# ACS800

## Firmware Manual
## ACS800 Standard Control Program 7.x

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# Firmware Manual

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# Introduction to the manual

## Chapter overview

The chapter includes a description of the contents of the manual. In addition it contains information about the compatibility, safety and intended audience.

## Compatibility

The manual is compatible with Standard Control Program versions ASXR7360 and AS7R7363. See parameter 33.01 SOFTWARE VERSION.

## Safety instructions

Follow all safety instructions delivered with the drive.

- Read the **complete safety instructions** before you install, commission, or use the drive. The complete safety instructions are given at the beginning of the Hardware Manual.
- Read the **software function specific warnings and notes** before changing the default settings of the function. For each function, the warnings and notes are given in this manual in the section describing the related user-adjustable parameters.

## Reader

The reader of the manual is expected to know the standard electrical wiring practices, electronic components, and electrical schematic symbols.

## Contents

The manual consists of the following chapters:

- *Start-up and control through the I/O* instructs in setting up the application program, and how to start, stop and regulate the speed of the drive.
- *Control panel* gives instructions for using the panel.
- *Program features* contains the feature descriptions and the reference lists of the user settings and diagnostic signals.
- *Application macros* contains a short description of each macro together with a connection diagram.
- *Actual signals and parameters* describes the actual signals and parameters of the drive.
- *Fieldbus control* describes the communication through the serial communication links.

- *Fault tracing* lists the warning and fault messages with the possible causes and remedies.
- *Analogue Extension Module*, describes the communication between the drive and the analogue I/O extension (optional).
- *Additional data: actual signals and parameters* contains more information on the actual signals and parameters.
- *Control block diagrams* contains block diagrams concerning reference control chains and handling of Start, Stop, Run Enable and Start Interlock.

## Product and service inquiries

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# Start-up and control through the I/O

## Chapter overview

The chapter instructs how to:

- do the start-up
- start, stop, change the direction of rotation, and adjust the speed of the motor through the I/O interface
- perform an Identification Run for the drive.

## How to start-up the drive

There are two start-up methods between which the user can select: Run the Start-up Assistant, or perform a limited start-up. The Assistant guides the user through all essential settings to be done. In the limited start-up, the drive gives no guidance: The user goes through the very basic settings by following the instructions given in the manual.

- **If you want to run the Assistant**, follow the instructions given in section *How to perform the guided start-up (covers all essential settings)* on page *15*.
- **If you want to perform the limited start-up**, follow the instructions given in section *How to perform the limited start-up (covers only the basic settings)* on page *17*.

### How to perform the guided start-up (covers all essential settings)

Before you start, ensure you have the motor nameplate data on hand.

| SAFETY | |
|---|---|
|  | The start-up may only be carried out by a qualified electrician.<br>The safety instructions must be followed during the start-up procedure. See the appropriate hardware manual for safety instructions. |
| ☐ | Check the installation. See the installation checklist in the appropriate hardware/installation manual. |
| ☐ | Check that the starting of the motor does not cause any danger.<br>**De-couple the driven machine** if:<br>- there is a risk of damage in case of incorrect direction of rotation, or<br>- a Standard ID Run needs to be performed during the drive start-up. (ID Run is essential only in applications which require the ultimate in motor control accuracy.) |

| | | |
|---|---|---|
| | **POWER-UP** | |
| ☐ | Apply the main power. The control panel first shows the panel identification data … | `CDP312 PANEL Vx.xx`<br>`.......` |
| | … then the Identification Display of the drive … | `ACS800`<br>`ID NUMBER 1` |
| | … then the Actual Signal Display … | `1 -> 0.0 rpm O`<br>`FREQ 0.00 Hz`<br>`CURRENT 0.00 A`<br>`POWER 0.00 %` |
| | …after which the display suggests starting the Language Selection.<br>(If no key is pressed for a few seconds, the display starts to alternate between the Actual Signal Display and the suggestion on selecting the language.)<br>The drive is now ready for the start-up. | `1 -> 0.0 rpm O`<br>`*** INFORMATION ***`<br>`Press FUNC to start`<br>`Language Selection` |
| | **SELECTING THE LANGUAGE** | |
| ☐ | Press the FUNC key. | `Language Selection 1/1`<br>`LANGUAGE ?`<br>`[ENGLISH]`<br>`ENTER:OK ACT:EXIT` |
| ☐ | Scroll to the desired language by the arrow keys ( ▲ or ▼ ) and press ENTER to accept.<br>(The drive loads the selected language into use, shifts back to the Actual Signal Display and starts to alternate between the Actual Signal Display and the suggestion on starting the guided motor set-up.) | `1 -> 0.0 rpm O`<br>`*** INFORMATION ***`<br>`Press FUNC to start`<br>`guided Motor Setup` |
| | **STARTING THE GUIDED MOTOR SET-UP** | |
| ☐ | Press FUNC to start the guided motor set-up.<br>(The display shows which general command keys to use when stepping through the assistant.) | `Motor Setup 1/10`<br>`ENTER: Ok/Continue`<br>`ACT: Exit`<br>`FUNC: More Info` |
| ☐ | Press ENTER to step forward.<br>Follow the instructions given on the display. | `Motor Setup 2/10`<br>`MOTOR NAMEPLATE DATA`<br>`AVAILABLE?`<br>`ENTER:Yes FUNC:Info` |

**How to perform the limited start-up (covers only the basic settings)**

Before you start, ensure you have the motor nameplate data at your hand.

