:
100.0000 Ohm*	[1.0000 - 10000.0000 Ohm]	Set the main reactance of the motor using one of these methods: 1. Run an Auto Tune on a cold motor. The drive will measure the value from the motor. 2. Enter the X_h value manually. Obtain the value from the motor supplier. 3. Use the X_h default setting. The drive establishes the setting on the basis of 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 *P-36 Iron Loss Resistance (Rfe)* on default setting.

P-37 d-axis inductance (Ld)

Range:		Function:
0 mH*	[0 - 0.000 mH]	Enter the value of the d-axis inductance. Obtain the value from the permanent magnet motor data sheet. The d-axis inductance cannot be found by performing an Auto Tune.

3

3.7 H-## High Perf Parameters

Parameter group related to high performance functions in the drive.

3.7.1 H-0# High Perf Operations

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

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

H-04 Auto-Reset (Times)		
Option:		**Function:**
		Select the reset function after tripping. Once reset, the adjustable frequency drive can be restarted.
[0] *	Manual reset	Select *Manual reset* [0], 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	

H-04 Auto-Reset (Times)		
Option:		**Function:**
[10]	Automatic reset x 10	
[11]	Automatic reset x 15	
[12]	Automatic reset x 20	
[13]	Infinite auto reset	Select *Infinite Automatic Reset* [13] for continuous resetting after tripping.

NOTE!

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

H-05 Auto-Reset (Reset Interval)		
Range:		**Function:**
10 s*	[0 - 600 s]	Enter the time interval from trip to start of the automatic reset function. This parameter is active when *H-04 Auto-Reset (Times)* is set to *Automatic reset* [1] - [13].

H-07 Accel/Decel Time 1 Type		
Option:		**Function:**
		Select the ramp type, depending on requirements for acceleration/deceleration. A linear ramp will give constant acceleration during ramping. An S-ramp will give non-linear acceleration, compensating for jerk in the application.
[0] *	Linear	
[1]	S-ramp Const Jerk	Acceleration with lowest possible jerk.
[2]	S-ramp Const Time	S-ramp based on the values set in *F-07 Accl Time 1* and *F-08 Decl Time 1*.

NOTE!

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

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.

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

NOTE!

This parameter cannot be adjusted while the motor is running.

H-09 Start Mode		
Option:		**Function:**
		This function makes it possible to catch a motor that is spinning freely due to a line drop-out.
[0] *	Disabled	No function
[1]	Enabled	Enables the drive to "catch" and control a spinning motor. When *H-09 Start Mode* is enabled, *F-24 Holding Time* and *F-25 Start Function* have no function.
[2]	Enabled Always	

NOTE!

This parameter cannot be adjusted while motor is running.

NOTE!

This function is not recommended for hoisting applications.

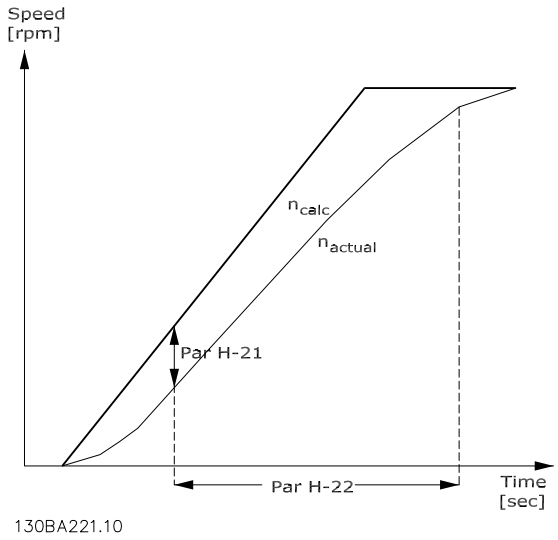
3.7.2 H-2# Motor Feedback Monitoring

Parameters to configure Motor Feedback Monitoring.

H-20 Motor Feedback Loss Function		
Option:		**Function:**
		Select which reaction the drive should take if a feedback fault is detected. The selected action is to take place when the feedback signal differs from the output speed where its range is specified in *H-21 Motor Feedback Speed Error* during its time frame set in *H-22 Motor Feedback Loss Time-out*.
[0]	Disabled	
[1]	Warning	
[2] *	Trip	
[3]	Jog	
[4]	Freeze Output	
[5]	Max Speed	
[6]	Switch to Open Loop	
[7]	Select Set-up 1	
[8]	Select Set-up 2	
[9]	Select Set-up 3	
[10]	Select Set-up 4	
[11]	stop & trip	

Warning/Alarm 61 Feedback Error is related to the Motor Feedback Loss Function.

H-21 Motor Feedback Speed Error		
Range:		**Function:**
300 RPM*	[1 - 600 RPM]	Select the max. allowed tracking error in speed from the calculated and the actual mechanical shaft output speeds.



H-22 Motor Feedback Loss Time-out		
Range:		**Function:**
0.05 s*	[0.00 - 60.00 s]	Set the timeout value allowing the speed error set in *H-21 Motor Feedback Speed Error* to be exceeded.

H-24 Tracking Error Function		
Option:		**Function:**
		Select which reaction the drive should take if a tracking error is detected. Closed-loop: The tracking error is measured between the output from the ramp generator and the speed feedback (filtered). Open-loop: The tracking error is measured between the output from the ramp generator - compensated for slip - and the frequency that is sent to the motor (*DR-13 Frequency*). The reaction will be activated if the measured difference is more than specified in *H-25 Tracking Error* for the time specified in *H-26 Tracking Error Timeout*. A tracking error in closed-loop does not imply that there is a problem with the feedback signal! A tracking error can be the result of torque limit for loads that are too big.
[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:**
1.00 s*	[0.00 - 60.00 s]	Enter the timeout period during which an error greater than the value set in *H-25 Tracking Error* is permissible.

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

H-28 Tracking Error Ramping Timeout		
Range:		**Function:**
1.00 s*	[0.00 - 60.00 s]	Enter the timeout period during which an error greater than the value set in *H-27 Tracking Error Ramping* while ramping is permissible.

H-29 Tracking Error After Ramping Timeout		
Range:		**Function:**
5.00 s*	[0.00 - 60.00 s]	Enter the timeout period after ramping where *H-27 Tracking Error Ramping* and *H-28 Tracking Error Ramping Timeout* are still active.

3.7.3 H-4# Advanced Settings

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

H-40 Configuration Mode		
Option:		**Function:**
		Select the application control principle to be used when a remote reference (i.e., via analog input or network) is active. A remote reference

H-40 Configuration Mode		
Option:		**Function:**
		can only be active when *F-02 Operation Method* is set to [0] or [1].
[0] *	Speed open loop	Enables speed control (without feedback signal from motor) with automatic slip compensation for almost constant speed at varying loads.
[1]	Speed closed loop	Enables 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.
[2]	Torque	Enables torque closed-loop control with feedback. Only possible with "Flux with motor feedback" option, *H-41 Motor Control Principle*. AF-650 GP only.
[3]	Process	Enables the use of process control in the drive. The process control parameters are set in parameter groups PI-2# and PI-3#.
[4]	Torque open loop	Enables the use of torque open-loop in Adv. Vector Control mode (*H-41 Motor Control Principle*). The torque PID parameters are set in parameter group PI-1#.
[5]	Wobble	Enables the wobble functionality in *SF-00 Wobble Mode* to *SF-19 Wobble Delta Freq. Scaled*.
[6]	Surface Winder	Enables the surface winder control specific parameters in parameter group PI-2# and PI-3#.
[7]	Ext. PID Speed OL	Specific parameters in parameter group PI-2# to PI-5#.
[8]	Ext. PID Speed CL	Specific parameters in parameter group PI-2# to PI-5#.

H-41 Motor Control Principle		
Option:		**Function:**
		Select which motor control principle to employ.
[0] *	U/f	special motor mode, for parallel connected motors in special motor applications. When U/f is selected the characteristic of the control principle can be edited in *H-55 U/f Characteristic - U* and *H-56 U/f Characteristic - F*.
[1]	Adv. Vector Control	Voltage vector control principle suitable for most applications. The main benefit of Advanced Vector Control operation is that it uses a robust motor model.

H-41 Motor Control Principle		
Option:		**Function:**
[2]	Flux sensorless	Flux Vector control without encoder feedback, for simple installation and robustness against sudden load changes.
[3]	Flux w/ motor feedb	very high accuracy speed and torque control, suitable for the most demanding applications.

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

NOTE!

This parameter cannot be adjusted while the motor is running.

H-42 Flux Motor Feedback Source		
Option:		**Function:**
		Select the interface at which to receive feedback from the motor.
[0]	Motr feedb par H-42	
[1] *	24V encoder	A and B channel encoder, which can only be connected to the digital input terminals 32/33. Terminals 32/33 must be programmed to *No operation*.
[2]	OPCENC	Encoder module option which can be configured in parameter group EC-1#.
[3]	OPCRES	Optional resolver interface module which can be configured in parameter group RS-5#
[6]	Analog Input 53	
[7]	Analog Input 54	
[8]	Frequency input 29	
[9]	Frequency input 33	

NOTE!

This parameter cannot be adjusted while the motor is running.

H-43 Torque Characteristics		
Option:		**Function:**
		Select the torque characteristic required. VT and Automatic Energy Savings are both energy saving operations.
[0] *	Constant torque	Motor shaft output provides constant torque under variable speed control.

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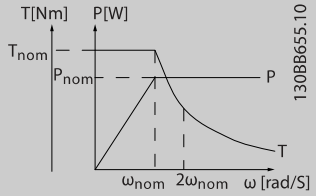
H-43 Torque Characteristics		
Option:		**Function:**
[1]	Variable torque	Motor shaft output provides variable torque under variable speed control. Set the variable torque level in *SP-40 VT Level*.
[2]	Energy Savings CT	Automatically optimizes energy consumption by minimizing magnetization and frequency via *SP-41 Energy Savings Min. Magnetisation* and *SP-42 Energy Savings Min. Frequency*.
[5]		The function provides a constant power in the field weakening area. The torque shape of motor mode is used as a limit in generator mode. This is done to limit the power in generatoric mode that otherwise becomes considerable larger than in motor mode, due to the high DC link voltage available in generator mode. $P_{shaft}[W] = \omega_{mech}[rad/s] \times T[Nm]$ This relationship with the constant power is illustrated in the following graph: 

NOTE!

This parameter cannot be adjusted while the motor is running.

H-44 Constant or Variable Torque OL		
Option:		**Function:**
[0] *	High torque	Allows up to 160% overtorque.
[1]	Normal torque	For oversized motor - allows up to 110% overtorque.

NOTE!

This parameter cannot be adjusted while the motor is running.

H-45 Local Mode Configuration		
Option:		**Function:**
		Select which application configuration mode (*H-40 Configuration Mode*), i.e., the application control principle, to use when a Local (Keypad) Reference is active. A local reference can be active only when *F-02 Operation Method* is set to [0] or [2]. By default, the local reference is active in hand mode only.
[0]	Speed open loop	
[1]	Speed closed loop	
[2] *	As mode par H-40	

H-46 Back EMF at 1000 RPM		
Range:		**Function:**
500. V*	[10. - 9000 V]	Set the nominal back EMF for the motor when running at 1,000 RPM. This parameter is only active when *P-20 Motor Construction* is set to *PM motor* [1] (Permanent Magnet Motor). **NOTE!** **When using PM motors, it is recommended to use brake resistors.**

H-47 Motor Angle Offset		
Range:		**Function:**
0 *	[-32768 - 32767]	Enter the correct offset angle between the PM motor and the index position (single-turn) of the attached encoder or resolver. The value range of 0–32768 corresponds to 0–2 * pi (radians). To obtain the offset angle value: After drive start-up, apply DC hold and enter the value of *DR-20 Motor Angle* into this parameter. This parameter is only active when *P-20 Motor Construction* is set to *PM, non-salient SPM* [1] (Permanent Magnet Motor).

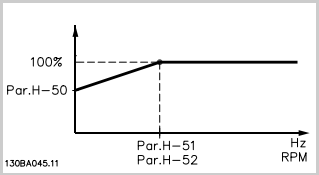
H-48 Clockwise Direction		
This parameter defines the term "Clockwise" corresponding to the Keypad direction arrow. Used for easy change of direction of shaft rotation without swapping motor wires.		
Option:		**Function:**
[0] *		Motor shaft will turn in clockwise direction when the drive is connected U -> U; V -> V, and W -> W to motor.
[1]		Motor shaft will turn in counter clockwise direction when the drive is connected U -> U; V -> V, and W -> W to motor.

NOTE!

This parameter cannot be changed while the motor is running.

3.7.4 H-5# Load Indep. Settings

Parameters to configure the load-independent motor settings.

H-50 Motor Magnetisation at Zero Speed		
Range:		**Function:**
100 %*	[0 - 300 %]	Use this parameter along with *H-51 Min Speed Normal Magnetising [RPM]* to obtain a different thermal load on the motor when running at low speed. Enter a value which is a percentage of the rated magnetizing current. If the setting is too low, the torque on the motor shaft may be reduced. 

NOTE!

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

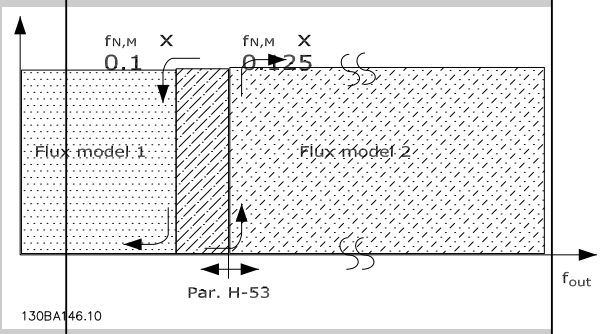
H-51 Min Speed Normal Magnetising [RPM]		
Range:		**Function:**
15. RPM*	[10 - 300 RPM]	Set the required speed for normal magnetizing current. If the speed is set lower than the motor slip speed, *H-50 Motor Magnetisation at Zero Speed* and *H-51 Min Speed Normal Magnetising [RPM]* are of no significance.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

NOTE!

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

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

H-52 Min Speed Normal Magnetising [Hz]		
Range:		**Function:**
		Use this parameter along with *H-50 Motor Magnetisation at Zero Speed*. See drawing for *H-50 Motor Magnetisation at Zero Speed*.

H-53 Model Shift Frequency		
Range:		**Function:**
0 Hz*	[4.0 - 0 Hz]	**Flux Model shift** Enter the frequency value for shift between two models for determining motor speed. Choose the value based on settings in *H-40 Configuration Mode* and *H-41 Motor Control Principle*. There are two options: shift between flux model 1 and flux model 2; or shift between variable current mode and flux model 2. This parameter cannot be adjusted while the motor is running. **Flux model 1 – Flux model 2** This model is used when *H-40 Configuration Mode* is set to *Speed closed-loop* [1] or *Torque* [2] and *H-41 Motor Control Principle* is set to *Flux w/motor feedback* [3]. With this parameter, it is possible to make an adjustment of the shifting point where AF-650 GP changes between Flux model 1 and Flux model 2, which is useful in some sensitive speed and torque control applications.  **Figure 3.6 H-40 = [1] Speed closed-loop or [2] Torque and H-41 = [3] Flux w/motor feedback** **Variable Current - Flux model - Sensorless** This model is used when H-40 is set to *Speed open-loop* [0] and H-41 is set to *Flux sensorless* [2]. In speed open-loop in flux mode, the speed is determined by the current measurement. Below f_{norm} x 0.1, the drive runs on a variable current model. Above f_{norm} x 0.125 the adjustable frequency drive runs on a Flux model.

3

H-53 Model Shift Frequency

Range:		Function:

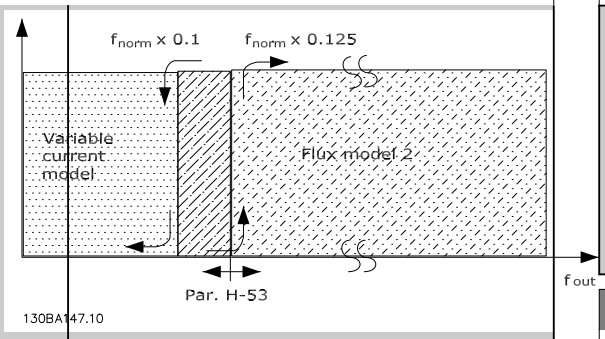


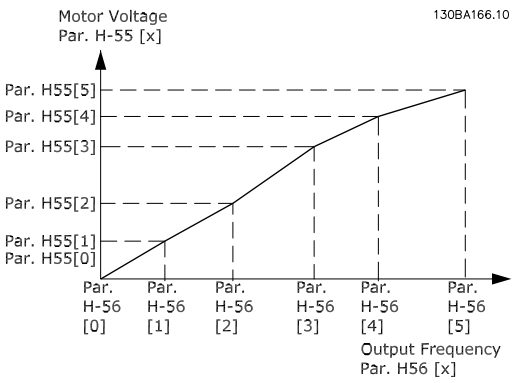
Figure 3.7 H-40 = [0] Speed open-loop, H-41 = [2] Flux sensorless

H-55 U/f Characteristic - U

Range:		Function:
0 V*	[0.0 - 1000.0 V]	Enter the voltage at each frequency point to manually form a U/f characteristic matching the motor. The frequency points are defined in *H-56 U/f Characteristic - F*. This parameter is an array parameter [0-5] and is only accessible when *H-41 Motor Control Principle* is set to *U/f* [0].

H-56 U/f Characteristic - F

Range:		Function:
0 Hz*	[0 - 1000.0 Hz]	Enter the frequency points to manually form a U/f-characteristic matching the motor. The voltage at each point is defined in *H-55 U/f Characteristic - U*. This parameter is an array parameter [0-5] and is only accessible when *H-41 Motor Control Principle* is set to *U/f* [0].



H-58 Flystart Test Pulses Current

Range:		Function:
30 %*	[0 - 200 %]	Control the percentage of the magnetizing current for the pulses used to detect the motor direction. Reducing this value will reduce the generated torque. 100% means nominal motor current. The parameter is active when *H-09 Start Mode* is enabled. This parameter is only available in Advanced Vector Control.

H-59 Flystart Test Pulses Frequency

Range:		Function:
200 %*	[0 - 500 %]	Control the percentage of the frequency for the pulses used to detect the motor direction. Increasing this value will reduce the generated torque. 100% means 2 times the slip frequency. The parameter is active when *H-09 Start Mode* is enabled. This parameter is only available in Advanced Vector Control.

3.7.5 H-6# Load Depen. Settings

Parameters to configure the load-dependent motor settings.

H-61 High Speed Load Compensation

Range:		Function:
100 %*	[0 - 300 %]	Enter the % value to compensate voltage in relation to load while the motor is running at high speed, and obtain the optimum U/f characteristic. The motor size determines the frequency range within which this parameter is active.

Motor size	Change-over
0.34–10 hp [0.25–7.5 kW]	> 10Hz

H-64 Resonance Dampening

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

NOTE!

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

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

NOTE!

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

H-66 Min. Current at Low Speed		
Range:		**Function:**
100 %*	[1. - 200. %]	

3.7.6 H-7# Adjustable Warnings

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

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

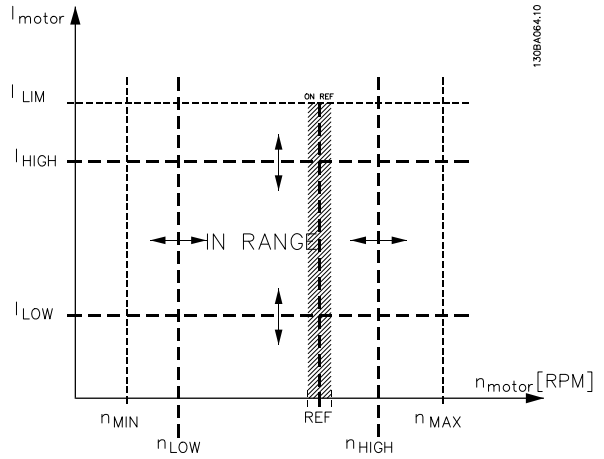


Figure 3.8 Adjustable Warnings

H-70 Warning Current Low		
Range:		**Function:**
0.00 A*	[0.00 - 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 *Figure 3.8*.

H-70 Warning Current Low		
Range:		**Function:**
		on terminal 27 or 29 and on relay output 01 or 02. Refer to *Figure 3.8*.

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 *Figure 3.8*.

H-72 Warning Speed Low		
Range:		**Function:**
0 RPM*	[0 - par. H-73 RPM]	Enter the n_{LOW} value. When the motor speed exceeds this limit, the display reads *Speed Low*. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02.

H-73 Warning Speed High		
Range:		**Function:**
par. 4-13 RPM*	[par. H-72 - par. F-17 RPM]	Enter the n_{HIGH} value. When the motor speed exceeds this limit, the display reads *Speed High*. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02. Program the upper signal limit of the motor speed, n_{HIGH}, within the normal working range of the drive. Refer to *Figure 3.8*.

H-74 Warning Reference Low		
Range:		**Function:**
-999999.999 *	[-999999.999 - par. H-75]	Enter the lower reference limit. When the actual reference falls below this limit, the display indicates Ref Low. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02.

H-75 Warning Reference High		
Range:		**Function:**
999999.999 *	[par. H-74 - 999999.999]	Enter the upper reference limit. When the actual reference exceeds this limit, the display

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H-75 Warning Reference High		
Range:		**Function:**
		reads Ref High. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02.

H-76 Warning Feedback Low		
Range:		**Function:**
-999999.999 ReferenceFeed-backUnit*	[-999999.999 - par. H-77 ReferenceFeed-backUnit]	Enter the lower feedback limit. When the feedback falls below this limit, the display reads Feedb Low. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02.

H-77 Warning Feedback High		
Range:		**Function:**
999999.999 ReferenceFeed-backUnit*	[par. H-76 - 999999.999 ReferenceFeed-backUnit]	Enter the upper feedback limit. When the feedback exceeds this limit, the display reads Feedb High. The signal outputs can be programmed to produce a status signal on terminal 27 or 29 and on relay output 01 or 02.

H-78 Missing Motor Phase Function		
Option:		**Function:**
		Displays an alarm in the event of a missing motor phase.
[0]	Disabled	No alarm is displayed if a missing motor phase occurs.
[2] *	Trip 1000 ms	

NOTE!

This parameter cannot be adjusted while the motor is running.

3.7.7 H-8# Stop Adjustments

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

H-80 Function at Stop		
Option:		**Function:**
		Select the drive function after a stop command or after the speed is decelled to the settings in *H-81 Min Speed for Function at Stop [RPM]*.
[0] *	Coast	Leaves motor in free mode. The motor is disconnected from the drive.
[1]	DC hold	Energizes motor with a DC holding current (see *B-00 DC Hold Current*).
[2]	Motor check	Checks if a motor has been connected.
[3]	Pre-magnetising	Builds up a magnetic field while the motor is stopped. This allows the motor to produce torque quickly at subsequent start commands (asynchronous motors only). This pre-magnetizing function does not help the very first start command. Two different solutions are available to pre-magnetize the machine for the first start command: 1. Start the drive with a 0RPM reference and wait 2 to 4 rotor time constants (see below) before increasing the speed reference. 2a. Set F-24 Start Delay to the desired pre-mag time (2 to 4 rotor time constants - see below). 2b. Set F-25 to either [0] DC-hold or [1] DC Brake. Set the DC hold or DC brake current magnitude to be equal to I_pre-mag = Unom / (1.73 x Xh) Sample rotor time constants = (Xh+X2) / (6.3*Freq_nom*Rr) 1.35 hp [1 kW] = 0.2 seconds 13.5 hp [10 kW] = 0.5 seconds 135 hp [100 kW] = 1.7 seconds 1,350 hp [1,000 kW] = 2.5 seconds
[4]	DC Voltage U0	When the motor is stopped, the H-55 [0] parameter defines the voltage at 0 Hz.
[5]		When the reference is below *H-81 Min Speed for Function at Stop [RPM]*, the motor is disconnected from the drive.

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

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H-82 Min Speed for Function at Stop [Hz]		
Range:		**Function:**
0.1 Hz*	[0.0 - 20.0 Hz]	Set the output frequency at which to activate *H-80 Function at Stop*.

H-83 Precise Stop Function		
Option:		**Function:**
[0] *	Precise ramp stop	Only optimal when the operational speed of, for example, the conveyor belt is constant. This is an open-loop control. Achieves high repetitive precision at the stopping point.
[1]	Cnt stop with reset	Counts the number of pulses, typically from an encoder and generates a stop signal after a pre-programmed number of pulses - *H-84 Precise Stop Counter Value* - has been received at T29 or T33 [30]. This is a direct feedback with one-way closed-loop control. The counter function is activated (starts timing) at the edge of the start signal (when it changes from stop to start). After each precise stop, the number of pulses counted during decel to 0 rpm is reset.
[2]	Cnt stop w/o reset	Same as [1] but the number of pulses counted during decel to 0 rpm is deducted from the counter value entered in *H-84 Precise Stop Counter Value*. This reset function can, for example, be used to compensate for the extra distance done during ramping down and to reduce the impact of gradual wear on mechanical parts.
[3]	Speed comp stop	Stops at precisely the same point, regardless of the present speed, the stop signal is delayed internally when the present speed is lower than the maximum speed (set in *F-03 Max Output Frequency 1*). The delay is calculated on the basis of the reference speed of the drive and not on the basis of the actual speed. Please therefore make sure that the drive has ramped up before you activate the speed compensated stop.
[4]	Com cnt stop w/rst	Same as [3] but after each precise stop, the number of pulses counted during decel to 0 rpm is reset.
[5]	Comp cnt stop w/o r	Same as [3] but the number of pulses counted during decel to 0 rpm is deducted from the counter value entered in *H-84 Precise Stop Counter Value*. This reset function can, for example, be used to compensate for the extra distance done during ramping down and to reduce the impact of gradual wear on mechanical parts.

The precise stop functions are advantageous in applications where high precision is required.
If you use a standard stop command the accuracy is determined by the internal task time. That is not the case when you use the precise stop function; it eliminates the task time dependence and increases the accuracy substantially.
The drive 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 drive program. The precise stop function gives a highly reproducible delay from the stop signal is given until the ramping down starts. A test must be done to find this delay as it is a sum of sensor, PLC, drive and mechanical parts.
To ensure optimum accuracy, there should be at least 10 cycles during ramping down, see *F-08 Decl Time 1*, *E-11 Decl Time 2*, *E-13 Decl Time 3* and *E-15 Decl Time 4* .
The precise stop function is set up here and enabled from DI T29 or T33.

NOTE!

This parameter cannot be adjusted while the motor is running.

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

H-85 Precise Stop Speed Compensation Delay		
Range:		**Function:**
10 ms*	[0 - 100 ms]	Enter the delay time for sensors, PLCs, etc. for use in *H-83 Precise Stop Function*. In speed compensated stop mode, the delay time at different frequencies has a major influence on the stop function. Not used for selection [0], [1] and [2] in *H-83 Precise Stop Function*

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

H-88 Minimum Inertia		
Range:		**Function:**
0.0048 kgm²*	[0.0001 - par. H-89 kgm²]	Needed for average inertia calculation. Enter the minimum moment of inertia of the mechanical system. *H-88 Minimum Inertia* and *H-89 Maximum Inertia* are used for pre-adjustment of the Proportional Gain in the speed control, see *PI-02 Speed PID Proportional Gain*.

This parameter cannot be adjusted while motor is running.

H-89 Maximum Inertia		
Range:		**Function:**
0.0048 kgm²*	[par. H-88 - 0.4800 kgm²]	Active in flux open-loop only. Used to compute the acceleration torque at low speed. Used in the torque limit controller.

This parameter cannot be adjusted while motor is running.

3.7.8 H-9# Motor Temperature

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

H-95 KTY Sensor Type		
Option:		**Function:**
		Select the used type of KTY sensor.
[0] *	KTY Sensor 1	1kΩ at 212° F [100° C]
[1]	KTY Sensor 2	1kΩ at 77 °F [25 °C]
[2]	KTY Sensor 3	2kΩ at 77 °F [25 °C]

H-96 KTY Thermistor Input		
Option:		**Function:**
		Selecting analog input terminal 54 to be used as KTY sensor input. Terminal 54 cannot be selected as KTY source if otherwise used as reference (see *F-01 Frequency Setting 1* to *C-34 Frequency Command 3*).

H-96 KTY Thermistor Input		
Option:		**Function:**
		NOTE! **Connection of KTY sensor between term. 54 and 55 (GND). See picture in section *KTY Sensor Connection*.**
[0] *	None	
[2]	Analog Input 54	

H-97 KTY Threshold level		
Range:		**Function:**
80 °C*	[-40 - 140 °C]	Select the KTY sensor threshold level for motor thermal protection.

3.8 AN-## Analog In/Out

Parameter group related to the analog inputs and outputs.

3.8.1 AN-0# Analog I/O Mode

Parameters to configure the analog inputs and output time out period for lost signals.

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

AN-01 Live Zero Time-out Function		
Option:		**Function:**
		Select the timeout function. The function set in *AN-01 Live Zero Time-out Function* will be activated if the input signal on terminal 53 or 54 is below 50% of the value in *AN-10 Terminal 53 Low Voltage*, *AN-12 Terminal 53 Low Current*, *AN-20 Terminal 54 Low Voltage* or *AN-22 Terminal 54 Low Current* for a time period defined in *AN-00 Live Zero Time-out Time*. If several timeouts occur simultaneously, the drive prioritizes the timeout functions as follows: 1. *AN-01 Live Zero Time-out Function* 2. *O-04 Control Word Time-out Function*
[0] *	Off	
[1]	Freeze output	Frozen at the present value
[2]	Stop	Overruled to stop
[3]	Jogging	Overruled to jog speed
[4]	Max. speed	Overruled to max. speed
[5]	Stop and trip	Overruled to stop with subsequent trip
[20]	Coast	Coast: Overruled to Coast
[21]	Coast and trip	Coast and trip: Overruled to Coast with subsequent trip.

3.8.2 AN-1# Analog Input 53

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

AN-10 Terminal 53 Low Voltage		
Range:		**Function:**
0.07 V*	[-10.00 - par. AN-11 V]	Enter the low voltage value. This analog input scaling value should correspond to the minimum reference value, set in *AN-14 Terminal 53 Low Ref./Feedb. Value*. See also the section *Reference Handling*.

AN-11 Terminal 53 High Voltage		
Range:		**Function:**
10.00 V*	[par. AN-10 - 10.00 V]	Enter the high voltage value. This analog input scaling value should correspond to the high reference/ feedback value set in *AN-15 Terminal 53 High Ref./Feedb. Value*.

AN-12 Terminal 53 Low Current		
Range:		**Function:**
0.14 mA*	[0.00 - par. AN-13 mA]	Enter the low current value. This reference signal should correspond to the minimum reference value, set in *F-52 Minimum Reference*. The value must be set at >2mA in order to activate the Live Zero Timeout Function in *AN-01 Live Zero Time-out Function*.

AN-13 Terminal 53 High Current		
Range:		**Function:**
20.00 mA*	[par. AN-12 - 20.00 mA]	Enter the high current value corresponding to the high reference/feedback set in *AN-15 Terminal 53 High Ref./Feedb. Value*.

AN-14 Terminal 53 Low Ref./Feedb. Value		
Range:		**Function:**
0.000 *	[-999999.999 - 999999.999]	Enter the analog input scaling value that corresponds to the low voltage/low current set in *AN-10 Terminal 53 Low Voltage* and *AN-12 Terminal 53 Low Current*.

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

AN-15 Terminal 53 High Ref./Feedb. Value		
Range:		**Function:**
		feedback value set in *AN-11 Terminal 53 High Voltage* and *AN-13 Terminal 53 High Current*.

AN-16 Terminal 53 Filter Time Constant		
Range:		**Function:**
0.001 s*	[0.001 - 10.000 s]	Enter the time constant. This is a first-order digital low pass filter time constant for suppressing electrical noise in terminal 53. A high time constant value improves dampening but also increases the time delay through the filter.

NOTE!

This parameter cannot be adjusted while the motor is running.

