

# AF-60 LP™ Micro Drive

## Programming Guide



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## 1 Safety

### 1.1.1 High Voltage Warning

#### **⚠ WARNING**

The voltage of the adjustable frequency drive is dangerous whenever it is connected to line power. Incorrect installation of the motor or adjustable frequency drive may cause damage to the equipment, serious injury or death. Consequently, it is essential to comply with the instructions in this manual as well as local and national rules and safety regulations.

### 1.1.2 Safety Instructions

#### **CAUTION**

Before using functions directly or indirectly influencing personal safety (e.g., Fire mode or other functions either forcing the motor to stop or attempting to keep it functioning), a thorough risk analysis and system test must be carried out. The system tests must include testing failure modes regarding the control signaling (analog and digital signals and serial communication).

- Make sure the adjustable frequency drive is properly grounded.
- Do not remove AC line input connections, motor connections or other power connections while the adjustable frequency drive is connected to line power.
- Protect users against supply voltage.
- Protect the motor against overloading according to national and local regulations.
- The ground leakage current exceeds 3.5 mA.
- The [Off] key is not a safety switch. It does not disconnect the adjustable frequency drive from line power.

### 1.1.3 Software Version and Approvals

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p style="text-align: center;"><b>Software Version<br/>Programming Guide<br/>AF-60 LP™ Micro Drive</b></p> <p style="text-align: center;">   </p> <p style="text-align: center;">This Programming Guide can be used for all AF-60 LP™ Micro Drive adjustable frequency drives with software version 2.7X.<br/>The software version number can be read in <i>15-43 Software Version</i>.</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Table 1.1

### 1.1.4 General Warning

#### **⚠ WARNING**

##### **ELECTRICAL SHOCK HAZARD**

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 DC bus power supplies). Be aware that there may be high voltage on the DC link even when the LEDs are turned off.

Before touching any potentially live parts of the adjustable frequency drive, wait at least four minutes for all sizes. Shorter time is allowed only if indicated on the nameplate for the specific unit.



## ⚠ CAUTION

### Leakage Current

The Ground leakage current from the adjustable frequency drive exceeds 3.5 mA. According to IEC 61800-5-1, a reinforced protective ground connection must be ensured by means of a min. 0.016 in<sup>2</sup> [10 mm<sup>2</sup>] Cu or an additional PE wire - with the same cable cross-section as the line power wiring - must be terminated separately.

### Residual Current Device

This product can cause a DC current in the protective conductor. Where a residual current device (RCD) is used for extra protection, only an RCD of Type B (time delayed) shall be used on the supply side of this product. Protective grounding of the adjustable frequency drive and the use of RCDs must always follow national and local regulations.

- Disconnect the adjustable frequency drive from line power to avoid unintended start of any motors.
- To avoid unintended start, always press the [Off] key before changing parameters.

## 1.1.7 Disposal Instruction

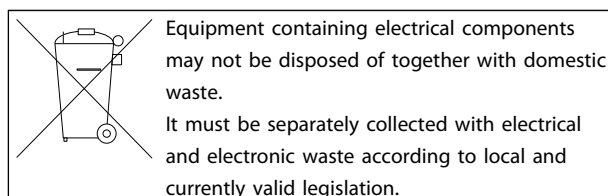


Table 1.2

## ⚠ CAUTION

Motor overload protection is possible by setting *1-90 Motor Thermal Protection* to the value Electronic overload trip. For the North American market: Electronic overload functions provide class 20 motor overload protection, in accordance with NEC.

## ⚠ WARNING

### Installation at high altitudes:

For altitudes above 6,600 feet [2 km], please contact GE.

## 1.1.8 Before Commencing Repair Work

1. Disconnect AF-60 LP™ Micro Drive from line power (and external DC supply, if present).
2. Wait for four minutes (M1, M2 and M3) and 15 min (M4 and M5) for discharge of the DC link.
3. Disconnect the DC bus terminals and brake terminals (if present)
4. Remove motor cable

## 1.1.5 IT Lines

## ⚠ CAUTION

### IT Lines

Installation on isolated line power source, i.e., IT lines.  
Max. supply voltage allowed when connected to line power: 440 V.

As an option, GE offers line filters for improved harmonics performance.

## 1.1.6 Avoiding Unintended Start

While the adjustable frequency drive is connected to line power, the motor can be started/stopped using digital commands, bus commands, references or via the drive keypad.



## 2 Introduction

### 2.1.1 Drive Identification

The nameplate sticker is located on the top of each adjustable frequency drive and shows the ratings, serial number, warnings catalog number, and other relevant data for each unit. See *Table 2.1* for details on how to read the type code string.



Figure 2.1 This Example Shows the Nameplate Sticker

### 2.1.2 AF-60 LP Micro Drive Model Number System Diagram

AF-60LP Micro Drive Catalog Numbering System Diagram

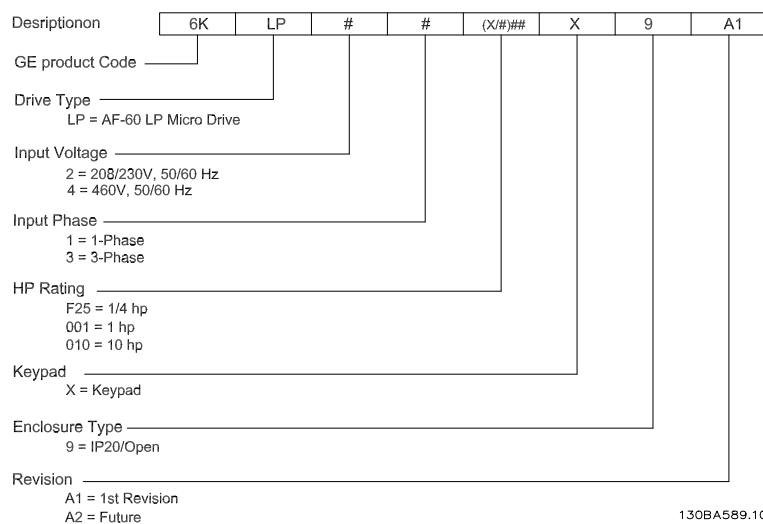


Figure 2.2



## Introduction

## AF-60 LP™ Micro Drive Programming Guide

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### 2.1.3 Warnings and Approvals

Symbols used in this Programming Guide.

#### Symbols

The following symbols are used in this manual.



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



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

#### CAUTION

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

### 2.1.4 Abbreviations and Standards

| Abbreviations:   | Terms:                       | SI units:           | I-P units:            |
|------------------|------------------------------|---------------------|-----------------------|
| a                | Acceleration                 | m/s <sup>2</sup>    | ft/s <sup>2</sup>     |
| AWG              | American wire gauge          |                     |                       |
| Auto Tune        | Automatic Motor Tuning       |                     |                       |
| °C               | Celsius                      |                     |                       |
| I                | Current                      | A                   | Amp                   |
| I <sub>LIM</sub> | Current limit                |                     |                       |
| DCT              | Drive Control Tool           |                     |                       |
| Joule            | Energy                       | J=N·m               | ft-lb, Btu            |
| °F               | Fahrenheit                   |                     |                       |
| f                | Frequency                    | Hz                  | Hz                    |
| kHz              | Kilohertz                    | kHz                 | kHz                   |
| mA               | Milliampere                  |                     |                       |
| ms               | Millisecond                  |                     |                       |
| min              | Minute                       |                     |                       |
| M-TYPE           | Motor Type Dependent         |                     |                       |
| Nm               | Newton meters                |                     | in-lbs                |
| I <sub>M,N</sub> | Nominal motor current        |                     |                       |
| f <sub>M,N</sub> | Nominal motor frequency      |                     |                       |
| P <sub>M,N</sub> | Nominal motor power          |                     |                       |
| U <sub>M,N</sub> | Nominal motor voltage        |                     |                       |
| PELV             | Protective Extra Low Voltage |                     |                       |
| Watt             | Power                        | W                   | Btu/hr, hp            |
| Pascal           | Pressure                     | Pa=N/m <sup>2</sup> | psi, psf, ft of water |
| I <sub>INV</sub> | Rated Drive Output Current   |                     |                       |
| RPM              | Revolutions Per Minute       |                     |                       |
| SR               | Size Related                 |                     |                       |
| T                | Temperature                  | C                   | F                     |
| t                | Time                         | s                   | s, hr                 |
| T <sub>LIM</sub> | Torque limit                 |                     |                       |
| U                | Voltage                      | V                   | V                     |

Table 2.1 Abbreviation and Standards table



## 3 Programming

### 3.1 How to Program

#### 3.1.1 Programming with DCT-10 Set-up Software

The adjustable frequency drive can be programmed from a PC via RS-485 COM port by installing the DCT-10 Set-up Software.

This software can be downloaded from the GE website:  
[www.geelectrical.com/drives](http://www.geelectrical.com/drives)

#### 3.1.2 Programming with the keypad

The keypad is divided into four functional groups:

1. Numeric display.
2. Menu key.
3. Navigation keys.
4. Operation keys and LEDs.

#### NOTE!

Parameters should be changed in numerical order. Certain parameter values are affected by the preceding changes.

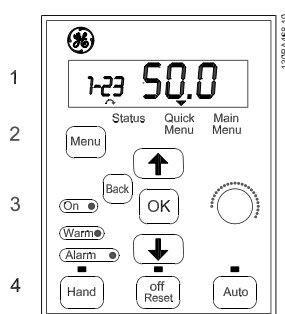


Figure 3.1 Keypad with Potentiometer

#### The display

Different information can be read from the display.

Set-up number shows the active set-up and the edit set-up. If the same set-up acts as both the active and edit set-up, only that set-up number is shown (factory setting). When active and edit set-up differ, both numbers are shown in the display (Set-up 12). The flashing number indicates the edit set-up.



Figure 3.2 Indicating the Set-up

The small digits to the left are the selected parameter number.

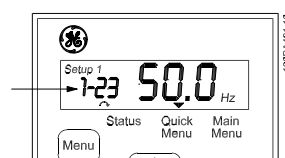


Figure 3.3 Indicating Selected Parameter Number

The large digits in the middle of the display show the **value** of the selected parameter.

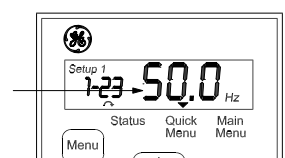


Figure 3.4 Indicating Value of Selected Parameter

The right side of the display shows the **unit** of the selected parameter. This can be either Hz, A, V, kW, HP, %, s or RPM.

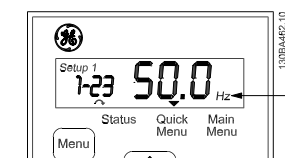


Figure 3.5 Indicating Unit of Selected Parameter



## Programming

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**Motor direction** is shown to the bottom left of the display - indicated by a small arrow pointing either clockwise or counter-clockwise.

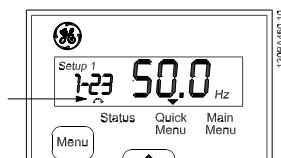


Figure 3.6 Indicating Motor Direction

Press the [Menu] key to select one of the following menus

### Status Menu

The Status Menu is either in *Read-out Mode* or *Hand Mode*. In *Read-out Mode*, the value of the currently selected readout parameter is shown in the display.

In *Hand Mode*, the local keypad reference is displayed.

### Quick Menu

Displays quick menu parameters and their settings. Parameters in the quick menu can be accessed and edited from here. Most applications can be run by setting the parameters in the quick menus.

### Main Menu

Displays main menu parameters and their settings. All parameters can be accessed and edited here.

### LEDs:

- Green LED: The adjustable frequency drive is on.
- Yellow LED: Indicates a warning. See 6 *Troubleshooting*.
- Flashing red LED: Indicates an alarm. See 6 *Troubleshooting*.

### Navigation Keys

**[Back]:** For moving to the previous step or layer in the navigation structure.

**[▲] [▼]:** For navigating between parameter groups, parameters and within parameters.

**[OK]:** For selecting a parameter and for accepting changes to parameter settings.

Pressing [OK] for more than 1 s enters 'Adjust' mode. In 'Adjust' mode, it is possible to make fast adjustment by pressing [▲] [▼] combined with [OK].

Press [▲] [▼] to change value. Press [OK] to shift between digits quickly.

To exit 'Adjust' mode, press [OK] more than 1 s again to save changes or press [Back] to not save changes.

### Operation Keys

A yellow light above the operation keys indicates the active key.

**[Hand]:** Starts the motor and enables control of the adjustable frequency drive via the keypad.

**[Off/Reset]:** The motor stops except when in alarm mode, in which case, the motor will be reset.

**[Auto]:** The adjustable frequency drive is controlled either via control terminals or serial communication.

**[Potentiometer] Keypad:** The potentiometer works in two ways depending on the mode in which the adjustable frequency drive is running.

In *Auto Mode*, the potentiometer acts as an extra programmable analog input.

In *Hand Mode*, the potentiometer controls local reference.

## 3.2 Status Menu

After power-up, the status menu is active. Press [Menu] to toggle between Status, Quick Menu and Main Menu.

[▲] and [▼] toggles between the choices in each menu.

The display indicates the status mode with a small arrow above "Status".

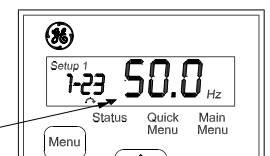


Figure 3.7 Indicating Status Mode

## 3.3 Quick Menu

The Quick Menu gives easy access to the most frequently used parameters.

1. To enter the Quick Menu, press [Menu] key until indicator in display is placed above *Quick Menu*.
2. Press [▲] [▼] to select either QM1 or QM2, then press [OK].
3. Press [▲] [▼] to browse through the parameters in the Quick Menu.
4. Press [OK] to select a parameter.
5. Press [▲] [▼] to change the value of a parameter setting.



6. Press [OK] to accept the change.
7. To exit, press either [Back] twice to enter *Status*, or press [Menu] once to enter *Main Menu*.

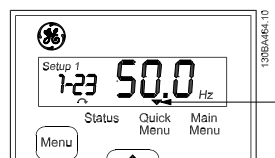


Figure 3.8 Indicating Quick Menu Mode

### 3.4 Main Menu

The main menu gives access to all parameters.

1. To enter the Main Menu, press [Menu] key until indicator in display is placed above *Main Menu*.
2. Press [▲] [▼] to browse through the parameter groups.
3. Press [OK] to select a parameter group.
4. Press [▲] [▼] to browse through the parameters in the specific group.
5. Press [OK] to select the parameter.
6. Press [▲] [▼] to set/change the parameter value.
7. Press [OK] to accept the value.
8. To exit, press either [Back] twice to enter *Quick Menu*, or press [Menu] once to enter *Status*.



Figure 3.9 Indicating Main Menu Mode





## 4 Parameter Descriptions

### 4.1 Parameter Group 0: Operation/Display

#### 0-03 Regional Settings

| Option: | Function:                                                                                                                                                                                                                                                            |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | In order to meet the needs for different default settings in different parts of the world, <i>0-03 Regional Settings</i> has been implemented in the adjustable frequency drive. The selected setting influences the default setting of the motor nominal frequency. |
| [0 ]    | International<br>Sets default of <i>1-23 Motor Frequency</i> , to 50 Hz, shows <i>1-20 Motor Power</i> in kW.                                                                                                                                                        |
| [1] *   | US<br>Sets default of <i>1-23 Motor Frequency</i> , to 60 Hz, shows <i>1-20 Motor Power</i> in HP.<br><b>NOTE!</b><br><b>This parameter cannot be changed while the motor is running.</b>                                                                            |

#### 0-04 Operating State at Power-up (Hand Mode)

| Option: | Function:                                                                                                                                                                                                                                                                                 |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | This parameter controls whether or not the adjustable frequency drive starts running the motor when powering up after a power-down in Hand mode.<br><b>NOTE!</b><br><b>If the keypad with potentiometer is mounted, the reference is set according to the actual potentiometer value.</b> |
| [0]     | Resume<br>The adjustable frequency drive starts in same hand or off state as when powered off. The local reference is stored and used after power-up.                                                                                                                                     |
| [1] *   | Forced Stop, Ref=Old<br>The adjustable frequency drive powers up in off state meaning that the motor is stopped after power-up. The local reference is stored and used after power-up.                                                                                                    |
| [2]     | Forced Stop, Ref=0<br>The adjustable frequency drive powers up in off state meaning that the motor is stopped after power-up. The Local reference is set to 0. Thus the motor will not start running before the local reference has been increased.                                       |

#### 4.1.1 0-1\* Set-up Handling

User-defined parameters and miscellaneous external inputs (e.g., bus, keypad, analog/digital inputs, feedback, etc.) controls the functionality of the adjustable frequency drive.

A complete set of all parameters controlling the adjustable frequency drive is called a set-up. The adjustable frequency drive contains two set-ups, *Set-up 1* and *Set-up 2*. Furthermore, a fixed set of factory settings can be copied into one or more set-ups.

Some of the advantages of having more than one set-up in the adjustable frequency drive are

- Run motor in one set-up (Active Set-up) while updating parameters in another set-up (Edit Set-up)
- Connect various motors (one at a time) to the adjustable frequency drive. Motor data for various motors can be placed in different set-ups.
- Rapidly change settings of the adjustable frequency drive and/or motor while motor is running (e.g., ramp time or preset references) via bus or digital inputs.

The *Active Set-up* can be set as *Multi Set-up* where the active set-up is selected via input on a digital input terminal and/or via the bus control word.

#### NOTE!

**Factory Set-up cannot be used as Active Set-up.**

#### 0-10 Active Set-up

| Option: | Function:                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | <i>Active Set-up</i> controls the motor. Shifts between set-ups can only happen when <ul style="list-style-type: none"> <li>• the motor is coasted</li> </ul> OR <ul style="list-style-type: none"> <li>• the set-ups between which the shift happens are linked to each other (see <i>0-12 Linked Set-ups</i>).</li> </ul> When changing between set-ups that are not linked, the change will not happen before the motor is coasted. |



## Parameter Descriptions

## AF-60 LP™ Micro Drive Programming Guide

| 0-10 Active Set-up |                                                                          |                                                                                             |
|--------------------|--------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Option:            | Function:                                                                |                                                                                             |
|                    | <b>NOTE!</b><br>The motor is only considered stopped when it is coasted. |                                                                                             |
| [1 ] *             | Set-up 1                                                                 | Set-up 1 is active.                                                                         |
| [2]                | Set-up 2                                                                 | Set-up 2 is active.                                                                         |
| [9]                | Multi Set-up                                                             | Select the active set-up via digital input and/or bus, see 5-1* Digital Inputs choice [23]. |

| 0-11 Edit Set-up |                                                                                                                                                                                                                                                                    |                                                                                        |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| Option:          | Function:                                                                                                                                                                                                                                                          |                                                                                        |
|                  | The <i>Edit Set-up</i> is for updating parameters in the adjustable frequency drive from either keypad or bus. It can be identical to or different from the <i>Active Set-up</i> . All set-ups can be edited during operation, independently of the active set-up. |                                                                                        |
| [1 ] *           | Set-up 1                                                                                                                                                                                                                                                           | Update parameters in Set-up 1.                                                         |
| [2]              | Set-up 2                                                                                                                                                                                                                                                           | Update parameters in Set-up 2.                                                         |
| [9]              | Active Set-up                                                                                                                                                                                                                                                      | Update parameters in set-up selected as <i>Active Set-up</i> (see 0-10 Active Set-up). |

| 0-12 Link Set-ups |                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                  |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Option:           | Function:                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                  |
|                   | The link ensures synchronizing of the “not changeable during operation” parameter values enabling shift from one set-up to another during operation. If the set-ups are not linked, a change between them is not possible while the motor is running. Thus the set-up change does not occur until the motor is coasted. |                                                                                                                                                                                                  |
| [0]               | Not linked                                                                                                                                                                                                                                                                                                              | Leaves parameters unchanged in both set-ups and cannot be changed while the motor is running.                                                                                                    |
| [1 ] *            | Linked                                                                                                                                                                                                                                                                                                                  | Copy parameter's “not changeable during operation” parameter values into currently selected <i>Edit Set-up</i> .<br><b>NOTE!</b><br>This parameter cannot be changed while the motor is running. |

| 0-31 Custom Readout Min Scale |                                                                                                                                                                                                                                                                                                 |  |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Range:                        | Function:                                                                                                                                                                                                                                                                                       |  |
| 0.00 * [0.00–9999.00 ]        | It is possible to create a customized readout related to the output frequency of the unit. The value entered in 0-31 <i>Custom Readout Min Scale</i> will be shown at 0 Hz. The readout can be shown in the keypad display when in Status Mode or it can be read in 16-09 <i>Custom Readout</i> |  |

| 0-32 Custom Readout Max Scale |                                                                                                                                                                                                                                                                                                                                                            |  |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Range:                        | Function:                                                                                                                                                                                                                                                                                                                                                  |  |
| 100.0* [0.00–9999.00]         | It is possible to create a customized readout related to the output frequency of the unit. The value entered in 0-32 <i>Custom Readout Max Scale</i> will be shown at the frequency programmed in 4-14 <i>Motor Speed High Limit</i> . The readout can be shown in the keypad display when in Status Mode or it can be read in 16-09 <i>Custom Readout</i> |  |

### 4.1.2 0-4\* Keypad

The adjustable frequency drive can operate in the following three modes: *Hand*, *Off* and *Auto*.

*Hand*: The adjustable frequency drive is locally operated and does not allow any remote control. By activating Hand, a start signal is given.

*Off*: The adjustable frequency drive stops with a normal stop ramp. When Off is chosen, the adjustable frequency drive can only be started by pressing either Hand or Auto on the keypad.

*Auto*: In Auto mode, the adjustable frequency drive can be remote controlled (bus/digital).

| 0-40 [Hand] Key on Keypad |           |                             |
|---------------------------|-----------|-----------------------------|
| Option:                   | Function: |                             |
| [0]                       | Disabled  | [Hand] key has no function. |
| [1 ] *                    | Enabled   | [Hand] key is functional.   |

| 0-41 [Off/Reset] Key on Keypad |                   |                                              |
|--------------------------------|-------------------|----------------------------------------------|
| Option:                        | Function:         |                                              |
| [0]                            | Disable Off/Reset | [Off/Reset] key has no function.             |
| [1 ] *                         | Enable Off/Reset  | Stop signal and reset of any faults.         |
| [2]                            | Enable Reset Only | Reset only. Stop (Off) function is disabled. |

| 0-42 [Auto] Key on Keypad |           |                             |
|---------------------------|-----------|-----------------------------|
| Option:                   | Function: |                             |
| [0]                       | Disabled  | [Auto] key has no function. |
| [1 ] *                    | Enabled   | [Auto] key is functional.   |

### 4.1.3 0-5\* Copy/Save

| 0-50 Keypad Copy |                                                                                                                                                                                                        |  |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Option:          | Function:                                                                                                                                                                                              |  |
|                  | The detachable keypad of the adjustable frequency drive can be used for storing set-ups, and thus for transferring data when moving parameter settings from one adjustable frequency drive to another. |  |

**0-50 Keypad Copy**

| Option:                          | Function:                                                                                                    |
|----------------------------------|--------------------------------------------------------------------------------------------------------------|
|                                  | <b>NOTE!</b><br><i>Keypad Copy can only be activated from the keypad and ONLY when the motor is coasted.</i> |
| [1] All to keypad                | Copy all set-ups from the adjustable frequency drive into the keypad.                                        |
| [2] All from keypad              | Copy all set-ups from keypad to adjustable frequency drive.                                                  |
| [3] Size independent from keypad | Copy non-motor size-dependent data from keypad to adjustable frequency drive.                                |

**0-51 Set-up Copy**

| Option:                      | Function:                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                              | Use this function to copy set-up content into the <i>Edit Set-up</i> .<br>In order to be able to make a set-up copy, make sure that <ul style="list-style-type: none"><li>the motor is coasted</li><li>0-10 Active Set-up, Active Set-up, is set to either [1] Set-up 1 or [2] Set-up 2</li></ul> <b>NOTE!</b><br>The keyboard/parameter database are blocked while Set-up Copy is running. |
| [0] * No Copy                | Copy function is inactive                                                                                                                                                                                                                                                                                                                                                                   |
| [1] Copy from Set-up 1       | Copy from Set-up 1 to edit set-up chosen in 0-11 Edit Set-up.                                                                                                                                                                                                                                                                                                                               |
| [2] Copy from Set-up 2       | Copy from Set-up 2 to edit set-up chosen in 0-11 Edit Set-up.                                                                                                                                                                                                                                                                                                                               |
| [9] Copy from Factory Set-up | Copy from Factory Settings to edit set-up chosen in 0-11 Edit set-up.                                                                                                                                                                                                                                                                                                                       |

**NOTE!**

Pressing [Menu], [OK] and [▼] will unlock the password. This will automatically open the parameter editing shield in the quick menu or main menu.

**0-61 Access to Main/Quick Menu w/o Password**

| Option:               | Function:                                                                                    |
|-----------------------|----------------------------------------------------------------------------------------------|
| [0] * Full access     | Select [0] Full Access to disable the password in 0-60 (Main) Menu Password.                 |
| [1] Keypad: Read Only | Select [1] Read Only to block unauthorized editing of Main/Quick menu parameter.             |
| [2] keypad: No Access | Select [2] No Access to block unauthorized editing and viewing of Main/Quick menu parameter. |

**4.1.4 0-6\* Password****0-60 (Main) Menu Password**

| Range:      | Function:                                                                                                                                                                 |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | Use a password to prevent unintentionally changing sensitive parameters, e.g., motor parameters.                                                                          |
| 0 * [0-999] | Enter the password for access to the main menu via the [Main Menu] key. Select the number that allows other parameter values to be changed. 0 means there is no password. |

**NOTE!**

A password has affect on the keypad - not on the bus communication.



## 4.2 Parameter Group 1: Load/Motor

### 1-00 Configuration Mode

| Option: | Function:                                                                                                                                                                                                                                                                                                                                                |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | Use this parameter for selecting the application control principle to be used when a remote reference is active.<br><b>NOTE!</b><br>Changing this parameter will reset 3-00 Reference Range, 3-02 Minimum Reference and 3-03 Maximum Reference to their default values.<br><b>NOTE!</b><br>This parameter cannot be adjusted while the motor is running. |
| [0] *   | Speed Open-loop<br>For normal speed control (References).                                                                                                                                                                                                                                                                                                |
| [3]     | Process Closed-loop<br>Enables process closed-loop control. See parameter group 7-3* Process PI Control for further information on PI controller.                                                                                                                                                                                                        |

### 1-01 Motor Control Principle

| Option: | Function:                                                                                                                                                                                                                                                         |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [0]     | U/f<br>Is used for parallel connected motors and/or special motor applications. The U/f settings are set in 1-55 U/f Characteristic -U and 1-56 U/f Characteristic -F.<br><b>NOTE!</b><br>When running U/f, control slip and load compensations are not included. |
| [1] *   | Advanced Vector Control<br>Normal running mode, including slip and load compensations.                                                                                                                                                                            |

### 1-03 Torque Characteristics

| Option: | Function:                                                                                                                                                            |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | With more torque characteristics, it is possible to run low energy consuming applications, as well as high torque applications.                                      |
| [0] *   | Constant Torque<br>Motor shaft output provides constant torque under variable speed control.                                                                         |
| [2]     | Energy Savings<br>This function automatically optimizes energy consumption in centrifugal pump and fan applications. See 14-41 Energy Savings Minimum Magnetization. |

### 1-05 Hand Mode Configuration

| Option: | Function:                                                                                                                                                                     |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | This parameter is only relevant when 1-00 Configuration Mode is set to [3] Process Closed-loop. The parameter is used for determining the reference or setpoint handling when |

### 1-05 Hand Mode Configuration

| Option: | Function:                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | changing from Auto mode to Hand mode on the keypad.                                                                                                                                                                                                                                                                                                                                                                  |
| [0]     | Speed Open-loop<br>In Hand mode, the drive always runs in Open-loop configuration regardless of setting in 1-00 Configuration Mode. Local potentiometer (if present) or Arrow up/down determines output frequency limited by Motor Speed High/Low Limit (4-14 Motor Speed High Limit and 4-12 Motor Speed Low Limit).                                                                                                |
| [2] *   | As configuration in 1-00 Configuration Mode.<br>If 1-00 Configuration Mode is set to [1] Open-loop, the function is as described above.<br>If 1-00 Configuration Mode is set to [3] Process Closed-loop, changing from Auto mode to Hand mode results in a setpoint change via local potentiometer or Arrow up/down. The change is limited by Reference Max/Min (3-02 Minimum Reference and 3-03 Maximum Reference). |

## 4.2.1 1-2\* Motor Data

Enter the correct motor nameplate data (power, voltage, frequency, current and speed).

Run Auto Tune, see 1-29 Auto Tune.

Factory settings for advanced motor data, parameter group 1-3\* Adv. Motor Data, are automatically calculated.

### NOTE!

Parameters in parameter group 1-2\* Motor Data cannot be adjusted while the motor is running.

### 1-20 Motor Power [kW]/[HP] (P<sub>m,n</sub>)

| Option: | Function:                                                                                                    |
|---------|--------------------------------------------------------------------------------------------------------------|
|         | Enter the motor power from the nameplate data.<br>Two sizes down, one size up from nominal AF-60 LP™ rating. |
| [1]     | 0.09 kW/0.12 HP                                                                                              |
| [2]     | 0.12 kW/0.16 HP                                                                                              |
| [3]     | 0.18 kW/0.25 HP                                                                                              |
| [4]     | 0.25 kW/0.33 HP                                                                                              |
| [5]     | 0.37 kW/0.50 HP                                                                                              |
| [6]     | 0.55 kW/0.75 HP                                                                                              |
| [7]     | 0.75 kW/1.00 HP                                                                                              |
| [8]     | 1.10 kW/1.50 HP                                                                                              |
| [9]     | 1.50 kW/2.00 HP                                                                                              |
| [10]    | 2.20 kW/3.00 HP                                                                                              |
| [11]    | 3.00 kW/4.00 HP                                                                                              |
| [12]    | 3.70 kW/5.00 HP                                                                                              |
| [13]    | 4.00 kW/5.40 HP                                                                                              |

**1-20 Motor Power [kW]/[HP] (P<sub>m,n</sub>)**

| Option:                | Function: |
|------------------------|-----------|
| [14] 5.50 kW/7.50 HP   |           |
| [15] 7.50 kW/10.0 HP   |           |
| [16] 11.00 kW/15.00 HP |           |
| [17] 15.00 kW/20.00 HP |           |
| [18] 18.50 kW/25.00 HP |           |
| [19] 22.00 kW/29.50 HP |           |
| [20] 30.00 kW/40.00 HP |           |

**NOTE!**

Changing this parameter affects parameters 1-22 Motor Voltage to 1-25 Motor Frequency, 1-30 Stator Resistance, 1-33 Stator Leakage Reactance and 1-35 Main Reactance.