| | | |
|---|---|---|
| **SAFETY** | | |
|  | The start-up may only be carried out by a qualified electrician.<br>The safety instructions must be followed during the start-up procedure. See the appropriate hardware manual for safety instructions. | |
| ☐ | Check the installation. See the installation checklist in the appropriate hardware/installation manual. | |
| ☐ | Check that the starting of the motor does not cause any danger.<br>**De-couple the driven machine** if:<br>- there is a risk of damage in case of incorrect direction of rotation, or<br>- a Standard ID Run needs to be performed during the drive start-up. (ID Run is essential only in applications which require the ultimate in motor control accuracy.) | |
| **POWER-UP** | | |
| ☐ | Apply the main power. The control panel first shows the panel identification data … | `CDP312 PANEL Vx.xx`<br>`.......` |
| | … then the Identification Display of the drive … | `ACS800`<br>`ID NUMBER 1` |
| | … then the Actual Signal Display … | `1 -> 0.0 rpm O`<br>`FREQ 0.00 Hz`<br>`CURRENT 0.00 A`<br>`POWER 0.00 %` |
| | …after which the display suggests starting the Language Selection.<br>(If no key is pressed for a few seconds, the display starts to alternate between the Actual Signal Display and the suggestion on starting the Language Selection.) | `1 -> 0.0 rpm O`<br>`*** INFORMATION ***`<br>`Press FUNC to start`<br>`Language Selection` |
| | Press ACT to remove the suggestion on starting the language selection.<br>The drive is now ready for the limited start-up. | `1 -> 0.0 rpm O`<br>`FREQ 0.00 Hz`<br>`CURRENT 0.00 A`<br>`POWER 0.00 %` |
| **MANUAL START-UP DATA ENTERING (parameter group 99)** | | |
| ☐ | Select the language. The general parameter setting procedure is described below.<br>The general parameter setting procedure:<br>- Press ***PAR*** to select the Parameter Mode of the panel.<br>- Press the double-arrow keys ( ⏫ or ⏬ ) to scroll the parameter groups.<br>- Press the arrow keys ( 🔼 or 🔽 ) to scroll parameters within a group.<br>- Activate the setting of a new value by ***ENTER.***<br>- Change the value by the arrow keys ( 🔼 or 🔽 ), fast change by the double-arrow keys ( ⏫ or ⏬ ).<br>- Press ***ENTER*** to accept the new value (brackets disappear). | `1 -> 0.0 rpm O`<br>`99 START-UP DATA`<br>`01 LANGUAGE`<br>`ENGLISH`<br><br>`1 -> 0.0 rpm O`<br>`99 START-UP DATA`<br>`01 LANGUAGE`<br>`[ENGLISH]` |

☐ Select the Application Macro. The general parameter setting procedure is given above.

The default value FACTORY is suitable in most cases.

```
1   ->  0.0 rpm   O
99 START-UP DATA
02 APPLICATION MACRO
[ ]
```

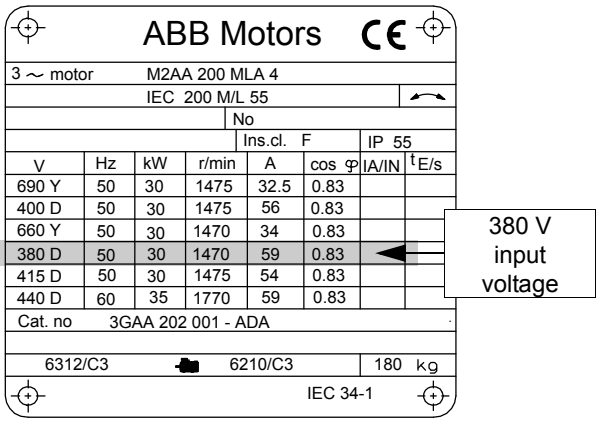
☐ Select the motor control mode. The general parameter setting procedure is given above.

DTC is suitable in most cases. The SCALAR control mode is recommended

- for multimotor drives when the number of the motors connected to the drive is variable
- when the nominal current of the motor is less than 1/6 of the nominal current of the inverter
- when the inverter is used for test purposes with no motor connected.

```
1   ->   0.0 rpm  O
99 START-UP DATA
04 MOTOR CTRL MODE
[DTC]
```

☐ Enter the motor data from the motor nameplate:




**Note:** Set the motor data to exactly the same value as on the motor nameplate. For example, if the motor nominal speed is 1440 rpm on the nameplate, setting the value of parameter 99.08 MOTOR NOM SPEED to 1500 rpm results in the wrong operation of the drive.

- motor nominal voltage

Allowed range: 1/2 · $U_N$ … 2 · $U_N$ of ACS800. ($U_N$ refers to the highest voltage in each of the nominal voltage ranges: 415 VAC for 400 VAC units, 500 VAC for 500 VAC units and 690 VAC for 600 VAC units.)

```
 1   ->  0.0 rpm   O
99 START-UP DATA
05 MOTOR NOM VOLTAGE
[ ]
```

- motor nominal current

Allowed range: approx. 1/6 · $I_{2hd}$ … 2 · $I_{2hd}$ of ACS800 (0 … 2 · $I_{2hd}$ if parameter 99.04 = SCALAR))

```
 1   ->  0.0 rpm   O
99 START-UP DATA
06 MOTOR NOM CURRENT
[ ]
```

- motor nominal frequency

Range: 8 … 300 Hz

```
 1   ->  0.0 rpm   O
99 START-UP DATA
07 MOTOR NOM FREQ
[ ]
```