3.8.3 AN-2# Analog Input 54

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

AN-20 Terminal 54 Low Voltage		
Range:		**Function:**
0.07 V*	[-10.00 - par. AN-21 V]	Enter the low voltage value. This analog input scaling value should correspond to the minimum reference value, set in *F-52 Minimum Reference*. See also the section *Reference Handling*.

AN-21 Terminal 54 High Voltage		
Range:		**Function:**
10.00 V*	[par. AN-20 - 10.00 V]	Enter the high voltage value. This analog input scaling value should correspond to the high reference/ feedback value set in *AN-25 Terminal 54 High Ref./Feedb. Value*.

AN-22 Terminal 54 Low Current		
Range:		**Function:**
0.14 mA*	[0.00 - par. AN-23 mA]	Enter the low current value. This reference signal should correspond to the minimum reference value, set in *F-52 Minimum Reference*. The value must be set at >2mA in order to activate the Live Zero Timeout Function in *AN-01 Live Zero Time-out Function*.

AN-23 Terminal 54 High Current		
Range:		**Function:**
20.00 mA*	[par. AN-22 - 20.00 mA]	Enter the high current value corresponding to the high reference/feedback value set in *AN-25 Terminal 54 High Ref./Feedb. Value*.

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

AN-25 Terminal 54 High Ref./Feedb. Value		
Range:		**Function:**
1500.000 ReferenceFeed-backUnit*	[-999999.999 - 999999.999 ReferenceFeedbackUnit]	

AN-26 Terminal 54 Filter Time Constant		
Range:		**Function:**
0.001 s*	[0.001 - 10.000 s]	Enter the time constant. This is a first-order digital low pass filter time constant for suppressing electrical noise in terminal 54. A high time constant value improves dampening but also increases the time delay through the filter.

NOTE!

This parameter cannot be adjusted while the motor is running.

3.8.4 AN-3# Analog Input X30/11

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

AN-30 Terminal X30/11 Low Voltage		
Range:		**Function:**
0.07 V*	[0.00 - par. AN-31 V]	Sets the analog input scaling value to correspond to the low reference/ feedback value (set in *AN-34 Term. X30/11 Low Ref./Feedb. Value*).

AN-31 Terminal X30/11 High Voltage		
Range:		**Function:**
10.00 V*	[par. AN-30 - 10.00 V]	Sets the analog input scaling value to correspond to the high reference/ feedback value (set in *AN-35 Term. X30/11 High Ref./Feedb. Value*).

AN-34 Term. X30/11 Low Ref./Feedb. Value		
Range:		**Function:**
0.000 *	[-999999.999 - 999999.999]	Sets the analog input scaling value to correspond to the low voltage value (set in *AN-30 Terminal X30/11 Low Voltage*).

AN-35 Term. X30/11 High Ref./Feedb. Value		
Range:		**Function:**
100.000 *	[-999999.999 - 999999.999]	Sets the analog input scaling value to correspond to the high voltage value (set in *AN-31 Terminal X30/11 High Voltage*).

AN-36 Term. X30/11 Filter Time Constant		
Range:		**Function:**
0.001 s*	[0.001 - 10.000 s]	A 1st order digital low pass filter time constant for suppressing electrical noise on terminal X30/11.

NOTE!

This parameter cannot be changed while the motor is running.

3.8.5 AN-4# Analog Input X30/12

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

AN-40 Terminal X30/12 Low Voltage		
Range:		**Function:**
0.07 V*	[0.00 - par. AN-41 V]	Sets the analog input scaling value to correspond to the low reference/ feedback value set in *AN-44 Term. X30/12 Low Ref./Feedb. Value*.

AN-41 Terminal X30/12 High Voltage		
Range:		**Function:**
10.00 V*	[par. AN-40 - 10.00 V]	Sets the analog input scaling value to correspond to the high reference/ feedback value set in *AN-45 Term. X30/12 High Ref./Feedb. Value*.

AN-44 Term. X30/12 Low Ref./Feedb. Value		
Range:		**Function:**
0.000 *	[-999999.999 - 999999.999]	Sets the analog output scaling value to correspond to the low voltage value set in *AN-40 Terminal X30/12 Low Voltage*.

AN-45 Term. X30/12 High Ref./Feedb. Value		
Range:		**Function:**
100.000 *	[-999999.999 - 999999.999]	Sets the analog input scaling value to correspond to the high voltage value set in *AN-41 Terminal X30/12 High Voltage*.

AN-46 Term. X30/12 Filter Time Constant		
Range:		**Function:**
0.001 s*	[0.001 - 10.000 s]	A 1st order digital low pass filter time constant for suppressing electrical noise on terminal X30/12.

NOTE!

This parameter cannot be changed while the motor is running.

3.8.6 AN-5# Analog Output 42

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

AN-50 Terminal 42 Output		
Option:		**Function:**
		Select the function of Terminal 42 as an analog current output. Depending on the selection the output is either a 0-20mA or 4-20mA output. The current value can be read out in Keypad in *DR-65 Analog Output 42 [mA]*.
[0] *	No operation	When no signal on the analog output.
[100]	Output frequency	0Hz = 0mA; 100Hz = 20mA.
[101]	Reference	*F-50 Reference Range* [Min - Max] 0% = 0mA; 100% = 20mA *F-50 Reference Range* [-Max - Max] -100% = 0mA; 0% = 10mA; +100% = 20 mA
[102]	Feedback	*F-50 Reference Range* [Min - Max] 0% = 0mA; 100% = 20mA *F-50 Reference Range* [-Max - Max] -100% = 0mA; 0% = 10mA; +100% = 20 mA

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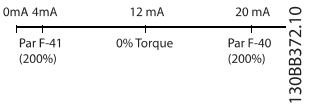
AN-50 Terminal 42 Output		
Option:		**Function:**
[103]	Motor Current	Value is taken from *DR-37 Drive Max. Current*. Inverter max. current (160% current) is equal to 20mA. Example: Inverter norm current (11kW) = 24A. 160% = 38.4A. Motor norm current = 22A Readout 11.46mA. $\frac{20\ mA \times 22\ A}{38.4\ A} = 11.46\ mA$ In case the norm motor current is equal to 20mA, the output setting of *AN-52 Terminal 42 Output Max Scale* is: $\frac{I_{DRIVE_{Max}} \times 100}{I_{Motor_{Norm}}} = \frac{38.4 \times 100}{22} = 175\ \%$
[104]	Torque rel to limit	The torque setting is related to setting in *F-40 Torque Limiter (Driving)*
[105]	Torq relate to rated	The torque is related to the motor torque setting.
[106]	Power	Taken from *P-07 Motor Power [kW]*.
[107]	Speed	Taken from *F-53 Maximum Reference*. 20mA = value in *F-53 Maximum Reference*
[108]	Torque	Torque reference related to 160% torque.
[109]	Max Out Freq	0Hz = 0mA,*F-03 Max Output Frequency 1* = 20mA.
[113]	PID Clamped Output	
[119]	Torque % lim	Torque% lim: Torque reference. *F-50 Reference Range* [Min - Max] 0% = 0mA; 100% = 20mA *F-50 Reference Range* [-Max - Max] -100% = 0mA; 0% = 10mA; +100% = 20 mA
[130]	Output fr 4-20mA	0Hz = 4mA, 100Hz = 20mA
[131]	Reference 4-20 mA	*F-50 Reference Range* [Min-Max] 0% = 4mA; 100% = 20mA *F-50 Reference Range* [-Max-Max] -100% = 4mA; 0% = 12 mA; +100% = 20 mA
[132]	Feedback 4-20 mA	Feedback 4-20 mA: *F-50 Reference Range* [Min-Max] 0% = 4mA; 100% = 20mA *F-50 Reference Range* [-Max-Max] -100% = 4mA; 0% = 12 mA; +100% = 20 mA
[133]	Motor cur. 4-20 mA	Value is taken from *DR-37 Drive Max. Current*. Inverter max. current (160% current) is equal to 20mA.
[134]	Torq% lim 4-20mA	The torque setting is related to setting in *F-40 Torque Limiter (Driving)*.

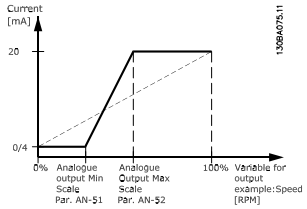
AN-50 Terminal 42 Output		
Option:		**Function:**
[135]	Torq% nom 4-20mA	The torque setting is related to the motor torque setting.
[136]	Power 4-20 mA	Taken from *P-07 Motor Power [kW]*
[137]	Speed 4-20 mA	Taken from *F-53 Maximum Reference*. 20mA = Value in *F-53 Maximum Reference*.
[138]	Torque 4-20 mA	Torque reference related to 160% torque.
[139]	Bus ctrl. 0-20 mA	An output value set from Network process data. The output will work independently of internal functions in the drive.
[140]	Bus ctrl. 4-20 mA	An output value set from Network process data. The output will work independently of internal functions in the drive.
[141]	Bus ctrl 0-20mA t.o.	*H-74 Warning Reference Low* defines the behavior of the analog output in case of bus timeout.
[142]	Bus ctrl 4-20mA t.o.	*H-74 Warning Reference Low* defines the behavior of the analog output in case of bus timeout.
[149]	Torq% lim 4-20mA	Analog output at zero torque = 12mA. Motoric torque will increase the output current to max torque limit 20mA (set in *F-40 Torque Limiter (Driving)*). Generative torque will decrease the output to torque limit Generator Mode (set in *F-41 Torque Limiter (Braking)*) Ex: *F-40 Torque Limiter (Driving)* : 200% and *F-41 Torque Limiter (Braking)*: 200%. 20mA = 200% Motoric and 4mA = 200% Generatoric. 
[150]	Max out fr 4-20mA	0hz = 0mA,*F-03 Max Output Frequency 1* = 20mA.

AN-51 Terminal 42 Output Min Scale		
Range:		**Function:**
0.00 %*	[0.00 - 200.00 %]	Scale for the minimum output (0 or 4 mA) of the analog signal at terminal 42. Set the value to be the percentage of the full range of the variable selected in *AN-50 Terminal 42 Output*.

AN-52 Terminal 42 Output Max Scale		
Range:		**Function:**
100.00 %*	[0.00 - 200.00 %]	Scale the maximum output of the selected analog signal at terminal 42. Set the value to the maximum value of the current signal output. Scale the output to give a current lower than 20 mA at full scale, or 20 mA at an output below 100% of the maximum signal value. If 20mA is the desired output current at a value between 0–100% of the full-scale output, program the percentage value in the parameter, i.e., 50% = 20mA. If a current between 4 and 20mA is desired at maximum output (100%), calculate the percentage value as follows:

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

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



AN-53 Terminal 42 Output Bus Control		
Range:		**Function:**
0.00 %*	[0.00 - 100.00 %]	Holds the level of Output 42 if controlled by bus.

AN-54 Terminal 42 Output Time-out Preset		
Range:		**Function:**
0.00 %*	[0.00 - 100.00 %]	Holds the preset level of Output 42. In case of a bus timeout and a timeout function is selected in *AN-50 Terminal 42 Output* the output will preset to this level.

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

Selection	0-20mA	4-20mA
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 - Speedmax)	[107]	[137]

AN-55 Terminal 42 Output Filter		
Option:		**Function:**
[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 0-20mA or 4-20mA output. The current value can be read out in Keypad in *DR-65 Analog Output 42 [mA]*.
[0] *	No operation	When no signal on the analog output.
[100]	Output frequency	0hz = 0mA; 100hz = 20mA.
[101]	Reference	*F-50 Reference Range* [Min - Max] 0% = 0mA; 100% = 20mA *F-50 Reference Range* [-Max - Max] -100% = 0mA; 0% = 10mA; +100% = 20 mA
[102]	Feedback	*F-50 Reference Range* [Min - Max] 0% = 0mA; 100% = 20mA *F-50 Reference Range* [-Max - Max] -100% = 0mA; 0% = 10mA; +100% = 20 mA
[103]	Motor Current	Value is taken from *DR-37 Drive Max. Current*. Inverter max. current (160% current) is equal to 20mA. Example: Inverter norm current (15 hp [11 kW]) = 24 A. 160% = 38.4 A. Motor norm current = 22 A Readout 11.46mA. $\frac{20\ mA\ x\ 22\ A}{38.4\ A} = 11.46\ mA$ If the norm motor current is equal to 20mA, the output setting of *AN-62 Terminal X30/8 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 *F-40 Torque Limiter (Driving)*.
[105]	Torq relate to rated	The torque is related to the motor torque setting.
[106]	Power	Taken from *P-07 Motor Power [kW]*.
[107]	Speed	Taken from *F-53 Maximum Reference*. 20mA = value in *F-53 Maximum Reference*

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AN-60 Terminal X30/8 Output		
Option:		**Function:**
[108]	Torque	Torque reference related to 160% torque.
[109]	Max Out Freq	In relation to *F-03 Max Output Frequency 1*.
[113]	PID Clamped Output	
[119]	Torque % lim	Torque% lim: Torque reference. *F-50 Reference Range* [Min - Max] 0% = 0mA; 100% = 20mA *F-50 Reference Range* [-Max - Max] -100% = 0mA; 0% = 10mA; +100% = 20 mA
[130]	Output fr 4-20mA	0hz = 4mA, 100hz = 20mA
[131]	Reference 4-20 mA	*F-50 Reference Range* [Min-Max] 0% = 4mA; 100% = 20mA *F-50 Reference Range* [-Max-Max] -100% = 4mA; 0% = 12 mA; +100% = 20 mA
[132]	Feedback 4-20 mA	Feedback 4-20 mA: *F-50 Reference Range* [Min-Max] 0% = 4mA; 100% = 20mA *F-50 Reference Range* [-Max-Max] -100% = 4mA; 0% = 12 mA; +100% = 20 mA
[133]	Motor cur. 4-20 mA	Value is taken from *DR-37 Drive Max. Current*. Inverter max. current (160% current) is equal to 20mA.
[134]	Torq% lim 4-20mA	The torque setting is related to setting in *F-40 Torque Limiter (Driving)*.
[135]	Torq% nom 4-20mA	The torque setting is related to the motor torque setting.
[136]	Power 4-20 mA	Taken from *P-07 Motor Power [kW]*
[137]	Speed 4-20 mA	Taken from *F-53 Maximum Reference*. 20mA = Value in *F-53 Maximum Reference*.
[138]	Torque 4-20 mA	Torque reference related to 160% torque.
[139]	Bus ctrl. 0-20 mA	An output value set from Network process data. The output will work independently of internal functions in the drive.
[140]	Bus ctrl. 4-20 mA	An output value set from Network process data. The output will work independently of internal functions in the drive.
[141]	Bus ctrl 0-20mA t.o.	*H-74 Warning Reference Low* defines the behavior of the analog output in case of bus timeout.
[142]	Bus ctrl 4-20mA t.o.	*H-74 Warning Reference Low* defines the behavior of the analog output in case of bus timeout.

AN-60 Terminal X30/8 Output		
Option:		**Function:**
[149]	Torq% lim 4-20mA	Torque% Lim 4-20mA: Torque reference. *F-50 Reference Range* [Min-Max] 0% = 4mA; 100% = 20mA *F-50 Reference Range* [-Max - Max] -100% = 4mA; 0% = 12 mA; +100% = 20 mA
[150]	Max out fr 4-20mA	In relation to *F-03 Max Output Frequency 1*.

AN-61 Terminal X30/8 Min. Scale		
Range:		**Function:**
0.00 %*	[0.00 - 200.00 %]	Scales the minimum output of the selected analog signal on terminal X30/8. Scale the minimum value as a percentage of the maximum signal value, i.e., 0mA (or 0hz) is desired at 25% of the maximum output value and 25% is programmed. The value can never be higher than the corresponding setting in *AN-62 Terminal X30/8 Max. Scale* if value is below 100%. This parameter is active when option module OPCGPIO General Purpose I/O Option Module is mounted in the drive.

AN-62 Terminal X30/8 Max. Scale		
Range:		**Function:**
100.00 %*	[0.00 - 200.00 %]	Scales the maximum output of the selected analog signal on terminal X30/8. Scale the value to the desired maximum value of the current signal output. Scale the output to give a lower current than 20mA at full scale or 20mA at an output below 100% of the maximum signal value. If 20mA is the desired output current at a value between 0–100% of the full-scale output, program the percentage value in the parameter, i.e., 50% = 20mA. If a current between 4 and 20mA is desired at maximum output (100%), calculate the percentage value as follows:

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

$$i.e.\ 10\ mA\ :\ \frac{20-4}{10}\ x\ 100\ =\ 160\ \%$$

AN-63 Terminal X30/8 Bus Control		
Range:		**Function:**
0.00 %*	[0.00 - 100.00 %]	Holds the level of Output X30/8 if controlled by bus.

AN-64 Terminal X30/8 Output Timeout Preset		
Range:		**Function:**
0.00 %*	[0.00 - 100.00 %]	Holds the preset level of Output X30/8. If a bus timeout and a timeout function are selected in *AN-60 Terminal X30/8 Output*, the output will preset to this level.

3.9 SP-## Special Functions

Parameter group related to special functions with regards to Line Voltage, Reset Functions, Current Limit, Energy Savings, Derating, and Accel/Decel Ramp Types.

SP-00 Fault Level		
Option:		**Function:**
[0] *	Off	Use this parameter to customize fault levels. Use [0] "Off" with caution as it will ignore all warnings and alarms for the chosen source.

SP-00 Fault Level		
Option:		**Function:**
[1]	Warning	
[2]	Trip	
[3]	Trip Lock	

Failure	Alarm	Off	Warning	Trip	Trip Lock
10 V low	1	X	D		
24 V low	47	X			D
1.8 V supply low	48	X			D
Voltage limit	64	X	D		
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
Heatsink temperature	29			X	D
Heatsink sensor	39			X	D
Control card temperature	65			X	D
Power card temperature	6		2)	X	D
Heatsink temperature[1)]	244			X	D
Heatsink sensor [1)]	245			X	D
Power card temperature [1)]	247				

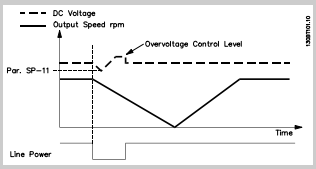
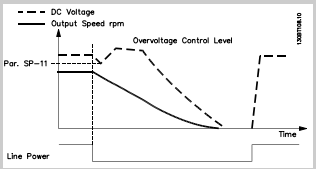
Table 3.5 Table for selection of choice of action when selected alarm appears

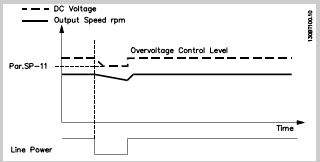
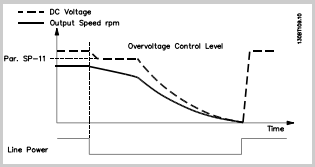
D = Default setting. x = possible selection.

1) Only high power drives

3.9.1 SP-1# Line On/Off

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

SP-10 Mains failure		
Option:		**Function:**
		SP-10 Mains failure is typically used where very short line power interruptions (voltage dips) are present. At 100% load and a short voltage interruption, the DC voltage on the main capacitors drops quickly. For larger drives it only takes a few milliseconds before the DC level is down to about 373 V DC and the main IGBT cuts off and looses the control over the motor. When the mains is restored, and the IGBT starts again, the output frequency and voltage vector does not correspond to the speed/frequency of the motor, and the result is normally an overvoltage or overcurrent, mostly resulting in a trip lock. *SP-10 Mains failure* can be programmed to avoid this situation. Select the function to which the drive must act when the threshold in *SP-11 Mains Voltage at Input Fault* has been reached. *SP-10 Mains failure* cannot be changed while motor is running. **Controlled decel:** The drive will perform a controlled decel. If *B-10 Brake Function* is *Off* [0] or *AC brake* [2], the ramp will follow the Overvoltage Ramping. If *B-10 Brake Function* is [1] *Resistor Brake,* the ramp will follow the setting in *C-23 Quick Stop Decel Time*. *Controlled decel [1]:* After power-up, the drive is ready for start. Controlled decel and trip [2]: After power-up, the drive needs a reset for starting.  

SP-10 Mains failure		
Option:		**Function:**
		1. The power is back before the energy from DC / moment of inertia from load is too low. The drive will perform a controlled decel when *SP-11 Mains Voltage at Input Fault* level has been reached. 2. The drive will perform a controlled decel as long as energy in the DC link is present. After this point, the motor will be coasted. **Kinetic backup:** The drive will perform a kinetic backup. If *B-10 Brake Function* is *Off* [0] or *AC brake* [2], the ramp will follow the overvoltage ramping. If *B-10 Brake Function* is [1] *Resistor Brake,* the ramp will follow the setting in *C-23 Quick Stop Decel Time*. Kinetic Backup [4]: The drive will keep on running as long as there is energy in the system due to the moment of inertia produced by the load. Kinetic Backup [5]: The drive will ride through on speed as long as the energy is present from moment of inertia from the load. If the DC voltage goes below *SP-11 Mains Voltage at Input Fault*, the drive will perform a trip.   **NOTE!** **For the best kinetic backup performance, the advanced motor data parameters, *P-30 Stator Resistance (Rs)* to *P-35 Main Reactance (Xh)*, must be accurate.**
[0] *	No function	This selection does not present a danger to the drive, but a trip lock would normally be the result of the short voltage interruptions.
[1]	Ctrl. Decel	This selection will keep the output frequency following the motor speed. The IGBT will not

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SP-10 Mains failure		
Option:		**Function:**
		lose the connection to the motor, but will follow the slow. This is particularly useful in pump applications where the inertia is low and the friction is high. When line power is restored, the output frequency will ramp the motor up to the reference speed (if the line power interruption is prolonged, the controlled ramp-down might take the output frequency all the way down to 0 rpm, and when line power is restored, the application is ramped up from 0 rpm to the previous reference speed via the normal ramp-up).
[2]	Ctrl. Decel, trip	
[3]	Coasting	Centrifuges can run for an hour without power supply. In those situations, it is possible to select a coast function at line power interruption, together with a flying start which occurs when line power is restored.
[4]	Kinetic back-up	Kinetic backup will maintain the DC level as long as possible, by converting the mechanical energy from the motor to the DC level supply. Fans normally can extend line power interruptions for several seconds. Pumps can normally only extend the interruptions for 1-2 seconds or fractions of seconds. Compressors only for fractions of seconds.
[5]	Kinetic back-up, trip	
[6]	Alarm	

SP-11 Mains Voltage at Input Fault		
Range:		**Function:**
342. V*	[180 - 600 V]	This parameter defines the threshold voltage at which the selected function in *SP-10 Mains failure* should be activated. The detection level is at a factor sqrt(2) of the value in *SP-11 Mains Voltage at Input Fault*.

SP-12 Function at Mains Imbalance		
Operating under severe line imbalance conditions reduces the lifetime of the motor. Conditions are considered severe if the motor operates continuously near nominal load (such as when a pump or fan runs near full speed).		
Option:		**Function:**
[0] *	Trip	Trips the drive
[1]	Warning	Issues a warning.

SP-12 Function at Mains Imbalance		
Operating under severe line imbalance conditions reduces the lifetime of the motor. Conditions are considered severe if the motor operates continuously near nominal load (such as when a pump or fan runs near full speed).		
Option:		**Function:**
[2]	Disabled	No action

SP-13 Line Failure Step Factor		
Range:		**Function:**
1.0 *	[0.0 - 5.0]	

3.9.2 SP-2# Reset Functions

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

SP-24 Trip Delay at Current Limit		
Range:		**Function:**
60 s*	[0 - 60 s]	Enter the current limit trip delay in seconds. When the output current reaches the current limit (*F-43 Current Limit*), a warning is triggered. When the current limit warning has been continuously present for the period specified in this parameter, the adjustable frequency drive trips. Disable the trip delay by setting the parameter to 60 s = OFF. Thermal monitoring of the adjustable frequency drive will still remain active.

SP-25 Trip Delay at Torque Limit		
Range:		**Function:**
60 s*	[0 - 60 s]	Enter the torque limit trip delay in seconds. When the output torque reaches the torque limits (*F-40 Torque Limiter (Driving)* and *F-41 Torque Limiter (Braking)*), a warning is triggered. When the torque limit warning has been continuously present for the period specified in this parameter, the drive trips. Disable the trip delay by setting the parameter to 60 sec. = OFF. Thermal monitoring of the drive will still remain active.

SP-26 Trip Delay at Drive Fault		
Range:		**Function:**
0. s*	[0 - 35 s]	When the drive detects an overvoltage in the set time, tripping will be effected after the set time. If value = 0, *protection mode* is disabled **NOTE!** **It is recommended to disable *protection mode* in hoisting applications.**

SP-29 Service Code		
Range:		Function:
0 *	[-2147483647 - 2147483647]	For internal service only.

3.9.3 SP-3# Current Limit Ctrl.

Parameters to configure the Current Limit Control which is activated when the motor current, and thus the torque, is higher than the torque limits set in par. F-40 Torque Limiter Driving and F-41 Torque Limiter Braking.

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

SP-31 Current Lim Ctrl, Integration Time		
Range:		Function:
0.020 s*	[0.002 - 2.000 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*	[1.0 - 100.0 ms]	

SP-35 Stall Protection		
Option:		Function:
		Select Enable [1] to enable the stall protection in field-weakening in flux mode. Select Disable [0] if you desire to disable it. This might cause the motor to be lost. *SP-35 Stall Protection* is active in flux mode only.
[0]	Disabled	
[1] *	Enabled	

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 %]	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.

NOTE!

This parameter cannot be adjusted while the motor is running.

NOTE!

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

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

NOTE!

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

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

NOTE!

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

SP-43 Motor Cos-Phi		
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.

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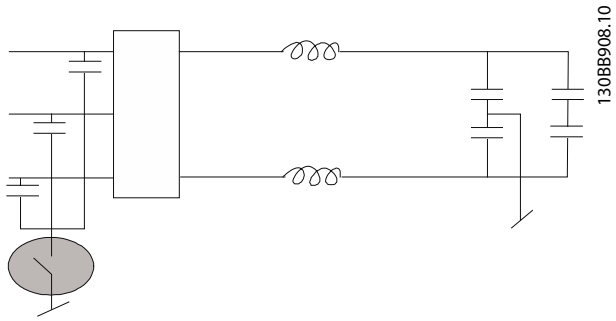
3.9.5 SP-5# Environment

Parameters to enable/disable the optional factory installed A1/B1 RFI Filter, and Fan Monitor and to configure an output filter if installed.

SP-50 RFI Filter

This parameter is only available for AF-650 GP. It is not relevant toAF-650 GP due to different design and shorter motor cables.

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



SP-51 DC Link Compensation

Option:		Function:
[0]	Off	Disables DC Link Compensation.
[1] *	On	Enables DC Link Compensation.

SP-52 Fan Operation

Select minimum speed of the main fan.

Option:		Function:
[0] *	Auto	Select *Auto* [0] to run fan only when internal temperature in drive is in the range 95°F [35°C] to approx. 131°F [55°C]. Fan runs at low speed below 95°F [35°C], and at full speed at approx. 131°F [55°C].
[1]	On 50%	
[2]	On 75%	
[3]	On 100%	

SP-53 Fan Monitor

Option:		Function:
		Select which reaction the drive should take in case a fan fault is detected.
[0]	Disabled	
[1] *	Warning	
[2]	Trip	

SP-55 Output Filter

Option:		Function:
		Select if a sine-wave output filter connected. This parameter cannot be adjusted while motor is running.
[0] *	No Filter	This is the default setting and should be used with dU/dt filters or high frequency common mode (HF-CM) filters.
[1]	Sine-Wave Filter	This setting is only for backwards compatibility. It enables operation with FLUX control principle when the parameters *SP-56 Capacitance Output Filter* and *SP-57 Inductance Output Filter* are programmed with the output filter capacitance and inductance. It DOES NOT limit the range of the switching frequency.
[2]		This parameter sets a minimum allowed limit to the switching frequency and ensures that the filter will be operated within the safe range of switching frequencies. Operation is possible with all control principles. For FLUX control principle, the parameters *SP-56 Capacitance Output Filter* and *SP-57 Inductance Output Filter* have to be programmed (these parameters have no effect in Advanced Vector Control and U/f). The modulation patter will be set to SFAVM which gives the lowest acoustic noise in the filter. Remember to always set *SP-55 Output Filter* to sine-wave fixed when you use a sine-wave filter.

SP-56 Capacitance Output Filter

Range:		Function:
2.0 uF*	[0.1 - 6500.0 uF]	Set the capacitance of the output filter. The value can be found on the filter label. **NOTE!** **This is required for correct compensation in flux mode (*H-41 Motor Control Principle*)**

SP-57 Inductance Output Filter		
Range:		**Function:**
7.000 mH*	[0.001 - 65.000 mH]	Set the inductance of the output filter. The value can be found on the filter label. **NOTE!** **This is required for correct compensation in flux mode (*H-41 Motor Control Principle*)**

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

SP-63 Option Supplied by External 24VDC		
Option:		**Function:**
[0]	No	Select No [0] to use the adjustable frequency drive's 24 V DC supply.
[1] *	Yes	Select Yes [1] if an external 24 V DC supply will be used to power the option. Inputs/outputs will be galvanically isolated from the drive when operated from an external supply.

NOTE!

This parameter is only changing function by performing a power cycle.

3.9.6 SP-7# Additional ADD/DEC Settings

Parameters to configure the jerk compensations for S-Ramps settings on Accel/Decel Ramps 1 through 4.

SP-71 Accl Time 1 S-ramp Rat at Accl Start		
Range:		**Function:**
50 %*	[1 - 99. %]	Enter the proportion of the total accel time (*F-07 Accl Time 1*) in which the acceleration torque increases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks occurring in the application.

SP-72 Accl Time 1 S-ramp Rat at Accl End		
Range:		**Function:**
50 %*	[1 - 99. %]	Enter the proportion of the total accel time (*F-07 Accl 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 Decl Time 1 S-ramp Rat at Decl Start		
Range:		**Function:**
50 %*	[1 - 99. %]	Enter the proportion of the total decel time (*F-08 Decl 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 Decl Time 1 S-ramp Rat at Decl End		
Range:		**Function:**
50 %*	[1 - 99. %]	Enter the proportion of the total decel time (*F-08 Decl Time 1*) where the deceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

SP-76 Accel/Decel Time 2 Type		
Option:		**Function:**
		Select the ramp type, depending on requirements for acceleration/deceleration. A linear ramp will give constant acceleration during ramping. An S-ramp will give non-linear acceleration, compensating for jerk in the application.
[0] *	Linear	
[1]	S-ramp Const Jerk	Acceleration with lowest possible jerk
[2]	S-ramp Const Time	S-ramp based on the values set in *E-10 Accl Time 2* and *E-11 Decl Time 2*

NOTE!

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

SP-79 Accl Time 2 S-ramp Rat at Accl Start		
Range:		**Function:**
50 %*	[1 - 99. %]	Enter the proportion of the total accel time (*E-10 Accl 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.

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SP-80 Accl Time 2 S-ramp Rat at Accl End

Range:		Function:
50 %*	[1 - 99. %]	Enter the proportion of the total accel time (*E-10 Accl 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 Decl Time 2 S-ramp Rat at Decl Start

Range:		Function:
50 %*	[1 - 99. %]	Enter the proportion of the total decel time (*E-11 Decl 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 Decl Time 2 S-ramp Rat at Decl End

Range:		Function:
50 %*	[1 - 99. %]	Enter the proportion of the total decel time (*E-11 Decl Time 2*) where the deceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

SP-84 Accel/Decel Ramp 3 Type

Option:		Function:
		Select the ramp type, depending on requirements for acceleration and deceleration. A linear ramp will give constant acceleration during ramping. An S-ramp will give non-linear acceleration, compensating for jerk in the application.
[0] *	Linear	
[1]	S-ramp Const Jerk	Accelerates with lowest possible jerk.
[2]	S-ramp Const Time	S-ramp based on the values set in *E-12 Accl Time 3* and *E-13 Decl Time 3*

NOTE!