**1-22 Motor Voltage (U<sub>m,n</sub>)**

| Range:               | Function:                                        |
|----------------------|--------------------------------------------------|
| 230/400 V [50–999 V] | Enter the motor voltage from the nameplate data. |

**1-23 Motor Frequency (f<sub>m,n</sub>)**

| Range:             | Function:                                          |
|--------------------|----------------------------------------------------|
| 60 Hz* [20–400 Hz] | Enter the motor frequency from the nameplate data. |

**1-24 Motor Current (I<sub>m,n</sub>)**

| Range:                            | Function:                                        |
|-----------------------------------|--------------------------------------------------|
| M-type dependent* [0.01–100.00 A] | Enter the motor current from the nameplate data. |

**1-25 Motor Nominal Speed (n<sub>m,n</sub>)**

| Range:                            | Function:                                      |
|-----------------------------------|------------------------------------------------|
| M-type Dependent* [100–9,999 RPM] | Enter motor nominal speed from nameplate data. |

**1-29 Auto Tune**

| Option:   | Function:                                                                                                                                                                                                                                                                                                                                              |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           | Use Auto Tune to optimize motor performance.<br><b>NOTE!</b><br>This parameter cannot be changed while the motor is running.                                                                                                                                                                                                                           |
|           | <ol style="list-style-type: none"> <li>1. Stop the adjustable frequency drive - make sure motor is at standstill.</li> <li>2. Choose [2] Enable Auto Tune</li> <li>3. Apply start signal. <ul style="list-style-type: none"> <li>- Via keypad: Press [Hand]</li> <li>- Or in Remote On mode: Apply start signal on terminal 18.</li> </ul> </li> </ol> |
| [0] * Off | Auto Tune function is disabled.                                                                                                                                                                                                                                                                                                                        |

**1-29 Auto Tune**

| Option:              | Function:                                                                                                                                      |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| [2] Enable Auto Tune | Auto Tune function starts running.<br><b>NOTE!</b><br>To gain optimum tuning of the adjustable frequency drive, run Auto Tune on a cold motor. |

**4.2.2 1-3\* Adv. Motor Data**

Adjust advanced motor data using one of these methods:

1. Run Auto Tune on cold motor. The adjustable frequency drive measures value from motor.
2. Enter the X<sub>1</sub> value manually. Obtain the value from the motor supplier.
3. Use R<sub>s</sub>, X<sub>1</sub>, and X<sub>2</sub> default setting. The adjustable frequency drive establishes setting based on motor nameplate data.

**NOTE!**

These parameters cannot be changed while the motor runs.

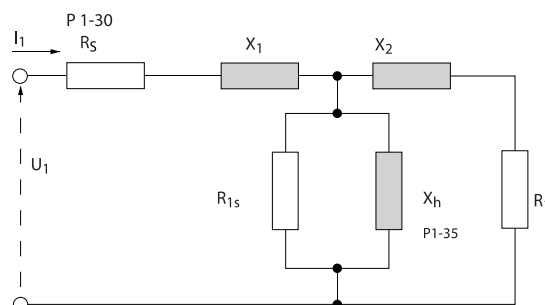


Figure 4.1

**1-30 Stator Resistance (R<sub>s</sub>)**

| Range:                         | Function:                        |
|--------------------------------|----------------------------------|
| Depending on motor data* [Ohm] | Set the stator resistance value. |

**1-33 Stator Leakage Reactance (X<sub>1</sub>)**

| Range:                         | Function:                                      |
|--------------------------------|------------------------------------------------|
| Depending on motor data* [Ohm] | Set the stator leakage reactance of the motor. |

**1-35 Main Reactance (X<sub>2</sub>)**

| Range:                         | Function:                     |
|--------------------------------|-------------------------------|
| Depending on motor data* [Ohm] | Set the motor main reactance. |



## Parameter Descriptions

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### 4.2.3 1-5\* Load Independent Setting

This parameter group is for setting the load-independent motor settings.

#### 1-50 Motor Magnetization at Zero Speed

| Range: | Function:                                                                                                          |
|--------|--------------------------------------------------------------------------------------------------------------------|
| 100%*  | [0–300%]                                                                                                           |
|        | This parameter enables different thermal loads on the motor when running at low speed.                             |
|        | Enter a percentage of rated magnetizing current. If the setting is too low, the motor shaft torque may be reduced. |

#### 1-52 Min. Speed Normal Magnetizing [Hz]

| Range:  | Function:                                                                                                                                                     |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.0 Hz* | [0.0–10.0 Hz]                                                                                                                                                 |
|         | Use this parameter along with 1-50 Motor Magnetizing at Zero Speed.                                                                                           |
|         | Set frequency required for normal magnetizing current. If frequency is set lower than motor slip frequency, 1-50 Motor Magnetizing at Zero Speed is inactive. |

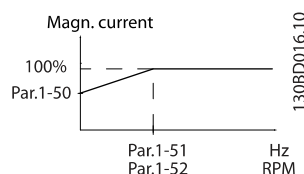


Figure 4.2

#### 1-55 U/f Characteristic - U

| Range: | Function:                                                                                                                                                 |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.0 V* | [0.0–999.9 V]                                                                                                                                             |
|        | This parameter is an array parameter [0–5] and is only functional when 1-01 Motor Control Principle is set to [0] U/f.                                    |
|        | Enter voltage at each frequency point to manually form a U/f characteristic matching motor. Frequency points are defined in 1-56 U/f characteristics - F. |

#### 1-56 U/f Characteristic - F

| Range:  | Function:                                                                                                                                     |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 0.0 Hz* | [0.0–1,000.0 Hz]                                                                                                                              |
|         | This parameter is an array parameter [0–5] and is only functional when 1-01 Motor Control Principle is set to [0] U/f.                        |
|         | Enter frequency points to manually form a U/f characteristic matching motor. Voltage at each point is defined in 1-55 U/f Characteristic - U. |
|         | Make a U/f characteristic based on six definable voltages and frequencies, see Figure 4.3.                                                    |

#### 1-56 U/f Characteristic - F

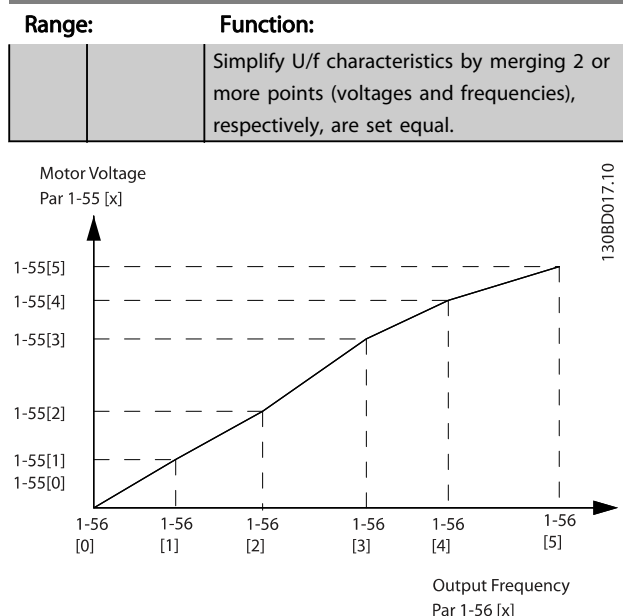


Figure 4.3 U/f Characteristics

### NOTE!

For 1-56 U/f characteristics - F the following applies  
 $[0] \leq [1] \leq [2] \leq [3] \leq [4] \leq [5]$

### 4.2.4 1-6\* Load Dependent Setting

Parameters for adjusting the load-dependent motor settings.

#### 1-60 Low Speed Load Compensation

| Range: | Function:                                                                                                                                                  |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 100%*  | [0–199%]                                                                                                                                                   |
|        | Use this parameter to gain an optimum U/f characteristic when running at low speed.                                                                        |
|        | Enter the percentage in relation to the load when the motor is running at low speed. The changeover point is automatically calculated based on motor size. |

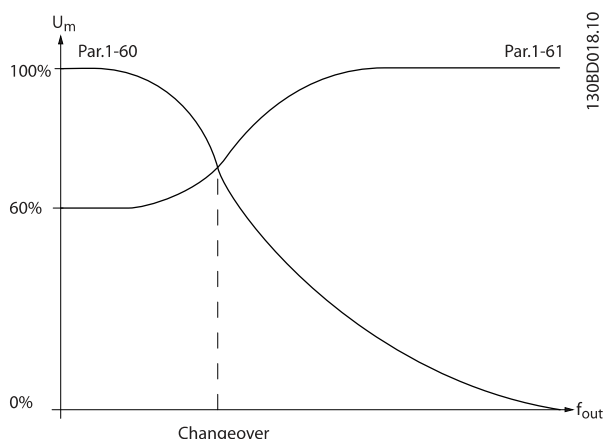


Figure 4.4

**1-61 High Speed Load Compensation****Range:** **Function:**

|       |          |                                                                                                                                                                          |
|-------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       |          | Use this parameter to obtain an optimum load compensation when running at high speed.                                                                                    |
| 100%* | [0–199%] | Enter the percentage to compensate in relation to the load when motor is running at high speed.<br>The changeover point is automatically calculated based on motor size. |

**1-62 Slip Compensation****Range:** **Function:**

|       |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 100%* | [-400–399%] | Compensation for load-dependent motor slip. The slip compensation is calculated automatically based on the rated motor speed, $n_{M,N}$ .<br>Example: if 1-62 <i>Slip Compensation</i> is set to 100% and the 4-pole 1,800 RPM motor has an actual nameplate RPM of 1,750 RPM, then 50 RPM is added to the output frequency by the drive.<br><b>NOTE!</b><br>This function is only active when 1-00 <i>Configuration Mode</i> , is set to [0] <i>Speed Open-loop</i> and when 1-01 <i>Motor Control Principle</i> , is set to [1] <i>Advanced Vector Control</i> |
|-------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**1-63 Slip Compensation Time****Range:** **Function:**

|        |               |                                                                                                                                                                                                               |
|--------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.10 s | [0.05–5.00 s] | Enter the slip compensation reaction speed. A high value results in a slow reaction whereas a low value results in a quick reaction.<br>If low-frequency resonance problems arise, use a longer time setting. |
|--------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**4.2.5 1-7\* Start Adjustments**

Considering the need for various start functions in different applications, it is possible to select a number of functions in this parameter group.

**1-71 Start Delay****Range:** **Function:**

|        |              |                                                                                                                                                                                                                |
|--------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|        |              | The start delay defines the time to pass from a start command is given until the motor starts accelerating.<br>Setting start delay to 0.0 s disables 1-72 <i>Start Function</i> , when start command is given. |
| 0.0 s* | [0.0–10.0 s] | Enter the time delay required before commencing acceleration.<br>1-72 <i>Start Function</i> is active during <i>Start delay time</i> .                                                                         |

**1-72 Start Function****Option:** **Function:**

|       |                     |                                                                                                     |
|-------|---------------------|-----------------------------------------------------------------------------------------------------|
| [0]   | DC Hold/Delay Time  | Motor is energized with DC holding current (2-00 <i>DC Hold Current</i> ) during start delay time.  |
| [1]   | DC Brake/Delay Time | Motor is energized with DC braking current (2-01 <i>DC Brake Current</i> ) during start delay time. |
| [2] * | Coast/Delay Time    | Drive is coasted during start delay time (Driveoff).                                                |

**1-73 Start Mode****Option:** **Function:**

|       |          |                                                                                                                                                                                            |
|-------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       |          | The Start Mode parameter is used to catch a spinning motor after, e.g., line drop-out.<br><b>NOTE!</b><br>This function is not suitable for hoisting applications.                         |
| [0] * | Disabled | Catch a spinning load disabled.                                                                                                                                                            |
| [1]   | Enabled  | Adjustable frequency drive enabled to catch a spinning motor.<br><b>NOTE!</b><br>When flying start is enabled 1-71 <i>Start Delay</i> , and 1-72 <i>Start Function</i> , have no function. |

**4.2.6 1-8\* Stop Adjustments**

To meet the need for various stop functions in different applications, these parameters offer some special stop features for the motor.

**1-80 Function at Stop****Option:** **Function:**

|  |  |                                                                  |
|--|--|------------------------------------------------------------------|
|  |  | The selected function at stop is active in following situations: |
|--|--|------------------------------------------------------------------|



## Parameter Descriptions

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### 1-80 Function at Stop

| Option: | Function:                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | <ul style="list-style-type: none"> <li>Stop command is given and output speed is ramped down to <i>Min. Speed for Function at Stop</i>.</li> <li>Start command is removed (standby), and output speed is ramped down to <i>Min. Speed for Function at Stop</i>.</li> <li>DC brake command is given, and DC brake time has passed.</li> <li>While running and calculated output speed is below <i>Min. Speed for Function at Stop</i>.</li> </ul> |
| [0] *   | Coast<br>The drive is coasted.                                                                                                                                                                                                                                                                                                                                                                                                                   |
| [1]     | DC hold<br>The motor is energized with DC current. See 2-00 <i>DC Hold Current</i> for more information.                                                                                                                                                                                                                                                                                                                                         |

### 1-82 Min. Speed For Function at Stop [Hz]

| Range:                | Function:                                                         |
|-----------------------|-------------------------------------------------------------------|
| 0.0 Hz* [0.0–20.0 Hz] | Set the speed at which to activate 1-80 <i>Function at Stop</i> . |

### 4.2.7 1-9\* Motor Temperature

With an estimated motor temperature monitor the adjustable frequency drive is able to estimate motor temperature without having a thermistor mounted. It is therefore possible to receive a warning or an alarm if the motor temperature exceeds the upper operational limit.

### 1-90 Motor Thermal Protection

| Option: | Function:                                                                                                                                                                                                                                                                                   |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | Using Electronic Overload the motor temperature is calculated based on frequency, speed and time. GE recommends using the Electronic Overload function, if a thermistor is not present.<br><b>NOTE!</b><br>calculation is based on motor data from parameter group 1-2* <i>Motor Data</i> . |
| [0] *   | No Protection<br>Disables temperature monitoring.                                                                                                                                                                                                                                           |
| [1]     | Thermistor Warning<br>A thermistor connected to either digital or analog input gives a warning if upper limit of motor temperature range is exceeded, (see 1-93 <i>Thermistor Resource</i> ).                                                                                               |
| [2]     | Thermistor Trip<br>A thermistor connected to either digital or analog input gives an alarm and makes the adjustable frequency drive trip if upper limit of motor temperature range is exceeded, (see 1-93 <i>Thermistor Resource</i> ).                                                     |

### 1-90 Motor Thermal Protection

| Option: | Function:                                                                                                                                                      |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [3]     | Electronic Overload Warning<br>If the calculated upper limit of the motor temperature range is exceeded, a warning is issued.                                  |
| [4]     | Electronic Overload Trip<br>If 90% of calculated upper limit of motor temperature range is exceeded, an alarm occurs and the adjustable frequency drive trips. |

### NOTE!

When the electronic overload function has been selected, the drive stores the recorded temperature at power-down; this temperature is resumed at power-up regardless of the elapsed time. Changing 1-90 *Motor Thermal Protection* back to [0] *No Protection* will reset the recorded temperature.

### 1-93 Thermistor Resource

| Option:                  | Function:                                                                                                                                                                                                                                                                                                                         |                                 |                   |                                 |         |      |                   |        |      |                   |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-------------------|---------------------------------|---------|------|-------------------|--------|------|-------------------|
|                          | Select the thermistor input terminal.                                                                                                                                                                                                                                                                                             |                                 |                   |                                 |         |      |                   |        |      |                   |
| [0] *                    | None<br>No thermistor is connected.                                                                                                                                                                                                                                                                                               |                                 |                   |                                 |         |      |                   |        |      |                   |
| [1]                      | Analog<br>Input 53<br>Connect the thermistor to analog input terminal 53.<br><b>NOTE!</b><br><b>Analog input 53 cannot be selected for other purposes when selected as the thermistor resource.</b>                                                                                                                               |                                 |                   |                                 |         |      |                   |        |      |                   |
| [6]                      | Digital<br>input 29<br>Connect the thermistor to digital input terminal 29.<br>While this input functions as thermistor input, it will not respond to the function chosen in 5-13 <i>Digital Input 29</i> . The value of 5-13 <i>Digital Input 29</i> remains however unchanged in parameter database while function is inactive. |                                 |                   |                                 |         |      |                   |        |      |                   |
|                          | <table><tr><th>Input Digital/<br/>Analog</th><th>Supply<br/>Voltage</th><th>Threshold Cut-<br/>out<br/>Values</th></tr><tr><td>Digital</td><td>10 V</td><td>&lt;800 Ω ⇒ 2.9 kohm</td></tr><tr><td>Analog</td><td>10 V</td><td>&lt;800 Ω ⇒ 2.9 kohm</td></tr></table>                                                              | Input Digital/<br>Analog        | Supply<br>Voltage | Threshold Cut-<br>out<br>Values | Digital | 10 V | <800 Ω ⇒ 2.9 kohm | Analog | 10 V | <800 Ω ⇒ 2.9 kohm |
| Input Digital/<br>Analog | Supply<br>Voltage                                                                                                                                                                                                                                                                                                                 | Threshold Cut-<br>out<br>Values |                   |                                 |         |      |                   |        |      |                   |
| Digital                  | 10 V                                                                                                                                                                                                                                                                                                                              | <800 Ω ⇒ 2.9 kohm               |                   |                                 |         |      |                   |        |      |                   |
| Analog                   | 10 V                                                                                                                                                                                                                                                                                                                              | <800 Ω ⇒ 2.9 kohm               |                   |                                 |         |      |                   |        |      |                   |
| <b>Table 4.1</b>         |                                                                                                                                                                                                                                                                                                                                   |                                 |                   |                                 |         |      |                   |        |      |                   |



## 4.3 Parameter Group 2: Brakes

## 4.3.1 2-\*\* Brakes

## 4.3.2 2-0\* DC Brake

The purpose of the DC brake function is to brake a rotating motor by applying DC current to the motor.

## 2-00 DC Hold Current

| Range:        | Function:                                                                                                                                                                                                            |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | This parameter either holds the motor (holding torque) or pre-heats the motor.<br>The parameter is active if <i>DC Hold</i> has been selected in either <i>1-72 Start Function</i> or <i>1-80 Function at Stop</i> . |
| 50%* [0–100%] | Enter a value for holding current as a percentage of the rated motor current set in <i>1-24 Motor Current</i> . 100% DC holding current corresponds to $I_{M,N}$ .                                                   |

**NOTE!**

Avoid 100% current for too long as it may overheat the motor.

## 2-01 DC Brake Current

| Range:        | Function:                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 50%* [0–150%] | Set the DC current needed to brake rotating motor.<br>Activate the DC brake in one of the four following ways: <ol style="list-style-type: none"> <li>1. DC brake command, see <i>5-1* Digital Inputs</i> choice [5]</li> <li>2. DC Cut-in function, see <i>2-04 DC-Brake Cut-in Speed</i></li> <li>3. DC brake selected as start function, see <i>1-72 Start Function</i></li> <li>4. DC brake in connection with <i>Flying Start</i>, <i>1-73 Flying Start</i>.</li> </ol> |

## 2-02 DC Braking Time

| Range:             | Function:                                                                                        |
|--------------------|--------------------------------------------------------------------------------------------------|
|                    | DC braking time defines the period during which <i>DC brake current</i> is applied to the motor. |
| 10.0 s* [0.0–60 s] | Set the time DC braking current, set in <i>2-01 DC Brake Current</i> , must be applied.          |

**NOTE!**

If DC brake is activated as start function, DC brake time is defined by *holding time*.

## 2-04 DC Brake Cut-in Speed

| Range:                 | Function:                                                                                                                                                 |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.0 Hz* [0.0–400.0 Hz] | Set DC brake cut-in speed to activate DC braking current, set in <i>2-01 DC Brake Current</i> , when ramping down.<br>When set to 0, the function is off. |

## 4.3.3 2-1\* Brake Energy Function

Use the parameters in this group for selecting dynamic braking parameters.

## 2-10 Brake Function

| Option:            | Function:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | <b>Resistor Brake:</b><br>The resistor brake limits voltage in the intermediate circuit when the motor acts as a generator. Without the brake resistor, the adjustable frequency drive eventually trips. The resistor brake consumes surplus energy resulting from motor braking. An adjustable frequency drive with brake, stops a motor faster than without a brake, which is used in many applications. Requires the connection of an external brake resistor.<br>An alternative to the resistor brake is the AC brake. |
|                    | <b>NOTE!</b><br>A resistor brake is only functional in adjustable frequency drives with an integrated dynamic brake. An external resistor must be connected.                                                                                                                                                                                                                                                                                                                                                               |
|                    | <b>AC Brake:</b><br>The AC brake consumes surplus energy by creating power loss in the motor. It is important to keep in mind that an increase in power loss causes the motor temperature to rise.                                                                                                                                                                                                                                                                                                                         |
| [0] * Off          | No brake function.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| [1] Resistor Brake | The resistor brake is active.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| [2] AC Brake       | AC brake is active.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## 2-11 Brake Resistor (Ohm)

| Range:           | Function:                     |
|------------------|-------------------------------|
| 5 Ω* [5–5,000 Ω] | Set the brake resistor value. |



## Parameter Descriptions

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### 2-16 AC Brake, Max Current

| Range:               | Function:                                                                                                                                         |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 100.0%* [0.0–150.0%] | Enter the max. permissible current for AC braking to avoid overheating the motor.<br>100% equals motor current set in 1-24 <i>Motor Current</i> . |

### 2-17 Over-voltage Control

| Option: | Function:                                                                                                                                                                                                                                                                               |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | Use Over-voltage Control (OVC) to reduce the risk of the adjustable frequency drive tripping due to an overvoltage on the DC link caused by generative power from the load.<br>An overvoltage occurs, e.g., if the ramp-down time is set too short compared to the actual load inertia. |
| [0] *   | Disabled The OVC is not active/required.                                                                                                                                                                                                                                                |
| [1]     | Enabled, not at stop OVC is running unless a stop signal is active.                                                                                                                                                                                                                     |
| [2]     | Enabled OVC is running, also when a stop signal is active.                                                                                                                                                                                                                              |

## NOTE!

If Resistor Brake has been chosen in 2-10 *Brake Function*, the OVC is not active even though enabled in this parameter.

### 2-22 Activating Mechanical Brake

| Range:           | Function:                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                  | <p>If the motor is stopped using ramp, the mechanical brake is activated when motor speed is less than <i>Active Brake Speed</i>.<br/>The motor is ramped down to stop in the following situations:</p> <ul style="list-style-type: none"> <li>• A start command is removed (stand by)</li> <li>• A stop command is activated</li> <li>• Quick-stop is activated (Q-stop ramp is used)</li> </ul> |
| 0 Hz* [0–400 Hz] | <p>Select motor speed at which mechanical brake activates when ramping down.<br/>The mechanical brake automatically activates if the adjustable frequency drive trips or reports an alarm.</p>                                                                                                                                                                                                    |

## 4.3.4 2-2\* Mechanical Brake

For hoisting applications, an electro-magnetic brake is required. The brake is controlled by a relay, which releases the brake when activated.

The brake activates if the adjustable frequency drive trips or a coast command is given. Furthermore, it activates when motor speed is ramped down below the speed set in 2-22 *Active Brake Speed*.

### 2-20 Release Brake Current

| Range:               | Function:                                                                                                                                                                                                                                                                                                      |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.00 A* [0.00–100 A] | <p>Select the motor current at which the mechanical brake releases.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <b>⚠ CAUTION</b> </div> <p>If start delay time has passed, and the motor current is below <i>Release brake current</i>, the adjustable frequency drive trips.</p> |



## 4.4 Parameter Group 3: Reference/Ramps

### 4.4.1 3-\*\* Reference/Ramps

Parameters for reference handling, definition of limitations, and configuring the adjustable frequency drive's reaction to changes

### 4.4.2 3-0\* Reference Limits

Parameters for setting the reference unit, limits and ranges.

#### 3-00 Reference Range

| Option: | Function:                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | Select the range of reference and feedback signals.                                                                                                                                                                                                                                                                                                                                                                                             |
| [0] *   | Min to Max<br>Reference setpoint ranges can have positive values only.<br>Select this if running in Process Closed-loop.                                                                                                                                                                                                                                                                                                                        |
| [1]     | -Max to +Max<br>Ranges can have both positive and negative values.<br>If potentiometer is used to adjust motor running in both direction, set reference range to -Max Reference to Max Reference by par.= [1] Choose hand on mode by keypad. Adjust the potentiometer to minimum, the motor can run counter-clockwise with max speed. Then adjust the potentiometer to maximum, the motor will ramp down to 0 and run clockwise with max speed. |

#### 3-02 Minimum Reference

| Range:               | Function:                                                                                                                                                                           |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.00* [-4,999–4,999] | Enter the value for the minimum reference.<br>The sum of all internal and external references are clamped (limited) to the minimum reference value, 3-02 <i>Minimum Reference</i> . |

#### 3-03 Maximum Reference

| Range:                | Function:                                                                                                                                                                           |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                       | Maximum Reference is adjustable in the range Minimum Reference -4,999.                                                                                                              |
| 50.00* [-4,999–4,999] | Enter the value for the maximum reference.<br>The sum of all internal and external references are clamped (limited) to the maximum reference value, 3-03 <i>Maximum Reference</i> . |

### 4.4.3 3-1\* References

Parameters for setting up the reference sources. Select the preset references for the corresponding digital inputs in parameter group, 5-1\* *Digital Inputs*.

#### 3-10 Preset Reference

| Option:      | Function:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |              |              |              |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|--------------|--------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|              | <div>Each parameter set-up contains 8 preset references which are selectable via 3 digital inputs or bus.</div> <table><tr><th>[18]<br/>Bit2</th><th>[17]<br/>Bit1</th><th>[16]<br/>Bit0</th><th>[16]<br/>Bit0</th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td><td>2</td></tr><tr><td>0</td><td>1</td><td>1</td><td>3</td></tr><tr><td>1</td><td>0</td><td>0</td><td>4</td></tr><tr><td>1</td><td>0</td><td>1</td><td>5</td></tr><tr><td>1</td><td>1</td><td>0</td><td>6</td></tr><tr><td>1</td><td>1</td><td>1</td><td>7</td></tr></table> <div>Table 4.2 Parameter Group 5-1* Digital Inputs Option [16], [17] and [18]</div> | [18]<br>Bit2 | [17]<br>Bit1 | [16]<br>Bit0 | [16]<br>Bit0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 2 | 0 | 1 | 1 | 3 | 1 | 0 | 0 | 4 | 1 | 0 | 1 | 5 | 1 | 1 | 0 | 6 | 1 | 1 | 1 | 7 |
| [18]<br>Bit2 | [17]<br>Bit1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | [16]<br>Bit0 | [16]<br>Bit0 |              |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0            | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0            | 0            |              |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0            | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1            | 1            |              |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0            | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0            | 2            |              |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0            | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1            | 3            |              |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1            | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0            | 4            |              |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1            | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1            | 5            |              |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1            | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0            | 6            |              |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1            | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1            | 7            |              |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| [0.00]<br>*  | <div>-100.00–100.00%</div> <div>Enter the different preset references using array programming.<br/>Normally, 100% = value set in 3-03 <i>Maximum Reference</i>.<br/>However, there are exceptions if 3-00 <i>Reference Range</i> is set to [0] <i>Min - Max</i>.<br/>Example 1:<br/>3-02 <i>Minimum Reference</i> is set to 20 and 3-03 <i>Maximum Reference</i> is set to 50. In this case 0%=0 and 100%=50.<br/>Example 2:<br/>3-02 <i>Minimum Reference</i> is set to -70 and 3-03 <i>Maximum Reference</i> is set to 50. In this case 0%=0 and 100%=70.</div>                                                                                                                                                            |              |              |              |              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

#### 3-11 Jog Speed [Hz]

| Range: | Function:                                                                                                                                                                                                                                                                                                              |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|        | Jog speed is a fixed output speed and overrules the selected reference speed, see parameter group 5-1* <i>Digital Inputs</i> option [14].<br>If the motor is stopped while in jog mode, the jog signal acts as a start signal.<br>Removing the jog signal makes the motor run according to the selected configuration. |
| 5.0 Hz | [0.0–400.0 Hz]<br>Select speed to function as jog speed.                                                                                                                                                                                                                                                               |



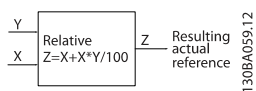
## Parameter Descriptions

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### 3-12 Catch Up/Slow-down Value

| Range:        | Function:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0% * [0–100%] | <p>The <i>Catch up/Slow-down function</i> is activated by an input command (see 5-1* <i>Digital Inputs</i>, choice [28]/[29]). If the command is active, the Catch up/Slow-down value (in %) is added to the reference function as follows:</p> $Reference = Reference + Reference \times \frac{Catch\ up\ Slow-down}{100}$ $Reference = Reference - Reference \times \frac{Catch\ up\ Slow-down}{100}$ <p>When the input command is inactivated, the reference returns to its original value i.e., <math>Reference = Reference + 0</math>.</p> |

### 3-14 Preset Relative Reference

| Range:                  | Function:                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.00% [-100.00–100.00%] | <p>Define fixed value in % to be added to variable value defined in 3-18 <i>Relative Scaling Reference Source</i>. The sum of fixed and variable values (labeled Y in the figure below) is multiplied with actual reference (labeled X in the figure). This product is added to the actual reference</p> $X + X \times \frac{Y}{100}$ <div style="text-align: center;">  <p>Figure 4.5</p> </div> |

### 3-15 Reference 1 Source

| Option: | Function:                                                                                                                                                                                                           |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | 3-15 <i>Reference 1 Source</i> , 3-16 <i>Reference 2 Source</i> and 3-17 <i>Reference 3 Source</i> define up to three different reference signals. The sum of these reference signals defines the actual reference. |
| [0]     | No Function<br>No reference signal is defined.                                                                                                                                                                      |
| [1] *   | Analog Input 53<br>Use signals from analog input 53 as reference, see parameter group 6-1* <i>Analog Input 1</i> .                                                                                                  |
| [2]     | Analog Input 60<br>Use signals from analog input 60 as reference, see parameter group 6-2* <i>Analog Input 2</i> .                                                                                                  |
| [8]     | Pulse input 33<br>Use signals from pulse input as reference, see parameter group 5-5* <i>Pulse Input</i> .                                                                                                          |
| [11]    | Local Bus Reference<br>Use signals from local bus as reference, see parameter group 8-9* <i>Bus Feedback</i> .                                                                                                      |

### 3-15 Reference 1 Source

| Option: | Function:                                                                                                                      |
|---------|--------------------------------------------------------------------------------------------------------------------------------|
| [21]    | Keypad Potentiometer<br>Use signals from keypad potentiometer as reference, parameter group 6-8* <i>Keypad Potentiometer</i> . |

### 3-16 Reference 2 Source

| Option: | Function:                                                                                                  |
|---------|------------------------------------------------------------------------------------------------------------|
|         | See 3-15 <i>Reference 1 Source</i> for description.                                                        |
| [0]     | No Function<br>No reference signal is defined.                                                             |
| [1]     | Analog Input 53<br>Use signals from analog input 53 as reference.                                          |
| [2] *   | Analog Input 60<br>Use signals from analog input 60 as reference.                                          |
| [8]     | Pulse input 33<br>Use signals from pulse input as reference, see parameter group 5-5* <i>Pulse Input</i> . |
| [11]    | Local Bus Reference<br>Use signals from the local bus as reference.                                        |
| [21]    | Keypad Potentiometer<br>Use signals from keypad potentiometer as reference.                                |

### 3-17 Reference 3 Source

| Option: | Function:                                                                                                  |
|---------|------------------------------------------------------------------------------------------------------------|
|         | See 3-15 <i>Reference 2 Source</i> for description.                                                        |
| [0]     | No Function<br>No reference signal is defined.                                                             |
| [1]     | Analog Input 53<br>Use signals from analog input 53 as reference.                                          |
| [2]     | Analog Input 60<br>Use signals from analog input 60 as reference.                                          |
| [8]     | Pulse input 33<br>Use signals from pulse input as reference, see parameter group 5-5* <i>Pulse Input</i> . |
| [11] *  | Local Bus Reference<br>Use signals from the local bus as reference.                                        |
| [21]    | Keypad Potentiometer<br>Use signals from keypad potentiometer as reference.                                |

### 3-18 Relative Scaling Reference Source

| Option: | Function:                                                                                                                |
|---------|--------------------------------------------------------------------------------------------------------------------------|
|         | Select the source for a variable value to be added to the fixed value defined in 3-14 <i>Preset Relative Reference</i> . |
| [0] *   | No Function<br>The function is disabled                                                                                  |
| [1]     | Analog Input 53<br>Select analog input 53 as the relative scaling reference source.                                      |
| [2]     | Analog Input 60<br>Select analog input 60 as relative scaling reference source.                                          |
| [8]     | Pulse Input 33<br>Select pulse input 33 as the relative scaling reference source.                                        |



## 3-18 Relative Scaling Reference Source

| Option: | Function:            |                                                                   |
|---------|----------------------|-------------------------------------------------------------------|
| [11]    | Local Bus Reference  | Select local bus ref. as the relative scaling reference source.   |
| [21]    | Keypad Potentiometer | Select keypad potentiometer as relative scaling reference source. |

## 4.4.4 3-4\* Accel/Decel 1

A linear ramp is characterized by ramping up at a constant speed until the desired motor speed has been reached. Some overshoot may be experienced when reaching speed, which may cause speed jerks for a short while before stabilizing.