- motor nominal speed

Range: 1 …18000 rpm

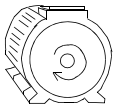
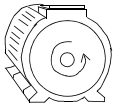
```
 1   ->  0.0 rpm   O
99 START-UP DATA
08 MOTOR NOM SPEED
[ ]
```

-motor nominal power

Range: 0 …9000 kW

```
 1   ->  0.0 rpm   O
99 START-UP DATA
09 MOTOR NOM POWER
[ ]
```

| | | |
|---|---|---|
| | When the motor data has been entered, two displays (warning and information) start to alternate. Move to next step without pressing any key.<br>**Note:** If you select STANDARD ID Run, the brake is opened when the Start command is given from the control panel and the brake remains open until the STANDARD ID Run is completed. If you select ID MAGN, the brake is kept closed during the ID Run sequence. | 1 -> 0.0 rpm O<br>ACS800<br>** WARNING **<br>ID MAGN REQ<br><br>1 -> 0.0 rpm I<br>*** Information ***<br>Press green button<br>to start ID MAGN |
| ☐ | Select the motor identification method.<br>The default value ID MAGN (ID Magnetisation) is suitable for most applications. It is applied in this basic start-up procedure. If your selection is ID Magnetisation, move to next step without pressing any key.<br>The ID Run (STANDARD or REDUCED) should be selected if:<br>- The operation point is near zero speed constantly, and/or<br>- Operation at torque range above the motor nominal torque within a wide speed range and without any measured speed feedback is required.<br>If your selection is ID Run, continue by following the separate instructions given a few pages ahead in section *How to perform the ID Run* on page *22*. | |
| | **IDENTIFICATION MAGNETISATION (with Motor ID Run selection ID MAGN)** | |
| ☐ | Press the ***LOC/REM*** key to change to local control (L shown on the first row).<br>Press ⏎ to start the Identification Magnetisation. The motor is magnetised at zero speed for 20 to 60 s. Three warnings are displayed:<br>The first warning is displayed when the magnetisation starts.<br>The second warning is displayed while the magnetisation is on.<br>The third warning is displayed after the magnetisation is completed. | 1 L -> 1242.0 rpm I<br>** WARNING **<br>MOTOR STARTS<br><br>1 L-> 0.0 rpm I<br>** WARNING **<br>ID MAGN<br><br>1 L-> 0.0 rpm O<br>** WARNING **<br>ID DONE |

| | | |
|---|---|---|
| | **DIRECTION OF ROTATION OF THE MOTOR** | |
| ☐ | Check the direction of rotation of the motor.<br>- Press ***ACT*** to get the status row visible.<br>- Increase the speed reference from zero to a small value by pressing ***REF*** and then the arrow keys (▲, ▼, ⏫ or ⏬).<br>- Press ⏯ to start the motor.<br>- Check that the motor is running in the desired direction.<br>- Stop the motor by pressing ⏹.<br><br>To change the direction of rotation of the motor:<br>- Disconnect the main power from the drive, and wait 5 minutes for the intermediate circuit capacitors to discharge. Measure the voltage between each input terminal (U1, V1 and W1) and earth with a multimeter to ensure that the frequency converter is discharged.<br>- Exchange the position of two motor cable phase conductors at the motor terminals or at the motor connection box.<br>- Verify your work by applying the main power and repeating the check as described above. | 1 L->[xxx] rpm I<br>FREQ xxx Hz<br>CURRENT xx A<br>POWER xx %<br><br>  forward direction<br>  reverse direction |
| | **SPEED LIMITS AND ACCELERATION/DECELERATION TIMES** | |
| ☐ | Set the minimum speed. | 1 L-> 0.0 rpm O<br>20 LIMITS<br>01 MINIMUM SPEED<br>[ ] |
| ☐ | Set the maximum speed. | 1 L-> 0.0 rpm O<br>20 LIMITS<br>02 MAXIMUM SPEED<br>[ ] |
| ☐ | Set the acceleration time 1.<br>**Note:** Check also acceleration time 2, if two acceleration times will be used in the application. | 1 L-> 0.0 rpm O<br>22 ACCEL/DECEL<br>02 ACCELER TIME 1<br>[ ] |
| ☐ | Set the deceleration time 1.<br>**Note:** Set also deceleration time 2, if two deceleration times will be used in the application. | 1 L-> 0.0 rpm O<br>22 ACCEL/DECEL<br>03 DECELER TIME 1<br>[ ] |
| | **The drive is now ready for use.** | |

## How to control the drive through the I/O interface

The table below instructs how to operate the drive through the digital and analogue inputs, when:

- the motor start-up is performed, and
- the default (factory) parameter settings are valid.

| PRELIMINARY SETTINGS | |
|---|---|
| Ensure the Factory macro is active. | See parameter 99.02. |
| If you need to change the direction of rotation, change the setting of parameter 10.03 to REQUEST. | |
| Ensure the control connections are wired according to the connection diagram given for the Factory macro. | See chapter *Application macros*. |
| Ensure the drive is in external control mode. Press the ***LOC/REM*** key to change between external and local control. | In External control, there is no L visible on the first row of the panel display. |
| **STARTING AND CONTROLLING THE SPEED OF THE MOTOR** | |
| Start by switching digital input DI1 on. | 1 -> 0.0 rpm I<br>FREQ 0.00 Hz<br>CURRENT 0.00 A<br>POWER 0.00 % |
| Regulate the speed by adjusting the voltage of analogue input AI1. | 1 -> 500.0 rpm I<br>FREQ 16.66 Hz<br>CURRENT 12.66 A<br>POWER 8.33 % |
| **CHANGING THE DIRECTION OF ROTATION OF THE MOTOR** | |
| Forward direction: Switch digital input DI2 off. | 1 -> 500.0 rpm I<br>FREQ 16.66 Hz<br>CURRENT 12.66 A<br>POWER 8.33 % |
| Reverse direction: Switch digital input DI2 on. | 1 <- 500.0 rpm I<br>FREQ 16.66 Hz<br>CURRENT 12.66 A<br>POWER 8.33 % |
| **STOPPING THE MOTOR** | |
| Switch off digital input DI1. | 1 -> 500.0 rpm O<br>FREQ 0.00 Hz<br>CURRENT 0.00 A<br>POWER 0.00 % |