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

SP-87 Accl Time 3 S-ramp Rat at Accl Start

Range:		Function:
50 %*	[1 - 99. %]	Enter the proportion of the total accel time (*E-12 Accl 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 Accl Time 3 S-ramp Rat at Accl End

Range:		Function:
50 %*	[1 - 99. %]	Enter the proportion of the total accel time (*E-12 Accl 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 Decl Time 3 S-ramp Rat at Decl Start

Range:		Function:
50 %*	[1 - 99. %]	Enter the proportion of the total decel time (*E-13 Decl 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 Decl Time 3 S-ramp Rat at Decl End

Range:		Function:
50 %*	[1 - 99. %]	Enter the proportion of the total decel time (*E-13 Decl Time 3*) where the deceleration torque decreases. The larger the percentage value, the greater the jerk compensation achieved, and thus the lower the torque jerks in the application.

SP-92 Accel/Decel Ramp 4 Type

Option:		Function:
		Select the ramp type, depending on requirements for acceleration and deceleration. A linear ramp will give constant acceleration during ramping. An S-ramp will give non-linear acceleration, compensating for jerk in the application.
[0] *	Linear	
[1]	S-ramp Const Jerk	Accelerates with lowest possible jerk.
[2]	S-ramp Const Time	S-ramp based on the values set in *E-14 Accl Time 4* and *E-15 Decl Time 4*.

NOTE!

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

SP-95 Accl Time 4 S-ramp Rat at Accl Start		
Range:		**Function:**
50 %*	[1 - 99. %]	Enter the proportion of the total accel time (*E-14 Accl 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 Accl Time 4 S-ramp Rat at Accl End		
Range:		**Function:**
50 %*	[1 - 99. %]	Enter the proportion of the total accell time (*E-14 Accl 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 Decl Time 4 S-ramp Rat at Decl Start		
Range:		**Function:**
50 %*	[1 - 99. %]	Enter the proportion of the total decel time (*E-15 Decl 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 Decl Time 4 S-ramp Rat at Decl End		
Range:		**Function:**
50 %*	[1 - 99. %]	Enter the proportion of the total decel time (*E-15 Decl 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.

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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 *O-50 Coasting Select* to *O-56 Preset Reference Select*.
[0] *	Digital and ctrl.word	Control by using both digital input and control word.
[1]	Digital only	Control by using digital inputs only.
[2]	Controlword only	Control by using control word only.

O-02 Control Word Source

Select the source of the control word: one of two serial interfaces or four installed options. During initial power-up, the drive automatically sets this parameter to *Option A* [3] if it detects a valid network option module installed in slot A. If the option is removed, the drive detects a change in the configuration, sets *O-02 Control Word Source* back to default setting RS-485, and the drive then trips. If an option is installed after initial power-up, the setting of *O-02 Control Word Source* will not change but the drive will trip and display: Alarm 67 *Option Changed*.
When you retrofit a bus option into a drive that did not have a bus option installed to begin with, you must take an ACTIVE decision to move the control to bus-based. This is done for safety reasons in order to avoid an accidental change.

Option:		Function:
[0]	None	
[1]	Drive RS485	
[2]	Drive USB	
[3] *	Option A	
[4]	Option B	
[5]	Option C0	
[6]	Option C1	
[30]	External Can	

NOTE!

This parameter cannot be adjusted while the motor is running.

O-03 Control Word Time-out Time

Range:		Function:
1.0 s*	[0.1 - 18000.0 s]	Enter the maximum time expected to pass between the reception of two consecutive messages. If this time is exceeded, it indicates that the serial communication has stopped. The function selected in *O-04 Control Word Time-out Function* will then be carried out. The timeout counter is triggered by a valid control word.

O-04 Control Word Time-out Function

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

Option:		Function:
[0] *	Off	Resumes control via serial bus (network or standard) using the most recent control word.
[1]	Freeze output	Freezes output frequency until communication resumes.
[2]	Stop	Stops with auto-restart when communication resumes.
[3]	Jogging	Runs the motor at JOG frequency until communication resumes.
[4]	Max. speed	Runs the motor at maximum frequency until communication resumes.
[5]	Stop and trip	Stops the motor, then resets the drive in order to restart: via the network, via the reset button on the Keypad or via a digital input.
[7]	Select set-up 1	Changes the set-up upon reestablishment of communication following a control word timeout. If communication resumes causing the timeout situation to disappear, *O-05 End-of-Time-out Function* defines whether to resume the set-up used before the timeout or to retain the set-up endorsed by the timeout function.
[8]	Select set-up 2	See [7] *Select setup 1*
[9]	Select set-up 3	See [7] *Select setup 1*
[10]	Select set-up 4	See [7] *Select setup 1*
[26]		

NOTE!

The following configuration is required in order to change the set-up after a timeout:
Set *K-10 Active Set-up* to [9] *Multi set-up* and select the relevant link in *K-12 This Set-up Linked to*.

O-05 End-of-Time-out Function

Option:		Function:
		Select the action after receiving a valid control word following a timeout. This parameter is active only when *O-04 Control Word Time-out Function* is set to [Set-up 1-4].
[0]	Hold set-up	Retains the set-up selected in *O-04 Control Word Time-out Function* and displays a warning, until *O-06 Reset Control Word Time-out* toggles. Then the drive resumes its original set-up.
[1] *	Resume set-up	Resumes the set-up active prior to the timeout.

O-06 Reset Control Word Time-out

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

Option:		Function:
[0] *	Do not reset	Retains the set-up specified in *O-04 Control Word Time-out Function*, following a control word timeout.
[1]	Do reset	Returns the drive to the original set-up following a control word timeout. The drive performs the reset and then immediately reverts to the *Do not reset* [0] setting

O-07 Diagnosis Trigger

Option:		Function:
		This parameter enables and controls the drive diagnosis function and permits expansion of the diagnosis data to 24 byte.

NOTE!

This is only valid for Profibus.

- *Disable* [0]: Do not send extended diagnosis data even if they appear in the drive.
- *Trigger on alarms* [1]: Send extended diagnosis data when one or more alarms appear in alarm *DR-90 Alarm Word* or *PB-53 Profibus Warning Word*.
- *Trigger alarms/warn.* [2]: Send extended diagnosis data if one or more alarms or warnings appear in alarm *DR-90 Alarm Word*, *PB-53 Profibus Warning Word*, or warning *DR-92 Warning Word*.

The content of the extended diagnosis frame is as follows:

Byte	Content	Description
0–5	Standard DP Diagnose Data	Standard DP Diagnose Data
6	PDU length xx	Header of extended diagnostic data
7	Status type = 0x81	Header of extended diagnostic data
8	Slot = 0	Header of extended diagnostic data
9	Status info = 0	Header of extended diagnostic data
10–13	*DR-92 Warning Word*	warning word
14–17	*DR-03 Status Word*	status word
18–21	*DR-90 Alarm Word*	alarm word
22–23	*PB-53 Profibus Warning Word*	Communication warning word (Profibus)

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

O-07 Diagnosis Trigger

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

O-08 Readout Filtering

The function is used if the speed feedback value readouts on serial communication bus are fluctuating. Select filtered if the function is required. A power-cycle is required for changes to take effect.

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

3

O-08 Readout Filtering		
The function is used if the speed feedback value readouts on serial communication bus are fluctuating. Select filtered if the function is required. A power-cycle is required for changes to take effect.		
Option:		**Function:**
		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 network. Only the selections valid for the network installed in slot A will be visible in the Keypad display. For guidelines in selection of *GE Drive profile* [0] and *PROFIdrive profile* [1] please refer to the *Serial communication via RS 485 Interface* section. For additional guidelines in the selection of *PROFIdrive profile* [1] and *ODVA* [5], please refer to the Instruction Manual for the installed network.		
Option:		**Function:**
[0] *	Drive Profile	
[1]	PROFIdrive profile	
[5]	ODVA	

O-13 Configurable Status Word STW		
Option:		**Function:**
		This parameter enables configuration of bits 12 – 15 in the status word.
[0]	No function	
[1] *	Profile Default	Function corresponds to the profile default selected in *O-10 Control Word Profile*.
[2]	Alarm 68 Only	Only set in case of an Alarm 68.
[3]	Trip excl Alarm 68	Set in the event of a trip, except if the trip is executed by Alarm 68.
[16]	T37 DI status	The bit indicates the status of terminal 37. "1" indicates T37 is high (normal) only available in AF-650 GP.

O-14 Configurable Control Word CTW		
Option:		**Function:**
		Selection of control word bit 10 if it is active low or active high
[0]	None	
[1] *	Profile default	
[2]	CTW Valid, act. low	

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 as described in the *AF-650 GP Design Guide, RS485 Installation and Set-up*.
[1]	Drive MC	Select the protocol for the drive (standard) port.
[2] *	Modbus RTU	

O-31 Address		
Range:		**Function:**
1. *	[1. - 126.]	Enter the address for the Drive (standard) port. Valid range: 1 - 126.

O-32 Drive Port Baud Rate		
Option:		**Function:**
[0]	2400 Baud	Baud rate selection for the Drive (standard) port.
[1]	4800 Baud	
[2] *	9600 Baud	
[3]	19200 Baud	
[4]	38400 Baud	
[5]	57600 Baud	
[6]	76800 Baud	
[7]	115200 Baud	

O-33 Drive Port Parity		
Option:		**Function:**
		Parity and Stop Bits for the protocol *O-30 Protocol* using the Drive Port. For some of the protocols, not all options will be visible. Default depends on the protocol selected.
[0] *	Ev. 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 a noisy environments, the interface may be blocked by due to overload of bad frames. This parameter specifies the time between two consecutive frames on the network. If the interface does not detect valid frames in that time it flushes the receive buffer.

O-35 Minimum Response Delay		
Range:		**Function:**
10 ms*	[1 - 10000. ms]	Specify the minimum delay time between receiving a request and transmitting a response. This is used for overcoming modem turnaround delays.

O-36 Max Response Delay		
Range:		**Function:**
10001. ms*	[11. - 10001 ms]	Specify the maximum permissible delay time between transmitting a request and receiving a response. If a response from the drive is exceeding the time setting then it will be discarded.

O-37 Max Inter-Char Delay		
Range:		**Function:**
25.00 ms*	[0.00 - 35.00 ms]	Specify the maximum permissible time interval between receiving two bytes. This parameter activates timeout if transmission is interrupted. This parameter is active only when *O-30 Protocol* is set to *Drive MC* [1] protocol.

3.10.4 O-4# Drive MC Port Settings

Parameters to configure the standard message or custom message for the GE drive port.

O-40 Telegram Selection		
Option:		**Function:**
[1] *	Standard telegram 1	Enables use of freely configurable messages or standard messages for the Drive port.
[100]		
[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]		

O-41 Parameters for Signals		
Option:		**Function:**
[0] *	None	This parameter contains a list of signals available for selection in *O-42 PCD Write Configuration* and *O-43 PCD Read Configuration*.
[001]	Accl Time 1	
[002]	Decl Time 1	
[015]	Motor Speed High Limit [Hz]	
[016]	Motor Speed Low Limit [Hz]	
[017]	Motor Speed High Limit [RPM]	
[018]	Motor Speed Low Limit [RPM]	
[040]	Torque Limiter (Driving)	
[041]	Torque Limiter (Braking)	
[052]	Minimum Reference	
[053]	Maximum Reference	
[062]	Catch up/speed down value	
[110]	Accl Time 2	
[111]	Decl Time 2	
[190]	Digital & Relay Bus Control	
[193]	Pulse Out #27 Bus Control	
[195]	Pulse Out #29 Bus Control	
[197]	Pulse Out #X30/6 Bus Control	
[222]	Jog Accel/Decel Time	
[223]	Quick Stop Decel Time	
[653]	Terminal 42 Output Bus Control	
[663]	Terminal X30/8 Bus Control	
[673]	Terminal X45/1 Bus Control	
[683]	Terminal X45/3 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]	Motor Voltage	
[1213]	Frequency	
[1214]	Motor Current	
[1215]	Frequency [%]	
[1216]	Torque [Nm]	
[1217]	Speed [RPM]	
[1218]	Motor Thermal	
[1219]	KTY sensor temperature	
[1220]	Motor Angle	
[1221]		
[1222]	Torque [%]	

O-41 Parameters for Signals		
Option:		**Function:**
[1225]	Torque [Nm] High	
[1230]	DC Link Voltage	
[1232]	Brake Power /s	
[1233]	Brake Power /2 min	
[1234]	Heatsink Temp.	
[1235]	Drive Thermal	
[1236]	Drive Nominal Current	
[1237]	Drive Max. Current	
[1238]	Logic Controller State	
[1239]	Control Card Temp.	
[1250]	External Reference	
[1251]	Pulse Reference	
[1252]	Feedback [Unit]	
[1253]	Digi Pot Reference	
[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]	
[1278]	Analog Out X45/1 [mA]	
[1279]	Analog Out X45/3 [mA]	
[1280]	Fieldbus CTW 1	
[1282]	Fieldbus REF 1	
[1284]	Comm. Option STW	
[1285]	Drive Port CTW 1	
[1286]	Drive Port REF 1	
[1290]	Alarm Word	
[1291]	Alarm Word 2	
[1292]	Warning Word	
[1293]	Warning Word 2	
[1294]	Ext. Status Word	
[1500]	Operating Hours	
[1501]	Running Hours	
[1502]	kWh Counter	

O-42 PCD Write Configuration		
Option:		**Function:**
[0]	None	Select the parameters to be assigned to the PCD's messages. The number of available PCDs depends on the message type. The values in the PCDs will then be written to the selected parameters as data values.
[007]	Accl Time 1	
[008]	Decl Time 1	
[015]	Motor Speed High Limit [Hz]	
[016]	Motor Speed Low Limit [Hz]	
[017]	Motor Speed High Limit [RPM]	
[018]	Motor Speed Low Limit [RPM]	
[040]	Torque Limiter (Driving)	
[041]	Torque Limiter (Braking)	
[052]	Minimum Reference	
[053]	Maximum Reference	
[062]	Catch up/speed down value	
[110]	Accl Time 2	
[111]	Decl Time 2	
[190]	Digital & Relay Bus Control	
[193]	Pulse Out #27 Bus Control	
[195]	Pulse Out #29 Bus Control	
[197]	Pulse Out #X30/6 Bus Control	
[222]	Jog Accel/Decel Time	
[223]	Quick Stop Decel Time	
[653]	Terminal 42 Output Bus Control	
[663]	Terminal X30/8 Bus Control	
[673]	Terminal X45/1 Bus Control	
[683]	Terminal X45/3 Bus Control	
[890]	Bus Jog 1 Speed	
[891]	Bus Jog 2 Speed	
[1280]	Fieldbus CTW 1	
[1282]	Fieldbus REF 1	

O-43 PCD Read Configuration		
Option:		**Function:**
[0]	None	Select the parameters to be assigned to PCDs of the messages. The number of available PCDs depends on the message type. PCDs contain the actual data values of the selected parameters.
[1200]	Control Word	
[1201]	Reference [Unit]	

O-43 PCD Read Configuration		
Option:		Function:
[1202]	Reference %	
[1203]	Status Word	
[1205]	Main Actual Value [%]	
[1209]	Custom Readout	
[1210]	Power [kW]	
[1211]	Power [hp]	
[1212]	Motor Voltage	
[1213]	Frequency	
[1214]	Motor Current	
[1215]	Frequency [%]	
[1216]	Torque [Nm]	
[1217]	Speed [RPM]	
[1218]	Motor Thermal	
[1219]	KTY sensor temperature	
[1220]	Motor Angle	
[1221]		
[1222]	Torque [%]	
[1225]	Torque [Nm] High	
[1230]	DC Link Voltage	
[1232]	Brake Power /s	
[1233]	Brake Power /2 min	
[1234]	Heatsink Temp.	
[1235]	Drive Thermal	
[1236]	Drive Nominal Current	
[1237]	Drive Max. Current	
[1238]	Logic Controller State	
[1239]	Control Card Temp.	
[1250]	External Reference	
[1251]	Pulse Reference	
[1252]	Feedback [Unit]	
[1253]	Digi Pot Reference	
[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]	
[1278]	Analog Out X45/1 [mA]	

O-43 PCD Read Configuration		
Option:		Function:
[1279]	Analog Out X45/3 [mA]	
[1280]	Fieldbus CTW 1	
[1282]	Fieldbus REF 1	
[1284]	Comm. Option STW	
[1285]	Drive Port CTW 1	
[1286]	Drive Port REF 1	
[1290]	Alarm Word	
[1291]	Alarm Word 2	
[1292]	Warning Word	
[1293]	Warning Word 2	
[1294]	Ext. Status Word	
[1500]	Operating Hours	
[1501]	Running Hours	
[1502]	kWh Counter	

3.10.5 O-5# Digital/Bus

Parameters to configure the control word digital/bus merging.

O-50 Coasting Select		
Option:		Function:
		Select control of the coasting function via the terminals (digital input) and/or via the network.
[0]	Digit Input	Activates Coast command via a digital input.
[1]	Bus	Activates Coast command via the serial communication port or network option module.
[2]	Logic AND	Activates Coast command via the network/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activates Coast command via the network/serial communication port OR via one of the digital inputs.

O-51 Quick Stop Select		
Select control of the quick stop function via the terminals (digital input) and/or via the network.		
Option:		Function:
[0]	Digital Input	
[1]	Bus	
[2]	Logic AND	
[3] *	Logic OR	

O-52 DC Brake Select		
Option:		Function:
		Select control of the DC brake via the terminals (digital input) and/or via the serial communi-cation bus.

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

O-53 Start Select		
Option:		**Function:**
		Select control of the drive start function via the terminals (digital input) and/or via the network.
[0]	Digit Input	Activates Start command via a digital input.
[1]	Bus	Activates Start command via the serial communication port or network option module.
[2]	Logic AND	Activates Start command via the network/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activates Start command via the network/serial communication port OR via one of the digital inputs.

O-54 Reversing Select		
Option:		**Function:**
[0]	Digital Input	Select control of the drive reverse function via the terminals (digital input) and/or via the network.
[1]	Bus	Activates the Reverse command via the serial communication port or network option module.
[2]	Logic AND	Activates the Reverse command via the network/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activates the Reverse command via the network/serial communication port OR via one of the digital inputs.

O-55 Set-up Select		
Option:		**Function:**
		Select control of the drive set-up selection via the terminals (digital input) and/or via the network.
[0]	Digit Input	Activates the set-up selection via a digital input.
[1]	Bus	Activates the set-up selection via the serial communication port or network option module.
[2]	Logic AND	Activates the set-up selection via the network/ serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activate the set-up selection via the network/ serial communication port OR via one of the digital inputs.

O-56 Preset Reference Select		
Option:		**Function:**
		Select control of the drive Preset Reference selection via the terminals (digital input) and/or via the network.
[0]	Digit Input	Activates Preset Reference selection via a digital input.
[1]	Bus	Activates Preset Reference selection via the serial communication port or network option module.
[2]	Logic AND	Activates Preset Reference selection via the network/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activates the Preset Reference selection via the network/serial communication port OR via one of the digital inputs.

3.10.6 O-8# Drive Port Diagnostics

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

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

O-82 Slave Messages Rcvd		
Range:		**Function:**
0 *	[0 - 0]	This parameter shows the number of valid messages addressed to the slave, sent by the drive.

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 drive.

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. This is a fixed jog speed activated 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. This is a fixed jog speed activated via the serial port or network option.

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3.11 DN-## CAN Ser. Com. Bus

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

3.11.1 DN-0# Common Settings

Parameters to configure the common settings for DeviceNet.

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

NOTE!
The options depend on installed option.

DN-01 Baud Rate Select		
Select the network transmission speed. The selection must correspond to the transmission speed of the master and the other network nodes.		
Option:		**Function:**
[16]	10 Kbps	
[17]	20 Kbps	
[18]	50 Kbps	
[19]	100 Kbps	
[20] *	125 Kbps	
[21]	250 Kbps	
[22]	500 Kbps	

DN-02 MAC ID		
Range:		**Function:**
63. *	[0 - 63.]	Selection of station address. Every station connected to the same network must have an unambiguous address.

DN-05 Readout Transmit Error Counter		
Range:		**Function:**
0 *	[0 - 255]	View the number of CAN control transmission errors since the last power-up.

DN-06 Readout Receive Error Counter		
Range:		**Function:**
0 *	[0 - 255]	View the number of CAN control receipt errors since the last power-up.

DN-07 Readout Bus Off Counter		
Range:		**Function:**
0 *	[0 - 255]	View the number of Bus Off events since the last power-up.

3.11.2 DN-1# DeviceNet

Parameters to configure the Process Data Type, Config Write, Config Read, Warnings, and keypad control of DeviceNet.

DN-10 Process Data Type Selection		
Option:		**Function:**
		Select the Instance (message) for data transmission. The instances available are dependent upon the setting of *O-10 Control Word Profile*. When *O-10 Control Word Profile* is set to [0] *Drive protocol*, *DN-10 Process Data Type Selection* options [0] and [1] are available. When *O-10 Control Word Profile* is set to [5] *ODVA*, *DN-10 Process Data Type Selection* options [2] and [3] are available. Instances 100/150 and 101/151 are GE-specific. Instances 20/70 and 21/71 are ODVA-specific AC Drive profiles. For guidelines in message selection, please refer to the *DeviceNet Instruction Manual*. Note that a change to this parameter will be executed immediately.
[0] *	INSTANCE 100/150	
[1]	INSTANCE 101/151	
[2]	INSTANCE 20/70	
[3]	INSTANCE 21/71	

DN-11 Process Data Config Write		
Select the process write data for I/O assembly instances 101/151. Elements [2] and [3] of this array can be selected. Elements [0] and [1] of the array are fixed.		
Option:		**Function:**
[0]	None	
[007]	Accl Time 1	
[008]	Decl Time 1	
[010]	Accl Time 2	
[011]	Decl Time 2	
[015]	Motor Speed High Limit [Hz]	
[016]	Motor Speed Low Limit [Hz]	
[017]	Motor Speed High Limit [RPM]	
[018]	Motor Speed Low Limit [RPM]	
[040]	Torque Limiter (Driving)	
[041]	Torque Limiter (Braking)	
[052]	Minimum Reference	
[053]	Maximum Reference	
[062]	Catch up/speed down value	

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:
[190]	Digital & Relay Bus Control	
[193]	Pulse Out #27 Bus Control	
[195]	Pulse Out #29 Bus Control	
[197]	Pulse Out #X30/6 Bus Control	
[222]	Jog Accel/Decel Time	
[223]	Quick Stop Decel Time	
[653]	Terminal 42 Output Bus Control	
[663]	Terminal X30/8 Bus Control	
[673]	Terminal X45/1 Bus Control	
[683]	Terminal X45/3 Bus Control	
[890]	Bus Jog 1 Speed	
[891]	Bus Jog 2 Speed	
[1280]	Fieldbus CTW 1	
[1282]	Fieldbus REF 1	

Select the process write data for I/O assembly instances 101/151. Elements [2] and [3] of this array can be selected. Elements [0] and [1] of the array are fixed.

DN-12 Process Data Config Read

Select the process read data for I/O assembly instances 101/151. Elements [2] and [3] of this array can be selected. Elements [0] and [1] of the array are fixed.

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

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:
[1232]	Brake Power /s	
[1233]	Brake Power /2 min	
[1234]	Heatsink Temp.	
[1235]	Drive Thermal	
[1236]	Drive Nominal Current	
[1237]	Drive Max. Current	
[1238]	Logic Controller State	
[1239]	Control Card Temp.	
[1250]	External Reference	
[1251]	Pulse Reference	
[1252]	Feedback [Unit]	
[1253]	Digi Pot Reference	
[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]	
[1278]	Analog Out X45/1 [mA]	
[1279]	Analog Out X45/3 [mA]	
[1280]	Fieldbus CTW 1	
[1282]	Fieldbus REF 1	
[1284]	Comm. Option STW	
[1285]	Drive Port CTW 1	
[1286]	Drive Port REF 1	
[1290]	Alarm Word	
[1291]	Alarm Word 2	
[1292]	Warning Word	
[1293]	Warning Word 2	
[1294]	Ext. Status Word	
[1500]	Operating Hours	
[1501]	Running Hours	
[1502]	kWh Counter	

3

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 Instruction Manual for further information.

Bit:	Meaning:
0	not active
1	Explicit connection timeout
2	I/O connection
3	Retry limit reached
4	Actual is not updated
5	CAN bus off
6	I/O send error
7	Initialization error
8	No bus supply
9	Bus off
10	Error passive
11	Error warning
12	Duplicate MAC ID Error
13	RX queue overrun
14	TX queue overrun
15	CAN overrun

DN-14 Net Reference		
Read only from Keypad		
Option:		**Function:**
		Select the reference source in instance 21/71 and 20/70.
[0] *	Off	Enables reference via analog/digital inputs.
[1]	On	Enables reference via the network.

DN-15 Net Control		
Read only from Keypad		
Option:		**Function:**
		Select the control source in Instance 21/71 and 20/70.
[0] *	Off	Enables control via analog/digital inputs.
[1]	On	Enable control via the network.

3.11.3 DN-2# COS Filters

Parameters to configure the filtering of change of state data.

DN-20 COS Filter 1		
Range:		**Function:**
0 *	[0 - 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-20 COS Filter 1		
Range:		**Function:**
		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 serial communication bus is installed.

DN-31 Store Data Values		
Option:		**Function:**
		Parameter values changed via DeviceNet are not automatically stored in non-volatile memory. Use this parameter to activate a function that stores parameter values in the EEPROM non-volatile memory, so that changed parameter values will be retained at power-down.
[0] *	Off	Deactivates the non-volatile storage function.
[1]	Store all set-ups	Stores all parameter values from the active set-up in the non-volatile memory. The selection returns to Off [0] when all values have been stored.
[2]	Store all set-ups	Stores all parameter values for all set-ups in the non-volatile memory. The selection returns to *Off* [0] when all parameter values have been stored.

DN-32 DeviceNet Revision		
Range:		**Function:**
0 *	[0 - 65535]	View the DeviceNet revision number. This parameter is used for EDS file creation.

DN-33 Store Always		
Option:		**Function:**
[0] *	Off	Deactivates non-volatile storage of data.
[1]	On	Stores parameter data received via DeviceNet in EEProm non-volatile memory as default.

DN-39 DeviceNet F Parameters		
Array [1000]		
No Keypad access		
Range:		**Function:**
0 *	[0 - 0]	This parameter is used to configure the drive via DeviceNet and build the EDS file.

3

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 drive is taken from this parameter, whereas the cyclical reference will be ignored.

PB-07 Actual Value

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

PB-15 PCD Write Configuration

Array [10]

Option:		Function:
		Select the parameters to be assigned to PCD 3 to 10 of the messages. The number of available PCDs depends on the message type. The values in PCD 3 to 10 will then be written to the selected parameters as data values. Alternatively, specify a standard Profibus message in *PB-22 Telegram Selection*.
[0] *	None	
[007]	Accl Time 1	
[008]	Decl Time 1	
[015]	Motor Speed High Limit [Hz]	
[016]	Motor Speed Low Limit [Hz]	
[017]	Motor Speed High Limit [RPM]	
[018]	Motor Speed Low Limit [RPM]	
[040]	Torque Limiter (Driving)	
[041]	Torque Limiter (Braking)	
[052]	Minimum Reference	
[053]	Maximum Reference	
[062]	Catch up/speed down value	
[110]	Accl Time 2	
[111]	Decl Time 2	
[190]	Digital & Relay Bus Control	
[193]	Pulse Out #27 Bus Control	
[195]	Pulse Out #29 Bus Control	

PB-15 PCD Write Configuration

Array [10]

Option:		Function:
[197]	Pulse Out #X30/6 Bus Control	
[222]	Jog Accel/Decel Time	
[223]	Quick Stop Decel Time	
[653]	Terminal 42 Output Bus Control	
[663]	Terminal X30/8 Bus Control	
[673]	Terminal X45/1 Bus Control	
[683]	Terminal X45/3 Bus Control	
[890]	Bus Jog 1 Speed	
[891]	Bus Jog 2 Speed	
[1280]	Fieldbus CTW 1	
[1282]	Fieldbus REF 1	

PB-16 PCD Read Configuration

Array [10]

Option:		Function:
		Select the parameters to be assigned to PCD 3 to 10 of the messages. The number of available PCDs depends on the message type. PCDs 3 to 10 contain the actual data values of the selected parameters. For standard Profibus messages, see *PB-22 Telegram Selection*.
[0] *	None	
[1200]	Control Word	
[1201]	Reference [Unit]	
[1202]	Reference %	
[1203]	Status Word	
[1205]	Main Actual Value [%]	
[1209]	Custom Readout	
[1210]	Power [kW]	
[1211]	Power [hp]	
[1212]	Motor Voltage	
[1213]	Frequency	
[1214]	Motor Current	
[1215]	Frequency [%]	
[1216]	Torque [Nm]	
[1217]	Speed [RPM]	
[1218]	Motor Thermal	
[1219]	KTY sensor temperature	
[1220]	Motor Angle	
[1221]		
[1222]	Torque [%]	
[1225]	Torque [Nm] High	
[1230]	DC Link Voltage	

PB-16 PCD Read Configuration

Array [10]

Option:		Function:
[1232]	Brake Power /s	
[1233]	Brake Power /2 min	
[1234]	Heatsink Temp.	
[1235]	Drive Thermal	
[1236]	Drive Nominal Current	
[1237]	Drive Max. Current	
[1238]	Logic Controller State	
[1239]	Control Card Temp.	
[1250]	External Reference	
[1251]	Pulse Reference	
[1252]	Feedback [Unit]	
[1253]	Digi Pot Reference	
[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]	
[1278]	Analog Out X45/1 [mA]	
[1279]	Analog Out X45/3 [mA]	
[1280]	Fieldbus CTW 1	
[1282]	Fieldbus REF 1	
[1284]	Comm. Option STW	
[1285]	Drive Port CTW 1	
[1286]	Drive Port REF 1	
[1290]	Alarm Word	
[1291]	Alarm Word 2	
[1292]	Warning Word	
[1293]	Warning Word 2	
[1294]	Ext. Status Word	
[1500]	Operating Hours	
[1501]	Running Hours	
[1502]	kWh Counter	

PB-18 Node Address

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

PB-22 Telegram Selection

Displays the Profibus message configuration.

Option:		Function:
[1]	Standard telegram 1	
[100] *		
[101]	PPO 1	
[102]	PPO 2	
[103]	PPO 3	
[104]	PPO 4	
[105]	PPO 5	
[106]	PPO 6	
[107]	PPO 7	
[108] *	PPO 8	Read only.
[200]	Custom telegram 1	
[202]		

PB-23 Parameters for Signals

Array [1000]

Read only

Option:		Function:
		This parameter contains a list of signals available for selection in *PB-15 PCD Write Configuration* and *PB-16 PCD Read Configuration*.
[0] *	None	
[007]	Accl Time 1	
[008]	Decl Time 1	
[015]	Motor Speed High Limit [Hz]	
[016]	Motor Speed Low Limit [Hz]	
[017]	Motor Speed High Limit [RPM]	
[018]	Motor Speed Low Limit [RPM]	
[040]	Torque Limiter (Driving)	
[041]	Torque Limiter (Braking)	
[052]	Minimum Reference	
[053]	Maximum Reference	
[062]	Catch up/speed down value	
[110]	Accl Time 2	
[111]	Decl Time 2	
[190]	Digital & Relay Bus Control	

PB-23 Parameters for Signals		
Array [1000]		
Read only		
Option:		**Function:**
[193]	Pulse Out #27 Bus Control	
[195]	Pulse Out #29 Bus Control	
[197]	Pulse Out #X30/6 Bus Control	
[222]	Jog Accel/Decel Time	
[223]	Quick Stop Decel Time	
[653]	Terminal 42 Output Bus Control	
[663]	Terminal X30/8 Bus Control	
[673]	Terminal X45/1 Bus Control	
[683]	Terminal X45/3 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]	Motor Voltage	
[1213]	Frequency	
[1214]	Motor Current	
[1215]	Frequency [%]	
[1216]	Torque [Nm]	
[1217]	Speed [RPM]	
[1218]	Motor Thermal	
[1219]	KTY sensor temperature	
[1220]	Motor Angle	
[1221]		
[1222]	Torque [%]	
[1225]	Torque [Nm] High	
[1230]	DC Link Voltage	
[1232]	Brake Power /s	
[1233]	Brake Power /2 min	
[1234]	Heatsink Temp.	
[1235]	Drive Thermal	
[1236]	Drive Nominal Current	
[1237]	Drive Max. Current	
[1238]	Logic Controller State	
[1239]	Control Card Temp.	
[1250]	External Reference	
[1251]	Pulse Reference	
[1252]	Feedback [Unit]	
[1253]	Digi Pot Reference	
[1260]	Digital Input	
[1261]	Terminal 53 Switch Setting	
[1262]	Analog Input 53	

PB-23 Parameters for Signals		
Array [1000]		
Read only		
Option:		**Function:**
[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]	
[1278]	Analog Out X45/1 [mA]	
[1279]	Analog Out X45/3 [mA]	
[1280]	Fieldbus CTW 1	
[1282]	Fieldbus REF 1	
[1284]	Comm. Option STW	
[1285]	Drive Port CTW 1	
[1286]	Drive Port REF 1	
[1290]	Alarm Word	
[1291]	Alarm Word 2	
[1292]	Warning Word	
[1293]	Warning Word 2	
[1294]	Ext. Status Word	
[1500]	Operating Hours	
[1501]	Running Hours	
[1502]	kWh Counter	

PB-27 Parameter Edit		
Option:		**Function:**
		Parameters can be edited via Profibus, the standard RS485 interface, or the Keypad.
[0]	Disabled	Disables editing via Profibus.
[1] *	Enabled	Enables editing via Profibus.