An S-ramp accelerates more smoothly thus compensating for jerks when the speed is reached.

See Figure 4.6 for a comparison of the two ramp types.

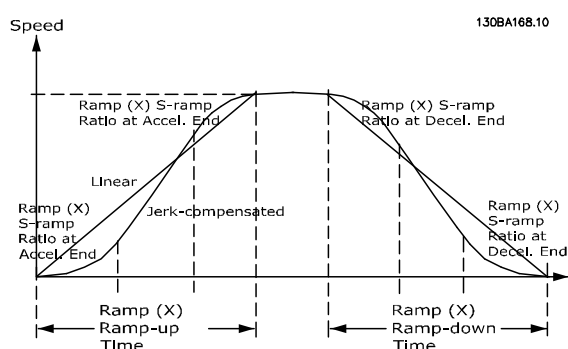


Figure 4.6

## Accel/Decel Time

Acceleration time from 0 to nominal motor frequency (1-23 Motor Frequency).

Ramp-down: Deceleration time from nominal motor frequency (1-23 Motor Frequency) to 0.

## Limitation

An Accel time that is too short can result in Torque limit warning (W12) and/or DC overvoltage warning (W7). Ramping is stopped when the adjustable frequency drive has reached Torque limit motor mode (4-16 Torque Limit in Motor Mode).

A Decel time that is too short can result in Torque limit warning (W12) and/or DC overvoltage warning (W7). Ramping is stopped when the adjustable frequency drive reaches the Torque limit generator mode (4-17 Torque Limit in Generator Mode) and/or the internal DC overvoltage limit.

## 3-40 Accel/Decel 1 Type

| Option: | Function: |                                                    |
|---------|-----------|----------------------------------------------------|
| [0] *   | Linear    | Constant acceleration/deceleration.                |
| [2]     | S-ramp    | Smooth jerk compensated acceleration/deceleration. |

## 3-41 Accel Time 1

| Range:        | Function:         |                                                                                                                                                                                                      |
|---------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Size related* | [0.05–3,600.00 s] | Enter accel time from 0 Hz to rated motor frequency ( $f_{M,N}$ ) set in 1-23 Motor Frequency. Choose an accel time ensuring that torque limit is not exceeded, see 4-16 Torque Limit in Motor Mode. |

## 3-42 Decel Time 1

| Range:        | Function:         |                                                                                                                                                                                                                                                                                           |
|---------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Size related* | [0.05–3,600.00 s] | Enter decel time from rated motor frequency ( $f_{M,N}$ ) in 1-23 Motor Frequency to 0 Hz. Choose a decel time that does not cause overvoltage due to regenerative operation of motor. Furthermore, regenerative torque must not exceed limit set in 4-17 Torque Limit in Generator Mode. |

## 4.4.5 3-5\* Accel/Decel 2

See parameter group 3-4\* Ramp 1 for a description of ramp types.

## NOTE!

Accel/Decel 2 - alternative ramp times:

Changing from Accel/Decel 1 to Accel/Decel 2 is done via the digital input. See 5-1\* Digital Inputs, option [34].

## 3-50 Accel/Decel 2 Type

| Option: | Function: |                                                    |
|---------|-----------|----------------------------------------------------|
| [0] *   | Linear    | Constant acceleration/deceleration.                |
| [2]     | S-ramp    | Smooth jerk compensated acceleration/deceleration. |

## 3-51 Accel Time 2

| Range:        | Function:         |                                                                                                                                                                                                      |
|---------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Size related* | [0.05–3,600.00 s] | Enter accel time from 0 Hz to rated motor frequency ( $f_{M,N}$ ) set in 1-23 Motor Frequency. Choose an accel time ensuring that torque limit is not exceeded, see 4-16 Torque Limit in Motor Mode. |



## Parameter Descriptions

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### 3-52 Decel Time 2

#### Range:

#### Function:

|              |                   |                                                                                                                                                                                                                                                                                              |
|--------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Size related | [0.05–3,600.00 s] | Enter decel time from rated motor frequency ( $f_{M,N}$ ) in 1-23 Motor Frequency to 0 Hz.<br>Choose a decel time that does not cause overvoltage due to regenerative operation of motor. Furthermore, regenerative torque must not exceed limit set in 4-17 Torque Limit in Generator Mode. |
|--------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### 4.4.6 3-8\* OtherAccel/Decel Ramps

This section contains parameters for Jog and Quick Stop Ramps.

With a Jog Ramp, it is possible to both ramp up and down; it is only possible to ramp down with the Quick Stop Ramp.

### 3-80 Jog Accel/Decel Time

#### Range:

#### Function:

|               |                   |                                                                                                                                                                                                                                                      |
|---------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Size related* | [0.05–3,600.00 s] | A linear ramp applicable when Jog is activated. See parameter group 5-1* Digital Inputs, option [14].<br>Accel time = Decel time.<br>Jog Ramp time starts upon activation of a jog signal via a selected digital input or serial communication port. |
|---------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### 3-81 Quick Stop Decel Time

#### Range:

#### Function:

|               |                   |                                                                                                         |
|---------------|-------------------|---------------------------------------------------------------------------------------------------------|
| Size related* | [0.05–3,600.00 s] | A linear ramp applicable when Q-stop is activated. See parameter group 5-1* Digital Inputs, option [4]. |
|---------------|-------------------|---------------------------------------------------------------------------------------------------------|



## 4.5 Parameter Group 4: Limits/Warnings

## 4.5.1 4-\*\* Motor Limits

Parameter group for configuring limits and warning.

## 4.5.2 4-1\* Motor Limits

Use these parameters for defining the speed, torque and current working range for the motor.

## 4-10 Reverse Lock

| Option:            | Function:                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | If terminals 96, 97 and 98 are connected to U, V and W respectively, the motor runs clockwise when seen from the front.<br><b>NOTE!</b><br><b>This parameter cannot be adjusted while the motor is running.</b>                                                                                                                                              |
| [0] * Reverse Lock | The motor shaft rotates in a forward direction. This setting prevents the motor from running in a reverse direction. If 1-00 Configuration Mode is set to close-loop control, 4-10 Motor Speed Direction will be automatically set to clockwise.                                                                                                             |
| [1] Reverse only   | The motor shaft rotates in a reverse direction. This setting prevents the motor from running in a forward direction.                                                                                                                                                                                                                                         |
| [2] * Both         | With this setting, the motor can run in both directions. However, the output frequency is limited to the range: Motor Speed Low Limit (4-12 Motor Speed Low Limit) to Motor Speed High Limit (4-14 Motor Speed High Limit). If 1-00 Configuration Mode is set to open-loop control, 4-10 Motor Speed Direction will be automatically set to both directions. |

## 4-12 Motor Speed Low Limit

| Range:                 | Function:                                                                                                                                                                                                                    |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.0 Hz* [0.0–400.0 Hz] | Set the <i>Minimum Motor Speed Limit</i> corresponding to the minimum output frequency of the motor shaft.<br><b>NOTE!</b><br><b>As the minimum output frequency is an absolute value, no deviation can be made from it.</b> |

## 4-14 Motor Speed High Limit

| Range:                  | Function:                                                                                            |
|-------------------------|------------------------------------------------------------------------------------------------------|
| 65.0 Hz* [0.0–400.0 Hz] | Set the <i>Maximum Motor Speed</i> corresponding to the maximum output frequency of the motor shaft. |

## 4-14 Motor Speed High Limit

| Range: | Function:                                                                                                      |
|--------|----------------------------------------------------------------------------------------------------------------|
|        | <b>NOTE!</b><br><b>As the maximum output frequency is an absolute value, no deviation can be made from it.</b> |

## 4-16 Torque Limit in Motor Mode

| Range:         | Function:                                                                                                                                                           |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 150%* [0–400%] | Set the torque limit for motor operation. The setting is not automatically reset to default when changing settings in 1-00 Configuration Mode to 1-25 Load & Motor. |

## 4-17 Torque Limit in Generator Mode

| Range:         | Function:                                                                                                                                                                    |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 100%* [0–400%] | Set the torque limit for generator mode operation. The setting is not automatically reset to default when changing settings in 1-00 Configuration Mode to 1-25 Load & Motor. |

## 4.5.3 4-4\* Adjustable Warnings 2

## 4-40 Warning Frequency Low

| Range:                                                                | Function:                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.00 Hz* [0.0 Hz-Depends on the value of 4-41 Warning Frequency High] | Use this parameter to set a lower limit for the frequency ranges. When the motor speed falls below this limit, the display reads SPEED LOW. Warning bit 10 is set in 16-94 Ext. Status Word. Output Relay can be configured to indicate this warning. Keypad warning light does not light when this parameter set limit is reached. |

## 4-41 Warning Frequency High

| Range:                                                                  | Function:                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 400.0 Hz* [Depend on the value of 4-40 Warning Frequency Low -400.0 Hz] | Use this parameter to set a higher limit for the frequency ranges. When the motor speed exceeds this limit, the display reads SPEED HIGH. Warning bit 9 is set in 16-94 Ext. Status Word. Output Relay can be configured to indicate this warning. Keypad warning light does not light when this parameter set limit is reached. |



## Parameter Descriptions

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### 4.5.4 4-5\* Adjustable Warnings

Parameter group containing adjustable warning limits for current, speed, reference and feedback.

#### 4-50 Warning Current Low

| Range:                 | Function:                                                                                                                                                                                                                                                                                                       |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                        | Use this parameter to set a lower limit for the current range.<br>If current drops below the set limit, warning bit 8 is set in <i>16-94 Ext. Status Word</i> .<br>Output Relay can be configured to indicate this warning. The keypad warning light does not light when this parameter's set limit is reached. |
| 0.00 A* [0.00–26.00 A] | Set the value for the low current limit.                                                                                                                                                                                                                                                                        |

#### 4-51 Warning Current High

| Range:                  | Function:                                                                                                                                                                                                                                                                                                    |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                         | Use this parameter to set an upper limit for the current range.<br>If current exceeds the set limit, warning bit 7 is set in <i>16-94 Ext. Status Word</i> .<br>Output Relay can be configured to indicate this warning. The keypad warning light does not light when this parameter's set limit is reached. |
| 26.00 A* [0.00–26.00 A] | Set the upper current limit.                                                                                                                                                                                                                                                                                 |

#### 4-54 Warning Reference Low

| Range:      | Function:                                                                                                                                                                                                                                                                                                                                                 |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -4,999.000* | [-4,999.000 - Depends on the value of 4-55<br><i>Warning Reference High</i> ]                                                                                                                                                                                                                                                                             |
|             | Use this parameter to set a lower limit for the reference range.<br>When the actual reference falls below this limit, the display reads Reference Low. Warning bit 20 is set in <i>16-94 Ext. Status Word</i> .<br>Output Relay can be configured to indicate this warning. Keypad warning light does not light when this parameter set limit is reached. |

#### 4-55 Warning Reference High

| Range:     | Function:                                                                                                                                                                                                                                          |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4,999.000* | [Depend on the value of 4-54<br><i>Warning Reference Low</i> -4,999.000]                                                                                                                                                                           |
|            | Use this parameter to set a higher limit for the reference range.<br>When the actual reference exceeds this limit, the display reads Reference High. Warning bit 19 is set in <i>16-94 Ext. Status Word</i> .<br>Output Relay can be configured to |

#### 4-55 Warning Reference High

| Range: | Function:                                                                                            |
|--------|------------------------------------------------------------------------------------------------------|
|        | indicate this warning. Keypad warning light does not light when this parameter set limit is reached. |

#### 4-56 Warning Feedback Low

| Range:      | Function:                                                                                                                                                                                                                                                                                                                                      |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -4,999.000* | [-4,999.000 - Depend on the value of 4-57<br><i>Warning Feedback High</i> ]                                                                                                                                                                                                                                                                    |
|             | Use this parameter to set a lower limit for the feedback range.<br>When the feedback falls below this limit, the display reads Feedback Low. Warning bit 6 is set in <i>16-94 Ext. Status Word</i> .<br>Output Relay can be configured to indicate this warning. Keypad warning light does not light when this parameter set limit is reached. |

#### 4-57 Warning Feedback High

| Range:     | Function:                                                                                                                                                                                                                                                                                                                                 |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4,999.000* | [Depends on the value of 4-56<br><i>Warning Feedback Low</i> -4,999.000]                                                                                                                                                                                                                                                                  |
|            | Use this parameter to set a higher limit for the feedback range.<br>When the feedback exceeds this limit, the display reads Feedback High. Warning bit 5 is set in <i>16-94 Ext. Status Word</i> . Output Relay can be configured to indicate this warning. Keypad warning light does not light when this parameter set limit is reached. |

#### 4-58 Missing Motor Phase Function

| Option: | Function:                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | A missing motor phase causes the motor torque to drop. This monitor may be disabled for special purposes (e.g., small motors running in pure U/f mode), but as there is a risk of overheating the motor, GE strongly recommends that the function be On. A missing motor phase causes the adjustable frequency drive to trip and report an alarm.<br><b>NOTE!</b><br><b>This parameter cannot be changed while the motor is running.</b> |
| [0]     | Off The function is disabled.                                                                                                                                                                                                                                                                                                                                                                                                            |
| [1] *   | On The function is enabled.                                                                                                                                                                                                                                                                                                                                                                                                              |

### 4.5.5 4-6\* Jump Frequencies

In some applications, mechanical resonance may occur. Avoid resonance points by creating a Jump frequency. The adjustable frequency drive ramps through the Jump



frequency area thereby passing mechanical resonance points quickly.

**4-61 Jump Frequency From [Hz]**

Array [2]

**Range:****Function:**

|         |                |                                                                                                                                                                                                                                                      |
|---------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.0 Hz* | [0.0–400.0 Hz] | Enter either the lower or upper limit of the speeds to be avoided.<br>It does not matter whether Jump From or Jump To is the upper or lower limit; however, the Jump Frequency function is disabled if the two parameters are set to the same value. |
|---------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**4-63 Jump Frequency To [Hz]**

Array [2]

**Range:****Function:**

|         |                |                                                                                                                                                                          |
|---------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.0 Hz* | [0.0–400.0 Hz] | Enter either the upper or lower limit of the speed area to be avoided.<br>Make sure to enter the <b>opposite</b> limit of that in 4-61 <i>Jump Frequency From [Hz]</i> . |
|---------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



## Parameter Descriptions

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### 4.6 Parameter Group 5: Digital In/Out

#### 4.6.1 5-\*\* Digital In/Out

The following describes all digital input command functions and signals.

#### 4.6.2 5-1\* Digital Inputs

Parameters for configuring the 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:

|      |                      |                                                                                                                                                                                                                                                         |
|------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [0]  | No Operation         | The adjustable frequency drive will not react to signals transmitted to the terminal.                                                                                                                                                                   |
| [1]  | Reset                | Reset the adjustable frequency drive after a trip/alarm. Not all alarms can be reset.                                                                                                                                                                   |
| [2]  | Coast Inverse        | Coasting stop, inverted input (NC). The adjustable frequency drive leaves the motor in free mode.                                                                                                                                                       |
| [3]  | Coast and reset inv. | Reset and coasting stop inverted input (NC). The adjustable frequency drive resets and leaves the motor in free mode.                                                                                                                                   |
| [4]  | Quick stop inverse   | Inverted input (NC). Generates a stop in accordance with the quick-stop ramp time set in 3-81 <i>Quick Stop Ramp Time</i> . When the motor stops, the shaft is in free mode.                                                                            |
| [5]  | DC brake inv.        | Inverted input for DC braking (NC). Stops motor by energizing it with DC current for a certain time period, see 2-01 <i>DC Brake Current</i> . Function is only active when value in 2-02 <i>DC Braking Time</i> is different from 0.                   |
| [6]  | Stop inv.            | Stop inverted function. Generates stop function when the selected terminal goes from logical level "1" to "0". The stop is performed according to the selected ramp time.                                                                               |
| [8]  | Start                | Select start for a start/stop command. 1 = Start, 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            | Change the direction of the motor shaft rotation. Reversing signal only changes the direction of rotation; it does not activate the start function. Select [2] <i>Both directions</i> in 4.10 <i>Motor Speed Direction</i> . 0 = normal, 1 = reversing. |
| [11] | Start reversing      | Use for start/stop and for reversing at the same time. Signals on start [8] are not allowed at the same time.                                                                                                                                           |

|      |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      |                        | 0 = stop, 1 = start reversing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| [12] | Enable start forward   | Use if the motor shaft must rotate clockwise at start.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| [13] | Enable start reverse   | Use if motor shaft must rotate counter-clockwise at start.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| [14] | Jog                    | Use for activating jog speed. See 3-11 <i>Jog Speed</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| [16] | Preset reference bit 0 | Preset reference bit 0, 1 and 2 enables a choice between one of the eight preset references according to below.                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| [17] | Preset reference bit 1 | Same as preset reference bit 0 [16], see 3-10 <i>Preset Reference</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| [18] | Preset reference bit 2 | Same as preset reference bit 0 [16].                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| [19] | Freeze reference       | Freeze actual reference. The frozen reference is now the point of enable/condition for Speed up and Slow to be used. If Speed up/down is used, speed change always follows ramp 2 (3-51 <i>Ramp2 Ramp-up Time</i> and 3-52 <i>Ramp2 Ramp-down Time</i> ) in the range 3-02 <i>Minimum Reference</i> - 3-03 <i>Maximum Reference</i> .                                                                                                                                                                                                                         |
| [20] | Freeze output          | Freeze the actual motor frequency (Hz). The frozen motor frequency 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 in the range 4-12 <i>Motor Speed Low Limit</i> - 4-14 <i>Motor Speed High Limit</i> .<br><b>NOTE!</b><br>When freeze output is active, the adjustable frequency drive cannot be stopped via a low [8] <i>Start</i> signal. Stop the adjustable frequency drive via a terminal programmed for Coasting Inverse [2] or Coast and reset, inverse [3]. |
| [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 is activated for less than 400 ms, the resulting reference will be increased by 0.1%. If Speed-up is activated for more than 400 ms. the resulting reference will ramp according to ramp 2 in 3-51 <i>Ramp2 Ramp-up Time</i> .                                                                                                                                 |
| [22] | Slow                   | Same as Speed-up [21].                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| [23] | Set-up select bit 0    | Set 0-10 <i>Active set-up</i> to Multi set-up. Logic 0 = set-up 1, Logic 1 = Set-up 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |



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|      |                                         |                                                                                                                                             |
|------|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| [26] | Precise stop inverse (only terminal 33) | Prolong the stop signal to give a precise stop independent of scan time. The function is available for terminal 33 only.                    |
| [27] | Start, precise stop (only terminal 33)  | As [26], but including Start.                                                                                                               |
| [28] | Catch up                                | Select Catch up/Slow-down to increase or reduce the resulting reference value by the percentage set in 3-12 <i>Catch Up/Slow-down Value</i> |
| [29] | Slow-down                               | Same as Catch up [28]                                                                                                                       |
| [32] | Pulse input (only terminal 33)          | Select Pulse input when using a pulse sequence as either reference or feedback. Scaling is done in parameter group 5-5* <i>Pulse Input</i>  |
| [34] | Ramp bit 0                              | Logic 0=Ramp1, see parameter group 3-4* <i>Ramp1</i><br>Logic 1=Ramp2, see parameter group 3-5* <i>Ramp2</i> .                              |
| [60] | Counter A (up)                          | Input for counter A.                                                                                                                        |
| [61] | Counter A (down)                        | Input for counter A.                                                                                                                        |
| [62] | Reset counter A                         | Input for reset of counter A.                                                                                                               |
| [63] | Counter B (up)                          | Input for counter B.                                                                                                                        |
| [64] | Counter B (down)                        | Input for counter B.                                                                                                                        |
| [65] | Reset counter B                         | Input for reset of counter B.                                                                                                               |

## 5-10 Terminal 18 Digital Input

Option: Function:

|       |       |                                                                                                                            |
|-------|-------|----------------------------------------------------------------------------------------------------------------------------|
| [8] * | Start | Select the function from the available digital input range.<br>See parameter group 5-1* <i>Digital Inputs</i> for choices. |
|-------|-------|----------------------------------------------------------------------------------------------------------------------------|

## 5-11 Terminal 19 Digital Input

Option: Function:

|        |           |                                                                                                                            |
|--------|-----------|----------------------------------------------------------------------------------------------------------------------------|
| [10] * | Reversing | Select the function from the available digital input range.<br>See parameter group 5-1* <i>Digital Inputs</i> for choices. |
|--------|-----------|----------------------------------------------------------------------------------------------------------------------------|

## 5-12 Terminal 27 Digital Input

Option: Function:

|       |       |                                                                                                                            |
|-------|-------|----------------------------------------------------------------------------------------------------------------------------|
| [1] * | Reset | Select the function from the available digital input range.<br>See parameter group 5-1* <i>Digital Inputs</i> for choices. |
|-------|-------|----------------------------------------------------------------------------------------------------------------------------|

## 5-13 Terminal 29 Digital Input

Option: Function:

|        |     |                                                                                                                            |
|--------|-----|----------------------------------------------------------------------------------------------------------------------------|
| [14] * | Jog | Select the function from the available digital input range.<br>See parameter group 5-1* <i>Digital Inputs</i> for choices. |
|--------|-----|----------------------------------------------------------------------------------------------------------------------------|

## 5-15 Terminal 33 Digital Input

Option: Function:

|        |              |                                                                                                                            |
|--------|--------------|----------------------------------------------------------------------------------------------------------------------------|
| [16] * | Preset bit 0 | Select the function from the available digital input range.<br>See parameter group 5-1* <i>Digital Inputs</i> for choices. |
|--------|--------------|----------------------------------------------------------------------------------------------------------------------------|

## 4.6.3 5-3\* Digital Outputs

## 5-34 On delay, Terminal 42 Digital Output

Range: Function:

|         |                 |  |
|---------|-----------------|--|
| 0.01 s* | [0.00–600.00 s] |  |
|---------|-----------------|--|

## 5-35 Off delay, Terminal 42 Digital Output

Range: Function:

|         |                 |  |
|---------|-----------------|--|
| 0.01 s* | [0.00–600.00 s] |  |
|---------|-----------------|--|

## 4.6.4 5-4\* Relays

Parameter group for configuring timing and output functions for relays.

|      |                         |                                                                                                                                                  |
|------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| [0]  | No Operation            | Default for all digital 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 supply the signal on the control board.                                        |
| [3]  | Drive Ready, Remote     | Adjustable frequency drive is ready for operation in Auto mode.                                                                                  |
| [4]  | Enable/No Warning       | The adjustable frequency drive is ready for operation. No start or stop command is given. No warnings are present.                               |
| [5]  | Drive Running           | Motor is running.                                                                                                                                |
| [6]  | Running/No Warning      | Motor runs, and no warning are present.                                                                                                          |
| [7]  | Run in Range/No Warning | Motor runs within programmed current ranges, see 4-50 <i>Warning Current Low</i> and 4-51 <i>Warning Current High</i> . No warnings are present. |
| [8]  | Run on ref/No Warning   | Motor runs at reference speed.                                                                                                                   |
| [9]  | Alarm                   | An alarm activates output.                                                                                                                       |
| [10] | Alarm on Warning        | An alarm or warning activates output.                                                                                                            |



## Parameter Descriptions

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|      |                                  |                                                                                                                                                                      |
|------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [12] | Out of Current Range             | Motor current is outside range set in 4-50 <i>Warning Current Low</i> and 4-51 <i>Warning Current High</i> .                                                         |
| [13] | Below Current, low               | Motor current is lower than set in 4-50 <i>Warning Current Low</i> .                                                                                                 |
| [14] | Above Current, high              | Motor current is higher than set in 4-51 <i>Warning Current High</i> .                                                                                               |
| [16] | Below Frequency, low             | Motor speed is lower than set in 4-40 <i>Warning Frequency Low</i> .                                                                                                 |
| [17] | Above Frequency, high            | Motor speed is higher than set in 4-41 <i>Warning Frequency High</i> .                                                                                               |
| [19] | Below Feedback, low              | Feedback is lower than set in 4-56 <i>Warning Feedback Low</i> .                                                                                                     |
| [20] | Above Feedback, high             | Feedback is higher than set in 4-57 <i>Warning Feedback High</i> .                                                                                                   |
| [21] | Thermal Warning                  | A thermal warning is present when the temperature exceeds the limit in the motor, adjustable frequency drive, brake resistor or thermistor.                          |
| [22] | Ready, No Thermal Warning        | The adjustable frequency drive is ready for operation and no overtemperature warning is present.                                                                     |
| [23] | Remote Ready, No Thermal Warning | The adjustable frequency drive is ready for operation in auto mode, and no overtemperature warning is present.                                                       |
| [24] | Ready, Voltage OK                | The adjustable frequency drive is ready for operation and AC line voltage is within the specified voltage range.                                                     |
| [25] | Reverse                          | Motor runs/is ready to run clockwise when logic = 0 and counter-clockwise when logic = 1. Output changes as soon as reversing signal is applied.                     |
| [26] | Bus OK                           | Active communication (no timeout) via serial communication port.                                                                                                     |
| [28] | Brake, No Warn                   | Brake is active, and no warnings are present.                                                                                                                        |
| [29] | Brake Ready/No Fault             | Brake is ready for operation, and no faults are present.                                                                                                             |
| [30] | Brake Fault (IGBT)               | Protects the adjustable frequency drive if a fault on the brake modules is present. Use the relay to cut out line power voltage from the adjustable frequency drive. |
| [32] | Mech. Brake Control              | Enables control of external mechanical brake, see parameter group 2-2* <i>Mechanical Brake</i> .                                                                     |
| [36] | Control Word Bit 11              | Bit 11 in the control word controls the relay.                                                                                                                       |
| [41] | Below Reference, low             | Reference is lower than set in 4-54 <i>Warning Reference Low</i> .                                                                                                   |
| [42] | Above Reference, high            | Reference is higher than set in 4-55 <i>Warning Reference High</i> .                                                                                                 |

|      |                                   |                                                                                                                                                                                                                               |
|------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [51] | Local Reference Active            |                                                                                                                                                                                                                               |
| [52] | Remote Reference Active           |                                                                                                                                                                                                                               |
| [53] | No Alarm                          |                                                                                                                                                                                                                               |
| [54] | Start Cmd Active                  |                                                                                                                                                                                                                               |
| [55] | Running Reverse                   |                                                                                                                                                                                                                               |
| [56] | Drive in Hand Mode                |                                                                                                                                                                                                                               |
| [57] | Drive in Auto Mode                |                                                                                                                                                                                                                               |
| [60] | Comparator 0                      | See parameter group 13-1* <i>Comparators</i> . If comparator 0 is evaluated as TRUE, output goes high. Otherwise, it is low.                                                                                                  |
| [61] | Comparator 1                      | See parameter group 13-1* <i>Comparators</i> . If comparator 1 is evaluated as TRUE, output goes high. Otherwise, it is low.                                                                                                  |
| [62] | Comparator 2                      | See parameter group 13-1* <i>Comparators</i> . If comparator 2 is evaluated as TRUE, output goes high. Otherwise, it is low.                                                                                                  |
| [63] | Comparator 3                      | See parameter group 13-1* <i>Comparators</i> . If comparator 3 is evaluated as TRUE, output goes high. Otherwise, it is low.                                                                                                  |
| [70] | Logic Rule 0                      | See parameter group 13-4* <i>Logic Rules</i> . If logic rule 1 is evaluated as TRUE, output goes high. Otherwise, it is low.                                                                                                  |
| [71] | Logic Rule 1                      | See parameter group 13-4* <i>Logic Rules</i> . If logic rule 2 is evaluated as TRUE, output goes high. Otherwise, it is low.                                                                                                  |
| [72] | Logic Rule 2                      | See parameter group 13-4* <i>Logic Rules</i> . If logic rule 3 is evaluated as TRUE, output goes high. Otherwise, it is low.                                                                                                  |
| [73] | Logic Rule 3                      | See parameter group 13-4* <i>Logic Rules</i> . If logic rule 3 is evaluated as TRUE, output goes high. Otherwise, it is low.                                                                                                  |
| [81] | Logic Controller Digital Output B | See 13-52 <i>Logic Controller Action</i> . When Logic Controller Action [39] <i>Set dig. out</i> . A high is executed, input goes high. When Smart Logic Action [33] <i>Set dig. out</i> . A low is executed, input goes low. |

### 5-40 Function Relay

#### Option:                      Function:

|       |              |                                                    |
|-------|--------------|----------------------------------------------------|
| [0] * | No Operation | Select function from available relay output range. |
|-------|--------------|----------------------------------------------------|

### 5-41 On delay, Relay

#### Option:                      Function:

|            |                 |                                                                                                                                                                                                                         |
|------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [0.01 s] * | [0.00–600.00 s] | Enter the delay of the relay cut-in time. If the Selected Event condition changes before the On delay timer expires, the relay output is unaffected. The function to control the relay see 5-40 <i>Function Relay</i> . |
|------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**5-42 Off delay, Relay**

| Option:    |                 | Function:                                                                                                                                                                                                                 |
|------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [0.01 s] * | [0.00–600.00 s] | Enter the delay of the relay cut-off time. If the Selected Event condition changes before the off delay timer expires, the relay output is unaffected. The function to control the relay see 5-40 <i>Function Relay</i> . |

**4.6.5 5-5\* Pulse Input**

Set 5-15 *Terminal 33 Digital Input* to choice [32] *pulse input*. Now terminal 33 handles a pulse input in the range from Low frequency, 5-55 *Terminal 33 Low Frequency*, to 5-56 *Terminal 33 High Frequency*. Scale frequency input via 5-57 *Terminal 33 Low Ref./Feedb. Value* and 5-58 *Terminal 33 High Ref./Feedb. Value*.