## How to perform the ID Run

The drive performs the ID Magnetisation automatically at the first start. In most applications there is no need to perform a separate ID Run. The ID Run (Standard or Reduced) should be selected if:

- The operation point is near zero speed, and/or
- Operation at torque range above the motor nominal torque within a wide speed range and without any measured speed feedback is required.

The Reduced ID Run is to be performed instead of the Standard if it is not possible to disengage the driven machine from the motor.

---

**Note:** If you select STANDARD ID Run, the brake is opened when the Start command is given from the control panel and the brake remains open until the STANDARD ID Run is completed. If you select ID MAGN, the brake is kept closed during the ID Run sequence.

---

### ID Run Procedure

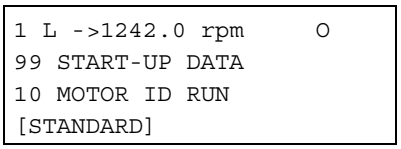
---

**Note:** If parameter values (Group 10 to 98) are changed before the ID Run, check that the new settings meet the following conditions:

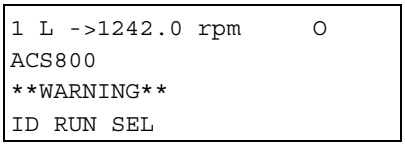
- 20.01 MINIMUM SPEED $\leq$ 0 rpm
- 20.02 MAXIMUM SPEED > 80% of motor rated speed
- 20.03 MAXIMUM CURRENT $\geq$ 100% · $I_{hd}$
- 20.04 MAXIMUM TORQUE > 50%

---

- Ensure that the panel is in the local control mode (L displayed on the status row). Press the ***LOC/REM*** key to switch between modes.
- Change the ID Run selection to STANDARD or REDUCED.




- Press ***ENTER*** to verify selection. The following message will be displayed:



- To start the ID Run, press the key. The Start Interlock (digital input DI_IL) and Run Enable signals (parameter 16.01 RUN ENABLE) must be active.

| Warning when the ID Run is started | Warning during the ID Run | Warning after a successfully completed ID Run |
|---|---|---|
| 1 L -> 1242.0 rpm I<br>ACS800<br>**WARNING**<br>MOTOR STARTS | 1 L -> 1242.0 rpm I<br>ACS800<br>**WARNING**<br>ID RUN | 1 L -> 1242.0 rpm I<br>ACS800<br>**WARNING**<br>ID DONE |

In general it is recommended not to press any control panel keys during the ID run. However:

- The Motor ID Run can be stopped at any time by pressing the control panel stop key ( ).
- After the ID Run is started with the start key ( ), it is possible to monitor the actual values by first pressing the ***ACT*** key and then a double-arrow key ( ).

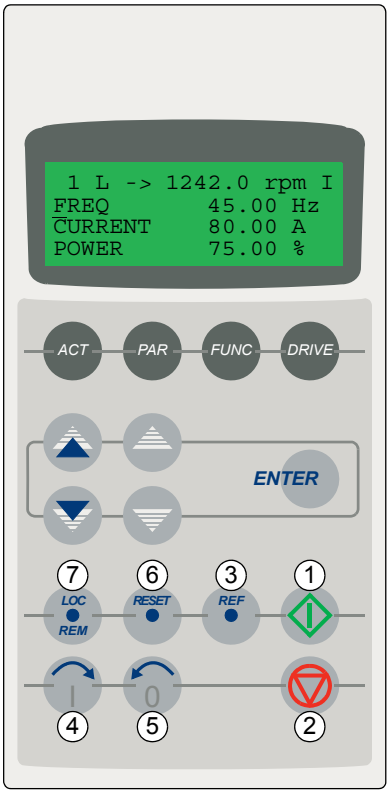
# Control panel

## Chapter overview

The chapter describes how to use the control panel CDP 312R.

The same control panel is used with all ACS800 series drives, so the instructions given apply to all ACS800 types. The display examples shown are based on the Standard Control Program; displays produced by other application programs may differ slightly.

## Overview of the panel




The LCD type display has 4 lines of 20 characters.

The language is selected at start-up (parameter 99.01).