PB-28 Process Control

Option:		Function:
		Process control (setting of the control word, speed reference, and process data) is possible via either Profibus or standard network but not both simultaneously. Local control is always possible via the Keypad. Control via process control is possible via either terminals or network depending on the settings in *O-50 Coasting Select* to *O-56 Preset Reference Select*.
[0]	Disable	Disables process control via Profibus, and enables process control via standard network or Profibus Master class 2.
[1] *	Enable cyclic master	Enables process control via Profibus Master Class 1, and disables process control via standard network or Profibus Master class 2.

PB-44 Fault Message Counter

Range:		Function:
0 *	[0 - 65535]	This parameter displays the number of error events stored in *PB-45 Fault Code* and *PB-47 Fault Number*. The maximum buffer 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 the 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 line 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 the last reset of power-up.

PB-53 Profibus Warning Word

Range:		Function:
0 *	[0 - 65535]	This parameter displays Profibus communication warnings. Please refer to the *Profibus Instruction Manual* for further information.

Read only

Bit:	Meaning:
0	Connection with DP master is not ok
1	Not used
2	(Network Data link Layer) is not ok
3	Clear data command received
4	Actual value is not updated
5	Baudrate search
6	PROFIBUS ASIC is not transmitting
7	Restore of PROFIBUS is not ok
8	Drive is tripped
9	Internal CAN error
10	Wrong configuration data from PLC
11	Wrong ID sent by PLC
12	Internal error occured
13	Not configured
14	Timeout active
15	Warning 34 active

PB-63 Actual Baud Rate

Option:		Function:
		This parameter displays the actual Profibus baud rate. The Profibus Master automatically sets the baud rate.
[0]	9.6 kbit/s	
[1]	19.2 kbit/s	
[2]	93.75 kbit/s	
[3]	187.5 kbit/s	
[4]	500 kbit/s	
[6]	1500 kbit/s	
[7]	3000 kbit/s	
[8]	6000 kbit/s	
[9]	12000 kbit/s	
[10]	31.25 kbit/s	
[11]	45.45 kbit/s	
[255] *	No baud rate found	

PB-64 Device Identification

Range:		Function:
0 *	[0 - 0]	This parameter displays the device identification. Please refer to the *Instruction Manual for Profibus,* for further explanation.

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

NOTE!

This parameter is not visible via Keypad.

PB-67 Control Word 1		
Range:		**Function:**
0 *	[0 - 65535]	This parameter accepts the control word from a Master Class 2 in the same format as PCD 1.

PB-68 Status Word 1		
Range:		**Function:**
0 *	[0 - 65535]	This parameter delivers the status word for a Master Class 2 in the same format as PCD 2.

PB-71 Profibus Save Data Values		
Option:		**Function:**
		Parameter values changed via Profibus are not automatically stored in non-volatile memory. Use this parameter to activate a function that stores parameter values in the EEPROM non-volatile memory, so changed parameter values will be retained at power-down.
[0] *	Off	Deactivates the non-volatile storage function.
[1]	Store all set-ups	Stores all parameter values for all set-ups in the non-volatile memory. The selection returns to *Off* [0] when all parameter values have been stored.
[2]	Store all set-ups	Stores all parameter values for all set-ups in the non-volatile memory. The selection returns to *Off* [0] when all parameter values have been stored.

PB-72 ProfibusDriveReset		
Option:		**Function:**
[0] *	No action	
[1]	Power-on reset	Resets drive upon power-up, as for power-cycle.
[3]	Comm option reset	Resets the Profibus option only, useful after changing certain settings in parameter group PB-##, e.g., *PB-18 Node Address*. When reset, the drive disappears from the Network, which may cause a communi-cation error from the master.

PB-80 Defined Parameters (1)		
Array [116]		
No Keypad access		
Read only		
Range:		**Function:**
0 *	[0 - 9999]	This parameter displays a list of all the defined drive parameters available for Profibus.

PB-81 Defined Parameters (2)		
Array [116]		
No Keypad access		
Read only		
Range:		**Function:**
0 *	[0 - 9999]	This parameter displays a list of all the defined drive parameters available for Profibus.

PB-82 Defined Parameters (3)		
Array [116]		
No Keypad access		
Read only		
Range:		**Function:**
0 *	[0 - 9999]	This parameter displays a list of all the defined drive parameters available for Profibus.

PB-83 Defined Parameters (4)		
Array [116]		
No Keypad access		
Read only		
Range:		**Function:**
0 *	[0 - 9999]	This parameter displays a list of all the defined drive parameters available for Profibus.

PB-84 Defined Parameters (5)		
Range:		**Function:**
0 *	[0 - 9999]	This parameter displays a list of all the defined drive parameters available for Profibus.

PB-90 Changed Parameters (1)		
Array [116]		
No Keypad access		
Read only		
Range:		**Function:**
0 *	[0 - 9999]	This parameter displays a list of all the drive parameters deviating from default setting.

PB-91 Changed Parameters (2)

Array [116]
No Keypad access
Read only

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

PB-92 Changed Parameters (3)

Array [116]
No Keypad access
Read only

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

PB-94 Changed Parameters (5)

Array [116]
No Keypad Address
Read only

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

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3.13 EN-## EtherNet

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

EN-00 IP Address Assignment

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

EN-01 IP Address

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

EN-02 Subnet Mask

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

EN-03 Default Gateway

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

EN-04 DHCP Server

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

NOTE!

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

EN-05 Lease Expires

Range:	Function:
[dd:hh:mm:ss]	Read only. Displays the lease time left for the current DHCP-assigned IP address.

EN-06 Name Servers

Option:		Function:
		IP addresses of Domain Name Servers. Can be automatically assigned when using DHCP.
[0]	Primary DNS	
[1]	Secondary DNS	

EN-07 Domain Name

Range:		Function:
Blank	[0–19 characters]	Domain name of the attached network. Can be automatically assigned when using DHCP.

EN-08 Host Name

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

EN-09 Physical Address

Range:	Function:
[00:1B:08:00:00:00–00:1B:08:FF:FF:FF]	Read only: Displays the Physical (MAC) address of the option.

EN-1# Ethernet link parameters

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

EN-10 Link Status

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

EN-11 Link Duration

Option:	Function:
Link Duration Port 1 (dd:hh:mm:ss)	Read only. Displays the duration of the present link on each port in dd:hh:mm:ss.

EN-12 Auto Negotiation

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

EN-13 Link Speed

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

EN-14 Link Duplex

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

EN-20 Control Instance

Range:	Function:
[None, 20, 21, 100, 101, 103]	Read only. Displays the originator-to-target connection point. 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.

NOTE!

To configure 2-word (32-bit) parameters for read/write, use two consecutive arrays in *EN-21 Process Data Config Write* and *EN-22 Process Data Config Read*.

EN-22 Process Data Config Read

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

EN-28 Store Data Values

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

EN-29 Store Always

Option:		Function:
		Activates function that will always store 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

EN-31 Net Reference

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

EN-32 Net Control

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

EN-33 CIP Revision

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

EN-34 CIP Product Code

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

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EN-37 COS Inhibit Timer

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

EN-38 COS Filters

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

EN-40 Status Parameter

Range:		Function:
0 *	[0 - 0]	

NOTE!

This parameter is for Modbus TCP only

EN-41 Slave Message Count

Range:		Function:
0 *	[0 - 0]	

NOTE!

This parameter is for Modbus TCP only

EN-42 Slave Exception Message Count

Range:		Function:
0 *	[0 - 0]	

NOTE!

This parameter is for Modbus TCP only

EN-80 FTP Server

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

EN-81 HTTP Server

Option:		Function:
[0] *	Disable	Disables the built-in HTTP (web) server.
[1]	Enable	Enables the built-in HTTP (web) server.

EN-82 SMTP Service

Option:		Function:
[0] *	Disable	Disables the SMTP (e-mail) service on the option.
[1]	Enable	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 Diagnostics

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

NOTE!

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

EN-91 Auto Cross-Over

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

NOTE!

Disabling of the auto cross-over function will require 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

Option:		Function:
		If Cable Diagnostics is enabled in EN-90, the built-in switch is able via Time Domain Reflectometry (TDR). This is a measurement technique which detects common cabling problems such as open circuits, short circuits and impedance mismatches or breaks in transmission cables. The distance from the option to the error is displayed in meters [feet] with an accuracy of +/- 2 m [6.5 ft]. The value 0 means no errors detected.

EN-93 Cable Error Length

Option:		Function:
[0]	Error length Port 1 (0–656 ft [0–200 m])	
[1]	Error length Port 2 (0–656 ft [0–200 m])	

EN-94 Broadcast Storm Protection

Option:		Function:
		The built-in switch is capable of protecting the switch system from receiving too many broadcast packages, which can use up network resources. The value indicates a percentage of the total bandwidth that is allowed for broadcast messages. Example: The "OFF" means that the filter is disabled, and all broadcast messages will be passed through. The value "0%" means that no broadcast messages will be passed through. A value of "10%" means that 10% of the total bandwidth is allowed for broadcast messages. If the amount of broadcast messages increases above the 10% threshold, they will be blocked.
[0]	Protection Value Port 1 (*Off – 20%)	
[1]	Protection Value Port 2 (*Off – 20%)	

EN-95 Broadcast Storm Filter

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

EN-98 Interface Counters

Option:		Function:
		Read only. Advanced interface counters from the built-in switch can be used for low-level trouble-shooting. The parameter shows the sum of port 1 + port 2.
[0]	In Octets	
[1]	In Unicast Packets	
[2]	In Non-Unicast Packets	

EN-98 Interface Counters

Option:		Function:
[3]	In Discards	
[4]	In Errors	
[5]	In Unknown Protocols	
[6]	Out Octets	
[7]	Out Unicast Packets	
[8]	Out Non-Unicast Packets	
[9]	Out Discards	
[10]	Out Errors	

EN-99 Media Counters

Option:		Function:
		Read only. Advanced interface counters from the built-in switch can be used for low-level troubleshooting. The parameter shows the sum of port 1 + port 2.
[0]	Alignment Errors	
[1]	FCS Errors	
[2]	Single Collisions	
[3]	Multiple Collisions	
[4]	SQE Test Errors	
[5]	Deferred Errors	
[6]	Late Collisions	
[7]	Excessive Collisions	
[8]	MAC Transmit Errors	
[9]	Carrier Sense Errors	
[10]	Frame Too Long	
[11]	MAC Receive Errors	

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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 data sheet.
Select *None* [0] 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]	

3.14.2 EC-2# Abs. Enc. Interface

EC-20 Protocol Selection

Select HIPERFACE [1] if the encoder is absolute only.
Select None [0] if the feedback sensor is an incremental encoder only.

Option:		Function:
[0] *	None	
[1]	HIPERFACE	
[2]	EnDat	
[4]	SSI	

NOTE!
This parameter cannot be adjusted while the motor is running.

EC-21 Resolution (Positions/Rev)

Select the resolution of the absolute encoder, i.e., the number of counts per revolution.
The value depends on setting in *EC-20 Protocol Selection*.

Range:		Function:
8192. *	[4. - 131072.]	

NOTE!
This parameter cannot be adjusted while the motor is running.

EC-24 SSI Data Length

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

EC-25 Clock Rate

Range:		Function:
0 kHz*	[100 - 0 kHz]	Set the SSI clock rate. With long encoder cables the clock rate must be reduced.

EC-26 SSI Data Format

Option:		Function:
[0] *	Gray code	
[1]	Binary code	Set the data format of the SSI data. Choose between Gray or Binary format.

EC-34 HIPERFACE Baud rate

Select the baud rate of the attached encoder.
The parameter is only accessible when *EC-20 Protocol Selection* is set to HIPERFACE [1].

Option:		Function:
[0]	600	
[1]	1200	
[2]	2400	
[3]	4800	
[4] *	9600	
[5]	19200	
[6]	38400	

NOTE!
This parameter cannot be adjusted while the motor is running.

3.14.3 EC-6# Monitoring and App.

EC-60 Feedback Direction

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

Option:		Function:
[0] *	Clockwise	
[1]	Counter-clockwise	

NOTE!
This parameter cannot be adjusted while the motor is running.

EC-61 Feedback Signal Monitoring

Select which reaction the drive should take if a faulty encoder signal is detected.
The encoder function in *EC-61 Feedback Signal Monitoring* is an electrical check of the hardware circuit in the encoder system.

Option:		Function:
[0]	Disabled	
[1] *	Warning	
[2]	Trip	
[3]	Jog	

EC-61 Feedback Signal Monitoring		
Select which reaction the drive should take if a faulty encoder signal is detected. The encoder function in *EC-61 Feedback Signal Monitoring* is an electrical check of the hardware circuit in the encoder system.		
Option:		**Function:**
[4]	Freeze Output	
[5]	Max Speed	
[6]	Switch to Open Loop	
[7]	Select Set-up 1	
[8]	Select Set-up 2	
[9]	Select Set-up 3	
[10]	Select Set-up 4	
[11]	stop & trip	

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3.15 RS-## Resolver Interface

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

RS-51 Input Voltage		
Range:		**Function:**
7.0 V*	[2.0 - 8.0 V]	Set the input voltage to the resolver. The voltage is stated as an RMS value. The value is stated in the data sheet for resolvers.

RS-52 Input Frequency		
Range:		**Function:**
10.0 kHz*	[2.0 - 15.0 kHz]	Set the input frequency to the resolver. The value is stated in the data sheet for resolvers.

RS-53 Transformation Ratio		
Range:		**Function:**
0.5 *	[0.1 - 1.1]	Set the transformation ratio for the resolver. The transformation ration is: $T_{ratio} = \frac{V_{Out}}{V_{In}}$ The value is stated in the data sheet for resolvers.

RS-59 Resolver Interface		
Activate the OPCRES resolver option when the resolver parameters are selected. To avoid damage to resolvers, *RS-50 Poles – RS-53 Transformation Ratio* must be adjusted before activating this parameter.		
Option:		**Function:**
[0] *	Disabled	
[1]	Enabled	

3.16 Parameter Data Check

3.16.1 Last 10 Changes

Displays a list of the 10 last changes made to the parameters in the present parameter set-up. 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 drive has run. The value is saved when the drive is turned off.

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

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

ID-03 Power Ups		
Range:		**Function:**
0 *	[0 - 2147483647]	View the number of times the drive has been powered up.

ID-04 Overtemps		
Range:		**Function:**
0 *	[0 - 65535]	View the number of drive temperature faults which have occurred.

ID-05 Overvolts		
Range:		**Function:**
0 *	[0 - 65535]	View the number of drive overvoltages which have occurred.

ID-06 Reset kWh Counter		
Option:		**Function:**
[0] *	Do not reset	Select *Do not reset* [0] if no reset of the kWh counter is desired.

ID-06 Reset kWh Counter		
Option:		**Function:**
[1]	Reset counter	Select *Reset* [1] and press [OK] to reset the kWh counter to zero (see *ID-02 kWh Counter*).

NOTE!

The reset is carried out by pressing [OK].

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

ID-08 Number of Starts		
Range:		**Function:**
0 *	[0 - 2147483647]	This is a readout parameter only. The counter shows the numbers of starts and stops caused by a normal Start/Stop command and/or when entering/leaving sleep mode.

NOTE!

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

3.17.2 ID-1# Data Trending Settings

Data Log Settings enables continous logging of up to 4 data sources (par. ID-10) at individual rates (par. ID-11). A trigger event (Par. ID-12) and window (par. ID-14) are used to start and stop the logging conditionally.

ID-10 Trending Source		
Array [4]		
Option:		**Function:**
		Select which variables are to be logged.
[0] *	None	
[1200]	Control Word	
[1201]	Reference [Unit]	
[1202]	Reference %	
[1203]	Status Word	
[1205]	Main Actual Value [%]	
[1209]	Custom Readout	
[1210]	Power [kW]	
[1211]	Power [hp]	

ID-10 Trending Source

Array [4]

Option:		Function:
[1212]	Motor Voltage	
[1213]	Frequency	
[1214]	Motor Current	
[1215]	Frequency [%]	
[1216]	Torque [Nm]	
[1217]	Speed [RPM]	
[1218]	Motor Thermal	
[1219]	KTY sensor temperature	
[1220]	Motor Angle	
[1221]		
[1222]	Torque [%]	
[1225]	Torque [Nm] High	
[1230]	DC Link Voltage	
[1232]	Brake Power /s	
[1233]	Brake Power /2 min	
[1234]	Heatsink Temp.	
[1235]	Drive Thermal	
[1236]	Drive Nominal Current	
[1237]	Drive Max. Current	
[1238]	Logic Controller State	
[1239]	Control Card Temp.	
[1250]	External Reference	
[1251]	Pulse Reference	
[1252]	Feedback [Unit]	
[1253]	Digi Pot Reference	
[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]	
[1278]	Analog Out X45/1 [mA]	
[1279]	Analog Out X45/3 [mA]	
[1280]	Fieldbus CTW 1	
[1282]	Fieldbus REF 1	
[1284]	Comm. Option STW	

ID-10 Trending Source

Array [4]

Option:		Function:
[1285]	Drive Port CTW 1	
[1286]	Drive Port REF 1	
[1290]	Alarm Word	
[1291]	Alarm Word 2	
[1292]	Warning Word	
[1293]	Warning Word 2	
[1294]	Ext. Status Word	

ID-11 Trending Interval

Range:		Function:
0.000 *	[0.000 - 0.000]	Enter the interval in milliseconds between each sampling of the variables to be logged.

ID-12 Trigger Event

Select the trigger event. When the trigger event occurs, a window is applied to freeze the log. The log will then retain a specified percentage of samples before the occurrence of the trigger event (*ID-14 Samples Before Trigger*).
Choices are described under E-## Digital Output.

Option:		Function:
[0] *	False	
[1]	True	
[2]	Running	
[3]	In range	
[4]	On reference	
[5]	Torque limit	
[6]	Current Limit	
[7]	Out of current range	
[8]	Below I low	
[9]	Above I high	
[10]	Out of speed range	
[11]	Below speed low	
[12]	Above speed high	
[13]	Out of feedb. range	
[14]	Below feedb. low	
[15]	Above feedb. high	
[16]	Thermal warning	
[17]	Mains vol out rang	
[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	

ID-12 Trigger Event

Select the trigger event. When the trigger event occurs, a window is applied to freeze the log. The log will then retain a specified percentage of samples before the occurrence of the trigger event (*ID-14 Samples Before Trigger*).
Choices are described under E-## Digital Output.

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

ID-14 Samples Before Trigger

Range:		Function:
50 *	[0 - 100]	Enter the percentage of all samples prior to a trigger event which are to be retained in the log. See also *ID-12 Trigger Event* and *ID-13 Trending Mode*.

3.17.3 ID-2# Historic Log

View up to 50 data items logged up to the last reported trip. The data is stored in array parameters, where [0] is the most recent data and [49] is the oldest data.

ID-20 Historic Log: Event

Array [50]

Range:		Function:
0 *	[0 - 255]	View the event type of the logged events.

ID-21 Historic Log: Value

Array [50]

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

Digital input	Decimal value. See *DR-60 Digital Input* for description after converting to binary value.
Digital output (not monitored in this SW release)	Decimal value. See *DR-66 Digital Output [bin]* for description after converting to binary value.
Warning word	Decimal value. See *DR-92 Warning Word* for description.
Alarm word	Decimal value. See *DR-90 Alarm Word* for description.
Status word	Decimal value. See *DR-03 Status Word* for description after converting to binary value.
Control word	Decimal value. See *DR-00 Control Word* for description.
Extended status word	Decimal value. See *DR-94 Ext. Status Word* for description.

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 drive start. The max. value corresponds to approx. 24 days which means that the count will restart at zero after this time period.

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3.17.4 ID-3# Alarm Log

View up to 10 alarm logs. The data is stored in array parameters, where [0] is the most recent and [9] is the oldest data. Error codes, values and time stamp can be viewed for all logged data.

ID-30 Fault Log: Error Code

Array [10]

Range:		Function:
0 *	[0 - 255]	View the error code and look up its meaning in the *Troubleshooting* chapter of the AF-650 GP Design Guide

ID-31 Alarm Log: Value

Array [10]

Range:		Function:
0 *	[-32767 - 32767]	View an extra description of the error. This parameter is mostly used in combination with alarm 38 'internal fault'.

ID-32 Alarm Log: Time

Array [10]

Range:		Function:
0 s*	[0 - 2147483647 s]	View the time when the logged event occurred. Time is measured in seconds from drive start-up.

3.17.5 ID-4# Drive Identification

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

ID-40 Drive Type

Range:		Function:
0 *	[0 - 0]	View the drive type.

ID-41 Power Section

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

ID-42 Voltage

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

ID-43 Software Version

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

ID-46 GE Product No.

Range:		Function:
0 *	[0 - 0]	View the 8-digit number.

ID-47 GE Power Card Model No

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

ID-48 Keypad ID Number

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

ID-49 SW ID Control Card

Range:		Function:
0 *	[0 - 0]	View the control card software version number.

ID-50 SW ID Power Card

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

ID-51 Drive Serial Number

Range:		Function:
0 *	[0 - 0]	View the drive serial number.

ID-53 Power Card Serial Number

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

3.17.6 ID-6# Option Ident

Parameters to view the information about the hardware and software configuration of the field installed I/O and network option modules.

ID-60 Option Mounted

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

ID-61 Option SW Version

Range:		Function:
0 *	[0 - 0]	View the installed option software version.

ID-62 Option Ordering No

Range:		Function:
0 *	[0 - 0]	Shows the ordering number for the installed options.

ID-63 Option Serial No

Range:		Function:
0 *	[0 - 0]	View the installed option serial number.

3.17.7 ID-9# Parameter Info

Parameters to view defined parameters and modified parameters.

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

ID-93 Modified Parameters		
Array [1000]		
Range:		**Function:**
0 *	[0 - 9999]	View a list of the parameters that have been changed from their default setting. The list ends with 0. Changes may not be visible until up to 30 sec. after implementation.

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

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3.18 DR-## Data Readouts

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 drive via the serial communication port in hex code.

DR-01 Reference [Unit]		
Range:		**Function:**
0.000 ReferenceFeedbackUnit*	[-999999.000 - 999999.000 ReferenceFeedbackUnit]	View the present reference value applied on impulse or analog basis in the unit resulting from the configuration selected in *H-40 Configuration Mode* (Hz, Nm or RPM).

DR-02 Reference [%]		
Range:		**Function:**
0.0 %*	[-200.0 - 200.0 %]	View the total reference. The total reference is the sum of digital, analog, preset, bus, and freeze references, plus catch-up and slow-down.

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

DR-05 Main Actual Value [%]		
Range:		**Function:**
0.00 %*	[-100.00 - 100.00 %]	View the two-byte word sent with the status word to the bus master reporting the main actual value.

DR-09 Custom Readout		
Range:		**Function:**
0.00 CustomReadoutUnit*	[0.00 - 0.00 CustomReadoutUnit]	View the value of custom readout from *K-30 Unit for Custom Readout* to *K-32 Max Value of Custom Readout*

3.18.2 DR-1# Motor Status

Parameters to view the motor status values.

DR-10 Power [kW]		
Range:		**Function:**
0.00 kW*	[0.00 - 10000.00 kW]	Displays motor power in kW. The value shown is calculated on the basis of the actual motor voltage and motor current. The value is filtered, and therefore approx. 30ms may pass from when an input value changes to when the data readout values change. The resolution of readout value on serial communication bus is in 10 W steps.

DR-11 Power [hp]		
Range:		**Function:**
0.00 hp*	[0.00 - 10000.00 hp]	View the motor power in HP. The value shown is calculated on the basis of the actual motor voltage and motor current. The value is filtered, and therefore approximately 30ms may pass from when an input value changes to when the data readout values change.

DR-12 Motor Rated Voltage		
Range:		**Function:**
0.0 V*	[0.0 - 6000.0 V]	View the motor voltage, a calculated value used for controlling the motor.

DR-13 Frequency		
Range:		**Function:**
0.0 Hz*	[0.0 - 6500.0 Hz]	View the motor frequency, without resonance dampening.

DR-14 Motor Current		
Range:		**Function:**
0.00 A*	[0.00 - 10000.00 A]	View the motor current measured as a mean value, IRMS. The value is filtered, and thus approximately 30ms may pass from when an input value changes to when the data readout values change.

DR-15 Frequency [%]		
Range:		**Function:**
0.00 %*	[-100.00 - 100.00 %]	View a two-byte word reporting the actual motor frequency (without resonance dampening) as a percentage (scale 0000–4000 Hex) of *F-03 Max Output Frequency 1*. Set *PB-16 PCD Read Configu-*

DR-15 Frequency [%]		
Range:		**Function:**
		ration index 1 to send it with the status word instead of the MAV.

DR-16 Torque [Nm]		
Range:		**Function:**
0.0 Nm*	[-3000.0 - 3000.0 Nm]	View the torque value with sign, applied to the motor shaft. Linearity is not exact between 160% motor current and torque in relation to the rated torque. Some motors supply more than 160% torque. Consequently, the min. value and the max. value will depend on the max. motor current as well as the motor used. The value is filtered, and thus approx. 30ms may pass from when an input changes value to when the data readout values change.

DR-17 Speed [RPM]		
Range:		**Function:**
0 RPM*	[-30000 - 30000 RPM]	View the actual motor RPM. In open-loop or closed-loop process control, the motor RPM is estimated. In speed closed-loop modes, the motor RPM is measured.

DR-18 Motor Thermal		
Range:		**Function:**
0 %*	[0 - 100 %]	View the calculated thermal load on the motor. The cut-out limit is 100%. The basis for calculation is the Electronic Thermal Overload function selected in *F-10 Electronic Overload*.

DR-19 KTY sensor temperature		
Range:		**Function:**
0 °C*	[0 - 0 °C]	Returning the actual temperature on the KTY sensor built into the motor. See parameter group F-1#.

DR-20 Motor Angle		
Range:		**Function:**
0 *	[0 - 65535]	View the current encoder/resolver angle offset relative to the index position. The value range of 0-65535 corresponds to 0-2*pi (radians).

DR-22 Torque [%]		
Range:		**Function:**
0 %*	[-200 - 200 %]	Value shown is the torque as a percentage of nominal torque, with sign, applied to the motor shaft.

DR-25 Torque [Nm] High		
Range:		**Function:**
0.0 Nm*	[-200000000.0 - 200000000.0 Nm]	View the torque value with sign, applied to the motor shaft. Some motors supply more than 160% torque. Consequently, the min. value and the max. value will depend on the max. motor current as well as the motor used. This specific readout has been adapted to show higher values than the standard readout in *DR-16 Torque [Nm]*.

3.18.3 DR-3# Drive Status

Parameters to view the drive status values.

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

DR-32 Brake Power /s		
Range:		**Function:**
0.000 kW*	[0.000 - 10000.000 kW]	View the braking energy transmitted to an external brake resistor, stated as an instantaneous value.

DR-33 Brake Power /2 min		
Range:		**Function:**
0.000 kW*	[0.000 - 10000.000 kW]	View the braking energy transmitted to an external brake resistor. The mean power is calculated on an average basis for the most recent 120 sec.

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

DR-35 Drive Thermal		
Range:		**Function:**
0 %*	[0 - 100 %]	View the percentage load on the inverter.

DR-36 Drive Nominal Current		
Range:		**Function:**
10.00 A*	[0.01 - 10000.00 A]	View the inverter nominal current, which should match the nameplate data on the connected motor. The

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DR-36 Drive Nominal Current		
Range:		**Function:**
		data are used for calculation of torque, motor protection, etc.

DR-37 Drive Max. Current		
Range:		**Function:**
16.00 A*	[0.01 - 10000.00 A]	View the inverter maximum current, which should match the nameplate data on the connected motor. The data are used for calculation of torque, motor protection, etc.

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

DR-39 Control Card Temp.		
Range:		**Function:**
0 °C*	[0 - 100 °C]	View the temperature on the control card, stated in °C.

DR-40 Trending Buffer Full		
Option:		**Function:**
		View whether the logging buffer is full (see parameter group ID-1#). The logging buffer will never be full when *ID-13 Trending Mode* is set to *Log always* [0].
[0] *	No	
[1]	Yes	

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

3.18.4 DR-5# Ref. & Feedb.

Parameters to view the reference and feedback status values.

DR-50 External Reference		
Range:		**Function:**
0.0 *	[-200.0 - 200.0]	View the total reference, the sum of digital, analog, preset, bus and freeze references, plus catch-up and slow-down.

DR-51 Pulse Reference		
Range:		**Function:**
0.0 *	[-200.0 - 200.0]	View the reference value from programmed digital input(s). The readout can also reflect the impulses from an incremental encoder.

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

DR-53 Digi Pot Reference		
Range:		**Function:**
0.00 *	[-200.00 - 200.00]	View the contribution of the digital potentiometer to the actual reference.

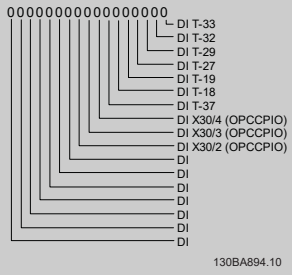
3.18.5 DR-6# Inputs/Outputs

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 no. 5, '0' = no signal, '1' = connected signal.

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



DR-61 Terminal 53 Switch Setting

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

DR-62 Analog Input 53

Range:		Function:
0.000 *	[-20.000 - 20.000]	View the actual value at input 53.

DR-63 Terminal 54 Switch Setting

Option:		Function:
		View the setting of input terminal 54. Current = 0; Voltage = 1.
[0] *	Current	
[1]	Voltage	
[2]	Pt 1000 [°C]	
[3]	Pt 1000 [°F]	
[4]	Ni 1000 [°C]	
[5]	Ni 1000 [°F]	

DR-64 Analog Input 54

Range:		Function:
0.000 *	[-20.000 - 20.000]	View the actual value at input 54.

DR-65 Analog Output 42 [mA]

Range:		Function:
0.000 *	[0.000 - 30.000]	View the actual value at output 42 in mA. The value shown reflects the selection in *AN-50 Terminal 42 Output*.

DR-66 Digital Output [bin]

Range:		Function:
0 *	[0 - 15]	View the binary value of all digital outputs.

DR-67 Freq. Input #29 [Hz]

Range:		Function:
0 *	[0 - 130000]	View the actual frequency rate on terminal 29.

DR-68 Freq. Input #33 [Hz]

Range:		Function:
0 *	[0 - 130000]	View the actual value of the frequency applied at terminal 33 as an impulse input.

DR-69 Pulse Output #27 [Hz]

Range:		Function:
0 *	[0 - 40000]	View the actual value of pulses applied to terminal 27 in digital output mode.

DR-70 Pulse Output #29 [Hz]

Range:		Function:
0 *	[0 - 40000]	View the actual value of pulses at terminal 29 in digital output mode.