**5-55 Terminal 33 Low Frequency**

| Range: |               | Function:                                                                                                                                 |
|--------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| 20 Hz* | [20-4,999 Hz] | Enter low frequency corresponding to low motor shaft speed (i.e., low reference value) in 5-57 <i>Terminal 33 Low Ref./Feedb. Value</i> . |

**5-56 Terminal 33 High Frequency**

| Range:    |               | Function:                                                                                                                                     |
|-----------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 5,000 Hz* | [21-5,000 Hz] | Enter high frequency corresponding to high motor shaft speed (i.e., high reference value) in 5-58 <i>Terminal 33 High Ref./Feedb. Value</i> . |

**5-57 Terminal 33 Low Ref./Feedb. Value**

| Range: |                | Function:                                                                                                              |
|--------|----------------|------------------------------------------------------------------------------------------------------------------------|
| 0.000* | [-4,999–4,999] | Set reference/feedback value corresponding to low pulse frequency value set in 5-55 <i>Terminal 33 Low Frequency</i> . |

**5-58 Terminal 33 High Ref./Feedb. Value**

| Range:  |                | Function:                                                                                                                |
|---------|----------------|--------------------------------------------------------------------------------------------------------------------------|
| 50.000* | [-4,999–4,999] | Set reference/feedback value corresponding to high pulse frequency value set in 5-56 <i>Terminal 33 High Frequency</i> . |



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### 4.7 Parameter Group 6: Analog In/Out

#### 4.7.1 6-\*\* Analog In/Out

Parameter group for configuring analog inputs and outputs.

#### 4.7.2 6-0\* Analog I/O Mode

Parameter group for setting up the analog I/O configuration.

##### 6-00 Live Zero Timeout Time

| Range: | Function:                                                                                                                                                                    |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10 s*  | [1–99 s]                                                                                                                                                                     |
|        | The live zero function is used for monitoring the signal on an analog input. If the signal disappears, a <i>Live Zero</i> warning is reported.                               |
|        | Set delay time before <i>Live Zero Timeout Function</i> is applied (6-01 <i>Live Zero Timeout Time</i> ). If the signal reappears during the set delay, timer will be reset. |
|        | When live zero is detected, the adjustable frequency drive freezes output frequency and starts <i>Live Zero Timeout</i> timer.                                               |

##### 6-01 Live Zero Timeout Function

| Option: | Function:                                                                                                                                                                             |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | Function is activated if input signal is below 50% of value set in 6-10 <i>Terminal 53 Low Voltage</i> , 6-12 <i>Terminal 53 Low Current</i> or 6-22 <i>Terminal 60 Low Current</i> . |
| [0] *   | Off                                                                                                                                                                                   |
| [1]     | Freeze output                                                                                                                                                                         |
| [2]     | Stop                                                                                                                                                                                  |
| [3]     | Jogging                                                                                                                                                                               |
| [4]     | Max Speed                                                                                                                                                                             |
| [5]     | Stop and Trip                                                                                                                                                                         |

#### 4.7.3 6-1\* Analog Input 1

Parameters for configuring scaling and limits for analog input 1 (terminal 53).

### NOTE!

Micro switch 4 in position U:

6-10 *Terminal 53 Low Voltage* and 6-11 *Terminal 53 High Voltage* are active.

Micro switch 4 in position I:

6-12 *Terminal 53 Low Current* and 6-13 *Terminal 53 High Current* are active.

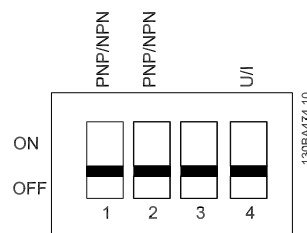


Figure 4.7

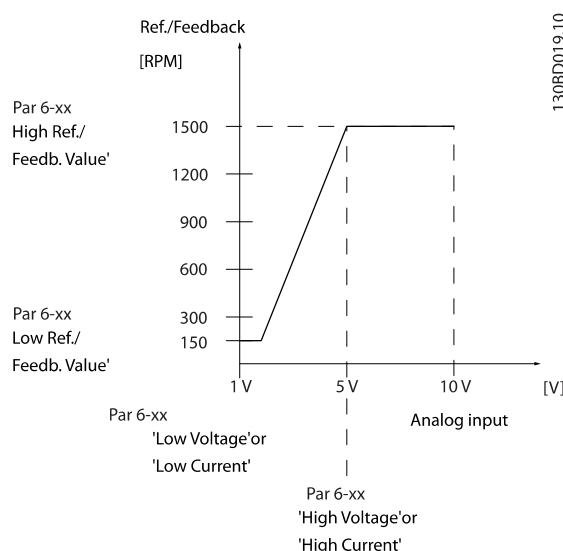


Figure 4.8

##### 6-10 Terminal 53 Low Voltage

| Range:  | Function:                                                                                                                                                                       |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.07 V* | [0.00–9.90 V]                                                                                                                                                                   |
|         | This scaling value should correspond to minimum reference value set in 6-14 <i>Terminal 53 Low Ref./Feedb. Value</i> . See also 4.4 <i>Parameter Group 3: Reference/Ramps</i> . |
|         | Enter the low voltage value.                                                                                                                                                    |

### CAUTION

The value must be set to min. 1 V in order to activate the *Live Zero Timeout function* in 6-01 *Live Zero Timeout Function*.

**6-11 Terminal 53 High Voltage**

| Range:  |                | Function:                                                                                                               |
|---------|----------------|-------------------------------------------------------------------------------------------------------------------------|
|         |                | This scaling value should correspond to maximum reference value set in 6-15 <i>Terminal 53 High Ref./Feedb. Value</i> . |
| 10.0 V* | [0.10–10.00 V] | Enter the high voltage value.                                                                                           |

**6-12 Terminal 53 Low Current**

| Range:   |                 | Function:                                                                                                                 |
|----------|-----------------|---------------------------------------------------------------------------------------------------------------------------|
|          |                 | This reference signal should correspond to minimum reference value set in 6-14 <i>Terminal 53 Low Ref./Feedb. Value</i> . |
| 0.14 mA* | [0.00–19.90 mA] | Enter the low current value.                                                                                              |

**⚠ CAUTION**

The value must be set to min. 2 mA in order to activate the Live Zero Timeout function in 6-01 *Live Zero Timeout Function*.

**6-13 Terminal 53 High Current**

| Range:    |                 | Function:                                                                                                                      |
|-----------|-----------------|--------------------------------------------------------------------------------------------------------------------------------|
|           |                 | This reference signal should correspond to the maximum reference value set in 6-15 <i>Terminal 53 High Ref./Feedb. Value</i> . |
| 20.00 mA* | [0.10–20.00 mA] | Enter the high current value.                                                                                                  |

**6-14 Terminal 53 Low Ref./Feedb. Value**

| Range: |                | Function:                                                                                                                                           |
|--------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
|        |                | The scaling value corresponding to the low voltage/low current set in 6-10 <i>Terminal 53 Low Voltage</i> and 6-12 <i>Terminal 53 Low Current</i> . |
| 0.000* | [-4,999–4,999] | Enter the analog input scaling value.                                                                                                               |

**6-15 Terminal 53 High Ref./Feedb. Value**

| Range:  |                        | Function:                                                                                                                                               |
|---------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
|         |                        | The scaling value corresponding to the high voltage/high current set in 6-11 <i>Terminal 53 High Voltage</i> and 6-13 <i>Terminal 53 High Current</i> . |
| 50.000* | [-4,999.000–4,999.000] | Enter the analog input scaling value.                                                                                                                   |

**6-16 Terminal 53 Filter Time Constant**

| Range: |  | Function:                                                                                                                       |
|--------|--|---------------------------------------------------------------------------------------------------------------------------------|
|        |  | A first-order digital low pass filter time constant for suppressing electrical noise in terminal 53. A high time constant value |

**6-16 Terminal 53 Filter Time Constant**

| Range:  |                | Function:                                                                |
|---------|----------------|--------------------------------------------------------------------------|
|         |                | improves dampening but also increases the time delay through the filter. |
| 0.01 s* | [0.01–10.00 s] | Enter the time constant.                                                 |

**6-19 Terminal 53 Mode**

| Option: |              | Function:                                                                     |
|---------|--------------|-------------------------------------------------------------------------------|
|         |              | Select the input to be present on terminal 53.                                |
|         |              | <b>⚠ CAUTION</b>                                                              |
|         |              | 6-19 <i>Terminal 53 Mode</i> MUST be set according to Micro switch 4 setting. |
| [0] *   | Voltage Mode |                                                                               |
| [1]     | Current Mode |                                                                               |

**4.7.4 6-2\* Analog Input 2**

Parameters for configuring scaling and limits for analog input 2, terminal 60.

**6-22 Terminal 60 Low Current**

| Range:   |                 | Function:                                                                                                                 |
|----------|-----------------|---------------------------------------------------------------------------------------------------------------------------|
|          |                 | This reference signal should correspond to minimum reference value set in 6-24 <i>Terminal 60 Low Ref./Feedb. Value</i> . |
| 0.14 mA* | [0.00–19.90 mA] | Enter the low current value.                                                                                              |

**⚠ CAUTION**

The value must be set to min. 2 mA in order to activate the Live Zero Timeout function in 6-01 *Live Zero Timeout Time*.

**6-23 Terminal 60 High Current**

| Range:    |                 | Function:                                                                                                                 |
|-----------|-----------------|---------------------------------------------------------------------------------------------------------------------------|
|           |                 | This reference signal should correspond to the high current value set in 6-25 <i>Terminal 60 High Ref./Feedb. Value</i> . |
| 20.00 mA* | [0.10–20.00 mA] | Enter the high current value.                                                                                             |

**6-24 Terminal 60 Low Ref./Feedb. Value**

| Range: |                | Function:                                                                                       |
|--------|----------------|-------------------------------------------------------------------------------------------------|
|        |                | The scaling value corresponding to the low current set in 6-22 <i>Terminal 60 Low Current</i> . |
| 0.000* | [-4,999–4,999] | Enter the analog input scaling value.                                                           |



## Parameter Descriptions

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| 6-25 Terminal 60 High Ref./Feedb. Value |                |                                                                                                   |
|-----------------------------------------|----------------|---------------------------------------------------------------------------------------------------|
| Range:                                  | Function:      |                                                                                                   |
|                                         |                | The scaling value corresponding to the high current set in 6-23 <i>Terminal 60 High Current</i> . |
| 50.00*                                  | [-4,999–4,999] | Enter the analog input scaling value.                                                             |

| 6-26 Terminal 60 Filter Time Constant |                |                                                                                                                                                                                                                                                                                                  |
|---------------------------------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Range:                                | Function:      |                                                                                                                                                                                                                                                                                                  |
|                                       |                | A first-order digital low pass filter time constant for suppressing electrical noise in terminal 60. A high time constant value improves dampening, but also increases the time delay through the filter.<br><b>NOTE!</b><br><b>This parameter cannot be changed while the motor is running.</b> |
| 0.01 s*                               | [0.01–10.00 s] | Enter the time constant.                                                                                                                                                                                                                                                                         |

| 6-82 Keypad Potentiometer High Ref. Value |           |                                                                                              |
|-------------------------------------------|-----------|----------------------------------------------------------------------------------------------|
| Range:                                    | Function: |                                                                                              |
|                                           |           | The reference value corresponding to the potentiometer turned fully clockwise (200 degrees). |

### 4.7.5 6-8\* Keypad Potentiometer

The keypad potentiometer can be selected either as Reference Resource or Relative Reference Resource.

#### NOTE!

In Hand mode, the keypad potentiometer functions as local reference.

| 6-80 Keypad Potmeter Enable |           |                                                                                                                                       |
|-----------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------|
| Option:                     | Function: |                                                                                                                                       |
|                             |           | If keypad Potmeter is disabled, [▲] [▼] can adjust local reference, and Potmeter value does not give any reference in Auto/Hand mode. |
| [0]                         | Disabled  |                                                                                                                                       |
| [1] *                       | Enable    |                                                                                                                                       |

| 6-81 Keypad Potentiometer Low Ref. Value |                |                                                                                                                                      |
|------------------------------------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Range:                                   | Function:      |                                                                                                                                      |
|                                          |                | The scaling value corresponding to 0.                                                                                                |
| 0.000*                                   | [-4,999–4,999] | Enter the low reference value.<br>The reference value corresponding to the potentiometer turned fully counter-clockwise (0 degrees). |

| 6-82 Keypad Potentiometer High Ref. Value |                |                                                                                                                |
|-------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------|
| Range:                                    | Function:      |                                                                                                                |
|                                           |                | The scaling value corresponding to the maximum reference feedback value set in 3-03 <i>Maximum Reference</i> . |
| 50.00*                                    | [-4,999–4,999] | Enter the high reference value.                                                                                |



### 4.7.6 6-9\* Analog Output

These parameters are for configuring the analog outputs of the adjustable frequency drive.

#### 6-90 Terminal 42 Mode

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

|       |                |                                                                                                                                     |
|-------|----------------|-------------------------------------------------------------------------------------------------------------------------------------|
| [0] * | 0-20 mA        | Range for analog outputs is 0-20 mA                                                                                                 |
| [1]   | 4-20 mA        | Range for analog outputs is 4-20 mA                                                                                                 |
| [2]   | Digital output | Functions as slow reacting digital output.<br>Set value to either 0 mA (off) or 20 mA (on),<br>see 6-92 Terminal 42 Digital Output. |

#### 6-91 Terminal 42 Analog Output

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

|       |                               |                                                                          |
|-------|-------------------------------|--------------------------------------------------------------------------|
|       |                               | Select the function for terminal 42 as an analog output.                 |
| [0] * | No Operation                  |                                                                          |
| [10]  | Output Frequency [0–100 Hz]   |                                                                          |
| [11]  | Reference (REF min-max)       | 3-02 Minimum Reference to 3-03 Minimum Reference.                        |
| [12]  | Feedback (FB min-max)         |                                                                          |
| [13]  | Motor Current (0- $I_{max}$ ) | 16-37 Inv. Max. Current is $I_{max}$ .                                   |
| [16]  | Power (0- $P_{nom}$ )         | 1-20 Motor Power is $P_{nom}$ (motor).                                   |
| [19]  | DC Link Voltage (0–1000 V)    |                                                                          |
| [20]  | Bus Reference [0.0%–100.0%]   | The analog output will follow the reference value set on the RS-485 bus. |

#### 6-92 Terminal 42 Digital Output

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

|       |                                   |                                                                                                                                                                                                       |
|-------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       |                                   | See parameter group 5-4* Relays, for choices and descriptions.                                                                                                                                        |
| [0] * | No Operation                      |                                                                                                                                                                                                       |
| [80]  | Logic Controller Digital Output A | See 13-52 Logic Controller Action. When Logic Controller Action [38] Set dig. out. A high is executed, input goes high. When Smart Logic Action [32] Set dig. out. A low is executed, input goes low. |

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### 6-93 Terminal 42 Output Min. Scale

#### Range:

#### Function:

|       |               |                                                                                                                                                                                                                                                                                                              |
|-------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.00% | [0.00–200.0%] | Scale minimum output of selected analog signal at terminal 42 as percentage of maximum signal value, e.g., if 0 mA (or 0 Hz) is desired at 25% of maximum output value, program 25%. Scaling values up to 100% can never be higher than corresponding setting in 6-94 <i>Terminal 42 Output Max. Scale</i> . |
|-------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

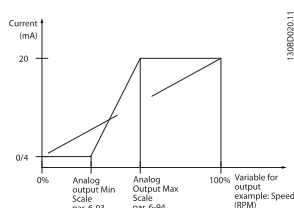


Figure 4.9

### 6-94 Terminal 42 Output Max. Scale

#### Range:

#### Function:

|          |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 100.00%* | [0.00–200.00%] | <p>Scale the maximum output of the selected analog signal on 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 maximum signal value.</p> <p>If 20 mA is the desired output current at a value between 0–100% of the full-scale output, program the percentage value in the parameter, e.g., 50% = 20 mA. If a current between 4 and 20 mA is desired at maximum output (100%), calculate the percentage value as follows:</p> $\frac{20 \text{ mA}}{\text{desired maximum current}} \times 100 \%$ <p>i.e.,</p> $10 \text{ mA} = \frac{20}{10} \times 100 = 200 \%$ |
|----------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



## 4.8 Parameter Group 7: Controllers

### 4.8.1 7-\*\* Controllers

Parameter group for configuring application controls.

### 4.8.2 7-2\* Process Ctrl. Feedback

Select feedback sources and handling for Process PI Control.

#### NOTE!

Set 3-15 Reference 1 Source to [0] No Function in order to use Analog Input as a feedback signal.

In order to use analog input as a feedback resource, do not use the same resource as reference resource in 3-15, 3-16 and 3-17.

#### 7-20 Process CL Feedback Resources

| Option: | Function:                                          |
|---------|----------------------------------------------------|
|         | Select the input to function as a feedback signal. |
| [0] *   | No Function                                        |
| [1]     | Analog Input 53                                    |
| [2]     | Analog Input 60                                    |
| [8]     | Pulse Input 33                                     |
| [11]    | Local Bus Ref.                                     |

### 4.8.3 7-3\* Process PI Control

#### 7-30 Process PI Normal/Inverse Control

| Option: | Function:                                                                                                                                   |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------|
| [0] *   | Normal<br>Feedback greater than the setpoint results in a speed reduction.<br>Feedback less than the setpoint results in a speed increase.  |
| [1]     | Inverse<br>Feedback greater than the setpoint results in a speed increase.<br>Feedback less than the setpoint results in a speed reduction. |

#### 7-31 Process PI Anti Windup

| Option: | Function:                                                                                                          |
|---------|--------------------------------------------------------------------------------------------------------------------|
| [0]     | Disable<br>Regulation of a given error will continue even when the output frequency cannot be increased/decreased. |
| [1] *   | Enable<br>PI controller stops regulating a given error when the output frequency cannot be increased/decreased.    |

#### 7-32 Process PI Start Speed

| Range:                 | Function:                                                                                              |
|------------------------|--------------------------------------------------------------------------------------------------------|
| 0.0 Hz* [0.0–200.0 Hz] | Until the set motor speed has been reached, the adjustable frequency drive operates in open-loop mode. |

#### 7-33 Process PI Proportional Gain

| Option:             | Function:                                                                                                                                                              |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [0.01] * 0.00–10.00 | Enter the value for the P proportional gain, i.e., the multiplication factor of the error between the setpoint and the feedback signal.<br><b>NOTE!</b><br>0.00 = Off. |

#### 7-34 Process PI Integral Time

| Range:                        | Function:                                                                                                                                                                                                            |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9,999.00 s* [0.10–9,999.00 s] | 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. |

#### 7-38 Process Feed Forward Factor

| Range:       | Function:                                                                                                                                                                                                                                                                                                                      |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0%* [0–400%] | The FF factor sends a part of the reference signal around the PI controller which then only affects part of the control signal.<br>By activating the FF factor, less overshoot and high dynamics are gained when changing the setpoint.<br>This parameter is always active when 1-00 Configuration Mode is set to [3] Process. |

#### 7-39 On Reference Bandwidth

| Range:      | Function:                                                                                                                                                                                                               |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5% [0–200%] | Enter the value for the On Reference Bandwidth.<br>The PI control error is the difference between the setpoint and the feedback and when this is less than the value set in this parameter, the On Reference is active. |



## Parameter Descriptions

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### 4.9 Parameter Group 8: Communication

#### 4.9.1 8-\*\* Communication

Parameter group for configuring communication.

#### 4.9.2 8-0\* General Settings

Use this parameter group for configuring the general settings for communication.

##### 8-01 Control Site

| Option:                        | Function:                                                                                                                                                      |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [0] * Digital and Control Word | Use both the digital input and the control word as control.                                                                                                    |
| [1] Digital Only               | Use the digital input as control.                                                                                                                              |
| [2] Control Word Only          | Use control word only as control.<br><b>NOTE!</b><br>The setting in this parameter overrules settings in 8-50 Coasting Select to 8-56 Preset Reference Select. |

##### 8-02 Control Word Source

| Option:            | Function:                                                                    |
|--------------------|------------------------------------------------------------------------------|
| [0] None           | Function is inactive                                                         |
| [1] * Drive RS-485 | Monitoring control word source is done via serial communication port RS-485. |

##### 8-03 Control Word Timeout Time

| Range:              | Function:                                                                                                         |
|---------------------|-------------------------------------------------------------------------------------------------------------------|
| 1.0 s* [0.1–6500 s] | Enter time to pass before control word timeout function (8-04 Control Word Timeout Function) must be carried out. |

##### 8-04 Control Word Timeout Function

| Option:           | Function:                                                                                                 |
|-------------------|-----------------------------------------------------------------------------------------------------------|
|                   | Select the action to be taken in case of a timeout.                                                       |
| [0] * Off         | No function                                                                                               |
| [1] Freeze Output | Freeze output until communication resumes.                                                                |
| [2] Stop          | Stop with auto-restart when communication resumes.                                                        |
| [3] Jogging       | Run motor at jog frequency until communication resumes.                                                   |
| [4] Max. Speed    | Run motor at max. frequency until communication resumes.                                                  |
| [5] Stop and Trip | Stop motor, then reset adjustable frequency drive in order to restart either via keypad or digital input. |

##### 8-06 Reset Control Word Timeout

| Option:           | Function:                                                                     |
|-------------------|-------------------------------------------------------------------------------|
|                   | Resetting the control word timeout will remove any timeout function.          |
| [0] * No Function | Control word timeout is not a reset.                                          |
| [1] Do Reset      | Control word timeout is reset, and parameter goes into [0] No Function state. |

#### 4.9.3 8-3\* GE Drive Port Settings

Parameters for configuring the GE Drive Port.

##### 8-30 Protocol

| Option:                 | Function:                                                                                                                                      |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
|                         | Select the protocol to be used. Note that changing the protocol will not be effective until after powering off the adjustable frequency drive. |
| [0] * GE Drive Protocol |                                                                                                                                                |
| [2] Modbus RTU          |                                                                                                                                                |

##### 8-31 Address

| Range:                      | Function:                                           |
|-----------------------------|-----------------------------------------------------|
|                             | Select the address for the bus.                     |
| 1* [1 - Protocol-dependent] | Drive bus range is 1–126.<br>Modbus range is 1-247. |

##### 8-32 Drive Port Baud Rate

| Option:           | Function:                                                                                                                                  |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
|                   | Select baud rate for Drive Port.<br><b>NOTE!</b><br>Changing the baud rate will be effective after responding to any ongoing bus requests. |
| [0] 2,400 Baud    |                                                                                                                                            |
| [1] 4,800 Baud    |                                                                                                                                            |
| [2] * 9,600 Baud  | When choosing GE Drive Protocol in 8-30                                                                                                    |
| [3] * 19,200 Baud | When choosing Modbus in 8-30                                                                                                               |
| [4] 38,400 Baud   |                                                                                                                                            |

##### 8-33 Drive Port Parity

| Option:                       | Function:                                                                   |
|-------------------------------|-----------------------------------------------------------------------------|
|                               | This parameter only affects Modbus as the Drive bus always has even parity. |
| [0] * Even Parity (1 stopbit) |                                                                             |
| [1] Odd parity                |                                                                             |
| [2] No Parity (1 stopbit)     | Select this for Modbus RTU                                                  |
| [3] No Parity (2 stopbits)    |                                                                             |



## Parameter Descriptions

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## 8-35 Minimum Response Delay

| Range:                   | Function:                                                                           |
|--------------------------|-------------------------------------------------------------------------------------|
| 0.010 s* [0.001–0.500 s] | Specify minimum delay time between receiving a request and transmitting a response. |

## 8-36 Max Response Delay

| Range:                   | Function:                                                                                                                                                |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5.000 s* [0.010–10.00 s] | Specify maximum permissible delay time between transmitting a request and receiving a response. Exceeding this time delay causes a control word timeout. |

## 4.9.4 8-4\* Drive MC Protocol Set

## 8-43 Drive Port PCD Read Configuration

Array [16]

| Option:                             | Function: |
|-------------------------------------|-----------|
| [0] * None                          |           |
| [1] 1500 Operation Hours            |           |
| [2] 1501 Running Hours              |           |
| [3] 1502 kWh Counter                |           |
| [4] 1600 Control Word               |           |
| [5] 1601 Reference [Unit]           |           |
| [6] 1602 Reference %                |           |
| [7] 1603 Status Word                |           |
| [8] 1605 Main Actual Value [%]      |           |
| [9] 1609 Custom Readout             |           |
| [10] 1610 Power [kW]                |           |
| [11] 1611 Power [hp]                |           |
| [12] 1612 Motor Voltage             |           |
| [13] 1613 Frequency                 |           |
| [14] 1614 Motor Current             |           |
| [15] 1615 Frequency [%]             |           |
| [16] 1618 Motor Thermal             |           |
| [17] 1630 DC Link Voltage           |           |
| [18] 1634 Heatsink Temp.            |           |
| [19] 1635 Inverter Thermal          |           |
| [20] 1638 Logic Controller State    |           |
| [21] 1650 External Reference        |           |
| [22] 1651 Pulse Reference           |           |
| [23] 1652 Feedback [Unit]           |           |
| [24] 1660 Digital Input 18,19,27,33 |           |
| [25] 1661 Digital Input 29          |           |
| [26] 1662 Analog Input 53(V)        |           |
| [27] 1663 Analog Input 53(mA)       |           |
| [28] 1664 Analog Input 60           |           |
| [29] 1665 Analog Output 42 [mA]     |           |
| [30] 1668 Freq. Input 33 [Hz]       |           |
| [31] 1671 Relay Output [bin]        |           |
| [32] 1672 Counter A                 |           |

## 8-43 Drive Port PCD Read Configuration

Array [16]

| Option:                    | Function:                                                                                                                                                                                                                                                                                  |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [33] 1673 Counter B        |                                                                                                                                                                                                                                                                                            |
| [34] 1690 Alarm Word       |                                                                                                                                                                                                                                                                                            |
| [35] 1692 Warning Word     |                                                                                                                                                                                                                                                                                            |
| [36] 1694 Ext. Status Word |                                                                                                                                                                                                                                                                                            |
|                            | Select the parameters to be assigned to PCD's of messages. The number of available PCDs depends on the messages. This table is not for [0] array and [1] array. For these two arrays, index 1 is fixed to [7] and index 2 is fixed to [8]. These two arrays cannot be changed by end user. |

## 4.9.5 8-5\* Digital/Bus

Parameters for configuring control word digital/bus merging.

**NOTE!**

Parameters are only active when 8-01 Control Site, is set to [0] Digital and control word.