The control panel has four operation modes:

- Actual Signal Display Mode (ACT key)
- Parameter Mode (PAR key)
- Function Mode (FUNC key)
- Drive Selection Mode (DRIVE key)

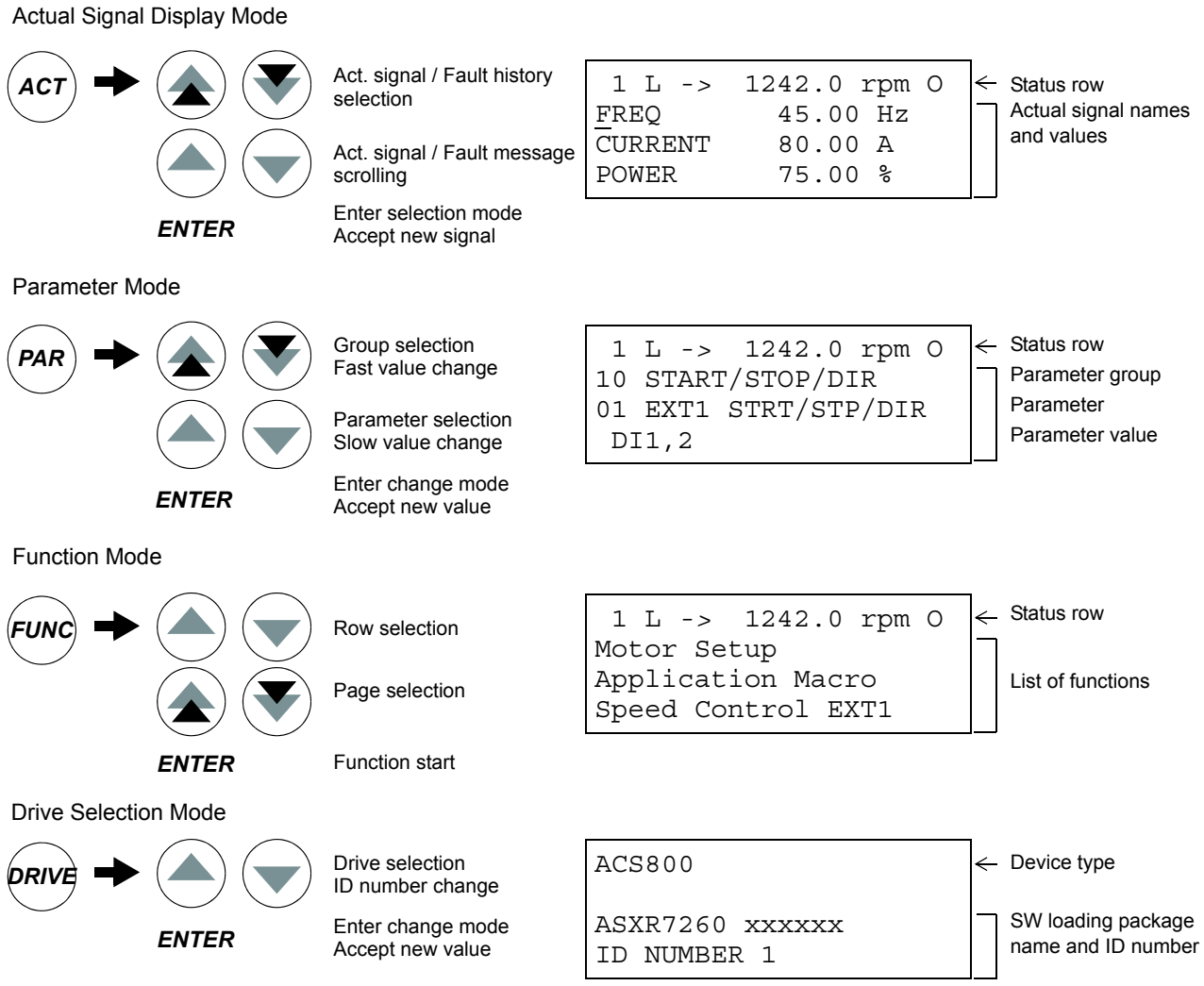
The use of single arrow keys, double arrow keys and ENTER depend on the operation mode of the panel.

The drive control keys are:

| No. | Use |
|---|---|
| 1 | Start |
| 2 | Stop |
| 3 | Activate reference setting |
| 4 | Forward direction of rotation |
| 5 | Reverse direction of rotation |
| 6 | Fault reset |
| 7 | Change between Local / Remote (external) control |

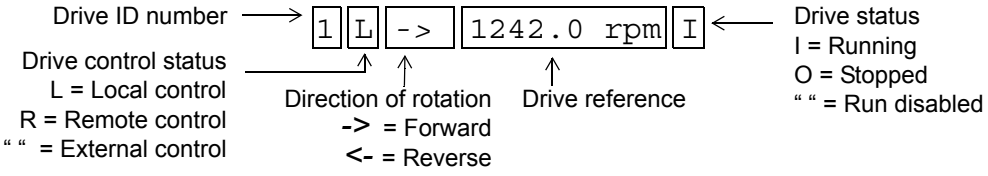
### Panel operation mode keys and displays

The figure below shows the mode selection keys of the panel, and the basic operations and displays in each mode.




### Status row

The figure below describes the status row digits.



## Drive control with the panel

The user can control the drive with the panel as follows:

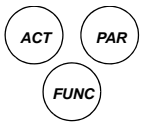
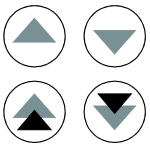
- start, stop, and change direction of the motor
- give the motor speed reference or torque reference
- give a process reference (when the process PID control is active)
- reset the fault and warning messages
- change between local and external drive control.

The panel can be used for control of the drive control always when the drive is under local control and the status row is visible on the display.