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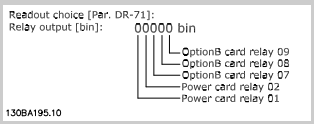
DR-71 Relay Output [bin]		
Range:		**Function:**
0 *	[0 - 511]	View the settings of all relays.



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

DR-73 Counter B		
Range:		**Function:**
0 *	[-2147483648 - 2147483647]	View the present value of Counter B. Counters are useful as comparator operands (*LC-10 Comparator Operand*). The value can be reset or changed either via digital inputs (parameter group E-0#) or by using an Logic Controller action (*LC-52 Logic Controller Action*).

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

DR-75 Analog In X30/11		
Range:		**Function:**
0.000 *	[-20.000 - 20.000]	View the actual value at input X30/11 of OPCGPIO General Purpose I/O Option Module.

DR-76 Analog In X30/12		
Range:		**Function:**
0.000 *	[-20.000 - 20.000]	View the actual value at input X30/12 of OPCGPIO General Purpose I/O Option Module.

DR-77 Analog Out X30/8 [mA]		
Range:		**Function:**
0.000 *	[0.000 - 30.000]	View the actual value at input X30/8 .

3.18.6 DR-8# Ser. Com. Bus & Drive Port

Parameters to view the bus references and control words.

DR-80 Fieldbus CTW 1		
Range:		**Function:**
0 *	[0 - 65535]	View the two-byte control word (CTW) received from the bus master. Interpretation of the control word depends on the network option installed and the control word profile selected in *O-10 Control Word Profile*. For more information, please refer to the relevant network manual.

DR-82 Fieldbus REF 1		
Range:		**Function:**
0 *	[-200 - 200]	View the two-byte word sent with the control word form the bus master to set the reference value. For more information, refer to the relevant network manual.

DR-84 Comm. Option STW		
Range:		**Function:**
0 *	[0 - 65535]	View the extended network comm. option status word.

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

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

3.18.7 DR-9# Diagnosis Readout

Parameters to view the alarms, warnings, and extended status words.

DR-90 Alarm Word		
Range:		**Function:**
0 *	[0 - 4294967295]	View the alarm word sent via the serial communication port in hex code.

DR-91 Alarm Word 2		
Range:		**Function:**
0 *	[0 - 4294967295]	View the alarm word sent via the serial communication port in hex code.

DR-92 Warning Word		
Range:		**Function:**
0 *	[0 - 4294967295]	View the warning word sent via the serial communication port in hex code.

DR-93 Warning Word 2		
Range:		**Function:**
0 *	[0 - 4294967295]	View the warning word sent via the serial communication port in hex code.

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

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3.19 LC-## Logic Controller

Parameter group related to programming the drive's built-in logic controller. The logic controller consists of a series of user-defined actions (see par. LC-53) that are executed when the corresponding user-defined events are met.

3.19.1 LC-0# LC Settings

Parameters to configure the activation, deactivations and reset of the logic controller (LC).

LC-00 Logic Controller Mode

Option:		Function:
[0] *	Off	Disables the Logic Controller.
[1]	On	Enables the Logic Controller.

LC-01 Start Event

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

LC-01 Start Event

Option:		Function:
[11]	Below speed low	*Below speed low* [11] The output speed is lower than the setting in *H-72 Warning Speed Low*.
[12]	Above speed high	*Above speed high* [12] The output speed is higher than the setting in *H-73 Warning Speed High*.
[13]	Out of feedb. range	*Out of feedb. Range* [13] The feedback is outside the range set in *H-76 Warning Feedback Low* and *H-77 Warning Feedback High*.
[14]	Below feedb. low	*Below feedb. Low* [14] The feedback is below the limit set in *H-76 Warning Feedback Low*.
[15]	Above feedb. high	*Above feedb. High* [15] The feedback is above the limit set in *H-77 Warning Feedback High*.
[16]	Thermal warning	*Thermal warning* [16] The thermal warning turns on when the temperature exceeds the limit in the motor, the drive, the brake resistor or the thermistor.
[17]	Mains vol out rang	*Mains out of range* [17] The AC line voltage is outside the specified voltage range.
[18]	Reversing	*Reverse* [18] The output is high when the drive is running counter clockwise (the logical product of the status bits “running” AND “reverse”).
[19]	Warning	*Warning* [19] A warning is active.
[20]	Alarm (trip)	*Alarm (trip)* [20] A (trip) alarm is active.
[21]	Alarm (trip lock)	*Alarm (trip lock)* [21] A (Trip lock) alarm is active.
[22]	Comparator 0	*Comparator 0* [22] Use the result of comparator 0.
[23]	Comparator 1	*Comparator 1* [23] Use the result of comparator 1.
[24]	Comparator 2	*Comparator 2* [24] Use the result of comparator 2.
[25]	Comparator 3	*Comparator 3* [25] Use the result of comparator 3.
[26]	Logic rule 0	*Logic rule 0* [26] Use the result of logic rule 0.
[27]	Logic rule 1	*Logic rule 1* [27] Use the result of logic rule 1.
[28]	Logic rule 2	*Logic rule 2* [28] Use the result of logic rule 2.

LC-01 Start Event		
Option:		**Function:**
[29]	Logic rule 3	*Logic rule 3* [29] Use the result of logic rule 3.
[33]	Digital input DI18	*Digital input DI18* [33] Use the result of digital input 18.
[34]	Digital input DI19	*Digital input DI19* [34] Use the result of digital input 19.
[35]	Digital input DI27	*Digital input DI27* [35] Use the result of digital input 27.
[36]	Digital input DI29	*Digital input DI27* [35] Use the result of digital input 29.
[37]	Digital input DI32	*Digital input DI32* [37] Use the result of digital input 32.
[38]	Digital input DI33	*Digital input DI33* [38] Use the result of digital input 33.
[39]	Start command	*Start command* [39] A start command is issued.
[40]	Converter stopped	*Drive stopped* [40] A stop command (Jog, Stop, Qstop, Coast) is issued – and not from the Logic Controller itself.
[41]	Reset Trip	*Reset Trip* [41] A reset is issued
[42]	Auto-reset Trip	*Auto-reset Trip* [42]: an auto reset is performed.
[43]	OK key	*OK key* [43] The [OK] key is pressed.
[44]	Reset key	*Reset key* [44] The [Reset] key is pressed.
[45]	Left key	*Left key* [45] The [◄] key is pressed.
[46]	Right key	*Right key* [46] The[►] key is pressed.
[47]	Up key	*Up key* [47] The [▲] key is pressed.
[48]	Down key	*Down key* [48] The [▼] key is pressed.
[50]	Comparator 4	*Comparator 4* [50] Use the result of comparator 4.
[51]	Comparator 5	*Comparator 5* [51] Use the result of comparator 5.
[60]	Logic rule 4	*Logic rule 4* [60] Use the result of logic rule 4.
[61]	Logic rule 5	*Logic rule 5* [61] Use the result of logic rule 5.

LC-02 Stop Event		
Select the Boolean (TRUE or FALSE) input to activate Logic Controller.		
Option:		**Function:**
[0] *	False	For descriptions [0] - [61], see *LC-01 Start Event Start Event*

LC-02 Stop Event		
Select the Boolean (TRUE or FALSE) input to activate Logic Controller.		
Option:		**Function:**
[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]	Mains vol out rang	
[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]	Log Ctrlr timeout 0	
[31]	Log Ctrlr timeout 1	
[32]	Log Ctrlr timeout 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]	Converter stopped	
[41]	Reset Trip	
[42]	Auto-reset Trip	
[43]	OK key	
[44]	Reset key	
[45]	Left key	
[46]	Right key	
[47]	Up key	

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LC-02 Stop Event		
Select the Boolean (TRUE or FALSE) input to activate Logic Controller.		
Option:		**Function:**
[48]	Down key	
[50]	Comparator 4	
[51]	Comparator 5	
[60]	Logic rule 4	
[61]	Logic rule 5	
[70]	Log Ctrlr timeout 3	*LC Timeout 3* [70] Logic Controller timer 3 is timed out.
[71]	Log Ctrlr timeout 4	*LC Timeout 4* [71] Logic Controller timer 4 is timed out.
[72]	Log Ctrlr timeout 5	*LC Timeout 5* [72] Logic Controller timer 5 is timed out.
[73]	Log Ctrlr timeout 6	*LC- Timeout 6* [73] Logic Controller timer 6 is timed out.
[74]	Log Ctrlr timeout 7	*LC Timeout 7* [74] 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	
[79]		
[80]		
[81]		
[82]		
[83]		
[84]		
[85]		

LC-03 Reset Log Ctlr		
Option:		**Function:**
[0] *	Do not reset Log Ctrl	Retains programmed settings in all group LC-## parameters .
[1]	Reset Log Ctlr	Resets all group LC-## parameters (LC-##) to default settings.

3.19.2 LC-1# Comparators

Parameters to configure the logic controller (LC) comparators. Comparators are used for comparing variables with fixed preset values.

LC-10 Comparator Operand		
Array [6]		
Option:		**Function:**
		Choices [1] to [31] are variables that will be compared based on their values.

LC-10 Comparator Operand		
Array [6]		
Option:		**Function:**
		Choices [50] to [186] are digital values (TRUE/FALSE) where the comparison is based on the amount of time during which they are set to TRUE or FALSE, respectively. See *LC-11 Comparator Operator*. Select the variable to be monitored by the comparator.
[0] *	DISABLED	*DISABLED* [0] The comparator is disabled.
[1]	Reference	*Reference* [1] The resulting remote reference (not local) as a percentage.
[2]	Feedback	*Feedback* [2] In the unit [RPM] or [Hz]
[3]	Motor speed	*Motor speed* [3] [RPM] or [Hz]
[4]	Motor Current	*Motor current* [4] [A]
[5]	Motor torque	*Motor torque* [5] [Nm]
[6]	Motor power	*Motor power* [6] [kW] or [hp]
[7]	Motor Rated Voltage	*Motor voltage* [7] [V]
[8]	DC-link voltage	*DC link voltage* [8] [V]
[9]	Motor Thermal	*Motor thermal* [9] Expressed as a percentage.
[10]	Converter thermal	*Drive thermal* [10] Expressed as a percentage.
[11]	Heat sink temp.	*Heatsink temp* [11] Expressed as a percentage.
[12]	Analog input AI53	*Analog input AI53* [12] Expressed as a percentage.
[13]	Analog input AI54	*Analog input AI54* [13] Expressed as a percentage.
[14]	Analog input AIFB10	*Analog input AIFB10* [14] [V]. AIFB10 is internal 10 V supply.
[15]	Analog input AIS24V	*Analog input AIS24V* [15] [V] Analog input AICCT [17] [°]. AIS24V is switch mode power supply: SMPS 24 V.
[17]	Analog input AICCT	Analog input AICCT [17] [°]. AICCT is control card temperature.
[18]	Pulse input FI29	*Pulse input FI29* [18] Expressed as a percentage.
[19]	Pulse input FI33	*Pulse input FI33* [19] Expressed as a percentage.
[20]	Alarm number	*Alarm number* [20] The error number.
[21]	Warning number	

LC-10 Comparator Operand		
Array [6]		
Option:		**Function:**
[22]		
[23]		
[30]	Counter A	*Counter A* [30] Number of counts
[31]	Counter B	*Counter B* [31] Number of counts
[50]	FALSE	*False* [50] Enters the fixed value of false in the comparator.
[51]	TRUE	*True* [51] Enters the fixed value of true in the comparator.
[52]	Control ready	*Control ready* [52] The control board receives supply voltage
[53]	Drive ready	*Drive ready* [53] The drive is ready for operation and applies a supply signal on the control board.
[54]	Running	*Running* [54] The motor is running.
[55]	Reversing	*Reversing* [55] The output is high when the drive is running counter clockwise (the logical product of the status bits "running" AND "reverse")
[56]	In range	*In range* [56] The motor is running within the programmed current and speed ranges set in *H-70 Warning Current Low* to *H-73 Warning Speed High*.
[60]	On reference	*On reference* [60] The motor is running on reference.
[61]	Below reference, low	*Below reference, low* [61] The motor is running below the value given in *H-74 Warning Reference Low*
[62]	Above ref, high	*Above reference, high* [62] The motor is running above the value given in *H-75 Warning Reference High*
[65]	Torque limit	*Torque limit* [65] The torque limit, set in *F-40 Torque Limiter (Driving)* or *F-41 Torque Limiter (Braking)*, has been exceeded.
[66]	Current Limit	*Current limit* [66] The motor current limit, set in *F-43 Current Limit*, has been exceeded.
[67]	Out of current range	*Out of current range* [67] The motor current is outside the range set in *F-43 Current Limit*.
[68]	Below I low	*Below I low* [68] The motor current is lower than set in *H-70 Warning Current Low*.

LC-10 Comparator Operand		
Array [6]		
Option:		**Function:**
[69]	Above I high	*Above I high* [69] The motor current is higher than set in *H-71 Warning Current High*.
[70]	Out of speed range	*Out of speed range* [70] The speed is outside the range set in *H-72 Warning Speed Low* and *H-73 Warning Speed High*.
[71]	Below speed low	*Below speed low* [71] The output speed is lower than the setting in *H-72 Warning Speed Low*.
[72]	Above speed high	*Above speed high* [72] The output speed is higher than the setting in *H-73 Warning Speed High*.
[75]	Out of feedback rang	*Out of feedb. Range* [75] The feedback is outside the range set in *H-76 Warning Feedback Low* and *H-77 Warning Feedback High*.
[76]	Below feedback low	*Below feedb. Low* [76] The feedback is below the limit set in *H-76 Warning Feedback Low*.
[77]	Above feedback high	*Above feedb. High* [77] The feedback is above the limit set in *H-77 Warning Feedback High*.
[80]	Thermal warning	*Thermal warning* [80] The thermal warning turns on when the temperature exceeds the limit in the motor, the drive, the brake resistor or thermistor.
[82]	Mains out of range	*Line power out of range* [82] The AC line voltage is outside the specified voltage range.
[85]	Warning	*Warning* [85] A warning is active.
[86]	Alarm (trip)	*Alarm (trip)* [86] A (trip) alarm is active.
[87]	Alarm (trip lock)	*Alarm (trip lock)* [87] A (Trip lock) alarm is active.
[90]	Bus OK	*Bus OK* [90] Active communication (no timeout) via the serial communication port.
[91]	Torque limit & stop	*Torque limit & stop* [91] If the drive has received a stop signal and is at the torque limit, the signal is logic "0".
[92]	Brake fault (IGBT)	*Brake fault (IGBT)* [92] The brake IGBT is short circuited.
[93]	Mech. brake control	*Mech. brake control* [93] The mechanical brake is active.
[94]	Safe stop active	

LC-10 Comparator Operand		
Array [6]		
Option:		**Function:**
[100]	Comparator 0	*Comparator 0* [100] The result of comparator 0.
[101]	Comparator 1	*Comparator 1* [101] The result of comparator 1.
[102]	Comparator 2	*Comparator 2* [102] The result of comparator 2.
[103]	Comparator 3	*Comparator 3* [103] The result of comparator 3.
[104]	Comparator 4	*Comparator 4* [104] The result of comparator 4.
[105]	Comparator 5	*Comparator 5* [105] The result of comparator 5.
[110]	Logic rule 0	*Logic rule 0* [110] The result of logic rule 0.
[111]	Logic rule 1	*Logic rule 1* [111] The result of logic rule 1.
[112]	Logic rule 2	*Logic rule 2* [112] The result of logic rule 2.
[113]	Logic rule 3	*Logic rule 3* [113] The result of logic rule 3.
[114]	Logic rule 4	*Logic rule 4* [114] The result of logic rule 4.
[115]	Logic rule 5	*Logic rule 5* [115] The result of logic rule 5.
[120]	Log Ctrlr timeout 0	*Logic Controller Timeout 0* [120] The result of LC timer 0.
[121]	Log Ctrlr timeout 1	*Logic Controller Timeout 1* [121] The result of LC timer 1.
[122]	Log Ctrlr timeout 2	*Logic Controller Timeout 2* [122] The result of LC timer 2.
[123]	Log Ctrlr timeout 3	*Logic Controller Timeout 3* [123] The result of LC timer 3.
[124]	Log Ctrlr timeout 4	*Logic Controller Timeout 4* [124] The result of LC timer 4.
[125]	Log Ctrlr timeout 5	*Logic Controller Timeout 5* [125] The result of LC timer 5.
[126]	Log Ctrlr timeout 6	*Logic Controller Timeout 6* [126] The result of LC timer 6.
[127]	Log Ctrlr timeout 7	*Logic Controller Timeout 7* [127] The result of LC timer 7.
[130]	Digital input DI18	*Digital input DI18* [130] Digital input 18. High = True.

LC-10 Comparator Operand		
Array [6]		
Option:		**Function:**
[131]	Digital input DI19	*Digital input DI19* [131] Digital input 19. High = True.
[132]	Digital input DI27	*Digital input DI27* [132] Digital input 27. High = True.
[133]	Digital input DI29	*Digital input DI29* [133] Digital input 29. High = True.
[134]	Digital input DI32	*Digital input DI32* [134] Digital input 32. High = True.
[135]	Digital input DI33	*Digital input DI33* [135] Digital input 33. High = True.
[150]	Log Ctrl digi output A	*Logic Controller digital output A* [150] Use the result of the Logic Controller output A.
[151]	Log Ctrl digi output B	*Logic Controller digital output B* [151] Use the result of the LC output B.
[152]	Log Ctrl digi output C	*Logic Controller digital output C* [152] Use the result of the LC output C.
[153]	Log Ctrl digi output D	*Logic Controller digital output D* [153] Use the result of the LC output D.
[154]	Log Ctrl digi output E	*Logic Controller digital output E* [154] Use the result of the LC output E.
[155]	Log Ctrl digi output F	*Logic Controller digital output F* [155] Use the result of the LC output F.
[160]	Relay 1	*Relay 1* [160] Relay 1 is active
[161]	Relay 2	*Relay 2* [161] Relay 2 is active
[180]	Local ref active	*Local ref. active* [180] High when *F-02 Operation Method* = [2] Local or when *F-02 Operation Method* is [0] Linked to hand auto, at the same time as the Keypad is in hand mode.
[181]	Remote ref active	*Remote ref. active* [181] High when *F-02 Operation Method*= [1] Remote or [0] Linked to hand/auto, while the Keypad is in auto mode.
[182]	Start command	*Start command* [182] High when there is an active start command and no stop command.
[183]	Converter stopped	*Drive stopped* [183] A stop command (Jog, Stop, Qstop, Coast) is issued – and not from the Logic Controller itself.
[185]	Drive in hand mode	*Drive in hand mode* [185] High when the drive is in hand mode.

LC-10 Comparator Operand		
Array [6]		
Option:		**Function:**
[186]	Drive in auto mode	*Drive in auto mode* [186] High when the drive is in auto mode.
[187]	Start command given	
[190]	Digital input x30 2	
[191]	Digital input x30 3	
[192]	Digital input x30 4	
[193]		
[194]		
[195]		
[196]		
[197]		
[198]		
[199]		

LC-11 Comparator Operator		
Array [6]		
Option:		**Function:**
[0] *	<	Select < [0] for the result of the evaluation to be TRUE, when the variable selected in *LC-10 Comparator Operand* is smaller than the fixed value in *LC-12 Comparator Value*. The result will be FALSE, if the variable selected in *LC-10 Comparator Operand* is greater than the fixed value in *LC-12 Comparator Value*.
[1]	≈ (equal)	Select ≈ [1] for the result of the evaluation to be TRUE, when the variable selected in *LC-10 Comparator Operand* is approximately equal to the fixed value in *LC-12 Comparator Value*.
[2]	>	Select > [2] for the inverse logic of option < [0].

LC-12 Comparator Value		
Array [6]		
Range:		**Function:**
0 *	[-100000.000 - 100000.000]	Enter the 'trigger level' for the variable that is monitored by this comparator. This is an array parameter containing comparator values 0 to 5.

3.19.3 LC-2# Timers

Parameters to configure the logic controller (LC) timers. Timers are used to define when an event can occur.

LC-20 Logic Controller Timer		
Range:		**Function:**
0.000 *	[0.000 - 0.000]	Enter the value to define the duration of the FALSE output from the programmed timer. A timer is only FALSE if it is started by an action (i.e., *Start timer 1* [29]) and until the given timer value has elapsed.

3.19.4 LC-4# Logic Rules

Parameters to configure the logic controller (LC) logic rules. Logic rules are used to define what conditions need to be met for the LC to step to the next event.

LC-40 Logic Rule Boolean 1		
Array [6]		
Option:		**Function:**
[0] *	False	Select the first boolean (TRUE or FALSE) input for the selected logic rule. See *LC-01 Start Event* ([0] - [61]) and *LC-02 Stop Event* ([70] - [75]) for further description.

LC-41 Logic Rule Operator 1		
Array [6]		
Option:		**Function:**
		Select the first logical operator to use on the Boolean inputs from *LC-40 Logic Rule Boolean 1* and *LC-42 Logic Rule Boolean 2*. [LC-##] signifies the Boolean input of parameter group LC-##.
[0] *	DISABLED	Ignores *LC-42 Logic Rule Boolean 2*, *LC-43 Logic Rule Operator 2*, and *LC-44 Logic Rule Boolean 3*.
[1]	AND	Evaluates the expression [LC-40] AND [LC-42].
[2]	OR	evaluates the expression [LC-40] OR [LC-42].
[3]	AND NOT	evaluates the expression [LC-40] AND NOT [LC-42].
[4]	OR NOT	evaluates the expression [LC-40] OR NOT [LC-42].
[5]	NOT AND	evaluates the expression NOT [LC-40] AND [LC-42].
[6]	NOT OR	evaluates the expression NOT [LC-40] OR [LC-42].
[7]	NOT AND NOT	evaluates the expression NOT [LC-40] AND NOT [LC-42].
[8]	NOT OR NOT	evaluates the expression NOT [LC-40] OR NOT [LC-42].

3

LC-42 Logic Rule Boolean 2

Array [6]

Option:		Function:
[0] *	False	Select the second boolean (TRUE or FALSE) input for the selected logic rule. See *LC-01 Start Event* ([0] - [61]) and *LC-02 Stop Event* ([70] - [75]) for further description.

LC-43 Logic Rule Operator 2

Array [6]

Option:		Function:
		Select the second logical operator to be used on the Boolean input calculated in *LC-40 Logic Rule Boolean 1*, *LC-41 Logic Rule Operator 1*, and *LC-42 Logic Rule Boolean 2*, and the Boolean input coming from *LC-42 Logic Rule Boolean 2*. [LC-44] signifies the Boolean input of *LC-44 Logic Rule Boolean 3*. [LC-40/LC-42] signifies the Boolean input calculated in *LC-40 Logic Rule Boolean 1*, *LC-41 Logic Rule Operator 1*, and *LC-42 Logic Rule Boolean 2*. DISABLED [0] (factory setting). select this option to ignore *LC-44 Logic Rule Boolean 3*.
[0] *	DISABLED	
[1]	AND	
[2]	OR	
[3]	AND NOT	
[4]	OR NOT	
[5]	NOT AND	
[6]	NOT OR	
[7]	NOT AND NOT	
[8]	NOT OR NOT	

LC-44 Logic Rule Boolean 3

Array [6]

Option:		Function:
[0] *	False	Select the third boolean (TRUE or FALSE) input for the selected logic rule. See *LC-01 Start Event* ([0] - [61]) and *LC-02 Stop Event* ([70] - [75]) for further description.

3.19.5 LC-5# States

Parameters to configure the logic controller (LC) states. States define the events and actions to take place in the drive.

LC-51 Logic Controller Event

Array [20]

Option:		Function:
[0] *	False	Select the boolean input (TRUE or FALSE) to define the Logic Controller event.See *LC-01 Start Event* ([0] - [61]) and *LC-02 Stop Event* ([70] - [74]) for further description.

LC-52 Logic Controller Action

Array [20]

Option:		Function:
[0] *	DISABLED	Select the action corresponding to the LC event. Actions are executed when the corresponding event (defined in *LC-51 Logic Controller Event*) is evaluated as true. The following actions are available for selection: **DISABLED* [0]
[1]	No action	*No action* [1]
[2]	Select set-up 1	*Select set-up 1* [2] - changes the active set-up (*K-10 Active Set-up*) to '1'. If the set-up is changed, it will merge with other set-up commands coming from either the digital inputs or via a network.
[3]	Select set-up 2	*Select set-up 2* [3] - changes the active set-up *K-10 Active Set-up*) to '2'. If the set-up is changed, it will merge with other set-up commands coming from either the digital inputs or via a network.
[4]	Select set-up 3	*Select set-up 3* [4] - changes the active set-up (*K-10 Active Set-up*) to '3'. If the set-up is changed, it will merge with other set-up commands coming from either the digital inputs or via a network.
[5]	Select set-up 4	*Select set-up 4* [5] - changes the active set-up (*K-10 Active Set-up*) to '4'. If the set-up is changed, it will merge with other set-up commands coming from either the digital inputs or via a network.
[10]	Select preset ref 0	*Select preset reference 0* [10] – selects preset reference 0. If the active preset reference is changed, it will merge with other preset reference commands coming from either the digital inputs or via a network.
[11]	Select preset ref 1	*Select preset reference 1* [11] – selects preset reference 1. If the active preset reference is changed, it will merge with other preset reference

LC-52 Logic Controller Action		
Array [20]		
Option:		**Function:**
		commands coming from either the digital inputs or via a network.
[12]	Select preset ref 2	*Select preset reference 2* [12] – selects preset reference 2. If the active preset reference is changed, it will merge with other preset reference commands coming from either the digital inputs or via a network.
[13]	Select preset ref 3	*Select preset reference 3* [13] – selects preset reference 3. If the active preset reference is changed, it will merge with other preset reference commands coming from either the digital inputs or via a network.
[14]	Select preset ref 4	*Select preset reference 4* [14] – selects preset reference 4. If the active preset reference is changed, it will merge with other preset reference commands coming from either the digital inputs or via a network.
[15]	Select preset ref 5	*Select preset reference 5* [15] – selects preset reference 5. If the active preset reference is changed, it will merge with other preset reference commands coming from either the digital inputs or via a network.
[16]	Select preset ref 6	*Select preset reference 6* [16] – selects preset reference 6. If the active preset reference is changed, it will merge with other preset reference commands coming from either the digital inputs or via a network.
[17]	Select preset ref 7	*Select preset reference 7* [17] - selects preset reference 7. If the active preset reference is changed, it will merge with other preset reference commands coming from either the digital inputs or via a network.
[18]	Select Accel/ Decel 1	*Select ramp 1* [18] - selects ramp 1.
[19]	Select Accel/ Decel 2	*Select ramp 2* [19] - selects ramp 2.
[20]	Select Accel/ Decel 3	*Select ramp 3* [20] - selects ramp 3.
[21]	Select Accel/ Decel 4	*Select ramp 4* [21] - selects ramp 4.
[22]	Run	*Run* [22] - issues a start command to the drive.

LC-52 Logic Controller Action		
Array [20]		
Option:		**Function:**
[23]	Run reverse	*Run reverse* [23] - issues a start reverse command to the drive.
[24]	Stop	*Stop* [24] - issues a stop command to the drive.
[25]	Qstop	*Q stop* [25] - issues a quick stop command to the drive.
[26]	Dcstop	*Dcstop* [26] - issues a DC stop command to the drive.
[27]	Coast	*Coast* [27] - the drive coasts immediately. All stop commands including the coast command stop the Logic Controller.
[28]	Freeze output	*Freeze output* [28] - freezes the output frequency of the drive.
[29]	Start timer 0	*Start timer 0* [29] - starts timer 0, see *LC-20 Logic Controller Timer* for further description.
[30]	Start timer 1	*Start timer 1* [30] - starts timer 1, see *LC-20 Logic Controller Timer* for further description.
[31]	Start timer 2	*Start timer 2* [31] - starts timer 2, see *LC-20 Logic Controller Timer* for further description.
[32]	Set digital out A low	*Set digital output A low* [32] - any output with LC output A will be low.
[33]	Set digital out B low	*Set digital output B low* [33] - any output with LC output B will be low.
[34]	Set digital out C low	*Set digital output C low* [34] - any output with LC output C will be low.
[35]	Set digital out D low	*Set digital output D low* [35] - any output with LC output D will be low.
[36]	Set digital out E low	*Set digital output E low* [36] - any output with LC output E will be low.
[37]	Set digital out F low	*Set digital output F low* [37] - any output with LC output F will be low.
[38]	Set digital out A high	*Set digital output A high* [38] - any output with LC output A will be high.
[39]	Set digital out B high	*Set digital output B high* [39] - any output with LC output B will be high.
[40]	Set digital out C high	*Set digital output C high* [40] - any output with LC output C will be high.
[41]	Set digital out D high	*Set digital output D high* [41] - any output with LC output D will be high.

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LC-52 Logic Controller Action		
Array [20]		
Option:		**Function:**
[42]	Set digital out E high	*Set digital output E high* [42] - any output with LC output E will be high.
[43]	Set digital out F high	*Set digital output F high* [43] - any output with LC output Fwill be high.
[60]	Reset Counter A	*Reset Counter A* [60] - resets Counter A to zero.
[61]	Reset Counter B	*Reset Counter B* [61] - resets Counter B to zero.
[70]	Start timer 3	*Start Timer 3* [70] - Start Timer 3, see *LC-20 Logic Controller Timer* for further description.
[71]	Start timer 4	*Start Timer 4* [71] - Start Timer 4, see *LC-20 Logic Controller Timer* for further description.
[72]	Start timer 5	*Start Timer 5* [72] - Start Timer 5, see *LC-20 Logic Controller Timer* for further description.
[73]	Start timer 6	*Start Timer 6* [73] - Start Timer 6, see *LC-20 Logic Controller Timer* for further description.
[74]	Start timer 7	*Start Timer 7* [74] - Start Timer 7, see p*LC-20 Logic Controller Timer* for further description.

3.20 B-## Brakes

Parameter group related to the brake features in the drive.

3.20.1 B-0# DC Brake

Parameters to configure the DC brake and DC hold functions.

B-00 DC Hold Current		
Range:		**Function:**
50 %*	[0 - 160. %]	Enter a value for holding current as a percentage of the rated motor current $I_{M,N}$ set in *P-03 Motor Current*. 100% DC holding current corresponds to $I_{M,N}$. This parameter holds the motor function (holding torque) or pre-heats the motor. This parameter is active if *DC hold* is selected in *F-25 Start Function* [0] or *H-80 Function at Stop* [1].

NOTE!

The maximum value depends on the rated motor current. Avoid 100% current for too long. It may damage the motor.
Low values of DC hold will produce larger than expected currents with larger motor power sizes. This error will increase as the motor power increases.

B-01 DC Brake Current		
Range:		**Function:**
50 %*	[0 - 1000. %]	Enter a value for current as a percentage of the rated motor current $I_{M,N}$, see *P-03 Motor Current*. 100% DC braking current corresponds to $I_{M,N}$. DC brake current is applied on a stop command, when the speed is lower than the limit set in *B-03 DC Brake Cut-in Speed [RPM]*; when the DC Brake Inverse function is active; or via the serial communication port. The braking current is active during the time period set in *B-02 DC Braking Time*.

NOTE!

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

B-02 DC Braking Time		
Range:		**Function:**
10.0 s*	[0.0 - 60.0 s]	Set the duration of the DC braking current set in *B-01 DC Brake Current*, once activated.

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

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

B-05 Maximum Reference		
Range:		**Function:**
par. 3-03 Reference-FeedbackUnit*	[par. F-52 - 999999.999 ReferenceFeedbackUnit]	

3.20.2 B-1# Brake Energy Funct.

Parameters to configure the dynamic braking functions in the drive. Note! This applies only to drives ordered with the optional factory installed brake chopper option.

B-10 Brake Function		
Option:		**Function:**
[0] *	Off	No brake resistor is installed.
[1]	Resistor brake	A brake resistor is incorporated in the system, for dissipating 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 adjustable frequency drives with an integral dynamic brake.
[2]	AC brake	Is selected to improve braking without using a brake resistor. This parameter controls an overmagnetization of the motor when running with a generatoric load. This function can improve the OVC function. Increasing the electrical losses in the motor allows the OVC function to increase the braking torque without exceeding the overvoltage limit. Please note that AC brake is not as effective as dynamic breaking with resistor. AC brake is for Adv. Vector Control and flux mode in both open-loop and closed-loop.