## 8-50 Coasting Select

| Option:           | Function:                                                             |
|-------------------|-----------------------------------------------------------------------|
|                   | Select control of the coasting function via digital input and/or bus. |
| [0] Digital Input | Activation via a digital input.                                       |
| [1] Bus           | Activation via serial communication port.                             |
| [2] LogicAnd      | Activation via serial communication port and a digital input.         |
| [3] * LogicOr     | Activation via serial communication port or a digital input.          |

## 8-51 Quick Stop Select

| Option:           | Function:                                                               |
|-------------------|-------------------------------------------------------------------------|
|                   | Select control of the quick stop function via digital input and/or bus. |
| [0] Digital Input | Activation via a digital input.                                         |
| [1] Bus           | Activation via the serial communication port.                           |
| [2] LogicAnd      | Activation via the serial communication port and a digital input.       |
| [3] * LogicOr     | Activation via the serial communication port or a digital input.        |



## Parameter Descriptions

## AF-60 LP™ Micro Drive Programming Guide

| 8-52 DC Brake Select |               |                                                                   |
|----------------------|---------------|-------------------------------------------------------------------|
| Option:              | Function:     |                                                                   |
|                      |               | Select control of the DC brake via digital input and/or bus.      |
| [0]                  | Digital Input | Activation via a digital input.                                   |
| [1]                  | Bus           | Activation via the serial communication port.                     |
| [2]                  | LogicAnd      | Activation via the serial communication port and a digital input. |
| [3] *                | LogicOr       | Activation via the serial communication port or a digital input.  |

| 8-53 Start Select |               |                                                                    |
|-------------------|---------------|--------------------------------------------------------------------|
| Option:           | Function:     |                                                                    |
|                   |               | Select control of the start function via digital input and/or bus. |
| [0]               | Digital Input | Activation via a digital input.                                    |
| [1]               | Bus           | Activation via the serial communication port.                      |
| [2]               | LogicAnd      | Activation via the serial communication port and a digital input.  |
| [3] *             | LogicOr       | Activation via the serial communication port or a digital input.   |

| 8-54 Reversing Select |               |                                                                        |
|-----------------------|---------------|------------------------------------------------------------------------|
| Option:               | Function:     |                                                                        |
|                       |               | Select control of the reversing function via digital input and/or bus. |
| [0]                   | Digital Input | Activation via a digital input.                                        |
| [1]                   | Bus           | Activation via the serial communication port.                          |
| [2]                   | LogicAnd      | Activation via the serial communication port and a digital input.      |
| [3] *                 | LogicOr       | Activation via the serial communication port or a digital input.       |

| 8-55 Set-up Select |               |                                                                      |
|--------------------|---------------|----------------------------------------------------------------------|
| Option:            | Function:     |                                                                      |
|                    |               | Select control of the set-up selection via digital input and/or bus. |
| [0]                | Digital Input | Activation via a digital input.                                      |
| [1]                | Bus           | Activation via the serial communication port.                        |
| [2]                | LogicAnd      | Activation via the serial communication port and a digital input.    |
| [3] *              | LogicOr       | Activation via the serial communication port or a digital input.     |

| 8-56 Preset Reference Select |               |                                                                                |
|------------------------------|---------------|--------------------------------------------------------------------------------|
| Option:                      | Function:     |                                                                                |
|                              |               | Select control of the Preset Reference selection via digital input and/or bus. |
| [0]                          | Digital Input | Activation via a digital input.                                                |
| [1]                          | Bus           | Activation via serial communication port.                                      |
| [2]                          | LogicAnd      | Activation via serial communication port and a digital input.                  |
| [3] *                        | LogicOr       | Activation via serial communication port or a digital input.                   |

### 4.9.6 8-8\* Bus communication diagnostics

These parameters are used for monitoring the bus communication via the port.

| 8-80 Bus Message Count |           |                                                                        |
|------------------------|-----------|------------------------------------------------------------------------|
| Range:                 | Function: |                                                                        |
| 0 N/A*                 | [0-0 N/A] | This parameter shows the number of valid messages detected on the bus. |

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

| 8-82 Slave Messages Rcvd |           |                                                                                                                   |
|--------------------------|-----------|-------------------------------------------------------------------------------------------------------------------|
| Range:                   | Function: |                                                                                                                   |
| 0 N/A*                   | [0-0 N/A] | This parameter shows the number of valid messages addressed to the slave, sent by the adjustable frequency drive. |

| 8-83 Slave Error Count |           |                                                                                                               |
|------------------------|-----------|---------------------------------------------------------------------------------------------------------------|
| Range:                 | Function: |                                                                                                               |
| 0 N/A*                 | [0-0 N/A] | This parameter shows the number of error messages, which could be executed by the adjustable frequency drive. |

### 4.9.7 8-9\* Bus Feedback

Parameter for configuring bus feedback.

| 8-94 Bus Feedback 1 |                 |                                                                                                  |
|---------------------|-----------------|--------------------------------------------------------------------------------------------------|
| Range:              | Function:       |                                                                                                  |
| 0*                  | [0x8000-0x7FFF] | Bus feedback is delivered via Drive or Modbus by writing the feedback value into this parameter. |



## 4.10 Parameter Group 13: Logic Controller

### 4.10.1 13-\*\* Programming Features

Logic Controller is a sequence of user-defined actions (13-52 *Logic Controller Action* [X]) executed by the Logic Controller when the associated user-defined event (13-51 *Logic Controller Event* [X]) is set to *True*.

Events and actions are linked in pairs, meaning that when an event is true, the linked action is carried out. After this, the next event is evaluated and its associated action carried out and so on. Only one event is evaluated at a time.

If an event is evaluated as *False*, the Logic Controller takes no action during the scan interval and no other events are evaluated.

It is possible to program from 1 to 20 events and actions. When the last event/action has been executed, the sequence starts again from event/action [0].

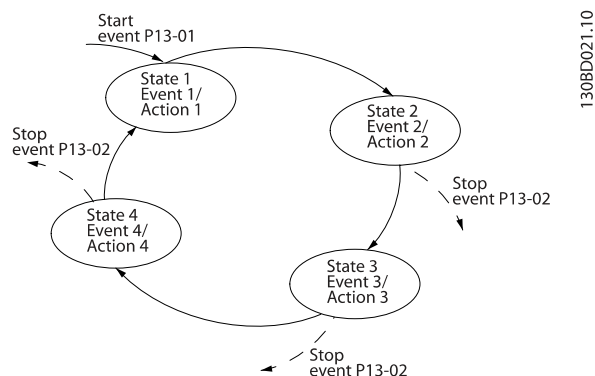


Figure 4.10 Example with Three Events/Actions

#### Starting and stopping the Logic Controller

Start the Logic Controller by selecting [1] *On* in 13-00 *Logic Controller Mode*. The Logic Controller starts evaluating Event 0, and if this is evaluated as *TRUE*, the Logic Controller continues its cycle.

The Logic Controller stops when the *Stop Event*, 13-02 *Stop Event*, is *TRUE*. The Logic Controller can also be stopped by selecting [0] *Off* in 13-00 *Logic Controller Mode*.

To reset all Logic Controller parameters select [1] *Reset Logic Controller* in 13-03 *Reset Logic Controller* and start programming from scratch.

### 4.10.2 13-0\* Logic Controller Settings

Use Logic Controller settings to activate, deactivate and reset the Logic Controller.

#### 13-00 Logic Controller Mode

##### Option:

##### Function:

|       |     |                             |
|-------|-----|-----------------------------|
| [0] * | Off | The function is disabled.   |
| [1]   | On  | Logic Controller is active. |

#### 13-01 Start Event

##### Option:

##### Function:

|      |                      |                                                              |
|------|----------------------|--------------------------------------------------------------|
|      |                      | Select input to activate Logic Controller.                   |
| [0]  | False                | Enters <i>False</i> in the logic rule.                       |
| [1]  | True                 | Enters <i>True</i> in the logic rule.                        |
| [2]  | Running              | See parameter group 5-4* <i>Relays</i> [5] for description.  |
| [3]  | InRange              | See parameter group 5-4* <i>Relays</i> [7] for description.  |
| [4]  | OnReference          | See parameter group 5-4* <i>Relays</i> [8] for description.  |
| [7]  | Out of Current Range | See parameter group 5-4* <i>Relays</i> [12] for description. |
| [8]  | BelowLow             | See parameter group 5-4* <i>Relays</i> [13] for description. |
| [9]  | AboveHigh            | See parameter group 5-4* <i>Relays</i> [14] for description. |
| [16] | ThermalWarning       | See parameter group 5-4* <i>Relays</i> [21] for description. |
| [17] | MainsOutOfRange      | AC line voltage is outside the specified voltage range.      |
| [18] | Reversing            | See parameter group 5-4* <i>Relays</i> [25] for description. |
| [19] | Warning              | A warning is active.                                         |
| [20] | Alarm_Trip           | A trip alarm is active.                                      |
| [21] | Alarm_TripLock       | A trip lock alarm is active.                                 |
| [22] | Comparator 0         | Use result of comparator 0 in the logic rule.                |
| [23] | Comparator 1         | Use result of comparator 1 in the logic rule.                |
| [24] | Comparator 2         | Use result of comparator 2 in the logic rule.                |
| [25] | Comparator 3         | Use result of comparator 3 in the logic rule.                |
| [26] | LogicRule 0          | Use result of logic rule 0 in the logic rule.                |
| [27] | LogicRule 1          | Use result of logic rule 1 in the logic rule.                |
| [28] | LogicRule 2          | Use result of logic rule 2 in the logic rule.                |
| [29] | LogicRule 3          | Use result of logic rule 3 in the logic rule.                |



## Parameter Descriptions

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| 13-01 Start Event |                  |                                                                                                                          |
|-------------------|------------------|--------------------------------------------------------------------------------------------------------------------------|
| Option:           | Function:        |                                                                                                                          |
| [33]              | DigitallInput_18 | Use value of DI 18 in the logic rule.                                                                                    |
| [34]              | DigitallInput_19 | Use value of DI 19 in the logic rule.                                                                                    |
| [35]              | DigitallInput_27 | Use value of DI 27 in the logic rule.                                                                                    |
| [36]              | DigitallInput_29 | Use value of DI 29 in the logic rule.                                                                                    |
| [38]              | DigitallInput_33 |                                                                                                                          |
| [39] *            | StartCommand     | This event is <i>True</i> if the adjustable frequency drive is started by any means (digital input or other).            |
| [40]              | DriveStopped     | This event is <i>True</i> if the adjustable frequency drive is stopped or coasted by any means (digital input or other). |

| 13-02 Stop Event |                      |                                                         |
|------------------|----------------------|---------------------------------------------------------|
| Option:          | Function:            |                                                         |
|                  |                      | Select input to activate Logic Controller.              |
| [0]              | False                | Enters <i>False</i> in the logic rule.                  |
| [1]              | True                 | Enters <i>True</i> in the logic rule.                   |
| [2]              | Running              | See parameter group 5-4* Relays [5] for description.    |
| [3]              | InRange              | See parameter group 5-4* Relays [7] for description.    |
| [4]              | OnReference          | See parameter group 5-4* Relays [8] for description.    |
| [7]              | Out of Current Range | See parameter group 5-4* Relays [12] for description.   |
| [8]              | BelowLow             | See parameter group 5-4* Relays [13] for description.   |
| [9]              | AboveHigh            | See parameter group 5-4* Relays [14] for description.   |
| [16]             | ThermalWarning       | See parameter group 5-4* Relays [21] for description.   |
| [17]             | MainsOutOfRange      | AC line voltage is outside the specified voltage range. |
| [18]             | Reversing            | See parameter group 5-4* Relays [25] for description.   |
| [19]             | Warning              | A warning is active.                                    |
| [20]             | Alarm_Trip           | A trip alarm is active.                                 |
| [21]             | Alarm_TripLock       | A trip lock alarm is active.                            |
| [22]             | Comparator 0         | Use result of comparator 0 in the logic rule.           |
| [23]             | Comparator 1         | Use result of comparator 1 in the logic rule.           |
| [24]             | Comparator 2         | Use result of comparator 2 in the logic rule.           |
| [25]             | Comparator 3         | Use result of comparator 3 in the logic rule.           |
| [26]             | LogicRule 0          | Use result of logic rule 0 in the logic rule.           |

| 13-02 Stop Event |                  |                                                                                                                          |
|------------------|------------------|--------------------------------------------------------------------------------------------------------------------------|
| Option:          | Function:        |                                                                                                                          |
| [27]             | LogicRule 1      | Use result of logic rule 1 in the logic rule.                                                                            |
| [28]             | LogicRule 2      | Use result of logic rule 2 in the logic rule.                                                                            |
| [29]             | LogicRule 3      | Use result of logic rule 3 in the logic rule.                                                                            |
| [30]             | LC Timeout0      | Use result of timer 0 in the logic rule.                                                                                 |
| [31]             | LC Timeout1      | Use result of timer 1 in the logic rule.                                                                                 |
| [32]             | LC Timeout2      | Use result of timer 2 in the logic rule.                                                                                 |
| [33]             | DigitallInput_18 | Use value of DI 18 in the logic rule.                                                                                    |
| [34]             | DigitallInput_19 | Use value of DI 19 in the logic rule.                                                                                    |
| [35]             | DigitallInput_27 | Use value of DI 27 in the logic rule.                                                                                    |
| [36]             | DigitallInput_29 | Use value of DI 29 in the logic rule.                                                                                    |
| [38]             | DigitallInput_33 |                                                                                                                          |
| [39]             | StartCommand     | This event is <i>True</i> if the adjustable frequency drive is started by any means (digital input or other).            |
| [40] *           | DriveStopped     | This event is <i>True</i> if the adjustable frequency drive is stopped or coasted by any means (digital input or other). |

| 13-03 Reset the Logic Controller |                            |                                                        |
|----------------------------------|----------------------------|--------------------------------------------------------|
| Option:                          | Function:                  |                                                        |
| [0] *                            | Do Not Reset               | Retains all settings programmed in parameter group 13. |
| [1]                              | Reset the Logic Controller | Reset all group 13 parameters to default settings.     |

### 4.10.3 13-04 Comparators

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

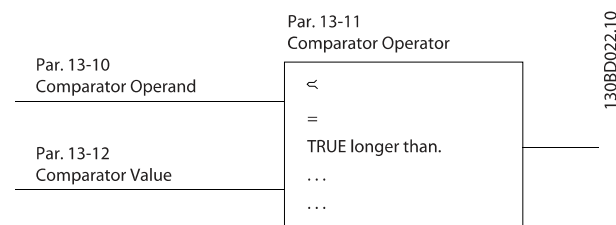


Figure 4.11

1308D022.10



In addition, there are digital values that will be compared to fixed time values. See explanation in *13-10 Comparator Operand*. Comparators are evaluated once in each scan interval. Use the result (TRUE or FALSE) directly. All parameters in this parameter group are array parameters with index 0 to 5. Select index 0 to program Comparator 0, select index 1 to program Comparator 1, and so on.



## Parameter Descriptions

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### 13-10 Comparator Operand

Array [4]

| Option: | Function:                                                            |
|---------|----------------------------------------------------------------------|
|         | Select variable to be monitored by the comparator.                   |
| [0] *   | Disabled<br>Comparator is disabled.                                  |
| [1]     | Reference<br>Resulting remote reference (not local) as a percentage. |
| [2]     | Feedback<br>Feedback in [Hz].                                        |
| [3]     | MotorSpeed<br>Motor speed in Hz.                                     |
| [4]     | MotorCurrent<br>Motor current in [A].                                |
| [6]     | MotorPower<br>Motor power in either [kW] or [hp].                    |
| [7]     | MotorVoltage<br>Motor voltage in [V].                                |
| [8]     | DCLinkVoltage<br>DC link voltage in [V].                             |
| [12]    | AnalogInput53<br>Expressed as actual value.                          |
| [13]    | AnalogInput60<br>Expressed as actual value.                          |
| [18]    | PulseInput33<br>Expressed as actual value.                           |
| [20]    | AlarmNumber<br>Shows number of the alarm.                            |
| [30]    | CounterA<br>Number of counts.                                        |
| [31]    | CounterB<br>Number of counts.                                        |

### 13-11 Comparator Operator

Array [4]

| Option: | Function:                                                                                                                                                                                                                                                                                                               |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | Select operator to be used in the comparison.                                                                                                                                                                                                                                                                           |
| [0]     | Less Than <<br>Result of evaluation is <i>True</i> if variable selected in <i>13-10 Comparator Operand</i> is smaller than fixed value in <i>13-12 Comparator Value</i> . Result is <i>False</i> if variable selected in <i>13-10 Comparator Operand</i> is greater than fixed value in <i>13-12 Comparator Value</i> . |
| [1] *   | Approximately equals ≈<br>Result of evaluation is <i>True</i> if variable selected in <i>13-10 Comparator Operand</i> is approximately equal to fixed value in <i>13-12 Comparator Value</i> .                                                                                                                          |
| [2]     | Greater Than ><br>Inverse logic of option [0].                                                                                                                                                                                                                                                                          |

### 13-12 Comparator Value

Array [4]

| Range:              | Function:                                                            |
|---------------------|----------------------------------------------------------------------|
| 0.0* [-9,999–9,999] | Enter “trigger level” for the variable monitored by this comparator. |

When the timer value has elapsed, the timer changes the state from *False* to *True*.

### 13-20 Logic Controller Controller Timer

Array [3]

| Range:               | Function:                                                                                                                                                                                            |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.0 s* [0.0–3,600 s] | Enter the value to define the duration of the <i>False</i> output from the programmed timer. A timer is only <i>False</i> if it is started by an action and until the given timer value has elapsed. |

## 4.10.5 13-4\* Logic Rules

Combine up to three Boolean inputs (TRUE/FALSE inputs) from timers, comtors, digital inputs, status bits and events using the logical operators AND, OR, and NOT. Select Boolean inputs for the calculation in *13-40 Logic Rule Boolean 1*, *13-42 Logic Rule Boolean 2* and *13-44 Logic Rule Boolean 3*. Define the operators used to logically combine the selected inputs in *13-41 Logic Rule Operator 1* and *13-43 Logic Rule Operator 2*.

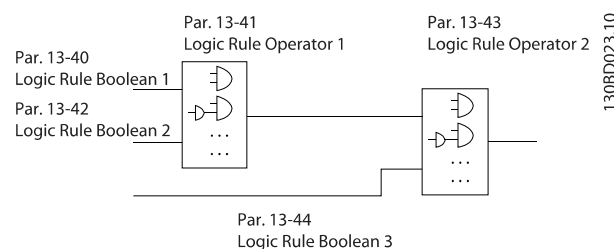


Figure 4.12

### Priority of calculation

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

## 4.10.4 13-2\* Timers

Use the timer results to define an event (*13-51 Logic Controller Action*) or as Boolean input in a logic rule (*13-40 Logic Rule Boolean 1*, *13-42 Logic Rule Boolean 2* or *13-44 Logic Rule Boolean 3*).



## 13-40 Logic Rule Boolean 1

Array [4]

Option:

Function:

|       |                      |                                                             |
|-------|----------------------|-------------------------------------------------------------|
|       |                      | Select the first Boolean input for the selected logic rule. |
| [0] * | False                | Enters <i>False</i> in the logic rule.                      |
| [1]   | True                 | Enters <i>True</i> in the logic rule.                       |
| [2]   | Running              | See parameter group 5-4* Relays [5] for description.        |
| [3]   | InRange              | See parameter group 5-4* Relays [7] for description.        |
| [4]   | OnReference          | See parameter group 5-4* Relays [8] for description.        |
| [7]   | Out of Current Range | See parameter group 5-4* Relays [12] for description.       |
| [8]   | BelowLow             | See parameter group 5-4* Relays [13] for description.       |
| [9]   | AboveHigh            | See parameter group 5-4* Relays [14] for description.       |
| [16]  | ThermalWarning       | See parameter group 5-4* Relays [21] for description.       |
| [17]  | MainsOutOfRange      | AC line voltage is outside the specified voltage range.     |
| [18]  | Reversing            | See parameter group 5-4* Relays [25] for description.       |
| [19]  | Warning              | A warning is active.                                        |
| [20]  | Alarm_Trip           | A trip alarm is active.                                     |
| [21]  | Alarm_TripLock       | A trip lock alarm is active.                                |
| [22]  | Comparator 0         | Use result of comparator 0 in the logic rule.               |
| [23]  | Comparator 1         | Use result of comparator 1 in the logic rule.               |
| [24]  | Comparator 2         | Use result of comparator 2 in the logic rule.               |
| [25]  | Comparator 3         | Use result of comparator 3 in the logic rule.               |
| [26]  | LogicRule 0          | Use result of logic rule 0 in the logic rule.               |
| [27]  | LogicRule 1          | Use result of logic rule 1 in the logic rule.               |
| [28]  | LogicRule 2          | Use result of logic rule 2 in the logic rule.               |
| [29]  | LogicRule 3          | Use result of logic rule 3 in the logic rule.               |
| [30]  | LC Timeout0          | Use result of timer 0 in the logic rule.                    |
| [31]  | LC Timeout1          | Use result of timer 1 in the logic rule.                    |
| [32]  | LC Timeout2          | Use result of timer 2 in the logic rule.                    |
| [33]  | DigitalInput_18      | Use value of DI 18 in the logic rule.                       |
| [34]  | DigitalInput_19      | Use value of DI 19 in the logic rule.                       |
| [35]  | DigitalInput_27      | Use value of DI 27 in the logic rule.                       |
| [36]  | DigitalInput_29      | Use value of DI 29 in the logic rule.                       |
| [38]  | DigitalInput_33      | Use value of DI 33 in logic rule                            |

## 13-40 Logic Rule Boolean 1

Array [4]

Option:

Function:

|      |              |                                                                                                                          |
|------|--------------|--------------------------------------------------------------------------------------------------------------------------|
| [39] | StartCommand | This event is <i>True</i> if the adjustable frequency drive is started by any means (digital input or other).            |
| [40] | DriveStopped | This event is <i>True</i> if the adjustable frequency drive is stopped or coasted by any means (digital input or other). |

## 13-41 Logic Rule Operator 1

Array [4]

Option:

Function:

|       |             |                                                                                                                        |
|-------|-------------|------------------------------------------------------------------------------------------------------------------------|
|       |             | Select first logical operator to use on Boolean inputs from 13-40 Logic Rule Boolean 1 and 13-42 Logic Rule Boolean 2. |
| [0] * | Disabled    | Ignores 13-42 Logic Rule Boolean 2, 13-43 Logic Rule Operator 2 and 13-44 Logic Rule Boolean 3.                        |
| [1]   | And         | Evaluates expression [13-40] AND [13-42].                                                                              |
| [2]   | Or          | Evaluates expression [13-40] OR [13-42].                                                                               |
| [3]   | And not     | Evaluates expression [13-40] AND NOT [13-42].                                                                          |
| [4]   | Or not      | Evaluates expression [13-40] OR NOT [13-42].                                                                           |
| [5]   | Not and     | Evaluates expression NOT [13-40] and [13-42].                                                                          |
| [6]   | Not or      | Evaluates expression NOT [13-40] OR [13-42].                                                                           |
| [7]   | Not and not | Evaluates expression NOT [13-40] AND NOT [13-42].                                                                      |
| [8]   | Not or not  | Evaluates expression NOT [13-40] OR NOT [13-42].                                                                       |

## 13-42 Logic Rule Boolean 2

Array [4]

Option: Function:

|  |  |                                                                                                                              |
|--|--|------------------------------------------------------------------------------------------------------------------------------|
|  |  | Select the second Boolean input for the selected logic rule.<br>See 13-40 Logic Rule Boolean 1 for choices and descriptions. |
|--|--|------------------------------------------------------------------------------------------------------------------------------|

## 13-43 Logic Rule Operator 2

Array [4]

Option:

Function:

|       |          |                                                                                                                                                                                                                      |
|-------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       |          | Select second logical operator to use on Boolean inputs calculated in 13-40 Logic Rule Boolean 1, 13-41 Logic Rule Operator 1, and 13-42 Logic Rule Boolean 2 and the Boolean input from 13-42 Logic Rule Boolean 2. |
| [0] * | Disabled | Ignores 13-44 Logic Rule Boolean 3.                                                                                                                                                                                  |
| [1]   | And      | Evaluates expression [13-40/13-42] AND [13-44].                                                                                                                                                                      |
| [2]   | Or       | Evaluates expression [13-40/13-42] OR [13-44].                                                                                                                                                                       |
| [3]   | And not  | Evaluates expression [13-40/13-42] AND NOT [13-44].                                                                                                                                                                  |



## Parameter Descriptions

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### 13-43 Logic Rule Operator 2

Array [4]

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

|     |             |                                                         |
|-----|-------------|---------------------------------------------------------|
| [4] | Or not      | Evaluates expression [13-40/13-42] OR NOT [13-44].      |
| [5] | Not and     | Evaluates expression NOT [13-40/13-42] and [13-44].     |
| [6] | Not or      | Evaluates expression NOT [13-40/13-42] OR [13-44].      |
| [7] | Not and not | Evaluates expression NOT [13-40/13-42] AND NOT [13-44]. |
| [8] | Not or not  | Evaluates expression NOT [13-40/13-42] OR NOT [13-44].  |

### 13-44 Logic Rule Boolean 3

Array [4]

**Option:**    **Function:**

|  |                                                                                                                             |
|--|-----------------------------------------------------------------------------------------------------------------------------|
|  | Select the third Boolean input for the selected logic rule.<br>See 13-40 Logic Rule Boolean 1 for choices and descriptions. |
|--|-----------------------------------------------------------------------------------------------------------------------------|

## 4.10.6 13-5\* States

### 13-51 Logic Controller Event

Array [20]

**Option:**    **Function:**

|  |                                                                                                                        |
|--|------------------------------------------------------------------------------------------------------------------------|
|  | Select Boolean input to define Logic Controller Event.<br>See 13-40 Logic Rule Boolean 1 for choices and descriptions. |
|--|------------------------------------------------------------------------------------------------------------------------|

### 13-52 LC Controller Action

Array [20]

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

|       |                  |                                                                                                                                                     |
|-------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
|       |                  | Select action corresponding to LC event. Actions are executed when corresponding event (13-51 Logic Controller Event) is evaluated as <i>True</i> . |
| [0] * | Disabled         | The function is disabled.                                                                                                                           |
| [1]   | No Action        | No action is taken.                                                                                                                                 |
| [2]   | Select Set-up1   | Changes active set-up to Set-up 1.                                                                                                                  |
| [3]   | Select Set-up2   | Changes active set-up to Set-up 2.                                                                                                                  |
| [10]  | SelectPresetRef0 | Selects preset reference 0                                                                                                                          |
| [11]  | SelectPresetRef1 | Selects preset reference 1                                                                                                                          |
| [12]  | SelectPresetRef2 | Selects preset reference 2                                                                                                                          |
| [13]  | SelectPresetRef3 | Selects preset reference 3                                                                                                                          |
| [14]  | SelectPresetRef4 | Selects preset reference 4                                                                                                                          |
| [15]  | SelectPresetRef5 | Selects preset reference 5                                                                                                                          |
| [16]  | SelectPresetRef6 | Selects preset reference 6                                                                                                                          |
| [17]  | SelectPresetRef7 | Selects preset reference 7                                                                                                                          |
| [18]  | SelectRamp1      | Selects ramp 1                                                                                                                                      |

### 13-52 LC Controller Action

Array [20]

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

|      |               |                                                                                                                     |
|------|---------------|---------------------------------------------------------------------------------------------------------------------|
| [19] | SelectRamp2   | Selects ramp 2                                                                                                      |
| [22] | Run           | Issues a start command to the adjustable frequency drive.                                                           |
| [23] | RunReverse    | Issues a start reverse command to the adjustable frequency drive.                                                   |
| [24] | Stop          | Issues a stop command to the adjustable frequency drive.                                                            |
| [25] | Qstop         | Issues a quick stop command to the adjustable frequency drive.                                                      |
| [26] | DCstop        | Issues a DC stop command to the adjustable frequency drive.                                                         |
| [27] | Coast         | adjustable frequency drive coasts immediately. All stop commands including coast command stop the Logic Controller. |
| [28] | Freeze Output | Freezes output frequency.                                                                                           |
| [29] | StartTimer0   | Starts timer 0.                                                                                                     |
| [30] | StartTimer1   | Starts timer 1                                                                                                      |
| [31] | StartTimer2   | Starts timer 2                                                                                                      |
| [32] | SetDO42Low    | Set Digital output 42 low.                                                                                          |
| [33] | SetRelayLow   | Set Relay low.                                                                                                      |
| [38] | SetDO42High   | Set Digital output 42 high.                                                                                         |
| [39] | SetRelayHigh  | Set Relay high.                                                                                                     |
| [60] | ResetCounterA | Resets counter A to 0.                                                                                              |
| [61] | ResetCounterB | Resets counter B to 0.                                                                                              |



## 4.11 Parameter Group 14: Special Functions

## 4.11.1 14-\*\* Special Functions

Parameter group for configuring special adjustable frequency drive functions.

## 4.11.2 14-0\* Carrier Frequency

## 14-01 Motor Noise (Carrier Frequency)

| Option: | Function:                                                                                                             |
|---------|-----------------------------------------------------------------------------------------------------------------------|
|         | Select the carrier frequency in order, for example, to minimize acoustic noise and power loss or maximize efficiency. |
| [0]     | 2 kHz                                                                                                                 |
| [1] *   | 4 kHz                                                                                                                 |
| [2]     | 8 kHz                                                                                                                 |
| [4]     | 16 kHz                                                                                                                |

**NOTE!**

For 25 hp [18.5 kW] and 30 hp [22 kW] adjustable frequency drive, option [4] is not available.

## 14-03 Overmodulation

| Option: | Function:                                                                                                                                                                                                    |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | This feature allows more accurate speed control near and over nominal speed (50/60 Hz). Another advantage with overmodulation is the ability to stay at a constant speed even though line power is dropping. |
| [0]     | Off Disables the overmodulation function to avoid torque ripple on the motor shaft.                                                                                                                          |
| [1] *   | On Connects the overmodulation function to obtain an output voltage of up to 15% greater than AC line voltage.                                                                                               |

## 4.11.3 14-1\* Line Power Monitoring

This parameter group supplies functions for handling imbalance on line power.

## 14-12 Functions at Line Imbalance

| Option: | Function:                                                                                                                                                |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | Operation under severe line imbalance conditions reduces drive lift time.<br>Select the function to take place when a severe line imbalance is detected. |
| [0] *   | Trip Adjustable frequency drive trips.                                                                                                                   |
| [1]     | Warning adjustable frequency drive issues a warning.                                                                                                     |
| [2]     | Disabled No action taken.                                                                                                                                |

Parameters for configuring auto reset handling, special trip handling and control card self test or restore.

## 14-20 Reset Mode

| Option: | Function:                                                                                                             |
|---------|-----------------------------------------------------------------------------------------------------------------------|
|         | Select the reset function after tripping. Once reset, the adjustable frequency drive can be restarted.                |
| [0] *   | Manual Reset Perform reset via [Reset] or digital inputs.                                                             |
| [1]     | AutoReset 1 Performs one automatic reset after tripping.                                                              |
| [2]     | AutoReset 2 Performs two automatic resets after tripping.                                                             |
| [3]     | AutoReset 3 Performs three automatic resets after tripping.                                                           |
| [4]     | AutoReset 4 Performs four automatic resets after tripping.                                                            |
| [5]     | AutoReset 5 Performs five automatic resets after tripping.                                                            |
| [6]     | AutoReset 6 Performs six automatic resets after tripping.                                                             |
| [7]     | AutoReset 7 Performs seven automatic resets after tripping.                                                           |
| [8]     | AutoReset 8 Performs eight automatic resets after tripping.                                                           |
| [9]     | AutoReset 9 Performs nine automatic resets after tripping.                                                            |
| [10]    | AutoReset 10 Performs ten automatic resets after tripping.                                                            |
| [11]    | AutoReset 15 Performs fifteen automatic resets after tripping.                                                        |
| [12]    | AutoReset 20 Performs twenty automatic resets after tripping.                                                         |
| [13]    | Infinite auto reset Performs an infinite number of automatic resets after tripping.                                   |
| [14]    | Reset at power-up Trip-lock alarm can be reset at power-up.<br><b>CAUTION</b><br>The motor may start without warning. |

## 14-21 Automatic Restart Time

| Range: | Function:                                                                                                                                                                            |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10 s*  | [0–600 s] Enter the time interval from the trip to the start of the automatic reset function. This parameter is active when 14-20 Reset Mode, is set to [1] to [13] Automatic Reset. |

## 14-22 Operation Mode

| Option: | Function:                                                                                                                                          |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------|
|         | Use this parameter for specifying normal operation or to initialize all parameters, except 15-03 Power Ups, 15-04 Over Temps and 15-05 Over Volts. |
| [0] *   | Normal Operation Adjustable frequency drive runs normal operation.                                                                                 |



## Parameter Descriptions

## AF-60 LP™ Micro Drive Programming Guide

### 14-22 Operation Mode

| Option:                      | Function:                                                                                                                                                                                                                                                          |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [2] Restore Factory Settings | Resets all parameters to default settings, except for 15-03 Power Ups, 15-04 Over Temps and 15-05 Over Volts. The adjustable frequency drive resets during the next power-up.<br><i>14-22 Operation Mode also reverts to default setting [0] Normal Operation.</i> |

### 14-26 Action at Inverter Fault

| Option:       | Function:                                                                                                                                                                                                                                    |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [0] Trip      | When the adjustable frequency drive detects an overvoltage, it will trip immediately.<br><b>NOTE!</b><br><b>It is recommended to choose [0] Trip in hoisting applications.</b>                                                               |
| [1] * Warning | When the adjustable frequency drive detects an overvoltage, it will give warning immediately. After protection filter, it will trip.<br><b>NOTE!</b><br><b>It is recommended to disable <i>protection mode</i> in hoisting applications.</b> |

### 4.11.4 14-4\* Drive Identification

Parameters containing read-only information about the hardware and software configuration of the adjustable frequency drive.