### How to start, stop and change direction

| Step | Action | Press Key | Display |
|---|---|---|---|
| 1. | To show the status row. | ACT PAR FUNC | 1 ->1242.0 rpm I<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |
| 2. | To switch to local control.<br>(only if the drive is not under local control, i.e. there is no L on the first row of the display.) | LOC REM | 1 L ->1242.0 rpm I<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |
| 3. | To stop | | 1 L ->1242.0 rpm O<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |
| 4. | To start | | 1 L ->1242.0 rpm I<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |
| 5. | To change the direction to reverse. | 0 | 1 L <-1242.0 rpm I<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |
| 6. | To change the direction to forward. | | 1 L ->1242.0 rpm I<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |

### How to set speed reference

| Step | Action | Press Key | Display |
|---|---|---|---|
| 1. | To show the status row. |  | 1 ->1242.0 rpm I<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |
| 2. | To switch to local control.<br>(Only if the drive is not under local control, i.e. there is no L on the first row of the display.) |  | 1 L ->1242.0 rpm I<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |
| 3. | To enter the Reference Setting function. |  | 1 L ->[1242.0 rpm]I<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |
| 4. | To change the reference.<br>(slow change)<br><br>(fast change) |  | 1 L ->[1325.0 rpm]I<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |
| 5. | To save the reference.<br>(The value is stored in the permanent memory; it is restored automatically after power switch-off.) | ***ENTER*** | 1 L -> 1325.0 rpm I<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |

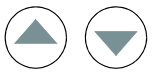
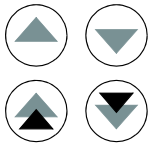
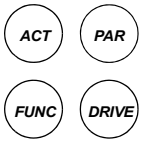
## Actual signal display mode

In the Actual Signal Display Mode, the user can:

- show three actual signals on the display at a time
- select the actual signals to display
- view the fault history
- reset the fault history.

The panel enters the Actual Signal Display Mode when the user presses the ***ACT*** key, or if he does not press any key within one minute.

### How to select actual signals to the display

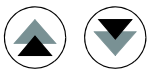
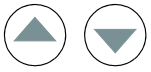
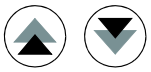
| Step | Action | Press key | Display |
|---|---|---|---|
| 1. | To enter the Actual Signal Display Mode. |  | 1 L -> 1242.0 rpm I<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |
| 2. | To select a row (a blinking cursor indicates the selected row). |  | 1 L -> 1242.0 rpm I<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |
| 3. | To enter the actual signal selection function. | ***ENTER*** | 1 L -> 1242.0 rpm I<br>1 ACTUAL SIGNALS<br>04 CURRENT<br>80.00 A |
| 4. | To select an actual signal.<br><br>To change the actual signal group. |  | 1 L -> 1242.0 rpm I<br>1 ACTUAL SIGNALS<br>05 TORQUE 70.00 % |
| 5.a | To accept the selection and to return to the Actual Signal Display Mode. | ***ENTER*** | 1 L -> 1242.0 rpm I<br>FREQ 45.00 Hz<br>TORQUE 70.00 %<br>POWER 75.00 % |
| 5.b | To cancel the selection and keep the original selection.<br><br>The selected keypad mode is entered. |  | 1 L -> 1242.0 rpm I<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |

### How to display the full name of the actual signals

| Step | Action | Press key | Display |
|---|---|---|---|
| 1. | To display the full name of the three actual signals. | **Hold**<br>  | 1 L -> 1242.0 rpm I<br>FREQUENCY<br>CURRENT<br>POWER |
| 2. | To return to the Actual Signal Display Mode. | **Release**<br>  | 1 L -> 1242.0 rpm I<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |

### How to view and reset the fault history

**Note:** The fault history cannot be reset if there are active faults or warnings.

| Step | Action | Press key | Display |
|---|---|---|---|
| 1. | To enter the Actual Signal Display Mode. |  | 1 L -> 1242.0 rpm I<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |
| 2. | To enter the Fault History Display. |  | 1 L -> 1242.0 rpm I<br>1 LAST FAULT<br>+OVERCURRENT<br>6451 H 21 MIN 23 S |
| 3. | To select the previous (UP) or the next fault/warning (DOWN).<br><br>To clear the Fault History. |  <br>  | 1 L -> 1242.0 rpm I<br>2 LAST FAULT<br>+OVERVOLTAGE<br>1121 H 1 MIN 23 S<br><br>1 L -> 1242.0 rpm I<br>2 LAST FAULT<br>H MIN S |
| 4. | To return to the Actual Signal Display Mode. |  | 1 L -> 1242.0 rpm I<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |

### How to display and reset an active fault

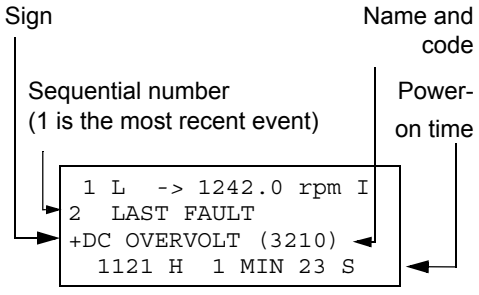
**WARNING!** If an external source for start command is selected and it is ON, the drive will start immediately after fault reset. If the cause of the fault has not been removed, the drive will trip again.

| Step | Action | Press Key | Display |
|---|---|---|---|
| 1. | To display an active fault. | ACT | 1 L -> 1242.0 rpm<br>ACS800<br>** FAULT **<br>ACS800 TEMP |
| 2. | To reset the fault. | RESET | 1 L -> 1242.0 rpm O<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |

### About the fault history

The fault history restores information on the latest events (faults, warnings and resets) of the drive. The table below shows how the events are stored in the fault history.