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B-11 Brake Resistor (ohm)

Range:		Function:
50.00 Ohm*	[5.00 - 65535.00 Ohm]	Set the brake resistor value in Ohms. This value is used for monitoring the power to the brake resistor in *B-13 Braking Thermal Overload*. This parameter is only active in adjustable frequency drives with an integral dynamic brake. Use this parameter for values without decimals. For a selection with two decimals, use *B-11 Brake Resistor (ohm)*.

B-12 Brake Power Limit (kW)

Range:		Function:
5.000 kW*	[0.001 - 2000.000 kW]	*B-12 Brake Power Limit (kW)* is the expected average power dissipated in the brake resistor over a period of 120 sec. It is used as the monitoring limit for *DR-33 Brake Power /2 min* and thereby specifies when a warning/ alarm is to be given. To calculate *B-12 Brake Power Limit (kW)*, the following formula can be used. $P_{br,avg}[W] = \frac{U_{br}^2[V] \times t_{br}[s]}{R_{br}[\Omega] \times T_{br}[s]}$ $P_{br,avg}$ is the average power dissipated in the brake resistor, R_{br} is the resistance of the brake resistor. t_{br} is the active breaking time within the 120 s period, T_{br}. U_{br} is the DC voltage where the brake resistor is active. This depends on the unit as follows: 200–240 V: 390 V 380–480 V: 778 V 525–600 V: 943 V 525–690 V: 1,099 V **NOTE! If R_{br} is not known or if T_{br} is different from 120s, the practical approach is to run the brake application, readout *DR-33 Brake Power /2 min* and then enter this + 20% in *B-12 Brake Power Limit (kW)*.**

B-13 Braking Thermal Overload

Option:		Function:
		This parameter is only active in adjustable frequency drives with an integral dynamic brake. This parameter enables monitoring of the power to the brake resistor. The power is calculated on the basis of the resistance (*B-11 Brake Resistor (ohm)*), the DC-link voltage, and the resistor duty time.
[0] *	Off	No braking energy monitoring required.
[1]	Warning	Activates a warning on the display when the power transmitted over 120 s exceeds 100% of the monitoring limit (*B-12 Brake Power Limit (kW)*). The warning disappears when the transmitted power falls below 80% of the monitoring limit.
[2]	Trip	Trips drive and displays an alarm when the calculated power exceeds 100% of the monitoring limit.
[3]	Warning and trip	Activates both of the above, including warning, trip and alarm.

If power monitoring is set to *Off* [0] or *Warning* [1], the brake function remains active, even if the monitoring limit is exceeded. This may lead to thermal overload of the resistor. It is also possible to generate a warning via a relay/digital 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:
		Select type of test and monitoring function to check the connection to the brake resistor, or whether a brake resistor is present, and then display a warning or an alarm in the event of a fault. **NOTE! The brake resistor disconnection function is tested during power-up. However, the brake IGBT test is performed when there is no braking. A warning or trip disconnects the brake function.** The testing sequence is as follows: 1. The DC link ripple amplitude is measured for 300 ms without braking. 2. The DC link ripple amplitude is measured for 300 ms with the brake turned on. 3. If the DC link ripple amplitude while braking is lower than the DC link ripple amplitude before braking + 1%: *Brake*

B-15 Brake Check		
Option:		**Function:**
		check has failed by returning a warning or alarm. 4. If the DC link ripple amplitude while braking is higher than the DC link ripple amplitude before braking + 1%: *Brake check is OK.*
[0] *	Off	Monitors brake resistor and brake IGBT for a short-circuit during operation. If a short-circuit occurs, warning 25 appears.
[1]	Warning	Monitors brake resistor and brake IGBT for a short-circuit, and runs a test for brake resistor disconnection during power-up.
[2]	Trip	Monitors for a short-circuit or disconnection of the brake resistor, or a short-circuit of the brake IGBT. If a fault occurs, the drive cuts out while displaying an alarm (trip locked).
[3]	Stop and trip	Monitors for a short-circuit or disconnection of the brake resistor, or a short-circuit of the brake IGBT. If a fault occurs, the drive decels to coast and then trips. A trip lock alarm is displayed (e.g., warning 25, 27 or 28).
[4]	AC brake	Monitors for a short-circuit or disconnection of the brake resistor, or a short-circuit of the brake IGBT. If a fault occurs, the drive performs a controlled decel.
[5]	Trip Lock	

NOTE!

Remove a warning arising in connection with *Off* [0] or *Warning* [1] by cycling the line power supply. The fault must be corrected first. For *Off* [0] or *Warning* [1], the drive keeps running even if a fault is located.

This parameter is only active in adjustable frequency drives with an integral dynamic brake.

B-16 AC brake Max. Current		
Range:		**Function:**
100.0 %*	[0.0 - 1000.0 %]	Enter the maximum permissible current when using AC brake to avoid overheating motor windings.

NOTE!

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

B-17 Overvoltage Control		
Option:		**Function:**
		Overvoltage control (OVC) reduces the risk of the drive 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 drive.
[2]	Enabled	Activates OVC.

NOTE!

OVC must not be enabled in hoisting applications.

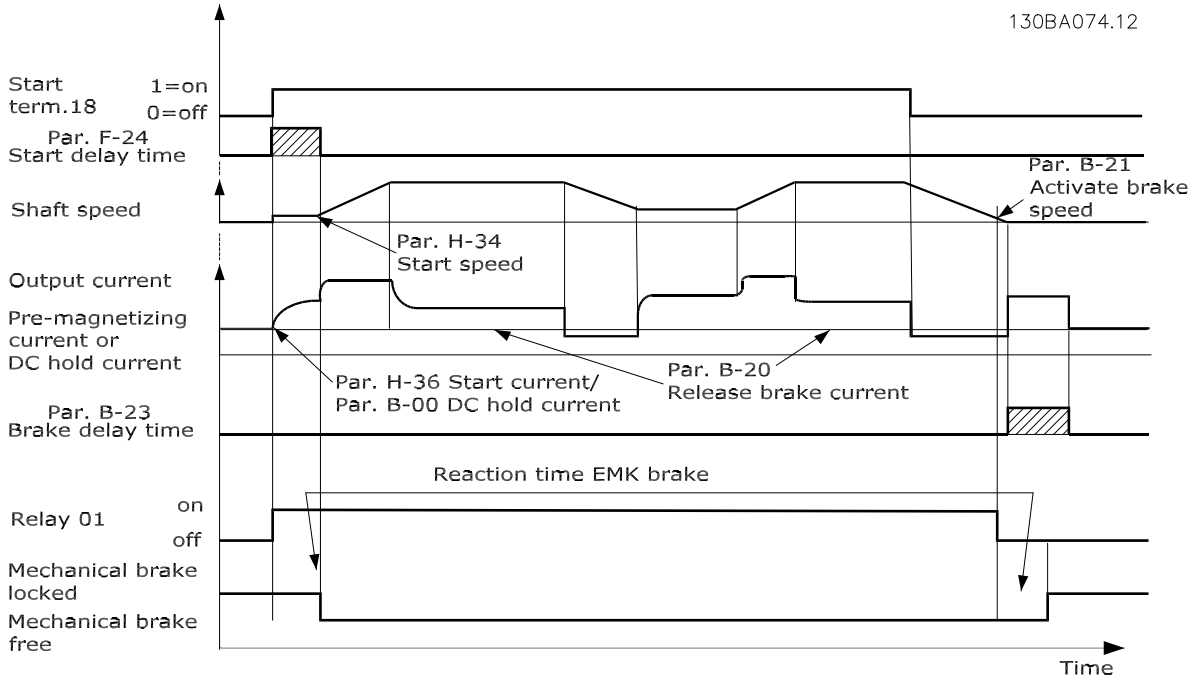
B-18 Brake Check Condition		
Range:		**Function:**
[0] *	At Power-up	Brake check will be performed at power-up
[1]	After Coast Sit.	Brake check will be performed after coast situations

3.20.3 B-2# Mechanical Brake

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

NOTE!

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



B-20 Release Brake Current		
Range:		**Function:**
par. 16-37 A*	[0.00 - par. DR-37 A]	Set the motor current for release of the mechanical brake, when a start condition is present. The default value is the maximum current the inverter can provide for the particular power size. The upper limit is specified in *DR-37 Drive Max. Current*. **NOTE! When Mechanical brake control output is selected but no mechanical brake is connected, the function will not work by default setting due to too low motor current.**

B-21 Activate Brake Speed [RPM]		
Range:		**Function:**
0 RPM*	[0 - 30000 RPM]	Set the motor speed for activation of the mechanical brake, when a stop condition is present. The upper speed limit is specified in *H-73 Warning Speed High*.

B-22 Activate Brake Speed [Hz]		
Range:		**Function:**
0 Hz*	[0.0 - 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:**
0.0 s*	[0.0 - 5.0 s]	Enter the brake delay time of the coast after decel time. The shaft is held at zero speed with full holding torque. Ensure that the mechanical brake has locked the load before the motor enters coast mode. See the *Mechanical Brake Control* section in the AF-650 GP Design Guide.

B-24 Stop Delay		
Range:		**Function:**
0.0 s*	[0.0 - 5.0 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*	[0.00 - 5.00 s]	This value defines the time it takes for the mechanical brake to open/close. This parameter must act as a timeout when brake feedback is activated.

B-26 Torque Ref		
Range:		**Function:**
0.00 %*	[0 - 0 %]	The value defines the torque applied against the closed mechanical brake before release

B-27 Torque Ramp Time		
Range:		**Function:**
0.2 s*	[0.0 - 5.0 s]	The value defines the duration of the torque ramp in clockwise direction.

B-28 Gain Boost Factor		
Range:		**Function:**
1.00 *	[1.00 - 4.00]	When a speed PID control is connected to the output (flux closed-loop), it must be possible to boost the proportional gain of the control during the *Activate Brake Delay* (*B-23 Activate Brake Delay*). By increasing the gain, the bump when the motor takes over the load from the brake can be reduced. The risk of oscillation is very small due to the relatively short duration and the low (zero) speed.

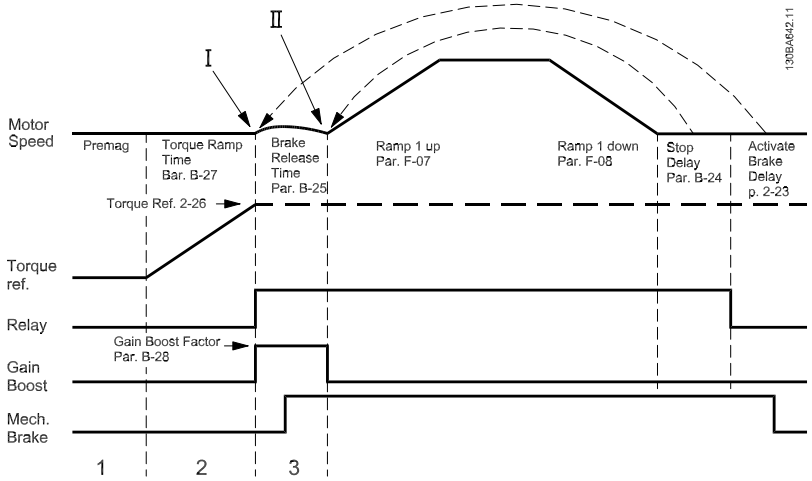


Figure 3.9 Brake release sequence for hoist mechanical brake control

I) *Activate brake delay*: The adjustable frequency drive starts again from the *mechanical brake engaged* position.

II) *Stop delay*: When the time between successive starts is shorter than the setting in *B-24 Stop Delay*, the adjustable frequency drive starts without applying the mechanical brake (e.g., reversing).

3

3.21 PI-## PID Controls

Parameter group related to PID controls

3.21.1 PI-0# Speed PID Control

Parameters to configure the Speed PID Control.

PI-00 Speed PID Feedback Source

Option:		Function:
		Select the encoder for closed-loop feedback. The feedback may come from a different encoder (typically mounted on the application itself) than the motor mounted encoder feedback selected in *H-42 Flux Motor Feedback Source*.
[0] *	Motr feedb 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	

NOTE!

This parameter cannot be adjusted while the motor is running.

PI-02 Speed PID Proportional Gain

Range:		Function:
0 *	[0.0000 - 1.0000]	Enter the speed controller proportional gain. Quick control is obtained at high amplification. However, if the amplification is too great, the process may become unstable.

PI-03 Speed PID Integral Time

Range:		Function:
8.0 ms*	[2.0 - 20000.0 ms]	Enter the speed controller integral time, which determines the time the internal PID control takes to correct errors. The greater the error, the more quickly the gain increases. The integral time causes a delay of the signal and therefore a damping 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,

PI-03 Speed PID Integral Time

Range:		Function:
		leading to major deviations from the required reference, since the process regulator takes too long to regulate errors. This parameter is used with *Speed open-loop* [0] and *Speed closed-loop* [1] control, set in *H-40 Configuration Mode*.

PI-04 Speed PID Differentiation Time

Range:		Function:
30.0 ms*	[0.0 - 200.0 ms]	Enter the speed controller differentiation time. The differentiator does not react to constant error. It provides gain proportional to the rate of change of the speed feedback. The quicker the error changes, the stronger the gain from the differentiator. The gain is proportional with the speed at which errors change. Setting this parameter to zero disables the differentiator. This parameter is used with *H-40 Configuration Mode Speed closed-loop* [1] control.

PI-05 Speed PID Diff. Gain Limit

Range:		Function:
5.0 *	[1.0 - 20.0]	Set a limit for the gain provided by the differentiator. Since the differential gain increases at higher frequencies, limiting the gain may be useful. For example, set up a pure D-link at low frequencies and a constant D-link at higher frequencies. This parameter is used with *H-40 Configuration Mode Speed closed-loop* [1] control.

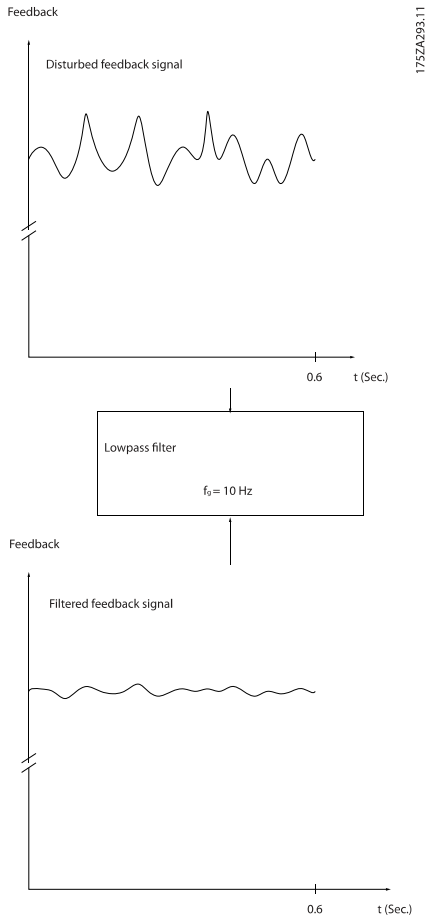
PI-06 Speed PID Lowpass Filter Time

Range:		Function:
10.0 ms*	[1.0 - 100.0 ms]	Set a time constant for the speed control lowpass filter. The low-pass filter improves steady-state performance and dampens oscillations on the feedback signal. This is an advantage if there is a great amount on noise in the system; see figure below. For example, if a time constant (τ) of 100 ms is programmed, the cut-off frequency for the low-pass filter will be 1/0.1= 10 RAD/sec., corresponding to (10/2 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 frequency higher than 1.6 Hz, the PID regulator does not react. Practical settings of *PI-06 Speed PID Lowpass Filter Time* taken from the number of pulses per revolutions from encoder:

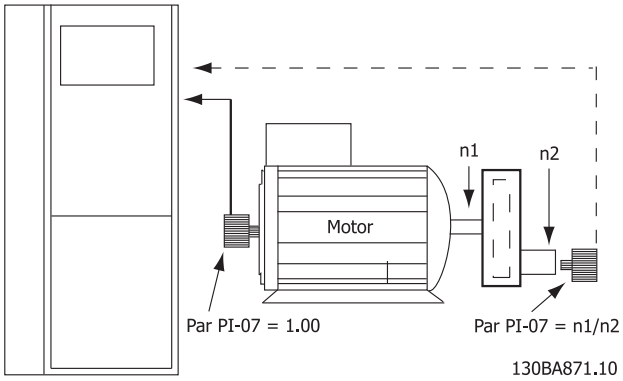
PI-06 Speed PID Lowpass Filter Time		
Range:	**Function:**	

Encoder PPR	*PI-06 Speed PID Lowpass Filter Time*
512	10 ms
1,024	5 ms
2,048	2 ms
4,096	1 ms

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



PI-07 Speed PID Feedback Gear Ratio		
Range:		**Function:**
1.0000 *	[0.0001 - 32.0000]	



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

3.21.2 PI-1# Torque PI Control

PI-12 Torque PI Proportional Gain		
Range:		**Function:**
100 %*	[0 - 500 %]	Enter the proportional gain value for the torque controller. Selection of a high value makes the controller react faster. Too high a setting leads to controller instability.

PI-13 Torque PI Integration Time		
Range:		**Function:**
0.020 s*	[0.002 - 2.000 s]	Enter the integration time for the torque controller. Selecting a low value causes the controller to react faster. Too low a setting leads to control instability.

3.21.3 PI-2# Proces PID Feedback

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

PI-20 Process CL Feedback 1 Resource		
Option:		**Function:**
		The effective feedback signal is made up of the sum of up to two different input signals.

3

PI-20 Process CL Feedback 1 Resource		
Option:		**Function:**
		Select which drive input should be treated as the source of the first of these signals. The second input signal is defined in *PI-22 Process CL Feedback 2 Resource*.
[0] *	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[3]	Frequency input 29	
[4]	Frequency input 33	
[7]	Analog Input X30/11	(OPCGPIO)
[8]	Analog Input X30/12	(OPCGPIO)

PI-22 Process CL Feedback 2 Resource		
Option:		**Function:**
		The effective feedback signal is made up of the sum of up to two different input signals. Select which drive input should be treated as the source of the second of these signals. The first input signal is defined in *PI-20 Process CL Feedback 1 Resource*.
[0] *	No function	
[1]	Analog Input 53	
[2]	Analog Input 54	
[3]	Frequency input 29	
[4]	Frequency input 33	
[7]	Analog Input X30/11	ar. (OPCGPIO)
[8]	Analog Input X30/12	(OPCGPIO)

3.21.4 PI-3# Process PID Control

Parameters to configure the Process PID Controls.

PI-30 Process PID Normal/Inverse Control		
Option:		**Function:**
		Normal and inverse control are implemented by introducing a difference between the reference signal and the feedback signal.
[0] *	Normal	Sets process control in order to increase the output frequency.
[1]	Inverse	Sets process control in order to reduce the output frequency.

PI-31 Process PID Anti Windup		
Option:		**Function:**
[0]	Off	Continues regulation of an error even when the output frequency cannot be increased or decreased.

PI-31 Process PID Anti Windup		
Option:		**Function:**
[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 drive will commence ramping and then operate under speed open-loop control. Thereafter, when the process PID start speed is reached, the drive will change over to process PID control.

PI-33 Process PID Proportional Gain		
Range:		**Function:**
0.01 *	[0.00 - 10.00]	Enter the PID proportional gain. The proportional gain multiplies the error between the setpoint and the feedback signal.

PI-34 Process PID Integral Time		
Range:		**Function:**
10000.00 s*	[0.01 - 10000.00 s]	Enter the PID integral time. The integrator provides an increasing gain at a constant error between the 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:**
0.00 s*	[0.00 - 10.00 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:**
5.0 *	[1.0 - 50.0]	Enter a limit for the differentiator gain (DG). If there is no limit, the DG will increase when there are fast changes. Limit the DG to obtain a pure differentiator gain at slow changes, and a constant differentiator gain where fast changes occur.

PI-38 Process PID Feed Forward Factor

Range:		Function:
0 %*	[0 - 200 %]	Enter the PID feed forward (FF) factor. The FF factor sends a constant fraction of the reference signal to bypass PID control, which means that PID control only affects the remaining fraction of the control signal. Any change to this parameter will thus affect the motor speed. When the FF factor is activated it provides less overshoot, and high dynamics when changing the setpoint. *PI-38 Process PID Feed Forward Factor* is active when *H-40 Configuration Mode* is set to [3] Process.

PI-39 On Reference Bandwidth

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

PI-40 Process PID I-part Reset

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

PI-41 Process PID Output Neg. Clamp

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

PI-42 Process PID Output Pos. Clamp

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

PI-43 Process PID Gain Scale at Min. Ref.

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

PI-44 Process PID Gain Scale at Max. Ref.

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

PI-45 Process PID Feed Fwd Resource

Option:		Function:
[0] *	No function	Select which drive input should be used as the feed forward factor. The FF factor is added directly to the output of the PID controller. This increases dynamic performance.
[1]	Analog Input 53	
[2]	Analog Input 54	
[7]	Frequency input 29	
[8]	Frequency input 33	
[11]	Local bus reference	
[20]	Digi. Potentiomtre	
[21]	Analog input X30-11	
[22]	Analog input X30-12	

PI-46 Process PID Feed Fwd Normal/ Inv. Ctrl.

Option:		Function:
[0] *	Normal	Select Normal [0] to set the feed forward factor to treat the FF resource as a positive value.
[1]	Inverse	Select Inverse [1] to treat the FF resource as a negative value.

PI-49 Process PID Output Normal/ Inv. Ctrl.

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

3.21.5 PI-5# Process PID Ctrl.

Parameter group PI-5# is only used if *H-40 Configuration Mode* is set to [7] Extended PID speed CL or [8] Extended PID Speed OL.

PI-50 Process PID Extended PID

Option:		Function:
[0]	Disabled	Disables the extended parts of the process PID controller.

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PI-50 Process PID Extended PID

Option:		Function:
[1] *	Enabled	Enables the extended parts of the PID controller.

PI-51 Process PID Feed Fwd Gain

Range:		Function:
1.00 *	[0.00 - 100.00]	The feed forward is used to obtain the desired level, based on a well-known signal available. The PID controller then only takes care of the smaller part of the control, necessary because of unknown characters. The standard feed fwd factor in *PI-38 Process PID Feed Forward Factor* is always related to the reference whereas *PI-51 Process PID Feed Fwd Gain* has more choices. In winder applications, the feed fwd factor will typically be the line speed of the system.

PI-52 Process PID Feed Fwd Ramp-up

Range:		Function:
0.01 s*	[0.01 - 10.00 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 - 10.00 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 - 1.000 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 - 1.000 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:
0.0 %*	[-200.0 - 200.0 %]	

PI-61 Process PID Output

Range:		Function:
0.0 %*	[-200.0 - 200.0 %]	

PI-62 Process PID Clamped Output

Range:		Function:
0.0 %*	[-200.0 - 200.0 %]	

PI-63 Process PID Gain Scaled Output

Range:		Function:
0.0 %*	[-200.0 - 200.0 %]	

4 Parameter Lists

4.1 Parameter Lists

Changes during operation
"TRUE" means that the parameter can be changed while the adjustable frequency drive is in operation, and "FALSE" means that the adjustable frequency drive must be stopped before a change can be made.

4-Set-up
'All set-ups': the parameter can be set individually in each of the four set-ups, i.e., one single parameter can have four different data values.
'1 set-up': the data value will be the same in all set-ups.

Data type	Description	Type
2	Integer 8	Int8
3	Integer 16	Int16
4	Integer 32	Int32
5	Unsigned 8	Uint8
6	Unsigned 16	Uint16
7	Unsigned 32	Uint32
9	Visible String	VisStr
33	Normalized value 2 bytes	N2
35	Bit sequence of 16 boolean variables	V2
54	Time difference w/o date	TimD

4

4.1.1 K-## Keypad Set-up

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
K-0#						
K-01	Language	[0] English	1 set-up	TRUE	-	Uint8
K-02	Motor Speed Unit	[0] RPM	2 set-ups	FALSE	-	Uint8
K-03	Regional Settings	[1] US	2 set-ups	FALSE	-	Uint8
K-04	Operating State at Power-up	[1] Forced stop, ref=old	All set-ups	TRUE	-	Uint8
K-09	Performance Monitor	0.0 %	All set-ups	TRUE	-1	Uint16
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-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	0.00 CustomReadoutUnit	All set-ups	TRUE	-2	Int32
K-32	Max Value of Custom Readout	100.00 CustomReadoutUnit	All set-ups	TRUE	-2	Int32
K-37	Display Text 1	0 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	ExpressionLimit	All set-ups	TRUE	-	Uint8
K-41	[Off] Button on Keypad	ExpressionLimit	All set-ups	TRUE	-	Uint8
K-42	[Auto] Button on Keypad	ExpressionLimit	All set-ups	TRUE	-	Uint8
K-43	[Reset] Button on Keypad	ExpressionLimit	All set-ups	TRUE	-	Uint8
K-44	[Off/Reset] Key on Keypad	[1] Enabled	All set-ups	TRUE	-	Uint8
K-5#						
K-50	Keypad Copy	[0] No copy	All set-ups	FALSE	-	Uint8
K-51	Set-up Copy	[0] No copy	All set-ups	FALSE	-	Uint8
K-6#						
K-60	Main Menu Password	100 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

4.1.2 F-## Fundamental Parameters

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion 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	132.0 Hz	All set-ups	FALSE	-1	Uint16
F-04	Base Frequency	ExpressionLimit	All set-ups	FALSE	0	Uint16
F-05	Motor Rated Voltage	ExpressionLimit	All set-ups	FALSE	0	Uint16
F-07	Accel Time 1	ExpressionLimit	All set-ups	TRUE	-2	Uint32
F-08	Decel Time 1	ExpressionLimit	All set-ups	TRUE	-2	Uint32
F-09	Torque Boost	100 %	All set-ups	TRUE	0	Int16
F-1#						
F-10	Electronic Overload	[0] No protection	All set-ups	TRUE	-	Uint8
F-11	Motor External Fan	[0] No	All set-ups	TRUE	-	Uint16
F-12	Motor Thermistor Input	[0] None	All set-ups	TRUE	-	Uint8
F-15	Motor Speed High Limit [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
F-16	Motor Speed Low Limit [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
F-17	Motor Speed High Limit [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
F-18	Motor Speed Low Limit [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
F-2#						
F-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	0.0 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	0.00 A	All set-ups	TRUE	-2	Uint32
F-3#						
F-37	Adv. Switching Pattern	ExpressionLimit	All set-ups	TRUE	-	Uint8
F-38	Overmodulation	[1] On	All set-ups	FALSE	-	Uint8
F-4#						
F-40	Torque Limiter (Driving)	ExpressionLimit	All set-ups	TRUE	-1	Uint16
F-41	Torque Limiter (Braking)	100.0 %	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	0.00 %	All set-ups	TRUE	-2	Int16
F-64	Preset Relative Reference	0.00 %	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	1.00 s	All set-ups	TRUE	-2	Uint32

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
F-92	Power Restore	[0] Off	All set-ups	TRUE	-	Uint8
F-93	Maximum Limit	100 %	All set-ups	TRUE	0	Int16
F-94	Minimum Limit	-100 %	All set-ups	TRUE	0	Int16
F-95	Accel/Decel Ramp Delay	ExpressionLimit	All set-ups	TRUE	-3	TimD

4.1.3 E-## Digital In/Outs

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
E-0#						
E-00	Digital I/O Mode	[0] PNP	All set-ups	FALSE	-	Uint8
E-01	Terminal 18 Digital Input	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-02	Terminal 19 Digital Input	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-03	Terminal 27 Digital Input	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-04	Terminal 29 Digital Input	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-05	Terminal 32 Digital Input	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-06	Terminal 33 Digital Input	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-07	Terminal 37 Safe Stop	[1] Safe Stop Alarm	1 set-up	TRUE	-	Uint8
E-1#						
E-10	Accel Time 2	ExpressionLimit	All set-ups	TRUE	-2	Uint32
E-11	Decel Time 2	ExpressionLimit	All set-ups	TRUE	-2	Uint32
E-12	Accel Time 3	ExpressionLimit	All set-ups	TRUE	-2	Uint32
E-13	Decel Time 3	ExpressionLimit	All set-ups	TRUE	-2	Uint32
E-14	Accel Time 4	ExpressionLimit	All set-ups	TRUE	-2	Uint32
E-15	Decel Time 4	ExpressionLimit	All set-ups	TRUE	-2	Uint32
E-2#						
E-20	Terminal 27 Digital Output	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-21	Terminal 29 Digital Output	ExpressionLimit	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-3#						
E-30	Terminal X46/1 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
E-31	Terminal X46/3 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
E-32	Terminal X46/5 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
E-33	Terminal X46/7 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
E-34	Terminal X46/9 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
E-35	Terminal X46/11 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
E-36	Terminal X46/13 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
E-5#						
E-51	Terminal 27 Mode	[0] Input	All set-ups	TRUE	-	Uint8
E-52	Terminal 29 Mode	[0] Input	All set-ups	TRUE	-	Uint8
E-53	Terminal X30/2 Digital Input	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)	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-57	Term X30/7 Digi Out (OPCGPIO)	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-6#						
E-60	Term. 29 Low Frequency	100 Hz	All set-ups	TRUE	0	Uint32
E-61	Term. 29 High Frequency	100 Hz	All set-ups	TRUE	0	Uint32
E-62	Term. 29 Low Ref./Feedb. Value	0.000 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Int32
E-63	Term. 29 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
E-64	Pulse Filter Time Constant #29	100 ms	All set-ups	FALSE	-3	Uint16
E-65	Term. 33 Low Frequency	100 Hz	All set-ups	TRUE	0	Uint32

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Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
E-66	Term. 33 High Frequency	100 Hz	All set-ups	TRUE	0	Uint32
E-67	Term. 33 Low Ref./Feedb. Value	0.000 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Int32
E-68	Term. 33 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
E-69	Pulse Filter Time Constant #33	100 ms	All set-ups	FALSE	-3	Uint16
E-7#						
E-70	Terminal 27 Pulse Output Variable	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-72	Pulse Output Max Freq #27	ExpressionLimit	All set-ups	TRUE	0	Uint32
E-73	Terminal 29 Pulse Output Variable	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-75	Pulse Output Max Freq #29	ExpressionLimit	All set-ups	TRUE	0	Uint32
E-76	Terminal X30/6 Pulse Output Variable	ExpressionLimit	All set-ups	TRUE	-	Uint8
E-78	Pulse Output Max Freq #X30/6	ExpressionLimit	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	0.00 %	All set-ups	TRUE	-2	N2
E-94	Pulse Out #27 Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16
E-95	Pulse Out #29 Bus Control	0.00 %	All set-ups	TRUE	-2	N2
E-96	Pulse Out #29 Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16
E-97	Pulse Out #X30/6 Bus Control	0.00 %	All set-ups	TRUE	-2	N2
E-98	Pulse Out #X30/6 Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16

4.1.4 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	0.00 %	All set-ups	TRUE	-2	Int16
C-2#						
C-20	Jog Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
C-21	Jog Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
C-22	Jog Accel/Decel Time	ExpressionLimit	All set-ups	TRUE	-2	Uint32
C-23	Quick Stop Decel Time	ExpressionLimit	2 set-ups	TRUE	-2	Uint32
C-24	Quick Stop Ramp Type	[0] Linear	All set-ups	TRUE	-	Uint8
C-25	Quick Stop S-ramp Ratio at Decel. Start	50 %	All set-ups	TRUE	0	Uint8
C-26	Quick Stop S-ramp Ratio at Decel. End	50 %	All set-ups	TRUE	0	Uint8
C-3#						
C-30	Frequency Command 2	ExpressionLimit	All set-ups	TRUE	-	Uint8
C-34	Frequency Command 3	ExpressionLimit	All set-ups	TRUE	-	Uint8