### 14-41 Energy Savings Minimum Magnetization

| Range:        | Function:                                                                                                                                                                    |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 66%* [40–75%] | Enter the minimum allowable magnetization for energy savings. Selecting a low value reduces energy loss in the motor, but may also reduce resistance to sudden load changes. |



## 4.12 Parameter Group 15: Drive Information

Parameter group containing information on operating data, hardware configuration, software version, etc.

## 15-00 Operating Time

| Range:                  | Function:                                                                                                                   |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 0 days* [0-65,535 days] | View how many days the adjustable frequency drive has been powered up. The value is saved at power-off and cannot be reset. |

## 15-01 Running Hours

| Range:               | Function:                                                                                                           |
|----------------------|---------------------------------------------------------------------------------------------------------------------|
| 0* [0-2,147,483,647] | View running hours of motor. The value is saved at power off and can be reset in 15-07 Reset Running Hours Counter. |

## 15-02 kWh Counter

| Range:       | Function:                                                                                              |
|--------------|--------------------------------------------------------------------------------------------------------|
| 0 [0-65,535] | View power consumption in kWh as a mean value over one hour. Reset counter in 15-06 Reset kWh Counter. |

## 15-03 Power-ups

| Range:              | Function:                                                                                             |
|---------------------|-------------------------------------------------------------------------------------------------------|
| 0 [0-2,147,483,647] | View the number of times the adjustable frequency drive has been powered up. Counter cannot be reset. |

## 15-04 Overtemps

| Range:       | Function:                                                                                                            |
|--------------|----------------------------------------------------------------------------------------------------------------------|
| 0 [0-65,535] | View the number of times the adjustable frequency drive has tripped due to overtemperature. Counter cannot be reset. |

## 15-05 Overvolts

| Range:        | Function:                                                                                                        |
|---------------|------------------------------------------------------------------------------------------------------------------|
| 0* [0-65,535] | View the number of times the adjustable frequency drive has tripped due to overvoltage. Counter cannot be reset. |

## 15-06 Reset kWh Counter

| Option: | Function:                          |
|---------|------------------------------------|
| [0] *   | Do Not Reset Counter is not reset. |
| [1]     | Reset Counter Counter is reset.    |

## 15-07 Reset Running Hours Counter

| Option: | Function:                          |
|---------|------------------------------------|
| [0] *   | Do Not Reset Counter is not reset. |
| [1]     | Reset Counter Counter is reset.    |

## 4.12.1 15-3\* Fault Log

This parameter group contains a fault log showing the reasons for the last ten trips.

## 15-30 Fault Log: Error Code

| Range:    | Function:                                                                |
|-----------|--------------------------------------------------------------------------|
| 0 [0-255] | View error code and look it up in <i>GE AF-60 LP Micro Quick Guide</i> . |

## 4.12.2 15-4# Drive Identification

Parameters containing read-only information about the hardware and software configuration of the .

## 15-40 Drive Type

| Option: | Function:            |
|---------|----------------------|
|         | View the Drive type. |

## 15-41 Power Section

| Option: | Function:                                                 |
|---------|-----------------------------------------------------------|
|         | View the power section of the adjustable frequency drive. |

## 15-42 Voltage

| Option: | Function:                                           |
|---------|-----------------------------------------------------|
|         | View the voltage of the adjustable frequency drive. |

## 15-43 Software Version

| Option: | Function:                                                    |
|---------|--------------------------------------------------------------|
|         | View the software version of the adjustable frequency drive. |

## 15-46 Adjustable Frequency Drive Ordering Number

| Option: | Function:                                                                                              |
|---------|--------------------------------------------------------------------------------------------------------|
|         | View the ordering number for re-ordering the adjustable frequency drive in its original configuration. |

## 15-48 Keypad ID #

| Option: | Function:              |
|---------|------------------------|
|         | View keypad ID number. |

## 15-51 Adjustable Frequency Drive Serial Number

| Option: | Function:                                          |
|---------|----------------------------------------------------|
|         | View the adjustable frequency drive serial number. |



## Parameter Descriptions

## AF-60 LP™ Micro Drive Programming Guide

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### 4.13 Parameter Group 16: Data Readouts

#### 16-00 Control Word

| Range:        | Function:                                                                                        |
|---------------|--------------------------------------------------------------------------------------------------|
| 0* [0–65,535] | View latest valid control word sent to adjustable frequency drive via serial communication port. |

#### 16-01 Reference [Unit]

| Range:                        | Function:                                                                                                                               |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| 0.000* [-4,999,000–4,999,000] | View the total remote reference. Total reference is sum of pulse, analog, preset, keypad potentiometer, local bus and freeze reference. |

#### 16-02 Reference %

| Range:               | Function:                                                                                                                                          |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.0* [-200.0–200.0%] | View the total remote reference in percent. Total reference is sum of pulse, analog, preset, keypad potentiometer, local bus and freeze reference. |

#### 16-03 Status Word

| Range:        | Function:                                                                                      |
|---------------|------------------------------------------------------------------------------------------------|
| 0* [0–65,535] | View the status word sent to the adjustable frequency drive via the serial communication port. |

#### 16-05 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. |

#### 16-09 Custom Readout

| Range:                | Function:                                                                                                                                |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| 0.00* [0.00–9999.00%] |                                                                                                                                          |
|                       | Customized readout based on the settings of 0-31 Custom Readout Min Scale, 0-32 Custom Readout Max Scale and 4-14 Motor Speed High Limit |

### 4.13.1 16-1\* Motor Status

#### 16-10 Power [kW]

| Range:          | Function:                |
|-----------------|--------------------------|
| 0 kW* [0–99 kW] | View output power in kW. |

#### 16-11 Power [hp]

| Range:         | Function:                    |
|----------------|------------------------------|
| 0 hp [0–99 hp] | View the output power in hp. |

#### 16-12 Motor Voltage

| Range:             | Function:                 |
|--------------------|---------------------------|
| 0.0* [0.0–999.9 V] | View motor phase voltage. |

#### 16-13 Frequency

| Range:                 | Function:                        |
|------------------------|----------------------------------|
| 0.0 Hz* [0.0–400.0 Hz] | View the output frequency in Hz. |

#### 16-14 Motor Current

| Range:               | Function:                     |
|----------------------|-------------------------------|
| 0.00 A* [0.00–655 A] | View the motor phase current. |

#### 16-15 Frequency [%]

| Range:                  | Function:                                                                                          |
|-------------------------|----------------------------------------------------------------------------------------------------|
| 0.00* [-100.00–100.00%] | View a 2-byte word reporting actual motor frequency as a percentage of 4-14 Motor Speed High Limit |

#### 16-18 Motor Thermal

| Range:       | Function:                                                                                   |
|--------------|---------------------------------------------------------------------------------------------|
| 0%* [0–100%] | View the calculated thermal motor load as a percentage of the estimated thermal motor load. |

### 4.13.2 16-3\* Drive Status

#### 16-30 DC Link Voltage

| Range:           | Function:                 |
|------------------|---------------------------|
| 0 V* [0–10000 V] | View the DC link voltage. |

#### 16-34 Heatsink Temp.

| Range:                   | Function:                                                        |
|--------------------------|------------------------------------------------------------------|
| 0* [32–491° F [0–255°C]] | View the heatsink temperature of the adjustable frequency drive. |

#### 16-35 Drive Thermal

| Range:       | Function:                                                                                                                       |
|--------------|---------------------------------------------------------------------------------------------------------------------------------|
| 0%* [0–100%] | View calculated thermal load on adjustable frequency drive in relation to estimated thermal load on adjustable frequency drive. |

#### 16-36 Drive Nom. Current

| Range:              | Function:                              |
|---------------------|----------------------------------------|
| 0.00 A* [0.01–655A] | View continuous nominal drive current. |

#### 16-37 Drive Max. Current

| Range:             | Function:                                       |
|--------------------|-------------------------------------------------|
| 0.00 A* [0.1–655A] | View intermittent maximum drive current (150%). |

#### 16-38 Logic Controller State

| Range:     | Function:                          |
|------------|------------------------------------|
| 0* [0–255] | View number of active Logic state. |



## 4.13.3 16-5\* Ref. &amp; Feedb.

## 16-50 External Reference

| Range:                | Function:                                               |
|-----------------------|---------------------------------------------------------|
| 0.0%* [-200.0–200.0%] | View the sum of all the external references in percent. |

## 16-51 Pulse Reference

| Range:                | Function:                                                        |
|-----------------------|------------------------------------------------------------------|
| 0.0%* [-200.0–200.0%] | View the actual pulse input converted to a reference in percent. |

## 16-52 Feedback

| Range:                        | Function:                                |
|-------------------------------|------------------------------------------|
| 0.000* [-4,999.000–4,999.000] | View the analog or pulse feedback in Hz. |

## 4.13.4 16-6\* Inputs and Outputs

## 16-60 Digital Input 18, 19, 27, 33

| Range:      | Function:                                          |
|-------------|----------------------------------------------------|
| 0* [0–1111] | View the signal states from active digital inputs. |

## 16-61 Digital Input 29

| Range:   | Function:                                  |
|----------|--------------------------------------------|
| 0* [0–1] | View the signal state on digital input 29. |

## 16-62 Analog Input 53 (volt)

| Range:               | Function:                                            |
|----------------------|------------------------------------------------------|
| 0.00* [0.00–10.00 V] | View the input voltage on the analog input terminal. |

## 16-63 Analog Input 53 (current)

| Range:                | Function:                                            |
|-----------------------|------------------------------------------------------|
| 0.00* [0.00–20.00 mA] | View the input current on the analog input terminal. |

## 16-64 Analog Input 60

| Range:                | Function:                                                                      |
|-----------------------|--------------------------------------------------------------------------------|
| 0.00* [0.00–20.00 mA] | View the actual value at input 60 either as a reference or a protection value. |

## 16-65 Analog Output 42 [mA]

| Range:                   | Function:                                    |
|--------------------------|----------------------------------------------|
| 0.00 mA* [0.00–20.00 mA] | View the output current on analog output 42. |

## 16-68 Pulse Input

| Range:               | Function:                                             |
|----------------------|-------------------------------------------------------|
| 20 Hz* [20–5,000 Hz] | View the input frequency on the pulse input terminal. |

## 16-71 Relay Output [bin]

| Range:   | Function:               |
|----------|-------------------------|
| 0* [0–1] | View the relay setting. |

## 16-72 Counter A

| Range:              | Function:                            |
|---------------------|--------------------------------------|
| 0* [-32,768–32,767] | View the present value of Counter A. |

## 16-73 Counter B

| Range:              | Function:                            |
|---------------------|--------------------------------------|
| 0* [-32,768–32,767] | View the present value of Counter B. |

## 4.13.5 16-8\* GE Drive Port

Parameter for viewing references from GE Drive Port.

## 16-86 GE Drive Port REF 1

| Range:             | Function:                                             |
|--------------------|-------------------------------------------------------|
| 0* [0x8000–0x7FFF] | View currently received reference from GE Drive Port. |

## 4.13.6 16-9\* Diagnosis Readouts

## 16-90 Alarm Word

| Range:            | Function:                                                      |
|-------------------|----------------------------------------------------------------|
| 0* [0–0xFFFFFFFF] | Via alarm word sent via serial communication port in hex code. |

## 16-92 Warning Word

| Range:            | Function:                                                                 |
|-------------------|---------------------------------------------------------------------------|
| 0* [0–0xFFFFFFFF] | View the warning word sent via the serial communication port in hex code. |

## 16-94 Ext. Status Word

| Range:            | Function:                                                                          |
|-------------------|------------------------------------------------------------------------------------|
| 0* [0–0xFFFFFFFF] | View the extended warning word sent via the serial communication port in hex code. |



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Parameter Descriptions

AF-60 LP™ Micro Drive Programming Guide

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## 5 Parameter Lists

| Parameter Overview                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>0-** Operation/Display</b><br><b>0-0/ Basic Settings</b><br><b>0-03 Regional Settings</b><br>[0] International<br>*[1] US<br><b>0-04 Oper. State at Power-up (Hand)</b><br>[0] Resume<br>[1] Forced stop, ref=f"old<br>[2] Forced stop, re=0<br><b>0-1* Set-up Handling</b><br><b>0-10 Active Set-up</b><br>*[1] Set-up 1<br>[2] Set-up 2<br>[9] Multi Set-up<br><b>0-11 Edit Set-up</b><br>*[1] Set-up 1<br>[2] Set-up 2<br>[9] Active Set-up<br><b>0-12 Link Set-ups</b><br>[0] Not Linked<br>*[20] Linked<br><b>0-31 Custom Readout Min Scale</b><br>0.00–9,999.00<br>*0.00<br><b>0-32 Custom Readout Max Scale</b><br>0.00–9,999.00<br>*100.0<br><b>0-4* Keypad</b><br><b>0-40 [Hand] Key on Keypad</b><br>[0] Disabled<br>*[1] Enabled<br><b>0-41 [Off / Reset] Key on Keypad</b><br>[0] Disable All<br>*[1] Enable All<br>[2] Enable Reset Only<br><b>0-42 [Auto] Key on Keypad</b><br>[0] Disabled<br>*[1] Enabled<br><b>0-5* Copy/Save</b><br><b>0-50 Keypad Copy</b><br>*[0] No copy<br>[1] All to keypad<br>[2] All from keypad<br>[3] Size indep. from keypad | <b>0-51 Set-up Copy</b><br>*[0] No copy<br>[1] Copy from set-up 1<br>[2] Copy from set-up 2<br>[9] Copy from Factory set-up<br><b>0-6* Password</b><br><b>0-60 (Main) Menu Password</b><br>0–999 *0<br><b>0-61 Access to Main/Quick Menu w/o Password</b><br>*[0] Full access<br>[1] Keypad: Read Only<br>[2] Keypad: No Access<br><b>1-** Load/Motor</b><br><b>1-0* General Settings</b><br><b>1-00 Configuration Mode</b><br>*[0] Speed open-loop<br>[3] Process<br><b>1-01 Motor Control Principle</b><br>[0] U/f<br>*[1] Adv.Vector Control<br><b>1-03 Torque Characteristics</b><br>*[0] Constant torque<br>[2] Energy Saving<br><b>1-05 Local Mode Configuration</b><br>[0] Speed Open-loop<br>*[2] As config in par. 1-00<br><b>1-2* Motor Data</b><br><b>1-20 Motor Power [kW] [HP]</b><br>[1] 0.09 kW/0.12 HP<br>[2] 0.12 kW/0.16 HP<br>[3] 0.18 kW/0.25 HP<br>[4] 0.25 kW/0.33 HP<br>[5] 0.37 kW/0.50 HP<br>[6] 0.55 kW/0.75 HP<br>[7] 0.75 kW/1.00 HP<br>[8] 1.10 kW/1.50 HP<br>[9] 1.50 kW/2.00 HP<br>[10] 2.20 kW/3.00 HP<br>[11] 3.00 kW/4.00 HP<br>[12] 3.70 kW/5.00 HP<br>[13] 4.00 kW/5.40 HP<br>[14] 5.50 kW/7.50 HP<br>[15] 7.50 kW/10.00 HP<br>[16] 11.00 kW/15.00 HP<br>[17] 15.00 kW/20.00 HP | [18] 18.50 kW/25.00 HP<br>[19] 22.00 kW/29.50 HP<br>[20] 30.00 kW/40.00 HP<br><b>1-22 Motor Voltage</b><br>50–999 V * 230–400 V<br><b>1-23 Motor Frequency</b><br>20–400 Hz *60 Hz<br><b>1-24 Motor Current</b><br>0.01–100.00 A *Motortype dep.<br><b>1-25 Motor Nominal Speed</b><br>100–9,999 rpm * Motortype dep.<br><b>1-29 Auto Tune</b><br>*[0] Off<br>[2] EnableAuto Tune<br><b>1-3* Adv. Motor Data</b><br><b>1-30 Stator Resistance (Rs)</b><br>[Ohm] * Dep. on motor data<br><b>1-33 Stator Leakage Reactance (X1)</b><br>[Ohm] * Dep. on motor data<br><b>1-35 Main Reactance (Xh)</b><br>[Ohm] * Dep. on motor data<br><b>1-5* Load Indep. Setting</b><br><b>1-50 Motor Magnetization at 0 Speed</b><br>0–300% *100%<br><b>1-52 Min Speed Norm. Magnet. [Hz]</b><br>0.0–10.0 Hz *0.0 Hz<br><b>1-55 U/f Characteristic - U</b><br>0–999.9 V<br><b>1-56 U/f Characteristic - F</b><br>0–400 Hz<br><b>1-6* Load Depen. Setting</b><br><b>1-60 Low Speed Load Compensation</b><br>0–199% Load CompensationLoad Compensation *100%<br><b>1-61 High Speed Load Compensation</b><br>0–199% *100%<br><b>1-62 Slip Compensation</b><br>–400–399% *100%<br><b>1-63 Slip Compensation Time Constant</b><br>0.05–5.00 s *0.10 s<br><b>1-7* Start Adjustments</b> | <b>1-71 Holding Time</b><br>0.0–10.0 s * 0.0 s<br><b>1-72 Start Function</b><br>[0] DC Hold/delay time<br>[1] DC brake/delay time<br>*[2] Coast/delay time<br><b>1-73 Start Mode</b><br>*[0] Disabled<br>[1] Enable - Catch Spinning Load<br><b>1-8* Stop Adjustments</b><br><b>1-80 Function at Stop</b><br>*[0] Coast<br>[1] DC hold<br><b>1-82 Min Speed for Funct. at Stop [Hz]</b><br>0.0–20.0 Hz *0.0 Hz<br><b>1-9* Motor Temperature</b><br><b>1-90 Motor Thermal Protection</b><br>*[0] No protection<br>[1] Thermistor warning<br>[2] Thermistor trip<br>[3] Electronic Overload warning<br>[4] Electronic Overload trip<br><b>1-93 Thermistor Resource</b><br>*[0] None<br>[1] Analog input 53<br>[6] Digital input 29<br><b>2-** Brakes</b><br><b>2-0* DC Brake</b><br><b>2-00 DC Hold Current</b><br>0–150% *50%<br><b>2-01 DC Brake Current</b><br>0–150% *50%<br><b>2-02 DC Braking Time</b><br>0.0–60.0 s *10.0 s<br><b>2-04 DC Brake Cut-in Speed</b><br>0.0–400.0 Hz * 0.0 Hz<br><b>2-1* Brake Energy Funct.</b><br><b>2-10 Brake Function</b><br>*[0] Off<br>[1] Resistor brake<br>[2] AC brake<br><b>2-11 Brake Resistor (ohm)</b><br>5–5,000 *5<br><b>2-16 AC Brake, Max current</b><br>0–150% *100% |

Table 5.1



## Parameter Lists

## AF-60 LP™ Micro Drive Programming Guide

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        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| <b>2-17 Over-voltage Control</b><br>*[0] Disabled<br>[1] Enabled (not at stop)<br>[2] Enabled<br><b>2-2* Mechanical Brake</b><br><b>2-20 Release Brake Current</b><br>0.00–100.0 A *0.00 A<br><b>2-22 Activate Brake Speed [Hz]</b><br>0.0–400.0 Hz * 0.0 Hz<br><b>3-** Reference / Ramps</b><br><b>3-0* Reference Limits</b><br><b>3-00 Reference Range</b><br>*[0] Min to Max<br>[1] -Max to+Max<br><b>3-02 Minimum Reference</b><br>-4,999–4,999 *0.000<br><b>3-03 Maximum Reference</b><br>-4,999–4,999 *50.00<br><b>3-1* References</b><br><b>3-10 Preset Reference</b><br>-100.0–100.0% *0.00%<br><b>3-11 Jog Speed [Hz]</b><br>0.0–400.0 Hz *5.0 Hz<br><b>3-12 Catch up/Slow-down Value</b><br>0.00–100.0% *0.00%<br><b>3-14 Preset Relative Reference</b><br>-100.0–100.0% *0.00%<br><b>3-15 Reference Resource 1</b><br>[0] No function<br>*[1] Analog Input 53<br>[2] Analog input 60<br>[8] Pulse input 33<br>[11] Local bus ref<br>[21] Keypad Potentiometer<br><b>3-16 Reference Resource 2</b><br>[0] No function<br>[1] Analog Input 53<br>*[2] Analog input 60<br>[8] Pulse input 33<br>*[11] Local bus ref<br>[21] Keypad Potentiometer<br><b>3-17 Reference Resource 3</b><br>[0] No function<br>[1] Analog Input 53<br>[2] Analog input 60<br>[8] Pulse input 33<br>*[11] Local bus ref<br>[21] Keypad Potentiometer | <b>3-18 Relative Scaling Ref. Resource</b><br>*[0] No function<br>[1] Analog Input 53<br>[2] Analog input 60<br>[8] Pulse input 33<br>[11] Local bus ref<br>[21] Keypad Potentiometer<br><b>3-4* Accel/Decel 1</b><br><b>3-40 Accel/Decel 1 Pattern</b><br>*[0] Linear<br>[2] S-Shape<br><b>3-41 Accel Time 1</b><br>0.05–3,600 s *3.00 s (10.00 s <sup>1)</sup> )<br><b>3-42 Decel Time 1</b><br>0.05–3,600 s *3.00 s (10.00 s <sup>1)</sup> )<br><b>3-5* Accel/Decel 2</b><br><b>3-50 Accel/Decel 2 Pattern</b><br>*[0] Linear<br>[2] S-Shape<br><b>3-51 Accel Time 2</b><br>0.05–3,600 s *3.00 s (10.00 s <sup>1)</sup> )<br><b>3-52 Decel Time 2</b><br>0.05–3,600 s *3.00 s (10.00 s <sup>1)</sup> )<br><b>3-8* Other Ramps</b><br><b>3-80 Jog Accel and Decel Time</b><br>0.05–3,600 s *3.00 s (10.00 s <sup>1)</sup> )<br><b>3-81 Quick Stop Decel Time</b><br>0.05–3,600 s *3.00 s (10.00 s <sup>1)</sup> )<br><b>4-** Limits/Warnings</b><br><b>4-1* Motor Limits</b><br><b>4-10 Reverse Lock</b><br>[0] Reverse Lock if Par. 1-00 is set to [3]<br>[1] Reverse<br>*[2] Both if Par. 1-00 is set to [0]<br><b>4-12 Motor Speed Low Limit [Hz]</b><br>0.0–400.0 Hz * 0.0 Hz<br><b>4-14 Motor Speed High Limit [Hz]</b><br>0.1–400.0 Hz *65.0 Hz<br><b>4-16 Torque Limit Motor Mode</b><br>0–400% *150%<br><b>4-17 Torque Limit Generator Mode</b><br>0–400% *100%<br><b>4-4* Adj. Warnings 2</b><br><b>4-40 Warning Frequency Low</b><br>0.00–Value of 4-41 Hz *0.0 Hz<br><b>4-41 Warning Frequency High</b><br>Value of 4-40–400.0 Hz *400.0 Hz | <b>4-5* Adj. Warnings</b><br><b>4-50 Warning Current Low</b><br>0.00–100.00 A *0.00 A<br><b>4-51 Warning Current High</b><br>0.00–100.00 A *100.00 A<br><b>4-54 Warning Reference Low</b><br>-4,999.000–Value of 4-55<br>*-4,999.000<br><b>4-55 Warning Reference High</b><br>Value of 4-54–4,999.000<br>*4,999.000<br><b>4-56 Warning Feedback Low</b><br>-4,999.000–Value of 4-57<br>*-4,999.000<br><b>4-57 Warning Feedback High</b><br>Value of 4-56–4,999.000<br>*4,999.000<br><b>4-58 Missing Motor Phase Function</b><br>[0] Off<br>*[1] On<br><b>4-6* Jump Frequencies</b><br><b>4-61 Jump Frequency From [Hz]</b><br>0.0–400.0 Hz * 0.0 Hz<br><b>4-63 Jump FrequencyTo [Hz]</b><br>0.0–400.0 Hz * 0.0 Hz<br><b>5-1* Digital Inputs</b><br><b>5-10 Terminal 18 Digital Input</b><br>[0] No function<br>[1] Reset<br>[2] Coast inverse<br>[3] Coast and reset inv.<br>[4] Quick stop inverse<br>[5] DC brake inv.<br>[6] Stop inv<br>*[8] Start<br>[9] Latched start<br>[10] Reversing<br>[11] Start reversing<br>[12] Enable start forward<br>[13] Enable start reverse<br>[14] Jog<br>[16–18] Preset ref bit 0-2<br>[19] Freeze reference<br>[20] Freeze output<br>[21] Speed up<br>[22] Slow<br>[23] Set-up select bit 0<br>[28] Catch up<br>[29] Slow-down<br>[34] Ramp bit 0 | [60] Counter A (up)<br>[61] Counter A (down)<br>[62] Reset counter A<br>[63] Counter B (up)<br>[64] Counter B (down)<br>[65] ResetCounter B<br><b>5-11 Terminal 19 Digital Input</b><br>See par. 5-10. *[10] Reversing<br><b>5-12 Terminal 27 Digital Input</b><br>See par. 5-10. * [1] Reset<br><b>5-13 Terminal 29 Digital Input</b><br>See par. 5-10. * [14] Jog<br><b>5-15 Terminal 33 Digital Input</b><br>See par. 5-10. * [16] Preset ref bit 0<br>[26] Precise Stop Inverse<br>[27] Start, Precise Stop<br>[32] Pulse Input<br><b>5-3* Digital Outputs 5-34 On Delay, Terminal 42 Digital Output</b><br>0.00–600.00 s *0.01 s<br><b>5-35 Off Delay, Terminal 42 Digital Output</b><br>0.00–600.00 s *0.01 s<br><b>5-4* Relays</b><br><b>5-40 Function Relay</b><br>*[0] No operation<br>[1] Control ready<br>[2] Drive ready<br>[3] Drive ready, Remote<br>[4] Enable/No warning<br>[5] Drive running<br>[6] Running/No warning<br>[7] Run in range/No warning<br>[8] Run on ref/No warning<br>[9] Alarm<br>[10] Alarm or warning<br>[12] Out of current range<br>[13] Below current, low<br>[14] Above current, high<br>[16] Below frequency, low<br>[17] Above frequency, high<br>[19] Below feedback, low<br>[20] Above feedback, high<br>[21] Thermal warning<br>[22] Ready, No thermal warning<br>[23] Remote ready, No thermal warning<br>[24] Ready, Voltage ok<br>[25] Reverse |
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<sup>1)</sup> M4 and M5 only