**A Fault History View**




| Event | Information on display |
|---|---|
| Drive detects a fault and generates a fault message | Sequential number of the event and LAST FAULT text.<br>Name of the fault and a “+” sign in front of the name.<br>Total power-on time. |
| User resets the fault message. | Sequential number of the event and LAST FAULT text.<br>-RESET FAULT text.<br>Total power-on time. |
| Drive generates a warning message. | Sequential number of the event and LAST WARNING text.<br>Name of the warning and a “+” sign in front of the name.<br>Total power-on time. |
| Drive deactivates the warning message. | Sequential number of the event and LAST WARNING text.<br>Name of the warning and a “-” sign in front of the name.<br>Total power-on time. |

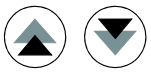
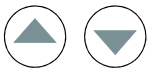
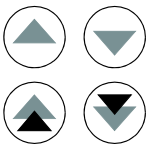
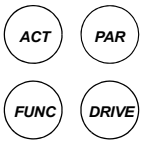
## Parameter mode

In the Parameter Mode, the user can:

- view the parameter values
- change the parameter settings.

The panel enters the Parameter Mode when the user presses the ***PAR*** key.

### How to select a parameter and change the value

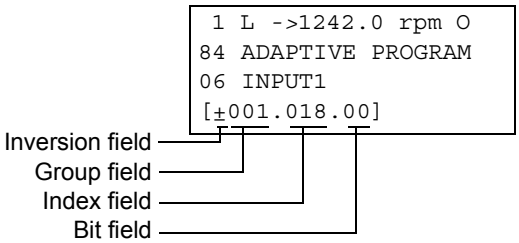
| Step | Action | Press key | Display |
|---|---|---|---|
| 1. | To enter the Parameter Mode. |   | 1 L -> 1242.0 rpm O<br>10 START/STOP/DIR<br>01 EXT1 STRT/STP/DIR<br>DI1,2 |
| 2. | To select a group. |  | 1 L -> 1242.0 rpm O<br>11 REFERENCE SELECT<br>01 KEYPAD REF SEL<br>REF1 (rpm) |
| 3. | To select a parameter within a group. |  | 1 L -> 1242.0 rpm O<br>11 REFERENCE SELECT<br>03 EXT REF1 SELECT<br>AI1 |
| 4. | To enter the parameter setting function. | ***ENTER*** | 1 L -> 1242.0 rpm O<br>11 REFERENCE SELECT<br>03 EXT REF1 SELECT<br>[AI1] |
| 5. | To change the parameter value.<br>- (slow change for numbers and text)<br><br>- (fast change for numbers only) |  | 1 L -> 1242.0 rpm O<br>11 REFERENCE SELECT<br>03 EXT REF1 SELECT<br>[AI2] |
| 6a. | To save the new value. | ***ENTER*** | 1 L -> 1242.0 rpm O<br>11 REFERENCE SELECT<br>03 EXT REF1 SELECT<br>AI2 |
| 6b. | To cancel the new setting and keep the original value, press any of the mode selection keys.<br>The selected mode is entered. |   | 1 L -> 1242.0 rpm O<br>11 REFERENCE SELECT<br>03 EXT REF1 SELECT<br>AI1 |

### How to adjust a source selection (pointer) parameter

Most parameters define values that are used directly in the drive application program. Source selection (pointer) parameters are exceptions: They point to the value of another parameter. The parameter setting procedure differs somewhat from that of the other parameters.

| Step | Action | Press Key | Display |
|---|---|---|---|
| 1. | See the table above to<br>- enter the Parameter Mode<br>- select the correct parameter group and parameter<br>- enter the parameter setting mode | PAR<br>ENTER | 1 L ->1242.0 rpm O<br>84 ADAPTIVE PROGRAM<br>06 INPUT1<br>[±000.000.00] |
| 2. | To scroll between the inversion, group, index and bit fields.[1)] | | 1 L ->1242.0 rpm O<br>84 ADAPTIVE PROGRAM<br>06 INPUT1<br>[±000.000.00] |
| 3. | To adjust the value of a field. | | 1 L ->1242.0 rpm O<br>84 ADAPTIVE PROGRAM<br>06 INPUT1<br>[±000.018.00] |
| 4. | To accept the value. | ENTER | |

1)




**Inversion field** inverts the selected parameter value. Plus sign (+): no inversion, minus (-) sign: inversion.

**Bit field** selects the bit number (relevant only if the parameter value is a packed boolean word).

**Index field** selects the parameter index.

**Group field** selects the parameter group.

**Note:** Instead of pointing to another parameter, it is also possible to define a constant by the source selection parameter. Proceed as follows:

- Change the inversion field to C. The appearance of the row changes. The rest of the line is now a constant setting field.

- Give the constant value to the constant setting field.

- Press Enter to accept.

## Function mode

In the Function Mode, the user can:

- start a guided procedure for adjusting the drive settings (assistants)
- upload the drive parameter values and motor data from the drive to the panel.
- download group 1 to 97 parameter values from the panel to the drive. [1)]
- adjust the contrast of the display.

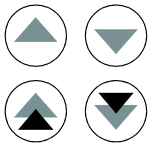
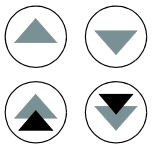
The panel enters the Function Mode when the user presses the ***FUNC*** key.

[1)] The parameter groups 98, 99 and the results of the motor identification are not included by default. The restriction prevents downloading of unfit motor data. In special cases it is, however, possible to download all. For more information, please contact your local ABB representative.

### How to enter an assistant, browse and exit

The table below shows the operation of the basic keys which lead the user through an assistant. The Motor Setup task of the Start-up Assistant is used as an example.