4.1.5 P-## Motor Data

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
P-0#						
P-01	Motor Poles	ExpressionLimit	All set-ups	FALSE	0	Uint8
P-02	Motor Power [HP]	ExpressionLimit	All set-ups	FALSE	-2	Uint32
P-03	Motor Current	ExpressionLimit	All set-ups	FALSE	-2	Uint32
P-04	Auto Tune	[0] Off	All set-ups	FALSE	-	Uint8
P-05	Motor Cont. Rated Torque	ExpressionLimit	All set-ups	FALSE	-1	Uint32
P-06	Base Speed	ExpressionLimit	All set-ups	FALSE	67	Uint16
P-07	Motor Power [kW]	ExpressionLimit	All set-ups	FALSE	1	Uint32
P-09	Slip Compensation	ExpressionLimit	All set-ups	TRUE	0	Int16
P-1#						
P-10	Slip Compensation Time Constant	ExpressionLimit	All set-ups	TRUE	-2	Uint16
P-2#						
P-20	Motor Construction	[0] Asynchron	All set-ups	FALSE	-	Uint8
P-3#						
P-30	Stator Resistance (Rs)	ExpressionLimit	All set-ups	FALSE	-4	Uint32
P-31	Rotor Resistance (Rr)	ExpressionLimit	All set-ups	FALSE	-4	Uint32
P-33	Stator Leakage Reactance (X1)	ExpressionLimit	All set-ups	FALSE	-4	Uint32
P-34	Rotor Leakage Reactance (X2)	ExpressionLimit	All set-ups	FALSE	-4	Uint32
P-35	Main Reactance (Xh)	ExpressionLimit	All set-ups	FALSE	-4	Uint32
P-36	Iron Loss Resistance (Rfe)	ExpressionLimit	All set-ups	FALSE	-3	Uint32
P-37	d-axis Inductance (Ld)	ExpressionLimit	All set-ups	FALSE	-6	Int32

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4.1.6 H-## High Perf Parameters

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
H-0#						
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)	10 s	All set-ups	TRUE	0	Uint16
H-07	Accel/Decel Time 1 Type	[0] Linear	All set-ups	TRUE	-	Uint8
H-08	Reverse Lock	ExpressionLimit	All set-ups	FALSE	-	Uint8
H-09	Start Mode	[0] Disabled	All set-ups	FALSE	-	Uint8
H-2#						
H-20	Motor Feedback Loss Function	[2] Trip	All set-ups	TRUE	-	Uint8
H-21	Motor Feedback Speed Error	300 RPM	All set-ups	TRUE	67	Uint16
H-22	Motor Feedback Loss Timeout	0.05 s	All set-ups	TRUE	-2	Uint16
H-24	Tracking Error Function	[0] Disable	All set-ups	TRUE	-	Uint8
H-25	Tracking Error	10 RPM	All set-ups	TRUE	67	Uint16
H-26	Tracking Error Timeout	1.00 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	1.00 s	All set-ups	TRUE	-2	Uint16
H-29	Tracking Error After Ramping Timeout	5.00 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-5#						
H-50	Motor Magnetisation at Zero Speed	100 %	All set-ups	TRUE	0	Uint16
H-51	Min Speed Normal Magnetising [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
H-52	Min Speed Normal Magnetising [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
H-53	Model Shift Frequency	ExpressionLimit	All set-ups	FALSE	-1	Uint16
H-54	Voltage reduction in fieldweakening	0 V	All set-ups	FALSE	0	Uint8
H-55	U/f Characteristic - U	ExpressionLimit	All set-ups	TRUE	-1	Uint16
H-56	U/f Characteristic - F	ExpressionLimit	All set-ups	TRUE	-1	Uint16
H-58	Flystart Test Pulses Current	30 %	All set-ups	FALSE	0	Uint16
H-59	Flystart Test Pulses Frequency	200 %	All set-ups	FALSE	0	Uint16
H-6#						
H-61	High Speed Load Compensation	100 %	All set-ups	TRUE	0	Int16
H-64	Resonance Dampening	100 %	All set-ups	TRUE	0	Uint16
H-65	Resonance Dampening Time Constant	5 ms	All set-ups	TRUE	-3	Uint8
H-66	Min. Current at Low Speed	100 %	All set-ups	TRUE	0	Uint8
H-7#						
H-70	Warning Current Low	0.00 A	All set-ups	TRUE	-2	Uint32
H-71	Warning Current High	ExpressionLimit	All set-ups	TRUE	-2	Uint32
H-72	Warning Speed Low	0 RPM	All set-ups	TRUE	67	Uint16

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
H-73	Warning Speed High	ExpressionLimit	All set-ups	TRUE	67	Uint16
H-74	Warning Reference Low	-999999.999 N/A	All set-ups	TRUE	-3	Int32
H-75	Warning Reference High	999999.999 N/A	All set-ups	TRUE	-3	Int32
H-76	Warning Feedback Low	-999999.999 Reference-FeedbackUnit	All set-ups	TRUE	-3	Int32
H-77	Warning Feedback High	999999.999 Reference-FeedbackUnit	All set-ups	TRUE	-3	Int32
H-78	Missing Motor Phase Function	ExpressionLimit	All set-ups	TRUE	-	Uint8
H-8#						
H-80	Function at Stop	[0] Coast	All set-ups	TRUE	-	Uint8
H-81	Min Speed for Function at Stop [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
H-82	Min Speed for Function at Stop [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
H-83	Precise Stop Function	[0] Precise ramp stop	All set-ups	FALSE	-	Uint8
H-84	Precise Stop Counter Value	100000 N/A	All set-ups	TRUE	0	Uint32
H-85	Precise Stop Speed Compensation Delay	10 ms	All set-ups	TRUE	-3	Uint8
H-87	Load Type	[0] Passive load	All set-ups	TRUE	-	Uint8
H-88	Minimum Inertia	ExpressionLimit	All set-ups	FALSE	-4	Uint32
H-89	Maximum Inertia	ExpressionLimit	All set-ups	FALSE	-4	Uint32
H-9#						
H-95	KTY Sensor Type	[0] KTY Sensor 1	All set-ups	TRUE	-	Uint8
H-96	KTY Thermistor Input	[0] None	All set-ups	TRUE	-	Uint8
H-97	KTY Threshold level	80 °C	1 set-up	TRUE	100	Int16

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4.1.7 AN-## Analog In / Out

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
AN-0#						
AN-00	Live Zero Timeout Time	10 s	All set-ups	TRUE	0	Uint8
AN-01	Live Zero Timeout Function	[0] Off	All set-ups	TRUE	-	Uint8
AN-1#						
AN-10	Terminal 53 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
AN-11	Terminal 53 High Voltage	10.00 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	20.00 mA	All set-ups	TRUE	-5	Int16
AN-14	Terminal 53 Low Ref./Feedb. Value	0 ReferenceFeed-backUnit	All set-ups	TRUE	-3	Int32
AN-15	Terminal 53 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
AN-16	Terminal 53 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
AN-2#						
AN-20	Terminal 54 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
AN-21	Terminal 54 High Voltage	10.00 V	All set-ups	TRUE	-2	Int16
AN-22	Terminal 54 Low Current	0.14 mA	All set-ups	TRUE	-5	Int16
AN-23	Terminal 54 High Current	20.00 mA	All set-ups	TRUE	-5	Int16
AN-24	Terminal 54 Low Ref./Feedb. Value	0 ReferenceFeed-backUnit	All set-ups	TRUE	-3	Int32
AN-25	Terminal 54 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
AN-26	Terminal 54 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
AN-3#						
AN-30	Terminal X30/11 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
AN-31	Terminal X30/11 High Voltage	10.00 V	All set-ups	TRUE	-2	Int16
AN-34	Term. X30/11 Low Ref./Feedb. Value	0 ReferenceFeed-backUnit	All set-ups	TRUE	-3	Int32
AN-35	Term. X30/11 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
AN-36	Term. X30/11 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
AN-4#						
AN-40	Terminal X30/12 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
AN-41	Terminal X30/12 High Voltage	10.00 V	All set-ups	TRUE	-2	Int16
AN-44	Term. X30/12 Low Ref./Feedb. Value	0 ReferenceFeed-backUnit	All set-ups	TRUE	-3	Int32
AN-45	Term. X30/12 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
AN-46	Term. X30/12 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
AN-5#						
AN-50	Terminal 42 Output	ExpressionLimit	All set-ups	TRUE	-	Uint8
AN-51	Terminal 42 Output Min Scale	0.00 %	All set-ups	TRUE	-2	Int16
AN-52	Terminal 42 Output Max Scale	100.00 %	All set-ups	TRUE	-2	Int16
AN-53	Terminal 42 Output Bus Control	0.00 %	All set-ups	TRUE	-2	N2
AN-54	Terminal 42 Output Timeout Preset	0.00 %	1 set-up	TRUE	-2	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	0.00 %	All set-ups	TRUE	-2	Int16
AN-62	Terminal X30/8 Max. Scale	100.00 %	All set-ups	TRUE	-2	Int16

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
AN-63	Terminal X30/8 Bus Control	0.00 %	All set-ups	TRUE	-2	N2
AN-64	Terminal X30/8 Output Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
AN-7#						
AN-70	Terminal X45/1 Output	ExpressionLimit	All set-ups	TRUE	-	Uint8
AN-71	Terminal X45/1 Min. Scale	0.00 %	All set-ups	TRUE	-2	Int16
AN-72	Terminal X45/1 Max. Scale	100.00 %	All set-ups	TRUE	-2	Int16
AN-73	Terminal X45/1 Bus Control	0.00 %	All set-ups	TRUE	-2	N2
AN-74	Terminal X45/1 Output Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16
AN-8#						
AN-80	Terminal X45/3 Output	ExpressionLimit	All set-ups	TRUE	-	Uint8
AN-81	Terminal X45/3 Min. Scale	0.00 %	All set-ups	TRUE	-2	Int16
AN-82	Terminal X45/3 Max. Scale	100.00 %	All set-ups	TRUE	-2	Int16
AN-83	Terminal X45/3 Bus Control	0.00 %	All set-ups	TRUE	-2	N2
AN-84	Terminal X45/3 Output Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16

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4.1.8 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-13	Mains Failure Step Factor	1.0 N/A	All set-ups	TRUE	-1	Uint8
SP-2#						
SP-23	Typecode Setting	ExpressionLimit	2 set-ups	FALSE	-	Uint8
SP-24	Trip Delay at Current Limit	60 s	All set-ups	TRUE	0	Uint8
SP-25	Trip Delay at Torque Limit	60 s	All set-ups	TRUE	0	Uint8
SP-26	Trip Delay at Drive Fault	ExpressionLimit	All set-ups	TRUE	0	Uint8
SP-28	Production Settings	[0] No action	All set-ups	TRUE	-	Uint8
SP-29	Service Code	0 N/A	All set-ups	TRUE	0	Int32
SP-3#						
SP-30	Current Lim Cont, Proportional Gain	100 %	All set-ups	FALSE	0	Uint16
SP-31	Current Lim Contr, Integration Time	0.020 s	All set-ups	FALSE	-3	Uint16
SP-32	Current Lim Ctrl, Filter Time	1.0 ms	All set-ups	TRUE	-4	Uint16
SP-35	Stall Protection	[1] Enabled	All set-ups	FALSE	-	Uint8
SP-4#						
SP-40	VT Level	66 %	All set-ups	FALSE	0	Uint8
SP-41	Energy Savings Min. Magnetisation	ExpressionLimit	All set-ups	TRUE	0	Uint8
SP-42	Energy Savings Min. Frequency	10 Hz	All set-ups	TRUE	0	Uint8
SP-43	Motor Cosphi	ExpressionLimit	All set-ups	TRUE	-2	Uint16
SP-5#						
SP-50	RFI Filter	[1] On	1 set-up	FALSE	-	Uint8
SP-51	DC Link Compensation	[1] On	1 set-up	TRUE	-	Uint8
SP-52	Fan Operation	[0] Auto	All set-ups	TRUE	-	Uint8
SP-53	Fan Monitor	[1] Warning	All set-ups	TRUE	-	Uint8
SP-55	Output Filter	[0] No Filter	All set-ups	FALSE	-	Uint8
SP-56	Capacitance Output Filter	2.0 uF	All set-ups	FALSE	-7	Uint16
SP-57	Inductance Output Filter	7.000 mH	All set-ups	FALSE	-6	Uint16
SP-59	Actual Number of Inverter Units	ExpressionLimit	1 set-up	FALSE	0	Uint8
SP-6#						
SP-63	Option Supplied by External 24VDC	[1] Yes	2 set-ups	FALSE	-	Uint8
SP-7#						
SP-71	Accel Time 1 S-ramp Ratio at Accel. Start	50 %	All set-ups	TRUE	0	Uint8
SP-72	Accel Time 1 S-ramp Ratio at Accel. End	50 %	All set-ups	TRUE	0	Uint8
SP-73	Decel Time 1 S-ramp Ratio at Decel. Start	50 %	All set-ups	TRUE	0	Uint8
SP-74	Decel Time 1 S-ramp Ratio at Decel. End	50 %	All set-ups	TRUE	0	Uint8
SP-76	Accel/Decel Time 2 Type	[0] Linear	All set-ups	TRUE	-	Uint8
SP-79	Accel Time 2 S-ramp Ratio at Accel. Start	50 %	All set-ups	TRUE	0	Uint8
SP-8#						
SP-80	Accel Time 2 S-ramp Ratio at Accel. End	50 %	All set-ups	TRUE	0	Uint8
SP-81	Decel Time 2 S-ramp Ratio at Decel. Start	50 %	All set-ups	TRUE	0	Uint8
SP-82	Decel Time 2 S-ramp Ratio at Decel. End	50 %	All set-ups	TRUE	0	Uint8

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

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4.1.9 O-## Options/Comms

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
O-0#						
O-01	Control Site	[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	1.0 s	1 set-up	TRUE	-1	Uint32
O-04	Control Word Timeout Function	ExpressionLimit	1 set-up	TRUE	-	Uint8
O-05	End-of-Timeout Function	[1] Resume set-up	1 set-up	TRUE	-	Uint8
O-06	Reset Control Word Timeout	[0] Do not reset	All set-ups	TRUE	-	Uint8
O-07	Diagnosis Trigger	[0] Disable	2 set-ups	TRUE	-	Uint8
O-08	Readout Filtering	ExpressionLimit	All set-ups	TRUE	-	Uint8
O-1#						
O-10	Control Word Profile	[0] Drive Profile	All set-ups	TRUE	-	Uint8
O-13	Configurable Status Word STW	ExpressionLimit	All set-ups	TRUE	-	Uint8
O-14	Configurable Control Word CTW	[1] Profile default	All set-ups	TRUE	-	Uint8
O-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	All set-ups	TRUE	-	Uint16
O-43	PCD Read Configuration	ExpressionLimit	All 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	[3] Logic OR	All set-ups	TRUE	-	Uint8
O-53	Start Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
O-54	Reversing Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
O-55	Set-up Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
O-56	Preset Reference Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
O-57	Profidrive OFF2 Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
O-58	Profidrive OFF3 Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
O-8#						
O-80	Bus Message Count	0 N/A	All set-ups	TRUE	0	Uint32
O-81	Bus Error Count	0 N/A	All set-ups	TRUE	0	Uint32
O-82	Slave Messages Rcvd	0 N/A	All set-ups	TRUE	0	Uint32
O-83	Slave Error Count	0 N/A	All set-ups	TRUE	0	Uint32
O-9#						
O-90	Bus Jog 1 Speed	100 RPM	All set-ups	TRUE	67	Uint16
O-91	Bus Jog 2 Speed	200 RPM	All set-ups	TRUE	67	Uint16

4.1.10 DN-## DevicNet

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
DN-0#						
DN-00	DeviceNet Protocol	ExpressionLimit	2 set-ups	FALSE	-	Uint8
DN-01	Baud Rate Select	ExpressionLimit	2 set-ups	TRUE	-	Uint8
DN-02	MAC ID	ExpressionLimit	2 set-ups	TRUE	0	Uint8
DN-05	Readout Transmit Error Counter	0 N/A	All set-ups	TRUE	0	Uint8
DN-06	Readout Receive Error Counter	0 N/A	All set-ups	TRUE	0	Uint8
DN-07	Readout Bus Off Counter	0 N/A	All set-ups	TRUE	0	Uint8
DN-1#						
DN-10	Process Data Type Selection	ExpressionLimit	All set-ups	TRUE	-	Uint8
DN-11	Process Data Config Write	ExpressionLimit	All set-ups	TRUE	-	Uint16
DN-12	Process Data Config Read	ExpressionLimit	All set-ups	TRUE	-	Uint16
DN-13	Warning Parameter	0 N/A	All set-ups	TRUE	0	Uint16
DN-14	Net Reference	[0] Off	2 set-ups	TRUE	-	Uint8
DN-15	Net Control	[0] Off	2 set-ups	TRUE	-	Uint8
DN-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

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4.1.11 PB-## Profibus

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conver-sion index	Type
PB-0#						
PB-00	Setpoint	0 N/A	All set-ups	TRUE	0	Uint16
PB-07	Actual Value	0 N/A	All set-ups	FALSE	0	Uint16
PB-1#						
PB-15	PCD Write Configuration	ExpressionLimit	2 set-ups	TRUE	-	Uint16
PB-16	PCD Read Configuration	ExpressionLimit	2 set-ups	TRUE	-	Uint16
PB-18	Node Address	126 N/A	1 set-up	TRUE	0	Uint8
PB-2#						
PB-22	Telegram Selection	[100] None	1 set-up	TRUE	-	Uint8
PB-23	Parameters for Signals	0	All set-ups	TRUE	-	Uint16
PB-27	Parameter Edit	[1] Enabled	2 set-ups	FALSE	-	Uint16
PB-28	Process Control	[1] Enable cyclic master	2 set-ups	FALSE	-	Uint8
PB-4#						
PB-44	Fault Message Counter	0 N/A	All set-ups	TRUE	0	Uint16
PB-45	Fault Code	0 N/A	All set-ups	TRUE	0	Uint16
PB-47	Fault Number	0 N/A	All set-ups	TRUE	0	Uint16
PB-5#						
PB-52	Fault Situation Counter	0 N/A	All set-ups	TRUE	0	Uint16
PB-53	Profibus Warning Word	0 N/A	All set-ups	TRUE	0	V2
PB-6#						
PB-63	Actual Baud Rate	[255] No baudrate found	All set-ups	TRUE	-	Uint8
PB-64	Device Identification	0 N/A	All set-ups	TRUE	0	Uint16
PB-65	Profile Number	0 N/A	All set-ups	TRUE	0	OctStr[2]
PB-67	Control Word 1	0 N/A	All set-ups	TRUE	0	V2
PB-68	Status Word 1	0 N/A	All set-ups	TRUE	0	V2
PB-7#						
PB-71	Profibus Save Data Values	[0] Off	All set-ups	TRUE	-	Uint8
PB-72	ProfibusDriveReset	[0] No action	1 set-up	FALSE	-	Uint8
PB-8#						
PB-80	Defined Parameters (1)	0 N/A	All set-ups	FALSE	0	Uint16
PB-81	Defined Parameters (2)	0 N/A	All set-ups	FALSE	0	Uint16
PB-82	Defined Parameters (3)	0 N/A	All set-ups	FALSE	0	Uint16
PB-83	Defined Parameters (4)	0 N/A	All set-ups	FALSE	0	Uint16
PB-84	Defined Parameters (5)	0 N/A	All set-ups	FALSE	0	Uint16
PB-9#						
PB-90	Changed Parameters (1)	0 N/A	All set-ups	FALSE	0	Uint16
PB-91	Changed Parameters (2)	0 N/A	All set-ups	FALSE	0	Uint16
PB-92	Changed Parameters (3)	0 N/A	All set-ups	FALSE	0	Uint16
PB-93	Changed parameters (4)	0 N/A	All set-ups	FALSE	0	Uint16
PB-94	Changed parameters (5)	0 N/A	All set-ups	FALSE	0	Uint16
PB-99	Profibus Revision Counter	0 N/A	All set-ups	TRUE	0	Uint16

4.1.12 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	1 set-up	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	ExpressionLimit	2 set-ups	TRUE	-	Uint8
EN-14	Link Duplex	[1] Full Duplex	2 set-ups	TRUE	-	Uint8
EN-2#						
EN-20	Control Instance	ExpressionLimit	1 set-up	TRUE	0	Uint8
EN-21	Process Data Config Write	ExpressionLimit	All set-ups	TRUE	-	Uint16
EN-22	Process Data Config Read	ExpressionLimit	All set-ups	TRUE	-	Uint16
EN-28	Store Data Values	[0] Off	All set-ups	TRUE	-	Uint8
EN-29	Store Always	[0] Off	1 set-up	TRUE	-	Uint8
EN-3#						
EN-30	Warning Parameter	0 N/A	All set-ups	TRUE	0	Uint16
EN-31	Net Reference	[0] Off	2 set-ups	TRUE	-	Uint8
EN-32	Net Control	[0] Off	2 set-ups	TRUE	-	Uint8
EN-33	CIP Revision	ExpressionLimit	All set-ups	TRUE	0	Uint16
EN-34	CIP Product Code	ExpressionLimit	1 set-up	TRUE	0	Uint16
EN-35	EDS Parameter	0 N/A	All set-ups	TRUE	0	Uint32
EN-37	COS Inhibit Timer	0 N/A	All set-ups	TRUE	0	Uint16
EN-38	COS Filter	0 N/A	All set-ups	TRUE	0	Uint16
EN-4#						
EN-40	Status Parameter	0 N/A	All set-ups	TRUE	0	Uint16
EN-41	Slave Message Count	0 N/A	All set-ups	TRUE	0	Uint32
EN-42	Slave Exception Message Count	0 N/A	All set-ups	TRUE	0	Uint32
EN-8#						
EN-80	FTP Server	[0] Disabled	2 set-ups	TRUE	-	Uint8
EN-81	HTTP Server	[0] Disabled	2 set-ups	TRUE	-	Uint8
EN-82	SMTP Service	[0] Disabled	2 set-ups	TRUE	-	Uint8
EN-89	Transparent Socket Channel Port	ExpressionLimit	2 set-ups	TRUE	0	Uint16
EN-9#						
EN-90	Cable Diagnostic	[0] Disabled	2 set-ups	TRUE	-	Uint8
EN-91	MDI-X	[1] Enabled	2 set-ups	TRUE	-	Uint8
EN-92	IGMP Snooping	[1] Enabled	2 set-ups	TRUE	-	Uint8
EN-93	Cable Error Length	0 N/A	1 set-up	TRUE	0	Uint16

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
EN-94	Broadcast Storm Protection	-1 %	2 set-ups	TRUE	0	Int8
EN-95	Broadcast Storm Filter	[0] Broadcast only	2 set-ups	TRUE	-	Uint8
EN-96	Port Mirroring	[0] Disable	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

4.1.13 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

4.1.14 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	7.0 V	1 set-up	FALSE	-1	Uint8
RS-52	Input Frequency	10.0 kHz	1 set-up	FALSE	2	Uint8
RS-53	Transformation Ratio	0.5 N/A	1 set-up	FALSE	-1	Uint8
RS-59	Resolver Interface	[0] Disabled	All set-ups	FALSE	-	Uint8

4.1.15 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

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Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
ID-14	Samples Before Trigger	50 N/A	2 set-ups	TRUE	0	Uint8
ID-2#						
ID-20	Historic Log: Event	0 N/A	All set-ups	FALSE	0	Uint8
ID-21	Historic Log: Value	0 N/A	All set-ups	FALSE	0	Uint32
ID-22	Historic Log: Time	0 ms	All set-ups	FALSE	-3	Uint32
ID-3#						
ID-30	Fault Log: Error Code	0 N/A	All set-ups	FALSE	0	Uint8
ID-31	Fault Log: Value	0 N/A	All set-ups	FALSE	0	Int16
ID-32	Fault Log: Time	0 s	All set-ups	FALSE	0	Uint32
ID-4#						
ID-40	Drive Type	0 N/A	All set-ups	FALSE	0	VisStr[6]
ID-41	Power Section	0 N/A	All set-ups	FALSE	0	VisStr[20]
ID-42	Voltage	0 N/A	All set-ups	FALSE	0	VisStr[20]
ID-43	Software Version	0 N/A	All set-ups	FALSE	0	VisStr[5]
ID-44	Ordered Typecode String	0 N/A	All set-ups	FALSE	0	VisStr[40]
ID-45	Actual Typecode String	0 N/A	All set-ups	FALSE	0	VisStr[40]
ID-46	GE Product No.	0 N/A	All set-ups	FALSE	0	VisStr[8]
ID-47	Power Card Ordering No	0 N/A	All set-ups	FALSE	0	VisStr[8]
ID-48	Keypad ID Number	0 N/A	All set-ups	FALSE	0	VisStr[20]
ID-49	SW ID Control Card	0 N/A	All set-ups	FALSE	0	VisStr[20]
ID-5#						
ID-50	SW ID Power Card	0 N/A	All set-ups	FALSE	0	VisStr[20]
ID-51	Drive Serial Number	0 N/A	All set-ups	FALSE	0	VisStr[10]
ID-53	Power Card Serial Number	0 N/A	All set-ups	FALSE	0	VisStr[19]
ID-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-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

4.1.16 DR-## Data Readouts

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
DR-0#						
DR-00	Control Word	0 N/A	All set-ups	FALSE	0	V2
DR-01	Reference [Unit]	0.000 ReferenceFeedbackUnit	All set-ups	FALSE	-3	Int32
DR-02	Reference %	0.0 %	All set-ups	FALSE	-1	Int16
DR-03	Status Word	0 N/A	All set-ups	FALSE	0	V2
DR-05	Main Actual Value [%]	0.00 %	All set-ups	FALSE	-2	N2
DR-09	Custom Readout	0.00 CustomReadoutUnit	All set-ups	FALSE	-2	Int32
DR-1#						
DR-10	Power [kW]	0.00 kW	All set-ups	FALSE	1	Int32
DR-11	Power [hp]	0.00 hp	All set-ups	FALSE	-2	Int32
DR-12	Motor Voltage	0.0 V	All set-ups	FALSE	-1	Uint16
DR-13	Frequency	0.0 Hz	All set-ups	FALSE	-1	Uint16
DR-14	Motor Current	0.00 A	All set-ups	FALSE	-2	Int32
DR-15	Frequency [%]	0.00 %	All set-ups	FALSE	-2	N2
DR-16	Torque [Nm]	0.0 Nm	All set-ups	FALSE	-1	Int16
DR-17	Speed [RPM]	0 RPM	All set-ups	FALSE	67	Int32
DR-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.	0.0 %	All set-ups	FALSE	-1	Int16
DR-22	Torque [%]	0 %	All set-ups	FALSE	0	Int16
DR-25	Torque [Nm] High	0.0 Nm	All set-ups	FALSE	-1	Int32
DR-3#						
DR-30	DC Link Voltage	0 V	All set-ups	FALSE	0	Uint16
DR-32	Brake Energy /s	0.000 kW	All set-ups	FALSE	0	Uint32
DR-33	Brake Energy /2 min	0.000 kW	All set-ups	FALSE	0	Uint32
DR-34	Heatsink Temp.	0 °C	All set-ups	FALSE	100	Uint8
DR-35	Drive Thermal	0 %	All set-ups	FALSE	0	Uint8
DR-36	Drive Nominal Current	ExpressionLimit	All set-ups	FALSE	-2	Uint32
DR-37	Drive Max. Current	ExpressionLimit	All set-ups	FALSE	-2	Uint32
DR-38	Logic Controller State	0 N/A	All set-ups	FALSE	0	Uint8
DR-39	Control Card Temp.	0 °C	All set-ups	FALSE	100	Uint8
DR-4#						
DR-40	Trending Buffer Full	[0] No	All set-ups	TRUE	-	Uint8
DR-41	Keypad Bottom Statusline	0 N/A	All set-ups	TRUE	0	VisStr[50]
DR-49	Current Fault Source	0 N/A	All set-ups	TRUE	0	Uint8
DR-5#						
DR-50	External Reference	0.0 N/A	All set-ups	FALSE	-1	Int16
DR-51	Pulse Reference	0.0 N/A	All set-ups	FALSE	-1	Int16
DR-52	Feedback [Unit]	0.000 ReferenceFeedbackUnit	All set-ups	FALSE	-3	Int32
DR-53	Digi Pot Reference	0.00 N/A	All set-ups	FALSE	-2	Int16
DR-6#						

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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	0.000 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	0.000 N/A	All set-ups	FALSE	-3	Int32
DR-65	Analog Output 42 [mA]	0.000 N/A	All set-ups	FALSE	-3	Int16
DR-66	Digital Output [bin]	0 N/A	All set-ups	FALSE	0	Int16
DR-67	Freq. Input #29 [Hz]	0 N/A	All set-ups	FALSE	0	Int32
DR-68	Freq. Input #33 [Hz]	0 N/A	All set-ups	FALSE	0	Int32
DR-69	Pulse Output #27 [Hz]	0 N/A	All set-ups	FALSE	0	Int32
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	0.000 N/A	All set-ups	FALSE	-3	Int32
DR-76	Analog In X30/12	0.000 N/A	All set-ups	FALSE	-3	Int32
DR-77	Analog Out X30/8 [mA]	0.000 N/A	All set-ups	FALSE	-3	Int16
DR-78	Analog Out X45/1 [mA]	0.000 N/A	All set-ups	FALSE	-3	Int16
DR-79	Analog Out X45/3 [mA]	0.000 N/A	All set-ups	FALSE	-3	Int16
DR-8#						
DR-80	Fieldbus CTW 1	0 N/A	All set-ups	FALSE	0	V2
DR-82	Fieldbus REF 1	0 N/A	All set-ups	FALSE	0	N2
DR-84	Comm. Option STW	0 N/A	All set-ups	FALSE	0	V2
DR-85	Drive Port CTW 1	0 N/A	All set-ups	FALSE	0	V2
DR-86	Drive Port REF 1	0 N/A	All set-ups	FALSE	0	N2
DR-9#						
DR-90	Alarm Word	0 N/A	All set-ups	FALSE	0	Uint32
DR-91	Alarm Word 2	0 N/A	All set-ups	FALSE	0	Uint32
DR-92	Warning Word	0 N/A	All set-ups	FALSE	0	Uint32
DR-93	Warning Word 2	0 N/A	All set-ups	FALSE	0	Uint32
DR-94	Ext. Status Word	0 N/A	All set-ups	FALSE	0	Uint32

4.1.17 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-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

4.1.18 B-## Braking Functions

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
B-0#						
B-00	DC Hold Current	50 %	All set-ups	TRUE	0	Uint8
B-01	DC Brake Current	50 %	All set-ups	TRUE	0	Uint16
B-02	DC Braking Time	10.0 s	All set-ups	TRUE	-1	Uint16
B-03	DC Brake Cut In Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
B-04	DC Brake Cut In Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
B-05	Maximum Reference	MaxReference (F-53)	All set-ups	TRUE	-3	Int32
B-1#						
B-10	Brake Function	ExpressionLimit	All set-ups	TRUE	-	Uint8
B-11	Brake Resistor (ohm)	ExpressionLimit	1 set-up	TRUE	-2	Uint32
B-12	Brake Power Limit (kW)	ExpressionLimit	All set-ups	TRUE	0	Uint32
B-13	Braking Thermal Overload	[0] Off	All set-ups	TRUE	-	Uint8
B-15	Brake Check	[0] Off	All set-ups	TRUE	-	Uint8
B-16	AC brake Max. Current	100.0 %	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	ImaxDrive (DR-37)	All set-ups	TRUE	-2	Uint32

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
B-21	Activate Brake Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
B-22	Activate Brake Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
B-23	Activate Brake Delay	0.0 s	All set-ups	TRUE	-1	Uint8
B-24	Stop Delay	0.0 s	All set-ups	TRUE	-1	Uint8
B-25	Brake Release Time	0.20 s	All set-ups	TRUE	-2	Uint16
B-26	Torque Ref	0.00 %	All set-ups	TRUE	-2	Int16
B-27	Torque Ramp Time	0.2 s	All set-ups	TRUE	-1	Uint8
B-28	Gain Boost Factor	1.00 N/A	All set-ups	TRUE	-2	Uint16

4.1.19 PI-## PID Controls

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
PI-0#						
PI-00	Speed PID Feedback Source	ExpressionLimit	All set-ups	FALSE	-	Uint8
PI-02	Speed PID Proportional Gain	ExpressionLimit	All set-ups	TRUE	-4	Uint32
PI-03	Speed PID Integral Time	ExpressionLimit	All set-ups	TRUE	-4	Uint32
PI-04	Speed PID Differentiation Time	ExpressionLimit	All set-ups	TRUE	-4	Uint16
PI-05	Speed PID Diff. Gain Limit	5.0 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	1.0000 N/A	All set-ups	FALSE	-4	Uint32
PI-08	Speed PID Feed Forward Factor	0 %	All set-ups	FALSE	0	Uint16
PI-1#						
PI-12	Torque PI Proportional Gain	100 %	All set-ups	TRUE	0	Uint16
PI-13	Torque PI Integration Time	0.020 s	All set-ups	TRUE	-3	Uint16
PI-2#						
PI-20	Process CL Feedback 1 Resource	[0] No function	All set-ups	TRUE	-	Uint8
PI-22	Process CL Feedback 2 Resource	[0] No function	All set-ups	TRUE	-	Uint8
PI-3#						
PI-30	Process PID Normal/ Inverse Control	[0] Normal	All set-ups	TRUE	-	Uint8
PI-31	Process PID Anti Windup	[1] On	All set-ups	TRUE	-	Uint8
PI-32	Process PID Start Speed	0 RPM	All set-ups	TRUE	67	Uint16
PI-33	Process PID Proportional Gain	0.01 N/A	All set-ups	TRUE	-2	Uint16
PI-34	Process PID Integral Time	10000.00 s	All set-ups	TRUE	-2	Uint32
PI-35	Process PID Differentiation Time	0.00 s	All set-ups	TRUE	-2	Uint16
PI-36	Process PID Diff. Gain Limit	5.0 N/A	All set-ups	TRUE	-1	Uint16
PI-38	Process PID Feed Forward Factor	0 %	All set-ups	TRUE	0	Uint16
PI-39	On Reference Bandwidth	5 %	All set-ups	TRUE	0	Uint8
PI-4#						
PI-40	Process PID I-part Reset	[0] No	All set-ups	TRUE	-	Uint8
PI-41	Process PID Output Neg. Clamp	-100 %	All set-ups	TRUE	0	Int16
PI-42	Process PID Output Pos. Clamp	100 %	All set-ups	TRUE	0	Int16
PI-43	Process PID Gain Scale at Min. Ref.	100 %	All set-ups	TRUE	0	Int16
PI-44	Process PID Gain Scale at Max. Ref.	100 %	All set-ups	TRUE	0	Int16
PI-45	Process PID Feed Fwd Resource	[0] No function	All set-ups	TRUE	-	Uint8
PI-46	Process PID Feed Fwd Normal/ Inv. Ctrl.	[0] Normal	All set-ups	TRUE	-	Uint8
PI-49	Process PID Output Normal/ Inv. Ctrl.	[0] Normal	All set-ups	TRUE	-	Uint8
PI-5#						
PI-50	Process PID Extended PID	[1] Enabled	All set-ups	TRUE	-	Uint8
PI-51	Process PID Feed Fwd Gain	1.00 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	0.0 %	All set-ups	FALSE	-1	Int16
PI-61	Process PID Output	0.0 %	All set-ups	FALSE	-1	Int16
PI-62	Process PID Clamped Output	0.0 %	All set-ups	FALSE	-1	Int16

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
PI-63	Process PID Gain Scaled Output	0.0 %	All set-ups	FALSE	-1	Int16

4.1.20 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]	5.0 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]	0.0 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	10.0 s	All set-ups	TRUE	-1	Uint16
SF-08	Wobble Up/ Down Time	5.0 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	1.0 N/A	All set-ups	TRUE	-1	Uint8
SF-11	Wobble Random Ratio Max.	10.0 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	0.0 Hz	All set-ups	FALSE	-1	Uint16
SF-2#						
SF-20	High Starting Torque Time [s]	0.00 s	All set-ups	TRUE	-2	Uint8
SF-21	High Starting Torque Current [%]	100.0 %	All set-ups	TRUE	-1	Uint32
SF-22	Locked Rotor Protection	[0] Off	All set-ups	TRUE	-	Uint8
SF-23	Locked Rotor Detection Time [s]	0.10 s	All set-ups	TRUE	-2	Uint8
SF-8#						
SF-84	Process PID Proportional Gain	0.100 N/A	All set-ups	TRUE	-3	Uint16

5 Troubleshooting

5.1.1 Warnings/Alarm Messages

A warning or an alarm is signaled by the relevant LED on the front of the drive 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 drive will have tripped. Alarms must be reset to restart operation once their cause has been rectified.