Table 5.2



## Parameter Lists

## AF-60 LP™ Micro Drive Programming Guide

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| <p>[26] Bus ok</p> <p>[28] Brake, NoWarn</p> <p>[29] Brake ready/NoFault</p> <p>[30] BrakeFault (IGBT)</p> <p>[32] Mech.brake control</p> <p>[36] Control word bit 11</p> <p>[41] Below reference, low</p> <p>[42] Above reference, high</p> <p>[51] Local ref. active</p> <p>[52] Remote ref. active</p> <p>[53] No alarm</p> <p>[54] Start cmd active</p> <p>[55] Running reverse</p> <p>[56] Drive in hand mode</p> <p>[57] Drive in auto mode</p> <p>[60-63] Comparator 0-3</p> <p>[70-73] Logic rule 0-3</p> <p>[81] Logic Controller digital output B</p> <p><b>5-41 On Delay, Relay</b><br/>0.00–600.00 s *0.01 s</p> <p><b>5-42 Off Delay, Relay</b><br/>0.00–600.00 s *0.01 s</p> <p><b>5-5* Pulse Input</b></p> <p><b>5-55 Terminal 33 Low Frequency</b><br/>20–4,999 Hz * 20 Hz</p> <p><b>5-56 Terminal 33 High Frequency</b><br/>21–5,000 Hz *5,000 Hz</p> <p><b>5-57 Term. 33 Low Ref./Feedb. Value</b><br/>–4,999–4,999 *0.000</p> <p><b>5-58 Term. 33 High Ref./Feedb. Value</b><br/>–4,999–4,999 *50.000</p> <p><b>6-** Analog In/Out</b></p> <p><b>6-0* Analog I/O Mode</b></p> <p><b>6-00 Live Zero Timeout Time</b><br/>1–99 s *10 s</p> <p><b>6-01 Live Zero TimeoutFunction</b><br/>*[0] Off<br/>[1] Freeze output<br/>[2] Stop<br/>[3] Jogging<br/>[4] Max speed<br/>[5] Stop and trip</p> <p><b>6-1* Analog Input 1</b></p> <p><b>6-10 Terminal 53 Low Voltage</b><br/>0.00–9.99 V *0.07 V</p> <p><b>6-11 Terminal 53 High Voltage</b><br/>0.01–10.00 V *10.00 V</p> <p><b>6-12 Terminal 53 Low Current</b><br/>0.00–19.99 mA *0.14 mA</p> <p><b>6-13 Terminal 53 High Current</b><br/>0.01–20.00 mA *20.00 mA</p> | <p><b>6-14 Term. 53 Low Ref./Feedb. Value</b><br/>–4,999–4,999 *0.000</p> <p><b>6-15 Term. 53 High Ref./Feedb. Value</b><br/>–4,999–4,999 *50.000</p> <p><b>6-16 Terminal 53 Filter Time Constant</b><br/>0.01–10.00 s *0.01 s</p> <p><b>6-19 Terminal 53 mode</b><br/>*[0] Voltage mode<br/>[1] Current mode</p> <p><b>6-2* Analog Input 2</b></p> <p><b>6-22 Terminal 60 Low Current</b><br/>0.00–19.99 mA *0.14 mA</p> <p><b>6-23 Terminal 60 High Current</b><br/>0.01–20.00 mA *20.00 mA</p> <p><b>6-24 Term. 60 Low Ref./Feedb. Value</b><br/>–4,999–4,999 *0.000</p> <p><b>6-25 Term. 60 High Ref./Feedb. Value</b><br/>–4,999–4,999 *50.00</p> <p><b>6-26 Terminal 60 Filter Time Constant</b><br/>0.01–10.00 s *0.01 s</p> <p><b>6-8* Keypad potentiometer</b></p> <p><b>6-80 Keypad Keypad Potmeter Enable</b><br/>[0] Disabled<br/>[1] * Enable</p> <p><b>6-81 keypad potm. Low Reference</b><br/>–4,999–4,999 *0.000</p> <p><b>6-82 Keypad potm. High Reference</b><br/>–4,999–4,999 *50.00</p> <p><b>6-9* Analog Output xx</b></p> <p><b>6-90 Terminal 42 Mode</b><br/>*[0] 0-20 mA<br/>[1] 4-20 mA<br/>[2] Digital Output</p> <p><b>6-91 Terminal 42 Analog Output</b><br/>*[0] No operation<br/>[10] Output Frequency<br/>[11] Reference<br/>[12] Feedback<br/>[13] Motor Current<br/>[16] Power<br/>[20] Bus Reference</p> <p><b>6-92 Terminal 42 Digital Output</b><br/>See par. 5-40<br/>*[0] No Operation<br/>[80] Logic Controller Digital Output A</p> | <p><b>6-93 Terminal 42 Output Min Scale</b><br/>0.00–200.0%<br/>*0.00%</p> <p><b>6-94 Terminal 42 Output Max Scale</b><br/>0.00–200.0% *100.0%</p> <p><b>7-** Controllers</b></p> <p><b>7-2* Process Ctrl. Feedb</b></p> <p><b>7-20 Process CL Feedback 1 Resource</b><br/>*[0] NoFunction<br/>[1] Analog Input 53<br/>[2] Analog input 60<br/>[8] PulseInput33<br/>[11] LocalBusRef</p> <p><b>7-3* Process PI Ctrl. 7-30 Process PI Normal/Inverse Ctrl</b><br/>*[0] Normal<br/>[1] Inverse</p> <p><b>7-31 Process PI Anti Windup</b><br/>[0] Disable<br/>*[1] Enable</p> <p><b>7-32 Process PI Start Speed</b><br/>0.0–200.0 Hz *0.0 Hz</p> <p><b>7-33 Process PI Proportional Gain</b><br/>0.00–10.00 *0.01</p> <p><b>7-34 Process PI Integral Time</b><br/>0.10–9999 s *9999 s</p> <p><b>7-38 Process PI Feed Forward Factor</b><br/>0–400% *0%</p> <p><b>7-39 On Reference Bandwidth</b><br/>0–200% *5%</p> <p><b>8-** Comm. and Options</b></p> <p><b>8-0* General Settings</b></p> <p><b>8-01 Control Site</b><br/>*[0] Digital and ControlWord<br/>[1] Digital only<br/>[2] ControlWord only</p> <p><b>8-02 Control Word Source</b><br/>[0] None<br/>*[1] GE Drive RS-485</p> <p><b>8-03 Control Word Timeout Time</b><br/>0.1–6,500 s *1.0 s</p> <p><b>8-04 Control Word Timeout Function</b><br/>*[0] Off<br/>[1] Freeze Output<br/>[2] Stop<br/>[3] Jogging<br/>[4] Max. Speed<br/>[5] Stop and trip</p> | <p><b>8-06 Reset Control Word Timeout</b><br/>*[0] No Function<br/>[1] Do reset</p> <p><b>8-3* GE Drive Port Settings</b></p> <p><b>8-30 Protocol</b><br/>*[0] GE Drive<br/>[2] Modbus RTU</p> <p><b>8-31 Address</b><br/>1–247 *1</p> <p><b>8-32 GE Drive Port Baud Rate</b><br/>[0] 2,400 Baud<br/>[1] 4,800 Baud<br/>*[2] 9,600 Baud For choosing GE Drive in 8-30<br/>* [3] 19,200 Baud For choosing GE Drive in 8-30<br/>*[4] 38,400 Baud</p> <p><b>8-33 GE Drive Port Parity</b><br/>*[0] Even Parity, 1 Stop Bit<br/>[1] Odd Parity, 1 Stop Bit<br/>[2] No Parity, 1 Stop Bit<br/>[3] No Parity, 2 Stop Bits</p> <p><b>8-35 Minimum Response Delay</b><br/>0.001–0.5 *0.010 s</p> <p><b>8-36 Max Response Delay</b><br/>0.100–10.00 s *5.000 s</p> <p><b>8-4* Drive MC protocol set</b></p> <p><b>8-43 Drive Port PCD Read Configuration</b><br/>*[0] None Expressionlimit<br/>[1] [1500] Operation Hours [8]<br/>[1605] Main Actual Value [%]<br/>[9] [1609] Custom Readout<br/>[10] [1610] Power [kW]<br/>[11] [1611] Power [hp]<br/>[12] [1612] Motor Voltage<br/>[13] [1613] Frequency<br/>[14] [1614] Motor Current<br/>[15] [1615] Frequency [%]<br/>[16] [1618] Motor Thermal<br/>[17] [1630] DC Link Voltage<br/>[18] [1634] Heatsink Temp.<br/>[19] [1635] Inverter Thermal<br/>[20] [1638] Logic Controller State<br/>[21] [1650] External Reference<br/>[22] [1651] Pulse Reference<br/>[23] [1652] Feedback [Unit]<br/>[24] [1660] Digital Input<br/>18,19,27,33<br/>[25] [1661] Digital Input 29<br/>[26] [1662] Analog Input 53(V)<br/>[27] [1663] Analog Input 53 (mA)<br/>[28] [1664] Analog Input 60</p> |
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Table 5.3



## Parameter Lists

## AF-60 LP™ Micro Drive Programming Guide

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| <p>[29] [1665] Analog Output 42 [mA]<br/>[30] [1668] Freq. Input 33 [Hz]<br/>[31] [1671] Relay Output [bin]<br/>[32] [1672] Counter A<br/>[33] [1673] Counter[34] [1690] Alarm Word<br/>[34] [1690] Alarm Word<br/>[35] [1692] Warning Word<br/>[36] [1694] Ext. Status Word</p> <p><b>8-5* Digital/Bus</b><br/><b>8-50 Coasting Select</b><br/>[0] DigitalInput<br/>[1] Bus<br/>[2] LogicAnd<br/>*[3] LogicOr</p> <p><b>8-51 Quick Stop Select</b><br/>See par. 8-50 * [3] LogicOr</p> <p><b>8-52 DC Brake Select</b><br/>See par. 8-50 * [3] LogicOr</p> <p><b>8-53 Start Select</b><br/>See par. 8-50 * [3] LogicOr</p> <p><b>8-54 Reversing Select</b><br/>See par. 8-50 * [3] LogicOr</p> <p><b>8-55 Set-up Select</b><br/>See par. 8-50 * [3] LogicOr</p> <p><b>8-56 Preset Reference Select</b><br/>See par. 8-50 * [3] LogicOr</p> <p><b>8-8X Bus communication</b><br/><b>Diagnostics</b><br/><b>8-80 Bus Message Count</b><br/>0-0 N/A *0 N/A<br/><b>8-81 Bus Error Count</b><br/>0-0 N/A *0 N/A<br/><b>8-82 Slave Messages Rcvd</b><br/>0-0 N/A *0 N/A<br/><b>8-83 Slave Error Count</b><br/>0-0 N/A *0 N/A<br/><b>8-9* Bus Jog / Feedback</b><br/><b>8-94 Bus feedback 1</b><br/>0x8000-0x7FFF *0<br/><b>13-** Controller Logic</b><br/><b>13-0* Logic Controller Settings</b><br/><b>13-00 Logic Controller Mode</b><br/>*[0] Off<br/>[1] On<br/><b>13-01 Start Event</b><br/>[0] False<br/>[1] True<br/>[2] Running<br/>[3] InRange<br/>[4] OnReference<br/>[7] OutOfCurrentRange<br/>[8] BelowLow<br/>[9] AboveHigh<br/>[16] ThermalWarning</p> | <p>[17] MainOutOfRange<br/>[18] Reversing<br/>[19] Warning<br/>[20] Alarm_Trip<br/>[21] Alarm_TripLock<br/>[22-25] Comparator 0-3<br/>[26-29] LogicRule0-3<br/>[33] DigitalInput_18<br/>[34] DigitalInput_19<br/>[35] DigitalInput_27<br/>[36] DigitalInput_29<br/>[38] DigitalInput_33<br/>*[39] StartCommand<br/>[40] DriveStopped</p> <p><b>13-02 Stop Event</b><br/>See par. 13-01 * [40] DriveS-topped</p> <p><b>13-03 Reset Logic Controller</b><br/>*[0] Do not reset<br/>[1] Reset Logic Controller</p> <p><b>13-1* Comparators</b><br/><b>13-10 Comparator Operand</b><br/>*[0] Disabled<br/>[1] Reference<br/>[2] Feedback<br/>[3] MotorSpeed<br/>[4] MotorCurrent<br/>[6] MotorPower<br/>[7] MotorVoltage<br/>[8] DCLinkVoltage<br/>[12] AnalogInput53<br/>[13] AnalogInput60<br/>[18] PulseInput33<br/>[20] AlarmNumber<br/>[30] CounterA<br/>[31] CounterB</p> <p><b>13-11 Comparator Operator</b><br/>[0] Less Than<br/>*[1] Approximately equals<br/>[2] Greater Than</p> <p><b>13-12 Comparator Value</b><br/>-9999-9999 *0.0</p> <p><b>13-2* Timers</b><br/><b>13-20 LC Controller Timer</b><br/>0.0-3,600 s *0.0 s</p> <p><b>13-4* Logic Rules</b><br/><b>13-40 Logic Rule Boolean 1</b><br/>See par. 13-01 * [0] False<br/>[30]-[32] LC Timeout 0-2</p> <p><b>13-41 Logic Rule Operator 1</b><br/>*[0] Disabled<br/>[1] And<br/>[2] Or<br/>[3] And not<br/>[4] Or not<br/>[5] Not and</p> | <p>[6] Not or<br/>[7] Not and not<br/>[8] Not or not</p> <p><b>13-42 Logic Rule Boolean 2</b><br/>See par. 13-40</p> <p><b>13-43 Logic Rule Operator 2</b><br/>See par. 13-41 * [0] Disabled</p> <p><b>13-44 Logic Rule Boolean 3</b><br/>See par. 13-40</p> <p><b>13-5* States</b><br/><b>13-51 LC Controller Event</b><br/>See par. 13-40</p> <p><b>13-52 LC Controller Action</b><br/>*[0] Disabled<br/>[1] NoAction<br/>[2] SelectSetup1<br/>[3] SelectSetup2<br/>[10-17] SelectPresetRef0-7<br/>[18] Select Accel/Decel 1.<br/>[19] Select Accel/Decel 2.<br/>[22] Run<br/>[23] RunReverse<br/>[24] Stop<br/>[25] Qstop<br/>[26] DCstop<br/>[27] Coast<br/>[28] FreezeOutput<br/>[29] StartTimer0<br/>[30] StartTimer1<br/>[31] StartTimer2<br/>et Digital Output B High<br/>[32] Set Digital Output A Low<br/>[33] Set Digital Output B Low<br/>[38] Set Digital Output A High<br/>[39] Set Digital Output B High<br/>[60] ResetCounterA<br/>[61] ResetCounterB</p> <p><b>14-** Special Functions</b><br/><b>14-0* Carrier Frequency</b><br/><b>14-01 Motor Noise (Carrier Frequency)</b><br/>[0] 2 kHz<br/>*[1] 4 kHz<br/>[2] 8 kHz<br/>[4] 16 kHz not available for M5</p> <p><b>14-03 Overmodulation</b><br/>[0] Off<br/>*[1] On</p> <p><b>14-1* Line power monitoring</b><br/><b>14-12 Function at line imbalance</b><br/>*[0] Trip<br/>[1] Warning<br/>[2] Disabled</p> <p><b>14-2* Trip Reset</b></p> | <p><b>14-20 Reset Mode</b><br/>*[0] Manual reset<br/>[1-9] AutoReset 1-9<br/>[10] AutoReset 10<br/>[11] AutoReset 15<br/>[12] AutoReset 20<br/>[13] Infinite auto reset<br/>[14] Reset at power-up</p> <p><b>14-21 Automatic Restart Time</b><br/>0-600 s * 10 s</p> <p><b>14-22 Restore Factory Settings</b><br/>*[0] Normal Operation<br/>[2] Restore Factory Settings</p> <p><b>14-26 Action At Drive Fault</b><br/>*[0] Trip<br/>[1] Warning</p> <p><b>14-4* Energy Savings</b><br/><b>14-41 Energy Savings Minimum Magnetization</b><br/>40-75% *66%</p> <p><b>15-** Drive Information 15-0*</b><br/><b>Operating Data</b><br/><b>15-00 Operating Days</b><br/><b>15-01 Running Hours</b><br/><b>15-02 kWh Counter</b><br/><b>15-03 Power-ups</b><br/><b>15-04 Over Temps</b><br/><b>15-05 Over-volts</b><br/><b>15-06 Reset kWh Counter</b><br/>*[0] Do not reset<br/>[1] Reset counter<br/><b>15-07 Reset Running Hours Counter</b><br/>*[0] Do not reset<br/>[1] Reset counter</p> <p><b>15-3* Fault Log</b><br/><b>15-30 Fault Log: Error Code 15-4*</b><br/><b>Drive Identification</b><br/><b>15-40 GE Drive Type</b><br/><b>15-41 Power Section</b><br/><b>15-42 Voltage</b><br/><b>15-43 Software Version</b><br/><b>15-46 Adjustable Frequency Drive Order. Number</b><br/><b>15-48 LCP ID #</b><br/><b>15-51 Adj Freq Drive Serial #</b></p> <p><b>16-** Data Readouts</b><br/><b>16-0* General Status</b><br/><b>16-00 Control Word</b><br/>0-0xFFFF<br/><b>16-01 Reference [Unit]</b><br/>-4,999-4,999<br/><b>16-02 Reference %</b><br/>-200.0-200.0%</p> |
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## Parameter Lists

## AF-60 LP™ Micro Drive Programming Guide

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| <b>16-03 Status Word</b><br>0–0xFFFF<br><b>16-05 Main Actual Value [%]</b><br>–200.0–200.0%<br><b>16-09 Custom Readout</b><br>Dep. on par. 0-31, 0-32 and 4-14<br><b>16-1* Motor Status</b><br><b>16-10 Power [kW]</b><br><b>16-11 Power [hp]</b><br><b>16-12 Motor Voltage [V]</b><br><b>16-13 Frequency [Hz]</b><br><b>16-14 Motor Current [A]</b><br><b>16-15 Frequency [%]</b><br><b>16-18 Motor Thermal [%]</b><br><b>16-3* Drive Status</b><br><b>16-30 DC Link Voltage</b> | <b>16-34 Heatsink Temp.</b><br><b>16-35 Inverter Thermal</b><br><b>16-36 Inv.Nom. Current</b><br><b>16-37 Inv. Max. Current</b><br><b>16-38 Logic Controller State</b><br><b>16-5* Ref. / Feedb.</b><br><b>16-50 External Reference</b><br><b>16-51 Pulse Reference</b><br><b>16-52 Feedback [Unit]</b><br><b>16-6* Inputs/Outputs</b><br><b>16-60 Digital Input 18,19,27,33</b><br>0–1111<br><b>16-61 Digital Input 29</b><br>0–1 | <b>16-62 Analog Input 53 (volt)</b><br><b>16-63 Analog Input 53 (current)</b><br><b>16-64 Analog Input 60</b><br><b>16-65 Analog Output 42 [mA]</b><br><b>16-68 Pulse Input [Hz]</b> <b>16-71 Relay</b><br><b>Output [bin]</b><br><b>16-72 Counter A</b><br><b>16-73 Counter B</b><br><b>16-8* GE Drive Port</b><br><b>16-86 GE Drive Port REF 1</b><br>0x8000–0x7FFFF<br><b>16-9* Diagnosis Readouts</b> | <b>16-90 Alarm Word</b><br>0–0xFFFFFFFF<br><b>16-92 Warning Word</b><br>0–0xFFFFFFFF<br><b>16-94 Ext. Status Word</b><br>0–0xFFFFFFFF<br><b>18-** Extended Motor Data</b><br><b>18-8* Motor Resistors</b><br><b>18-80 Stator Resistance (High resolution)</b><br>0.000–99.990 ohm *0.000 ohm<br><b>18-81 Stator Leakage Reactance (High resolution)</b><br>0.000–99.990 ohm *0.000 ohm |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Table 5.5

## 5.1.1 Conversion Index

The various attributes of each parameter are displayed in the section *Factory Settings*. Parameter values are transferred as whole numbers only. Conversion factors are therefore used to transfer decimals according to *Table 5.6*.

Example:

| Conversion index | Conversion factor |
|------------------|-------------------|
| 2                | 10                |
| 1                | 100               |
| 0                | 1                 |
| -1               | 0.1               |
| -2               | 0.01              |
| -3               | 0.001             |
| -4               | 0.0001            |
| -5               | 0.00001           |

Table 5.6 Conversion Table

## 5.1.2 Change 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.

## 5.1.3 2-set-up

“All set-up”: The parameter can be set individually in each of the two set-ups, i.e., one single parameter can have two different data values.

“1 set-up”: Data value will be the same in both set-ups.



## Parameter Lists

## AF-60 LP™ Micro Drive Programming Guide

### 5.1.4 Type

| 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 | VisibleString |

Table 5.7

### 5.1.5 0-\*\* Operation/Display

| Parameter Number | Parameter Description              | Default Value              | 2 set-up    | Change During Operation | Conversion Index | Type   |
|------------------|------------------------------------|----------------------------|-------------|-------------------------|------------------|--------|
| 0 03             | Regional Settings                  | [1] US                     | 1 set-up    | FALSE                   | -                | UInt8  |
| 0-04             | Operating State at Power-up (Hand) | [1] Forced stop<br>ref=old | All set-ups | TRUE                    | -                | UInt8  |
| 0-10             | Active Set-up                      | [1] Set-up 1               | 1 set-up    | TRUE                    | -                | UInt8  |
| 0-11             | Edit Set-up                        | [1] Set-up 1               | 1 set-up    | TRUE                    | -                | UInt8  |
| 0-12             | Link Set-ups                       | [20] Linked                | All set-ups | FALSE                   | -                | UInt8  |
| 0-40             | [Hand ] Key on keypad              | [1] Enabled                | All set-ups | TRUE                    | -                | UInt8  |
| 0-41             | [Off / Reset] Key on keypad        | [1] Enable All             | All set-ups | TRUE                    | -                | UInt8  |
| 0-42             | [Auto ] Key on keypad              | [1] Enabled                | All set-ups | TRUE                    | -                | UInt8  |
| 0-50             | Keypad Copy                        | [0] No copy                | 1 set-up    | FALSE                   | -                | UInt8  |
| 0-51             | Set-up Copy                        | [0] No copy                | 1 set-up    | FALSE                   | -                | UInt8  |
| 0-60             | Main Menu Password                 | 0                          | 1 set-up    | TRUE                    | 0                | UInt16 |

Table 5.8



## 5.1.6 1-\*\* Load/Motor

| Parameter Number | Parameter Description                | Default Value           | 2 set-up    | Change During Operation | Conversion Index | Type   |
|------------------|--------------------------------------|-------------------------|-------------|-------------------------|------------------|--------|
| 1-00             | Configuration Mode                   | [0] Speed open-loop     | All set-ups | TRUE                    | -                | Uint8  |
| 1-01             | Motor Control Principle              | [1] Adv. Vector Control | All set-ups | FALSE                   | -                | Uint8  |
| 1-03             | Torque Characteristics               | [0] Constant torque     | All set-ups | TRUE                    | -                | Uint8  |
| 1-05             | Hand Mode Configuration              | [2] As mode par 1-00    | All set-ups | TRUE                    | -                | Uint8  |
| 1-20             | Motor Power                          |                         | All set-ups | FALSE                   | -                | Uint8  |
| 1-22             | Motor Voltage                        |                         | All set-ups | FALSE                   | 0                | Uint16 |
| 1-23             | Motor Frequency                      |                         | All set-ups | FALSE                   | 0                | Uint16 |
| 1-24             | Motor Current                        |                         | All set-ups | FALSE                   | -2               | Uint16 |
| 1-25             | Motor Nominal Speed                  |                         | All set-ups | FALSE                   | 0                | Uint16 |
| 1-29             | Auto Tune                            | [0] Off                 | 1 set-up    | FALSE                   | -                | Uint8  |
| 1-30             | Stator Resistance (Rs)               |                         | All set-ups | FALSE                   | -2               | Uint16 |
| 1-33             | Stator Leakage Reactance (X1)        |                         | All set-ups | FALSE                   | -2               | Uint32 |
| 1-35             | Main Reactance (Xh)                  |                         | All set-ups | FALSE                   | -2               | Uint32 |
| 1-50             | Motor Magnetization at Zero Speed    | 100%                    | All set-ups | TRUE                    | 0                | Uint16 |
| 1-52             | Min Speed Normal Magnetizing [Hz]    | 0 Hz                    | All set-ups | TRUE                    | -1               | Uint16 |
| 1-55             | U/f Characteristic - U               |                         | All set-ups | TRUE                    | 0                | Uint16 |
| 1-56             | U/f Characteristic - F               |                         | All set-ups | TRUE                    | 0                | Uint16 |
| 1-60             | Low Speed Load Compensation          | 100%                    | All set-ups | TRUE                    | 0                | Uint16 |
| 1-61             | High Speed Load Compensation         | 100%                    | All set-ups | TRUE                    | 0                | Uint16 |
| 1-62             | Slip Compensation                    | 100%                    | All set-ups | TRUE                    | 0                | Int16  |
| 1-63             | Slip Compensation Time Constant      | 0.1 s                   | All set-ups | TRUE                    | -2               | Uint16 |
| 1-71             | Holding Time                         | 0 s                     | All set-ups | TRUE                    | -1               | Uint8  |
| 1-72             | Start Function                       | [2] Coast/delay time    | All set-ups | TRUE                    | -                | Uint8  |
| 1-73             | Start Mode                           | [0] Disabled            | All set-ups | FALSE                   | -                | Uint8  |
| 1-80             | Function at Stop                     | [0] Coast               | All set-ups | TRUE                    | -                | Uint8  |
| 1-82             | Min. Speed for Function at Stop [Hz] | 0 Hz                    | All set-ups | TRUE                    | -1               | Uint16 |
| 1-90             | Motor Thermal Protection             | [0] No protection       | All set-ups | TRUE                    | -                | Uint8  |
| 1-93             | Thermistor Resource                  | [0] None                | All set-ups | FALSE                   | -                | Uint8  |

Table 5.9



## Parameter Lists

## AF-60 LP™ Micro Drive Programming Guide

### 5.1.7 2-\*\* Brakes

| Parameter Number | Parameter Description     | Default Value | 2 set-up    | Change During Operation | Conversion Index | Type   |
|------------------|---------------------------|---------------|-------------|-------------------------|------------------|--------|
| 2-00             | DC Hold Current           | 50%           | All set-ups | TRUE                    | 0                | Uint16 |
| 2-01             | DC Brake Current          | 50%           | All set-ups | TRUE                    | 0                | Uint16 |
| 2-02             | DC Braking Time           | 10 s          | All set-ups | TRUE                    | -1               | Uint16 |
| 2-04             | DC Brake Cut-in Speed     | 0 Hz          | All set-ups | TRUE                    | -1               | Uint16 |
| 2-10             | Brake Function            | [0] Off       | All set-ups | TRUE                    | -                | Uint8  |
| 2-11             | Brake Resistor (ohm)      |               | All set-ups | TRUE                    | 0                | Uint16 |
| 2-16             | AC Brake, Max current     | 100%          | All set-ups | TRUE                    | 0                | Uint16 |
| 2-17             | Overvoltage Control       | [0] Disabled  | All set-ups | TRUE                    | -                | Uint8  |
| 2-20             | Release Brake Current     | 0 A           | All set-ups | TRUE                    | -2               | Uint32 |
| 2-22             | Activate Brake Speed [Hz] | 0 Hz          | All set-ups | TRUE                    | -1               | Uint16 |

Table 5.10

### 5.1.8 3-\*\* Reference/Ramps

| Parameter Number | Parameter Description               | Default Value            | 2 set-up    | Change During Operation | Conversion Index | Type   |
|------------------|-------------------------------------|--------------------------|-------------|-------------------------|------------------|--------|
| 3-00             | Reference Range                     | [0] Min - Max            | All set-ups | TRUE                    | -                | Uint8  |
| 3-02             | Minimum Reference                   | 0                        | All set-ups | TRUE                    | -3               | Int32  |
| 3-03             | Maximum Reference                   | 50                       | All set-ups | TRUE                    | -3               | Int32  |
| 3-10             | Preset Reference                    | 0%                       | All set-ups | TRUE                    | -2               | Int16  |
| 3-11             | Jog Speed [Hz]                      | 5 Hz                     | All set-ups | TRUE                    | -1               | Uint16 |
| 3-12             | Catch up/slow-down value            | 0%                       | All set-ups | TRUE                    | -2               | Int16  |
| 3-14             | Preset Relative Reference           | 0%                       | All set-ups | TRUE                    | -2               | Int16  |
| 3-15             | Reference Resource 1                | [1] Analog in 53         | All set-ups | TRUE                    | -                | Uint8  |
| 3-16             | Reference Resource 2                | [2] Analog in 60         | All set-ups | TRUE                    | -                | Uint8  |
| 3-17             | Reference Resource 3                | [11] Local bus reference | All set-ups | TRUE                    | -                | Uint8  |
| 3-18             | Relative Scaling Reference Resource | [0] No function          | All set-ups | TRUE                    | -                | Uint8  |
| 3-40             | Accel/Decel 1 Pattern               | [0] Linear               | All set-ups | TRUE                    | -                | Uint8  |
| 3-41             | Accel Time 1                        | 3 s                      | All set-ups | TRUE                    | -2               | Uint32 |
| 3-42             | Decel Time 1                        | 3 s                      | All set-ups | TRUE                    | -2               | Uint32 |
| 3-50             | Accel/Decel 2 Pattern               | [0] Linear               | All set-ups | TRUE                    | -                | Uint8  |
| 3-51             | Accel Time 2                        | 3 s                      | All set-ups | TRUE                    | -2               | Uint32 |
| 3-52             | Decel Time 2                        | 3 s                      | All set-ups | TRUE                    | -2               | Uint32 |
| 3-80             | Jog Accel/Decel Time                | 3 s                      | All set-ups | TRUE                    | -2               | Uint32 |
| 3-81             | Quick Stop Ramp Time                | 3 s                      | 1 set-up    | TRUE                    | -2               | Uint32 |

Table 5.11



## 5.1.9 4-\*\* Limits/Warnings

| Parameter Number | Parameter Description        | Default Value       | 2 set-up    | Change During Operation | Conversion Index | Type   |
|------------------|------------------------------|---------------------|-------------|-------------------------|------------------|--------|
| 4-10             | Reverse Lock                 | [2] Both directions | All set-ups | FALSE                   | -                | Uint8  |
| 4-12             | Motor Speed Low Limit [Hz]   | 0 Hz                | All set-ups | FALSE                   | -1               | Uint16 |
| 4-14             | Motor Speed High Limit [Hz]  | 65 Hz               | All set-ups | FALSE                   | -1               | Uint16 |
| 4-16             | Torque Limit Motor Mode      | 150%                | All set-ups | TRUE                    | 0                | Uint16 |
| 4-17             | Torque Limit Generator Mode  | 100%                | All set-ups | TRUE                    | 0                | Uint16 |
| 4-50             | Warning Current Low          | 0 A                 | All set-ups | TRUE                    | -2               | Uint32 |
| 4-51             | Warning Current High         | 26 A                | All set-ups | TRUE                    | -2               | Uint32 |
| 4-58             | Missing Motor Phase Function | [1] On              | All set-ups | FALSE                   | -                | Uint8  |
| 4-61             | Jump Frequency From [Hz]     | 0 Hz                | All set-ups | TRUE                    | -1               | Uint16 |
| 4-63             | Jump Frequency To [Hz]       | 0 Hz                | All set-ups | TRUE                    | -1               | Uint16 |

Table 5.12

## 5.1.10 5-\*\* Digital In/Out

| Parameter Number | Parameter Description              | Default Value         | 2 set-up    | Change During Operation | Conversion Index | Type   |
|------------------|------------------------------------|-----------------------|-------------|-------------------------|------------------|--------|
| 5-10             | Terminal 18 Digital Input          | [8] Start             | All set-ups | TRUE                    | -                | Uint8  |
| 5-11             | Terminal 19 Digital Input          | [10] Reversing        | All set-ups | TRUE                    | -                | Uint8  |
| 5-12             | Terminal 27 Digital Input          | [1] Reset             | All set-ups | TRUE                    | -                | Uint8  |
| 5-13             | Terminal 29 Digital Input          | [14] Jog              | All set-ups | TRUE                    | -                | Uint8  |
| 5-15             | Terminal 33 Digital Input          | [16] Preset ref bit 0 | All set-ups | TRUE                    | -                | Uint8  |
| 5-40             | Function Relay                     | [0] No operation      | All set-ups | TRUE                    | -                | Uint8  |
| 5-55             | Terminal 33 Low Frequency          | 20 Hz                 | All set-ups | TRUE                    | 0                | Uint16 |
| 5-56             | Terminal 33 High Frequency         | 5000 Hz               | All set-ups | TRUE                    | 0                | Uint16 |
| 5-57             | Terminal 33 Low Ref./Feedb. Value  | 0                     | All set-ups | TRUE                    | -3               | Int32  |
| 5-58             | Terminal 33 High Ref./Feedb. Value | 50                    | All set-ups | TRUE                    | -3               | Int32  |