This may be done in three ways:

1. By using the [RESET] control button on the Keypad.
2. Via a digital input with the "Reset" function.
3. Via serial communication/optional network.

NOTE!

After a manual reset using the [RESET] button on the Keypad, the [AUTO] button must be pressed to restart the motor.

If an alarm cannot be reset, the reason may be that its cause has not been rectified, or the alarm is trip-locked (see also table on following page).

Alarms that are trip-locked offer additional protection, meaning that the line power supply must be switched off before the alarm can be reset. After being switched back on, the drive is no longer blocked and may be reset as described above once the cause has been rectified.

Alarms that are not trip-locked can also be reset using the automatic reset function in *H-04 Auto-Reset (Times)* (Warning: automatic wake-up is possible!)

If a warning and alarm are marked against a code in the table on the following page, this means that either a warning occurs before an alarm, or that you can specify whether it is a warning or an alarm that is to be displayed for a given fault.

This is possible, for instance, in *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 drive is reset.

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
1	10 Volts low	X			
2	Live zero error	(X)	(X)		AN-01 *Live Zero Time-out Function*
3	No motor	(X)			H-80 *Function at Stop*
4	Line phase loss	(X)	(X)	(X)	SP-12 *Function at Mains Imbalance*
5	DC link voltage high	X			
6	DC link voltage low	X			
7	DC overvoltage	X	X		
8	DC under-voltage	X	X		
9	Inverter overloaded	X	X		
10	Motor Electronic OL over-temperature	(X)	(X)		F-10 *Electronic Overload*
11	Motor thermistor over-temperature	(X)	(X)		F-10 *Electronic Overload*
12	Torque limit	X	X		
13	Overcurrent	X	X	X	
14	Ground Fault	X	X	X	
15	Hardware mismatch		X	X	
16	Short Circuit		X	X	
17	Control word timeout	(X)	(X)		O-04 *Control Word Time-out Function*

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
20	Temp. Input Error				
21	Param Error				
22	Hoist Mech. Brake	(X)	(X)		Parameter group B-2#
23	Internal Fans	X			
24	External Fans	X			
25	Brake resistor short-circuited	X			
26	Brake resistor power limit	(X)	(X)		B-13 *Braking Thermal Overload*
27	Brake chopper short-circuited	X	X		
28	Brake check	(X)	(X)		B-15 *Brake Check*
29	Heatsink temp	X	X	X	
30	Motor phase U missing	(X)	(X)	(X)	H-78 *Missing Motor Phase Function*
31	Motor phase V missing	(X)	(X)	(X)	H-78 *Missing Motor Phase Function*
32	Motor phase W missing	(X)	(X)	(X)	H-78 *Missing Motor Phase Function*
33	Soft-charge Fault		X	X	
34	Network communication fault	X	X		
35	Option Fault				
36	Line failure	X	X		
37	Phase imbalance		X		
38	Internal Fault		X	X	
39	Heatsink sensor		X	X	
40	Overload of Digital Output Terminal 27	(X)			E-00 *Digital I/O Mode*, E-51 *Terminal 27 Mode*
41	Overload of Digital Output Terminal 29	(X)			E-00 *Digital I/O Mode*, E-52 *Terminal 29 Mode*
42	Ovrld X30/6-7	(X)			
43	Ext. Supply (option)				
45	Ground Fault 2	X	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			
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 timeout		X		
58	Auto Tune internal fault	X	X		
59	Current limit	X			
60	External Interlock	X	X		
61	Feedback Error	(X)	(X)		H-20 *Motor Feedback Loss Function*
62	Output Frequency at Maximum Limit	X			

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
63	Mechanical Brake Low		(X)		B-20 *Release Brake Current*
64	Voltage Limit	X			
65	Control Board Over-temperature	X	X	X	
66	Heat sink Temperature Low	X			
67	Option Module Configuration has Changed		X		
68	Safe Stop	(X)	(X)[1)]		E-07 *Terminal 37 Safe Stop*
69	Pwr. Card Temp		X	X	
70	Illegal Drive configuration			X	
77	Reduced power mode	X			SP-59 *Actual Number of Inverter Units*
78	Tracking Error	(X)	(X)		H-24 *Tracking Error Function*
79	Illegal PS config		X	X	
80	Drive Restored to Factory Settings		X		
89	Mechanical Brake Sliding	X			
90	Feedback Monitor	(X)	(X)		EC-61 *Feedback Signal Monitoring*
91	Analog input 54 wrong settings			X	S202
243	Brake IGBT	X	X	X	
244	Heatsink temp	X	X	X	
245	Heatsink sensor		X	X	
246	Pwr.card supply			X	
247	Pwr.card temp		X	X	
248	Illegal PS config			X	
249	Rect. low temp.	X			
250	New spare parts			X	
251	New Model number		X	X	

Table 5.1 Alarm/Warning code list

(X) Dependent on parameter

1) Cannot be Auto reset via H-04 Auto-Reset (Times)

A trip is the action when an alarm has appeared. The trip will coast the motor and can be reset by pressing the reset button or make a reset by a digital input (parameter group E-1# [1]). The original event that caused an alarm cannot damage the drive or cause dangerous conditions. A trip lock is an action when an alarm occurs that may cause damage to thedrive or connected parts. A trip lock situation can only be reset by power cycling.

LED indication	
Warning	yellow
Alarm	flashing red
Trip locked	yellow and red

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	Ground Fault (A14)	ServiceTrip, Typecode/ Sparepart	Ground Fault (W14)	reserved	Start CW/CCW
3	00000008	8	Ctrl.Card Temp (A65)	ServiceTrip, (reserved)	Ctrl.Card Temp (W65)	reserved	Slow Down
4	00000010	16	Ctrl. Word TO (A17)	ServiceTrip, (reserved)	Ctrl. Word TO (W17)		Catch Up
5	00000020	32	Overcurrent (A13)	reserved	Overcurrent (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	1,024	DC under-volt (A8)	reserved	DC under-volt (W8)		Output Freq Low
11	00000800	2,048	DC overvoltage (A7)	reserved	DC overvoltage (W7)		Brake Check OK
12	00001000	4,096	Short Circuit (A16)	reserved	DC Voltage Low (W6)	reserved	Braking Max
13	00002000	8,192	Soft-charge Fault (A33)	reserved	DC Voltage High (W5)		Braking
14	00004000	16,384	Line Ph. Loss (A4)	reserved	Line Ph. Loss (W4)		Out of Speed Range
15	00008000	32,768	Auto Tune Not OK	reserved	No Motor (W3)		OVC Active
16	00010000	65,536	Live Zero Error (A2)	reserved	Live Zero Error (W2)		AC Brake
17	00020000	131,072	Internal Fault (A38)	KTY error	10 V Low (W1)	KTY Warn	Password Timelock
18	00040000	262,144	Brake Overload (A26)	Fans error	Brake Overload (W26)	Fans Warn	Password Protection
19	00080000	524,288	U phase Loss (A30)	ECB error	Brake Resistor (W25)	ECB Warn	
20	00100000	1,048,576	V phase Loss (A31)	reserved	Brake IGBT (W27)	reserved	
21	00200000	2,097,152	W phase Loss (A32)	reserved	Speed Limit (W49)	reserved	
22	00400000	4,194,304	Network Fault (A34)	reserved	Network Fault (W34)	reserved	Unused
23	00800000	8,388,608	24 V Supply Low (A47)	reserved	24 V Supply Low (W47)	reserved	Unused
24	01000000	16,777,216	Line Failure (A36)	reserved	Line Failure (W36)	reserved	Unused
25	02000000	33,554,432	1.8 V Supply Low (A48)	reserved	Current Limit (W59)	reserved	Unused

Bit	Hex	Dec	Alarm Word	Alarm Word 2	Warning Word	Warning Word 2	Extended Status Word
26	04000000	67,108,864	Brake Resistor (A25)	reserved	Low Temp (W66)	reserved	Unused
27	08000000	134,217,728	Brake IGBT (A27)	reserved	Voltage Limit (W64)	reserved	Unused
28	10000000	268,435,456	Option Change (A67)	reserved	Encoder loss (W90)	reserved	Unused
29	20000000	536,870,912	Drive Restored to factory settings (A80)	Feedback Fault (A61, A90)	Feedback Fault (W61, W90)		Unused
30	40000000	1,073,741,824	Safe Stop (A68)	Safe Stop (A71)	Safe Stop (W68)	Safe Stop (W71)	Unused
31	80000000	2,147,483,648	Mech. brake low (A63)	Dangerous Failure (A72)	Extended Status Word		Unused

Table 5.2 Description of Alarm Word, Warning Word and Extended Status Word

The alarm words, warning words and extended status words can be read out via serial bus or optional network for diagnosis. See also *DR-94 Ext. Status Word*.

5

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

This condition can be caused by a short in a connected potentiometer or improper wiring of the potentiometer.

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

WARNING/ALARM 2, Live zero error
This warning or alarm will only appear if programmed by the user in *AN-01 Live Zero Time-out Function*. The signal on one of the analog inputs is less than 50% of the minimum value programmed for that input. This condition can be caused by broken wiring or faulty device sending the signal.

Troubleshooting

Check connections on all the analog input terminals. Control card terminals 53 and 54 for signals, terminal 55 common. OPCGPIO terminals 11 and 12 for signals, terminal 10 common. OPCAIO terminals 1, 3, 5 for signals, terminals 2, 4, 6 common).

Check that the drive programming and switch settings match the analog signal type.

Perform Input Terminal Signal Test.

WARNING/ALARM 3, No motor
No motor has been connected to the output of the drive.

WARNING/ALARM 4, Mains phase loss
A phase is missing on the supply side, or the line voltage imbalance is too high. This message also appears for a fault in the input rectifier on the drive. Options are programmed at *SP-12 Function at Mains Imbalance*.

Troubleshooting: Check the supply voltage and supply currents to the drive.

WARNING 5, DC link voltage high
The intermediate circuit voltage (DC) is higher than the high voltage warning limit. The limit is dependent on the drive voltage rating. The unit is still active.

WARNING 6, DC link voltage low
The intermediate circuit voltage (DC) is lower than the low voltage warning limit. The limit is dependent on the drive voltage rating. The unit is still active.

WARNING/ALARM 7, DC overvoltage
If the intermediate circuit voltage exceeds the limit, the drive trips after a time.

Troubleshooting

Connect a brake resistor

Extend the ramp time

Change the ramp type

Activate the functions in *B-10 Brake Function*

Increase *SP-26 Trip Delay at Drive Fault*

WARNING/ALARM 8, DC undervoltage
If the intermediate circuit voltage (DC link) drops below the under voltage limit, the drive checks if a 24V DC backup supply is connected. If no 24V DC backup supply is connected, the drive trips after a fixed time delay. The time delay varies with unit size.

Troubleshooting:

Check that the supply voltage matches the drive voltage.

Perform input voltage test

Perform soft charge circuit test

WARNING/ALARM 9, Inverter overload
The drive is about to cut out because of an overload (too high current for too long). The counter for electronic, thermal inverter protection gives a warning at 98% and trips at 100%, while giving an alarm. The drive *cannot* be reset until the counter is below 90%.
The fault is that the drive is overloaded by more than 100% for too long.

Troubleshooting

Compare the output current shown on the Keypad with the drive rated current.

Compare the output current shown on the Keypad with measured motor current.

Display the Thermal Drive Load on the Keypad and monitor the value. When running above the drive continuous current rating, the counter should increase. When running below the drive continuous current rating, the counter should decrease.

See the derating section in the *Design Guide* for more details if a high switching frequency is required.

WARNING/ALARM 10, Motor overload temperature
According to the electronic thermal protection, the motor is too hot. Select whether the drive gives a warning or an alarm when the counter reaches 100% in *F-10 Electronic Overload*. The fault occurs when the motor is overloaded by more than 100% for too long.

Troubleshooting

Check for motor overheating.

Check if the motor is mechanically overloaded.

Check that the motor current set in *P-03 Motor Current* is correct.

Ensure that Motor data in parameters P-02, P-03, P-06, P-07, F-04 and F-05 are set correctly.

If an external fan is in use, check in *F-11 Motor External Fan* that it is selected.

Running Auto tune in *P-04 Auto Tune* may tune the drive to the motor more accurately and reduce thermal loading.

WARNING/ALARM 11, Motor thermistor over temp

The thermistor might be disconnected. Select whether the drive gives a warning or an alarm in *F-10 Electronic Overload*.

Troubleshooting

Check for motor overheating.

Check if the motor is mechanically overloaded.

When using terminal 53 or 54, check that the thermistor is connected correctly between either terminal 53 or 54 (analog voltage input) and terminal 50 (+10V supply) and that the terminal switch for 53 or 54 is set for voltage. Check *F-12 Motor Thermistor Input* selects terminal 53 or 54.

When using digital inputs 18 or 19, check that the thermistor is connected correctly between either terminal 18 or 19 (digital input PNP only) and terminal 50. Check *F-12 Motor Thermistor Input* selects terminal 18 or 19.

WARNING/ALARM 12, Torque limit

The torque has exceeded the value in *F-40 Torque Limiter (Driving)* or the value in *F-41 Torque Limiter (Braking)*. *SP-25 Trip Delay at Torque Limit* can change this from a warning only condition to a warning followed by an alarm.

Troubleshooting

If the motor torque limit is exceeded during ramp, extend the ramp time.

If the generator torque limit is exceeded during ramp, extend the ramp- time.

If torque limit occurs while running, possibly increase the torque limit. Be sure the system can operate safely at a higher torque.

Check the application for excessive current draw on the motor.

WARNING/ALARM 13, Overcurrent

The inverter peak current limit (approximately 200% of the rated current) is exceeded. The warning lasts about 1.5 secs., then the drive trips and issues an alarm. This fault may be caused by shock loading or fast acceleration with high inertia loads. If extended mechanical brake control is selected, trip can be reset externally.

Troubleshooting:

Remove power and check if the motor shaft can be turned.

Check that the motor size matches the drive.

Check parameters P-02, P-03, P-06, P-07, F-04 and F-05 for correct motor data.

ALARM 14, Ground fault

There is current from the output phases to ground, either in the cable between the drive and the motor or in the motor itself.

Troubleshooting:

Remove power to the drive and repair the ground fault.

Check for ground faults in the motor by measuring the resistance to ground of the motor leads and the motor with a megohmmeter.

ALARM 15, Hardware mismatch

A fitted option is not operational with the present control board hardware or software.

Record the value of the following parameters and contact your GE supplier:

ID-40 Drive Type

ID-41 Power Section

ID-42 Voltage

ID-43 Software Version

ID-45 Actual Typecode String

ID-49 SW ID Control Card

ID-50 SW ID Power Card

ID-60 Option Mounted

ID-61 Option SW Version (for each option slot)

ALARM 16, Short circuit

There is short-circuiting in the motor or motor wiring.

Remove power to the drive and repair the short circuit.

WARNING/ALARM 17, Control word timeout

There is no communication to the drive.
The warning will only be active when *O-04 Control Word Time-out Function* is NOT set to *OFF*.

If *O-04 Control Word Time-out Function* is set to *Stop* and *Trip*, a warning appears and the drive ramps down until it stops then displays an alarm.

Troubleshooting:

Check connections on the serial communication cable.

Increase *O-03 Control Word Time-out Time*

Check the operation of the communication equipment.

Verify a proper installation based on EMC requirements.

WARNING/ALARM 20, Temp. input error
The temperature sensor is not connected.

WARNING/ALARM 21, Parameter error
The parameter is out of range. The parameter number is reported in the Keypad. The affected parameter must be set to a valid value.

WARNING/ALARM 22, Hoist mechanical brake
Report value will show what kind it is. 0 = The torque ref. was not reached before timeout. 1 = There was no brake feedback before timeout.

WARNING 23, Internal fan fault
The fan warning function is an extra protective function that checks if the fan is running/mounted. The fan warning can be disabled in *SP-53 Fan Monitor* ([0] Disabled).

Troubleshooting:

Check for proper fan operation.

Cycle power to the drive and make sure that the fan operates briefly at start-up.

Check the sensors on the heatsink and control card.

WARNING 24, External fan fault
The fan warning function is an extra protective function that checks if the fan is running/mounted. The fan warning can be disabled in *SP-53 Fan Monitor* ([0] Disabled).

Troubleshooting:

Check for proper fan operation.

Cycle power to the drive and make sure that the fan operates briefly at start-up.

Check the sensors on the heatsink and control card.

ALARM 29, Heatsink temp
The maximum temperature of the heatsink has been exceeded. The temperature fault will not reset until the temperature falls below a defined heatsink temperature. The trip and reset points are different based on the drive power size.

Troubleshooting:
Check for the following conditions.

Ambient temperature too high.

Motor cable too long.

Incorrect airflow clearance above and below the drive

Blocked airflow around the drive.

Damaged heatsink fan.

Dirty heatsink.

ALARM 30, Motor phase U missing
Motor phase U between the drive and the motor is missing.

Remove power from the drive and check motor phase U.

ALARM 31, Motor phase V missing
Motor phase V between the drive and the motor is missing.

Remove power from the drive and check motor phase V.

ALARM 32, Motor phase W missing
Motor phase W between the drive and the motor is missing.

Remove power from the drive and check motor phase W.

ALARM 33, Inrush fault
Too many power-ups have occurred within a short time period. Let the unit cool to operating temperature.

WARNING/ALARM 34, communication fault
The network on the communication option card is not working.

WARNING/ALARM 35, Option fault
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 drive is lost and *SP-10 Mains failure* is NOT set to [0] *No Function*. Check the fuses to the drive and line power supply to the unit.

ALARM 37, Imb of sup volt
There is a current imbalance between the power units

ALARM 38, Internal fault
When an internal fault occurs, a code number defined in the table below is displayed.

Troubleshooting

Cycle power

Check that the option is properly installed

Check for loose or missing wiring

It may be necessary to contact your GE supplier or service department. Note the code number for further trouble-shooting directions.

No.	Text
0	Serial port cannot be restore. Contact your GE supplier or GE Service Department.
256-258	Power EEPROM data is defect or too old
512-519	Internal fault. Contact your GE supplier or GE Service Department.
783	Parameter value outside of min/max limits
1024-1284	Internal fault. Contact your GE supplier or the GE Service Department.
1299	Option SW in slot A is too old
1300	Option SW in slot B is too old
1302	Option SW in slot C1 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)
1318	Option SW in slot C1 is not supported (not allowed)
1379-2819	Internal fault. Contact your GE supplier or GE Service Department.
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
5125	Option in slot C0: Hardware incompatible with control board hardware
5126	Option in slot C1: Hardware incompatible with control board hardware
5376-6231	Internal fault. Contact your GE supplier or GE Service Department.

ALARM 39, Heatsink sensor
No feedback from the heatsink temperature sensor.

The signal from the IGBT thermal sensor is not available on the power card. The problem could be on the power card, on the gate drive card, or the ribbon cable between the power card and gate drive card.

WARNING 40, Overload of digital output terminal 27
Check the load connected to terminal 27 or remove short-circuit connection. Check *E-00 Digital I/O Mode* and *E-51 Terminal 27 Mode*.

WARNING 41, Overload of digital output terminal 29
Check the load connected to terminal 29 or remove short-circuit connection. Check *E-00 Digital I/O Mode* and *E-52 Terminal 29 Mode*.

WARNING 42, Overload of digital output on X30/6 or overload of digital output on X30/7
For X30/6, check the load connected to X30/6 or remove short-circuit connection. Check *E-56 Term X30/6 Digi Out (OPCGPIO)*.

For X30/7, check the load connected to X30/7 or remove short-circuit connection. Check *E-57 Term X30/7 Digi Out (OPCGPIO)*.

ALARM 45, Earth Fault 2
Ground fault on start-up.

Troubleshooting

Check for proper grounding and loose connections.

Check for proper wire size.

Check motor cables for short-circuits or leakage currents.

ALARM 46, Power card supply
The supply on the power card is out of range.

There are three power supplies generated by the switch mode power supply (SMPS) on the power card: 24V, 5V, +/- 18V. When powered with three-phase AC line voltage, all three supplied are monitored.

Troubleshooting

Check for a defective power card.

Check for a defective control card.

Check for a defective option card.

If a 24V DC power supply is used, verify proper supply power.

WARNING 47, 24V supply low
The 24 V DC is measured on the control card. The external 24V DC backup power supply may be overloaded; otherwise, contact your GE supplier.

WARNING 48, 1.8V supply low
The 1.8V DC supply used on the control card is outside of allowable limits. The power supply is measured on the control card. Check for a defective control card. If an option card is present, check for an overvoltage condition.

WARNING 49, Speed limit
When the speed is not within the specified range in F-18 and F-17, the drive will show a warning. When the speed is below the specified limit in *H-36 Trip Speed Low [RPM]* (except when starting or stopping) the drive will trip.

ALARM 50, Auto Tune calibration failed
Contact your GE supplier or GE Service Department.

ALARM 51, Auto tune check U_{nom} and I_{nom}
The settings for motor voltage, motor current, and motor power are wrong. Check the settings in parameters P-02, P-03, P-06, P-07, F-04 and F-05.

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ALARM 52, Auto tune low I_{nom}
The motor current is too low. Check the setting in *F-43 Current Limit*.

ALARM 53, Auto tune motor too big
The motor is too big for the Auto tune to operate.

ALARM 54, Auto tune motor too small
The motor is too small for the Auto tune to operate.

ALARM 55, Auto tune Parameter out of range
The parameter values of the motor are outside of the acceptable range. Auto tune will not run.

ALARM 56, Auto Tune interrupted by user
The Auto Tune has been interrupted by the user.

ALARM 57, Auto tune timeout
Try to restart Auto tune again. Repeated restarts may overheat the motor.

ALARM 58, Auto Tune internal fault
Contact your GE supplier.

WARNING 59, Current limit
The current is higher than the value in *F-43 Current Limit*. Ensure that Motor data in parameters P-02, P-03, P-06, P-07, F-04 and F-05 are set correctly. Possibly increase the current limit. Be sure the system can operate safely at a higher limit.

WARNING 60, External interlock
A digital input signal is indicating a fault condition external to the drive. An external interlock has commanded the drive to trip. Clear the external fault condition. To resume normal operation, apply 24V DC to the terminal programmed for external interlock. Reset the drive.

WARNING/ALARM 61, Tracking error
An error has been detected between calculated speed and speed measurement from feedback device. The function Warning/Alarm/Disabling setting is in *H-20 Motor Feedback Loss Function*. Accepted error setting in *H-21 Motor Feedback Speed Error* and the allowed time the error occur setting in *H-22 Motor Feedback Loss Time-out*. During a commissioning procedure the function may be effective.

WARNING 62, Output frequency at maximum limit
The output frequency has reached the value set in *F-03 Max Output Frequency 1*. Check the application to determine the cause. Possibly increase the output frequency limit. Be sure the system can operate safely at a higher output frequency. The warning will clear when the output drops below the maximum limit.

ALARM 63, Mechanical brake low
The actual motor current has not exceeded the “release brake” current within the “Start delay” time window.

WARNING/ALARM 65, Control card over temperature
The cutout temperature of the control card is 176°F [80°C].

Troubleshooting

- Check that the ambient operating temperature is within limits.
- Check for clogged filters.
- Check fan operation.
- Check the control card.

WARNING 66, Heatsink temperature low
The drive 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 drive whenever the motor is stopped by setting *B-00 DC Hold Current* at 5% and *H-80 Function at Stop*

ALARM 67, Option module configuration has changed
One or more options have either been added or removed since the last power-down. Check that the configuration change is intentional and reset the unit.

ALARM 69, Power card temperaturePower card temperature
The temperature sensor on the power card is either too hot or too cold.

Troubleshooting

Check that the ambient operating temperature is within limits.

Check for clogged filters.

Check fan operation.

Check the power card.

ALARM 70, Illegal drive configuration
The control card and power card are incompatible. Contact your supplier with the model number of the unit from the nameplate and the part numbers of the cards to check compatibility.

WARNING 76, Power unit set-up
The required number of power units does not match the detected number of active power units.

77 WARNING, Reduced power mode
This warning indicates that the drive is operating in reduced power mode (i.e., less than the allowed number of inverter sections). This warning will be generated on power cycle when the drive is set to run with fewer inverters and will remain on.

ALARM 78, Tracking error
The difference between setpoint value and actual value has exceeded the value in *H-25 Tracking Error*. Disable the function by *H-24 Tracking Error Function* or select an alarm/warning also in *H-24 Tracking Error Function*. Investigate the mechanics around the load and motor. Check feedback connections from motor – encoder – to drive. Select motor feedback function in *H-20 Motor Feedback Loss Function*.

Adjust tracking error band in *H-25 Tracking Error* and *H-27 Tracking Error Ramping*.

ALARM 79, Illegal power section configuration
The scaling card is the incorrect part number or not installed. Also MK102 connector on the power card could not be installed.

ALARM 80, Unit Restored to Factory Settings
Parameter settings are restored to factory settings after a manual reset. Reset the unit to clear the alarm.

ALARM 83, Illegal option combination
The mounted options are not supported to work together.

WARNING 89, Mechanical brake sliding
The hoist brake monitor has detected a motor speed > 10rpm.

ALARM 90, Feedback mon.
Check the connection to encoder/ resolver option and eventually replace the OPCENC or OPCRES.

ALARM 91, Analogue input 54 wrong settings
Switch S202 has to be set in position OFF (voltage input) when a KTY sensor is connected to analog input terminal 54.

ALARM 243, Brake IGBT
This alarm is only for 6x unit size drives. It is equivalent to Alarm 27. The report value in the alarm log indicates which power module generated the alarm:

ALARM 244, Heatsink temperature
This alarm is only for 6x unit size adjustable frequency drives. It is equivalent to Alarm 29. The report value in the alarm log indicates which power module generated the alarm.

ALARM 245, Heatsink sensor
This alarm is only for 6x unit size adjustable frequency drives. It is equivalent to Alarm 39. The report value in the alarm log indicates which power module generated the alarm.

1 = left most inverter module.

2 = middle inverter module in 62 or 64 drive.

2 = right inverter module in 61 or 63 drivee.

3 = right inverter module in 62 or 64 drive.

5 = rectifier module.

ALARM 246, Power card supply
This alarm is only for 6x unit size drive. It is equivalent to Alarm 46. The report value in the alarm log indicates which power module generated the alarm.

1 = left most inverter module.

2 = middle inverter module in 62 or 64 drive.

2 = right inverter module in 61 or 63 drive.

3 = right inverter module in 62 or 64 drive.

5 = rectifier module.

ALARM 69, Power card temperaturePower card temperature
This alarm is only for 6x unit size drive. It is equivalent to Alarm 69. The report value in the alarm log indicates which power module generated the alarm.

1 = left most inverter module.

2 = middle inverter module in 62 or 64 drive.

2 = right inverter module in 61 or 63 drive.

3 = right inverter module in 62 or 64 drive.

5 = rectifier module.

ALARM 248, Illegal power section configuration
This alarm is only for 6x unit size adjustable frequency drives. It is equivalent to Alarm 79. The report value in the alarm log indicates which power module generated the alarm:

1 = left most inverter module.

2 = middle inverter module in 62 or 64 drive.

2 = right inverter module in 61 or 63 drive.

3 = right inverter module in 62 or 64 drive.

5 = rectifier module.

WARNING 249, Rect. low temperature
IGBT sensor fault (highpower units only).

WARNING 250, New spare part
A component in the drive has been replaced. Reset the drive for normal operation.

WARNING 251, New type code
The power card or other components have been replaced and the type code changed. Reset to remove the warning and resume normal operation.

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The instructions do not claim to cover every single detail or variation in the equipment nor do they provide for every possible contingency in connection with installation, operation or maintenance.
Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the GE company.

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