Table 5.13



## Parameter Lists

## AF-60 LP™ Micro Drive Programming Guide

### 5.1.11 6-\*\* Analog In/Out

| Parameter Number | Parameter Description              | Default Value    | 2 set-up    | Change During Operation | Conversion Index | Type   |
|------------------|------------------------------------|------------------|-------------|-------------------------|------------------|--------|
| 6-00             | Live Zero Timeout Time             | 10 s             | All set-ups | TRUE                    | 0                | UInt8  |
| 6-01             | Live Zero TimeoutFunction          | [0] Off          | All set-ups | TRUE                    | -                | UInt8  |
| 6-10             | Terminal 53 Low Voltage            | 0.07 V           | All set-ups | TRUE                    | -2               | UInt16 |
| 6-11             | Terminal 53 High Voltage           | 10 V             | All set-ups | TRUE                    | -2               | UInt16 |
| 6-12             | Terminal 53 Low Current            | 0.14 mA          | All set-ups | TRUE                    | -2               | UInt16 |
| 6-13             | Terminal 53 High Current           | 20 mA            | All set-ups | TRUE                    | -2               | UInt16 |
| 6-14             | Terminal 53 Low Ref./Feedb. Value  | 0                | All set-ups | TRUE                    | -3               | Int32  |
| 6-15             | Terminal 53 High Ref./Feedb. Value | 50               | All set-ups | TRUE                    | -3               | Int32  |
| 6-16             | Terminal 53 Filter Time Constant   | 0.01 s           | All set-ups | TRUE                    | -2               | UInt16 |
| 6-19             | Terminal 53 mode                   | [0] Voltage mode | 1 set-up    | TRUE                    | -                | UInt8  |
| 6-22             | Terminal 60 Low Current            | 0.14 mA          | All set-ups | TRUE                    | -2               | UInt16 |
| 6-23             | Terminal 60 High Current           | 20 mA            | All set-ups | TRUE                    | -2               | UInt16 |
| 6-24             | Terminal 60 Low Ref./Feedb. Value  | 0                | All set-ups | TRUE                    | -3               | Int32  |
| 6-25             | Terminal 60 High Ref./Feedb. Value | 50               | All set-ups | TRUE                    | -3               | Int32  |
| 6-26             | Terminal 60 Filter Time Constant   | 0.01 s           | All set-ups | TRUE                    | -2               | UInt16 |
| 6-81             | Keypad potentiometer Low Ref.      | 0                | All set-ups | TRUE                    | -3               | Int32  |
| 6-82             | Keypad potentiometer High Ref.     | 50               | All set-ups | TRUE                    | -3               | Int32  |
| 6-90             | Terminal 42 Mode                   | [0] 0–20 mA      | All set-ups | TRUE                    | -                | UInt8  |
| 6-91             | Terminal 42 Analog Output          | [0] No operation | All set-ups | TRUE                    | -                | UInt8  |
| 6-92             | Terminal 42 Digital Output         | [0] No operation | All set-ups | TRUE                    | -                | UInt8  |
| 6-93             | Terminal 42 Output Min Scale       | 0%               | All set-ups | TRUE                    | -2               | UInt16 |
| 6-94             | Terminal 42 Output Max Scale       | 100%             | All set-ups | TRUE                    | -2               | UInt16 |

Table 5.14

### 5.1.12 7-\*\* Controllers

| Parameter Number | Parameter Description              | Default Value   | 2 set-up    | Change During Operation | Conversion Index | Type   |
|------------------|------------------------------------|-----------------|-------------|-------------------------|------------------|--------|
| 7-20             | Process CL Feedback 1 Resource     | [0] No function | All set-ups | TRUE                    | -                | UInt8  |
| 7-30             | Process PI Normal/ Inverse Control | [0] Normal      | All set-ups | TRUE                    | -                | UInt8  |
| 7-31             | Process PI Anti Windup             | [1] Enabled     | All set-ups | TRUE                    | -                | UInt8  |
| 7-32             | Process PI Start Speed             | 0 Hz            | All set-ups | TRUE                    | -1               | UInt16 |
| 7-33             | Process PI Proportional Gain       | 0.01            | All set-ups | TRUE                    | -2               | UInt16 |
| 7-34             | Process PI Integral Time           | 9999 s          | All set-ups | TRUE                    | -2               | UInt32 |
| 7-38             | Process PI Feed Forward Factor     | 0%              | All set-ups | TRUE                    | 0                | UInt16 |
| 7-39             | On Reference Bandwidth             | 5%              | All set-ups | TRUE                    | 0                | UInt8  |

Table 5.15



## 5.1.13 8-\*\* Comm. and Options

| Parameter Number | Parameter Description         | Default Value              | 2 set-up    | Change During Operation | Conversion Index | Type   |
|------------------|-------------------------------|----------------------------|-------------|-------------------------|------------------|--------|
| 8-01             | Control Site                  | [0] Digital and ctrl.word  | All set-ups | TRUE                    | -                | UInt8  |
| 8-02             | Control Word Source           | [1] GE Drive RS485         | All set-ups | TRUE                    | -                | UInt8  |
| 8-03             | Control Word Timeout Time     | 1 s                        | 1 set-up    | TRUE                    | -1               | UInt16 |
| 8-04             | Control Word Timeout Function | [0] Off                    | 1 set-up    | TRUE                    | -                | UInt8  |
| 8-06             | Reset Control Word Timeout    | [0] No function            | 1 set-up    | TRUE                    | -                | UInt8  |
| 8-30             | Protocol                      | [0] GE Drive               | 1 set-up    | TRUE                    | 0                | UInt8  |
| 8-31             | Address                       | 1                          | 1 set-up    | TRUE                    | 0                | UInt8  |
| 8-32             | GE Drive Port Baud Rate       | [2] 9600 Baud              | 1 set-up    | TRUE                    | -                | UInt8  |
| 8-33             | GE Drive Port Parity          | [0] Even Parity 1 Stop Bit | 1 set-up    | TRUE                    | -                | UInt8  |
| 8-35             | Minimum Response Delay        | 0.01 s                     | 1 set-up    | TRUE                    | -3               | UInt16 |
| 8-36             | Max Response Delay            | 5 s                        | 1 set-up    | TRUE                    | -3               | UInt16 |
| 8-50             | Coasting Select               | [3] Logic OR               | All set-ups | TRUE                    | -                | UInt8  |
| 8-51             | Quick Stop Select             | [3] Logic OR               | All set-ups | TRUE                    | -                | UInt8  |
| 8-52             | DC Brake Select               | [3] Logic OR               | All set-ups | TRUE                    | -                | UInt8  |
| 8-53             | Start Select                  | [3] Logic OR               | All set-ups | TRUE                    | -                | UInt8  |
| 8-54             | Reversing Select              | [3] Logic OR               | All set-ups | TRUE                    | -                | UInt8  |
| 8-55             | Set-up Select                 | [3] Logic OR               | All set-ups | TRUE                    | -                | UInt8  |
| 8-56             | Preset Reference Select       | [3] Logic OR               | All set-ups | TRUE                    | -                | UInt8  |
| 8-94             | Bus feedback 1                | 0                          | All set-ups | TRUE                    | 0                | Int16  |

Table 5.16

## 5.1.14 13-\*\* Logic Controller

| Parameter Number | Parameter Description             | Default Value      | 2 set-up | Change During Operation | Conversion Index | Type   |
|------------------|-----------------------------------|--------------------|----------|-------------------------|------------------|--------|
| 13-00            | Logic Controller Mode             | [0] Off            | 1 set-up | TRUE                    | -                | UInt8  |
| 13-01            | Start Event                       | [39] Start command | 1 set-up | TRUE                    | -                | UInt8  |
| 13-02            | Stop Event                        | [40] Drive stopped | 1 set-up | TRUE                    | -                | UInt8  |
| 13-03            | Reset Logic Controller            | [0] Do not reset   | 1 set-up | TRUE                    | -                | UInt8  |
| 13-10            | Comparator Operand                | [0] Disabled       | 1 set-up | TRUE                    | -                | UInt8  |
| 13-11            | Comparator Operator               | [1] ApproxEqual    | 1 set-up | TRUE                    | -                | UInt8  |
| 13-12            | Comparator Value                  | 0                  | 1 set-up | TRUE                    | -1               | Int32  |
| 13-20            | Logic Controller Controller Timer | 0 s                | 1 set-up | TRUE                    | -1               | UInt32 |
| 13-40            | Logic Rule Boolean 1              | [0] False          | 1 set-up | TRUE                    | -                | UInt8  |
| 13-41            | Logic Rule Operator 1             | [0] Disabled       | 1 set-up | TRUE                    | -                | UInt8  |
| 13-42            | Logic Rule Boolean 2              | [0] False          | 1 set-up | TRUE                    | -                | UInt8  |
| 13-43            | Logic Rule Operator 2             | [0] Disabled       | 1 set-up | TRUE                    | -                | UInt8  |
| 13-44            | Logic Rule Boolean 3              | [0] False          | 1 set-up | TRUE                    | -                | UInt8  |
| 13-51            | Logic Controller Event            | [0] False          | 1 set-up | TRUE                    | -                | UInt8  |
| 13-52            | Logic Controller Action           | [0] Disabled       | 1 set-up | TRUE                    | -                | UInt8  |

Table 5.17



## Parameter Lists

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### 5.1.15 14-\*\* Special Functions

| Parameter Number | Parameter Description                | Default Value        | 2 set-up    | Change During Operation | Conversion Index | Type   |
|------------------|--------------------------------------|----------------------|-------------|-------------------------|------------------|--------|
| 14-01            | Motor Noise (Carrier Freq.)          | [1] 4.0 kHz          | All set-ups | TRUE                    | -                | Uint8  |
| 14-03            | Overmodulation                       | [1] On               | All set-ups | FALSE                   | -                | Uint8  |
| 14-12            | Function at Line Imbalance           | [0] Trip             | All set-ups | TRUE                    | -                | Uint8  |
| 14-20            | Reset Mode                           | [0] Manual reset     | All set-ups | TRUE                    | -                | Uint8  |
| 14-21            | Automatic Restart Time               | 10 s                 | All set-ups | TRUE                    | 0                | Uint16 |
| 14-22            | Restore Factory Settings             | [0] Normal operation | 1 set-up    | TRUE                    | -                | Uint8  |
| 14-26            | Action At Inverter Fault             | [0] Trip             | All set-ups | TRUE                    | -                | Uint8  |
| 14-41            | Energy Savings Minimum Magnetization | 66 %                 | All set-ups | TRUE                    | 0                | Uint8  |

Table 5.18

### 5.1.16 15-\*\* Drive Information

| Parameter Number | Parameter Description                    | Default Value    | 2 set-up | Change During Operation | Conversion Index | Type           |
|------------------|------------------------------------------|------------------|----------|-------------------------|------------------|----------------|
| 15-00            | Operating Time                           | 0                | 1 set-up | TRUE                    | 0                | Uint32         |
| 15-01            | Running Hours                            | 0                | 1 set-up | TRUE                    | 0                | Uint32         |
| 15-02            | kWh Counter                              | 0                | 1 set-up | TRUE                    | 0                | Uint32         |
| 15-03            | Power-ups                                | 0                | 1 set-up | TRUE                    | 0                | Uint32         |
| 15-04            | Overtmps                                 | 0                | 1 set-up | TRUE                    | 0                | Uint16         |
| 15-05            | Overvolts                                | 0                | 1 set-up | TRUE                    | 0                | Uint16         |
| 15-06            | Reset kWh Counter                        | [0] Do not reset | 1 set-up | TRUE                    | -                | Uint8          |
| 15-07            | Reset Running Hours Counter              | [0] Do not reset | 1 set-up | TRUE                    | -                | Uint8          |
| 15-30            | Fault Log: Error Code                    | 0                | 1 set-up | TRUE                    | 0                | Uint8          |
| 15-40            | GE Drive Type                            |                  | 1 set-up | FALSE                   | 0                | Visible-String |
| 15-41            | Power Section                            |                  | 1 set-up | FALSE                   | 0                | Visible-String |
| 15-42            | Voltage                                  |                  | 1 set-up | FALSE                   | 0                | Visible-String |
| 15-43            | SW ID Control Card                       |                  | 1 set-up | FALSE                   | 0                | Visible-String |
| 15-46            | Adjustable Frequency Drive Ordering No.  |                  | 1 set-up | FALSE                   | 0                | Visible-String |
| 15-48            | Keypad ID No                             |                  | 1 set-up | FALSE                   | 0                | Visible-String |
| 15-51            | Adjustable Frequency Drive Serial Number |                  | 1 set-up | FALSE                   | 0                | Visible-String |

Table 5.19



## 5.1.17 16-\*\* Data Readouts

| Parameter Number | Parameter Description     | Default Value | 2 set-up | Change During Operation | Conversion Index | Type   |
|------------------|---------------------------|---------------|----------|-------------------------|------------------|--------|
| 16-00            | Control Word              | 0             | 1 set-up | TRUE                    | 0                | UInt16 |
| 16-01            | Reference [Unit]          | 0             | 1 set-up | TRUE                    | -3               | Int32  |
| 16-02            | Reference %               | 0             | 1 set-up | TRUE                    | -1               | Int16  |
| 16-03            | Status Word               | 0             | 1 set-up | TRUE                    | 0                | UInt16 |
| 16-05            | Main Actual Value [%]     | 0             | 1 set-up | TRUE                    | -2               | Int16  |
| 16-10            | Power [kW]                | 0             | 1 set-up | TRUE                    | -3               | UInt16 |
| 16-11            | Power [hp]                | 0             | 1 set-up | TRUE                    | -3               | UInt16 |
| 16-12            | Motor Voltage             | 0             | 1 set-up | TRUE                    | 0                | UInt16 |
| 16-13            | Frequency                 | 0             | 1 set-up | TRUE                    | -1               | UInt16 |
| 16-14            | Motor Current             | 0             | 1 set-up | TRUE                    | -2               | UInt16 |
| 16-15            | Frequency [%]             | 0             | 1 set-up | TRUE                    | -1               | UInt16 |
| 16-18            | Motor Thermal             | 0             | 1 set-up | TRUE                    | 0                | UInt8  |
| 16-30            | DC-Link Voltage           | 0             | 1 set-up | TRUE                    | 0                | UInt16 |
| 16-34            | Heatsink Temp.            | 0             | 1 set-up | TRUE                    | 0                | UInt8  |
| 16-35            | Inverter Thermal          | 0             | 1 set-up | TRUE                    | 0                | UInt8  |
| 16-36            | Inv. Nom. Current         | 0             | 1 set-up | TRUE                    | -2               | UInt16 |
| 16-37            | Inv. Max. Current         | 0             | 1 set-up | TRUE                    | -2               | UInt16 |
| 16-38            | Logic Controller State    | 0             | 1 set-up | TRUE                    | 0                | UInt8  |
| 16-50            | External Reference        | 0             | 1 set-up | TRUE                    | -1               | Int16  |
| 16-51            | Pulse Reference           | 0             | 1 set-up | TRUE                    | -1               | Int16  |
| 16-52            | Feedback [Unit]           | 0             | 1 set-up | TRUE                    | -3               | Int32  |
| 16-60            | Digital input 18,19,27,33 | 0             | 1 set-up | TRUE                    | 0                | UInt16 |
| 16-61            | Digital input 29          | 0             | 1 set-up | TRUE                    | 0                | UInt8  |
| 16-62            | Analog Input 53 (V)       | 0             | 1 set-up | TRUE                    | -2               | UInt16 |
| 16-63            | Analog Input 53 (mA)      | 0             | 1 set-up | TRUE                    | -2               | UInt16 |
| 16-64            | Analog Input 60           | 0             | 1 set-up | TRUE                    | -2               | UInt16 |
| 16-65            | Analog Output 42 [mA]     | 0             | 1 set-up | TRUE                    | -2               | UInt16 |
| 16-68            | Pulse input 33            | 20            | 1 set-up | TRUE                    | 0                | UInt16 |
| 16-71            | Relay Output [bin]        | 0             | 1 set-up | TRUE                    | 0                | UInt8  |
| 16-72            | Counter A                 | 0             | 1 set-up | TRUE                    | 0                | Int16  |
| 16-73            | Counter B                 | 0             | 1 set-up | TRUE                    | 0                | Int16  |
| 16-86            | GE Drive Port REF 1       | 0             | 1 set-up | TRUE                    | 0                | Int16  |
| 16-90            | Alarm Word                | 0             | 1 set-up | TRUE                    | 0                | UInt32 |
| 16-92            | Warning Word              | 0             | 1 set-up | TRUE                    | 0                | UInt32 |
| 16-94            | Ext. Status Word          | 0             | 1 set-up | TRUE                    | 0                | UInt32 |

Table 5.20



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Parameter Lists

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## 6 Troubleshooting

A warning or an alarm is signaled by the relevant LED on the front of the adjustable frequency 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 adjustable frequency drive will have tripped. Alarms must be reset to restart operation once their cause has been rectified.

**This may be done in four ways:**

1. By pressing [Reset].
2. Via a digital input with the "Reset" function.
3. Via serial communication.

### NOTE!

After a manual reset press [Reset], [Auto] or [Hand] 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 6.1).

### CAUTION

Alarms that are trip-locked offer additional protection, means that the line power supply must be switched off before the alarm can be reset. After being switched back on, the adjustable frequency 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 14-20 Reset Mode (Warning: automatic wake-up is possible!)

If a warning and alarm is marked against a code in the Table 6.1, this means that either a warning occurs before an alarm, or it can be specified whether it is a warning or an alarm that is to be displayed for a given fault.

This is possible, for instance, in 1-90 Motor Thermal Protection. After an alarm or trip, the motor carries on coasting, and the alarm and warning flash on the adjustable frequency drive. Once the problem has been rectified, only the alarm continues flashing.

| Number | Description                      | Warning | Alarm | Trip Lock | Error | Parameter Reference |
|--------|----------------------------------|---------|-------|-----------|-------|---------------------|
| 2      | Live zero error                  | (X)     | (X)   |           |       | 6-01                |
| 4      | Line power phase loss            | (X)     | (X)   | (X)       |       | 14-12               |
| 7      | DC over-voltage                  | X       | X     |           |       |                     |
| 8      | DC undervoltage                  | X       | X     |           |       |                     |
| 9      | Inverter overloaded              | X       | X     |           |       |                     |
| 10     | Motor overload temperature       | (X)     | (X)   |           |       | 1-90                |
| 11     | Motor thermistor overtemperature | (X)     | (X)   |           |       | 1-90                |
| 12     | Torque limit                     | (X)     |       |           |       | 4-16, 4-17          |
| 13     | Overcurrent                      | X       | X     | X         |       |                     |
| 14     | Ground fault                     | X       | X     | X         |       |                     |
| 16     | Short-circuit                    |         | X     | X         |       |                     |
| 17     | Control word timeout             | (X)     | (X)   |           |       | 8-04                |
| 25     | Brake resistor short-circuited   |         | X     | X         |       |                     |
| 27     | Brake chopper short-circuited    |         | X     | X         |       |                     |
| 28     | Brake Check                      |         | X     |           |       |                     |
| 29     | Power board overtemp             |         | X     | X         |       |                     |
| 30     | Motor phase U missing            |         | (X)   | (X)       |       | 4-58                |
| 31     | Motor phase V missing            |         | (X)   | (X)       |       | 4-58                |
| 32     | Motor phase W missing            |         | (X)   | (X)       |       | 4-58                |
| 38     | Internal fault                   |         | X     | X         |       |                     |



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| Number | Description                                     | Warning | Alarm | Trip Lock | Error | Parameter Reference |
|--------|-------------------------------------------------|---------|-------|-----------|-------|---------------------|
| 44     | Ground fault 2                                  |         | X     | X         |       |                     |
| 47     | Control Voltage Fault                           |         | X     | 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     |           |       |                     |
| 59     | Current limit                                   | X       |       |           |       |                     |
| 63     | Mechanical Brake Low                            |         | X     |           |       |                     |
| 80     | Drive Initialized to Default Value              |         | X     |           |       |                     |
| 84     | The connection between drive and keypad is lost |         |       |           | X     |                     |
| 85     | Button disabled                                 |         |       |           | X     |                     |
| 86     | Copy fail                                       |         |       |           | X     |                     |
| 87     | Keypad data invalid                             |         |       |           | X     |                     |
| 88     | Keypad data not compatible                      |         |       |           | X     |                     |
| 89     | Parameter read-only                             |         |       |           | X     |                     |
| 90     | Parameter database busy                         |         |       |           | X     |                     |
| 91     | Parameter value is not valid in this mode       |         |       |           | X     |                     |
| 92     | Parameter value exceeds the min/max limits      |         |       |           | X     |                     |

**Table 6.1 Alarm/Warning Code List**

(X) Dependent on parameter

A trip is the action when an alarm has appeared. The trip will coast the motor and can be reset by pressing [Reset] or make a reset by a digital input (parameter group 5-1\* [1]). The original event that caused an alarm cannot damage the adjustable frequency drive or cause dangerous conditions. A trip lock is an action that occurs in conjunction with an alarm, which may cause damage to the adjustable frequency drive or connected parts. A trip lock situation can only be reset by power cycling.

| LED indication |              |
|----------------|--------------|
| Warning        | yellow       |
| Alarm          | flashing red |

**Table 6.2**

The alarm words, warning words and extended status words can be read out via serial bus or optional serial communication bus for diagnosis. See also *16-90 Alarm Word*, *16-92 Warning Word* and *16-94 Ext. Status Word*.



## 6.1.1 Alarm, Warning and Extended Status Word

|     |            |               | Par. 16-90                   | Par. 16-92               | Par. 16-94             |
|-----|------------|---------------|------------------------------|--------------------------|------------------------|
| Bit | Hex        | Dec           | AlarmWord                    | WarningWord              | ExtendedStatusWord     |
| 0   | 1          | 1             | Brake check                  |                          | Ramping                |
| 1   | 2          | 2             | Pwr.card temp                | Pwr.card temp            | Auto tune running      |
| 2   | 4          | 4             | Ground Fault                 |                          | Start CW/CCW           |
| 3   | 8          | 8             |                              |                          | Slow-down              |
| 4   | 10         | 16            | Ctrl.word TO                 | Ctrl.word TO             | Catch up               |
| 5   | 20         | 32            | Overcurrent                  | Overcurrent              | Above Feedback High    |
| 6   | 40         | 64            |                              | Torque limit             | Below Feedback Low     |
| 7   | 80         | 128           | Motor Thermistor Over        | Motor Thermistor Over    | Output current high    |
| 8   | 100        | 256           | Electronic Overload Over     | Electronic Overload Over | Output current low     |
| 9   | 200        | 512           | Inverter overload            | Inverter overload        | Above Frequency High   |
| 10  | 400        | 1,024         | DC under-volt                | DC under-volt            | Below Frequency Low    |
| 11  | 800        | 2,048         | DC over-volt                 | DC over-volt             |                        |
| 12  | 1,000      | 4,096         | Short-circuit                |                          |                        |
| 13  | 2,000      | 8,192         |                              |                          | Braking                |
| 14  | 4,000      | 16,384        | Mains phs. loss              | Line power phs. loss     |                        |
| 15  | 8,000      | 32,768        | "Auto Tune Not OK"           |                          | OVC active             |
| 16  | 10,000     | 65,536        | Live zero error              | Live zero error          | AC brake               |
| 17  | 20,000     | 131,072       | Internal fault               |                          |                        |
| 18  | 40,000     | 262,144       |                              |                          |                        |
| 19  | 80,000     | 524,288       | U phase loss                 |                          | Above Reference High   |
| 20  | 100,000    | 1,048,576     | V phase loss                 |                          | Below Reference Low    |
| 21  | 200,000    | 2,097,152     | W phase loss                 |                          | Local Ref./Remote Ref. |
| 22  | 400,000    | 4,194,304     |                              |                          |                        |
| 23  | 800,000    | 8,388,608     | Control Voltage Fault        |                          |                        |
| 24  | 1,000,000  | 16,777,216    |                              |                          |                        |
| 25  | 2,000,000  | 33,554,432    |                              | Current limit            |                        |
| 26  | 4,000,000  | 67,108,864    | Brake resistor short-circuit |                          |                        |
| 27  | 8,000,000  | 134,217,728   | Brake IGBT short-circuit     |                          |                        |
| 28  | 10,000,000 | 268,435,456   | M4/M5: Ground Fault (Desat)  | MotorPhaseMissing        |                        |
| 29  | 20,000,000 | 536,870,912   | Drive restored               |                          |                        |
| 30  | 40,000,000 | 1,073,741,824 |                              | Undefined                |                        |
| 31  | 80,000,000 | 2,147,483,648 | Mech. brake low              |                          | DatabaseBusy           |

Table 6.3

The alarm words, warning words and extended status words can be read out via serial bus for diagnosis. See also 16-94 Ext. Status Word.

**WARNING/ALARM 2, Live zero error**

Signal on terminal 53 or 60 is less than 50% of value set in 6-10 Terminal 53 Low Voltage, 6-12 Terminal 53 Low Current and 6-22 Terminal 60 Low Current.

**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 adjustable frequency drive.

**Troubleshooting:** Check the supply voltage and supply currents to the adjustable frequency drive. The fault may be caused by line power distortions. Installing a GE line filter may rectify this problem.

**WARNING/ALARM 7, DC over-voltage**

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

**Troubleshooting**

- Connect a brake resistor
- Extend the ramp time
- Change the ramp type



## Troubleshooting

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Activate the functions in *2-10 Brake Function*

Increase *14-26 Trip Delay at Inverter Fault*

The fault may be caused by line power distortions. Installing a GE line filter may rectify this problem.

### WARNING/ALARM 8, DC undervoltage

If the intermediate circuit voltage (DC link) drops below the under voltage limit, the adjustable frequency drive checks if a 24 V DC backup supply is connected. If no 24 V DC backup supply is connected, the adjustable frequency drive trips after a fixed time delay. The time delay varies with unit size.

#### Troubleshooting

Make sure that the supply voltage matches the adjustable frequency drive voltage.

Perform input voltage test.

Perform soft charge circuit test.

### WARNING/ALARM 9, Inverter overload

The adjustable frequency drive is about to cut out because of an overload (current too high for too long). The counter for electronic, thermal inverter protection issues a warning at 98% and trips at 100%, while giving an alarm. The adjustable frequency drive *cannot* be reset until the counter is below 90%.

The fault is that the adjustable frequency drive has run with more than 100% overload for too long.

#### Troubleshooting

Compare the output current shown on the keypad with the adjustable frequency 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 adjustable frequency drive continuous current rating, the counter increases. When running below the adjustable frequency drive continuous current rating, the counter decreases.

### WARNING/ALARM 10, Motor overload temperature

According to the electronic thermal protection, the motor is too hot. Select whether the adjustable frequency drive gives a warning or an alarm when the counter reaches 100% in *1-90 Motor Thermal Protection*. 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 *1-24 Motor Current* is correct.

Ensure that Motor data in parameters 1-20 through 1-25 are set correctly.

Running Auto tune in 1-29 Auto Tune. The inverter peak current limit (approx. 200% of the rated current) is exceeded. The warning will last approx. 8-12 s, then the adjustable frequency drive trips and issues an alarm. Turn off the adjustable frequency drive and check if the motor shaft can be turned and if the motor size matches the adjustable frequency drive. If extended mechanical brake control is selected, trip can be reset externally. May tune the adjustable frequency 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 adjustable frequency drive gives a warning or an alarm in *1-90 Motor Thermal Protection*.

#### Troubleshooting

Check for motor overheating.

Check if the motor is mechanically overloaded.

### WARNING/ALARM 13, Overcurrent

The inverter peak current limit (approx. 200% of the rated current) is exceeded. The warning will last approx. 8-12 s, then the adjustable frequency drive trips and issues an alarm. Turn off the adjustable frequency drive and check if the motor shaft can be turned and if the motor size matches the adjustable frequency drive. If extended mechanical brake control is selected, trip can be reset externally.

#### Troubleshooting:

Remove power and check if the motor shaft can be turned.

Make sure that the motor size matches the adjustable frequency drive.

Check parameters 1-20 through 1-25. for correct motor data.

### ALARM 14, Ground fault

There is current from the output phases to ground, either in the cable between the adjustable frequency drive and the motor or in the motor itself.

#### Troubleshooting:

Remove power to the adjustable frequency 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 16, Short-circuit**

There is short-circuiting in the motor or motor wiring.

Remove power to the adjustable frequency drive and repair the short circuit.

**WARNING/ALARM 17, Control word timeout**

There is no communication to the adjustable frequency drive.

The warning is only active when *8-04 Control Word Timeout Function* is NOT set to OFF.

If *8-04 Control Word Timeout Function* is set to *Stop and Trip*, a warning appears and the adjustable frequency drive ramps down until it trips, while giving an alarm.

*8-03 Control Timeout Time* could possibly be increased.

**Troubleshooting:**

Check connections on the serial communication cable.

Increase *8-03 Control Word Timeout Time*

Check the operation of the communication equipment.

Verify a proper installation based on EMC requirements.

**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 adjustable frequency drive power size.

**Troubleshooting**

Check for the following conditions.

Ambient temperature too high.

Motor cable too long.

Incorrect airflow clearance above and below the adjustable frequency drive.

Blocked airflow around the adjustable frequency drive.

Damaged heatsink fan.

Dirty heatsink.

**ALARM 30, Motor phase U missing**

Motor phase U between the adjustable frequency drive and the motor is missing.

Remove power from the adjustable frequency drive and check motor phase U.

**ALARM 31, Motor phase V missing**

Motor phase V between the adjustable frequency drive and the motor is missing.

Remove power from the adjustable frequency drive and check motor phase V.

**ALARM 32, Motor phase W missing**

Motor phase W between the adjustable frequency drive and the motor is missing.

Remove power from the adjustable frequency drive and check motor phase W.

**ALARM 38, Internal fault****Troubleshooting**

Cycle power

Check that the option is properly installed

Check for loose or missing wiring

It may be necessary to contact the local GE supplier or service department. Note the code number for further troubleshooting directions.

**WARNING 47, 24 V supply low**

The 24 V DC is measured on the control card. The external 24 V DC backup power supply may be overloaded, otherwise contact the GE supplier.

**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 1-20 to 1-25.

**ALARM 55, Auto Tune parameter out of range**

The parameter values of the motor are outside of the acceptable range. Auto tune does not run.

**ALARM 63, Mechanical brake low**

The actual motor current has not exceeded the "release brake" current within the "Start delay" time window.

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

Parameter settings are restored to factory settings after a manual reset. Reset the unit to clear the alarm.

**ALARM 84, The connection between drive and keypad is lost**

Try to reassemble the keypad gently.

**ALARM 85, Button disabled**

See parameter group *0-4\* Keypad*

**ALARM 86, Copy fail**

An error occurred while copying from adjustable frequency drive to keypad or vice versa.

**ALARM 87, Keypad data invalid**

Occurs when copying from keypad if the keypad contains erroneous data or if no data was uploaded to the keypad.

**ALARM 88, Keypad data not compatible**

Occurs when copying from keypad if data are moved between adjustable frequency drives with major differences in software versions.

**WARNING 89, Parameter read-only**

Occurs when trying to write to a read-only parameter.



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## Troubleshooting

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### **ALARM 90, Parameter database busy**

Keypad and RS-485 connection are trying to update parameters simultaneously.

### **ALARM 91, Parameter value is not valid in this mode**

Occurs when trying to write an illegal value to a parameter.

### **ALARM 92, Parameter value exceeds the min/max limits**

Occurs when trying to set a value outside the range. Parameter can only be changed when the motor is stopped. Err. A wrong password was entered, occurs when using a wrong password for changing a password-protected parameter.

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Industrial Solutions (formerly Power Protection), a division of GE Energy, is a first class European supplier of low and medium voltage products including wiring devices, residential and industrial electrical distribution components, automation products, enclosures and switchboards. Demand for the company's products comes from wholesalers, installers, panelboard builders, contractors, OEMs and utilities worldwide.

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