The Start-up Assistant is not available in Scalar mode or when the parameter lock is on. (99.04 MOTOR CTRL MODE = SCALAR or 16.02 PARAMETER LOCK = LOCKED or 16.10 ASSIST SEL = OFF)

| Step | Action | Press Key | Display |
|---|---|---|---|
| 1. | To enter the Function Mode. |   | 1 L -> 1242.0 rpm O<br>Motor Setup<br>Application Macro<br>Speed Control EXT1 |
| 2. | To select a task or function from the list (a flashing cursor indicates the selection).<br>Double arrows: To change page to see more assistants/ functions. |  | 1 L -> 1242.0 rpm O<br>Motor Setup<br>Application Macro<br>Speed Control EXT 1 |
| 3. | To enter the task. | ***ENTER*** | Motor Setup 1/10<br>ENTER: Ok/Continue<br>ACT: Exit<br>FUNC: More Info |
| 4. | To accept and continue. | ***ENTER*** | Motor Setup 2/10<br>MOTOR NAMEPLATE DATA AVAILABLE?<br>ENTER:Yes FUNC:Info |
| 5. | To accept and continue. | ***ENTER*** | Motor Setup 3/10<br>MOTOR NOM VOLTAGE?<br>[0 V]<br>ENTER:Ok RESET:Back |
| 6. | a. To adjust the requested drive parameter.<br><br>b. To ask for information on the requested value.<br>(To scroll the information displays<br>and return to the task). |  <br>***FUNC***<br>   | Motor Setup 3/10<br>MOTOR NOM VOLTAGE?<br>[415 V]<br>ENTER:Ok RESET:back<br><br>INFO P99.05<br>Set as given on the motor nameplate. |
| 7. | a. To accept a value and step forward.<br><br>b. To cancel the setting and take one step back. | ***ENTER***<br><br>***RESET*** | Motor Setup 4/10<br>MOTOR NOM CURRENT?<br>[0.0 A]<br>ENTER:Ok RESET:Back<br><br>Motor Setup 3/10<br>MOTOR NOM VOLTAGE?<br>[415 V]<br>ENTER:Ok RESET:back |

| Step | Action | Press Key | Display |
|---|---|---|---|
| 8. | To cancel and exit.<br>**Note:** 1 x ACT returns to the first display of the task. | ***2 x ACT*** | 1 L -> 0.0 rpm O<br>FREQ 0.00 Hz<br>CURRENT 0.00 A<br>POWER 0.00 % |

### How to upload data from a drive to the panel

**Note:**

- Upload before downloading.
- Ensure the firmware of the destination drive is the same (e.g. standard firmware).
- Before removing the panel from a drive, ensure the panel is in remote operating mode (change with the LOC/REM key).
- Stop the drive before downloading.

Before upload, repeat the following steps in each drive:

- Setup the motors.
- Activate the communication to the optional equipment. (See parameter group 98 OPTION MODULES.)

Before upload, do the following in the drive from which the copies are to be taken:

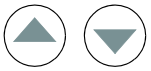
- Set the parameters in groups 10 to 97 as preferred.
- Proceed to the upload sequence (below).

| Step | Action | Press Key | Display |
|---|---|---|---|
| 1. | Enter the Function Mode. | FUNC | 1 L -> 1242.0 rpm O<br>Motor Setup<br>Application Macro<br>Speed Control EXT1 |
| 2. | Enter the page that contains the upload, download and contrast functions. | ▼ | 1 L -> 1242.0 rpm O<br>UPLOAD <=<=<br>DOWNLOAD =>=>=<br>CONTRAST 4 |
| 3. | Select the upload function (a flashing cursor indicates the selected function). | ▲ ▼ | 1 L -> 1242.0 rpm O<br>UPLOAD <=<=<br>DOWNLOAD =>=>=<br>CONTRAST 4 |
| 4. | Enter the upload function. | ***ENTER*** | 1 L -> 1242.0 rpm O<br>UPLOAD <=<= |
| 5. | Switch to external control.<br>(No L on the first row of the display.) | LOC REM | 1 -> 1242.0 rpm O<br>UPLOAD <=<=<br>DOWNLOAD =>=>=<br>CONTRAST 4 |

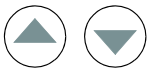
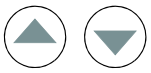
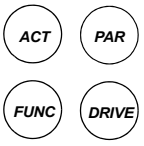
| Step | Action | Press Key | Display |
|---|---|---|---|
| 6. | Disconnect the panel and reconnect it to the drive into which the data will be downloaded. | | |

### How to download data from the panel to a drive

Consider the notes in section *How to upload data from a drive to the panel* on page *36*.

| Step | Action | Press Key | Display |
|---|---|---|---|
| 1. | Connect the panel containing the uploaded data to the drive. | | |
| 2. | Ensure the drive is in local control (L shown on the first row of the display). If necessary, press the ***LOC/REM*** key to change to local control. |  | 1 L -> 1242.0 rpm I<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |
| 3. | Enter the Function Mode. |  | 1 L -> 1242.0 rpm O<br>Motor Setup<br>Application Macro<br>Speed Control EXT1 |
| 4. | Enter the page that contains the upload, download and contrast functions. |  | 1 L -> 1242.0 rpm O<br>UPLOAD <=<=<br>DOWNLOAD =>=><br>CONTRAST 4 |
| 5. | Select the download function (a flashing cursor indicates the selected function). |  | 1 L -> 1242.0 rpm O<br>UPLOAD <=<=<br>DOWNLOAD =>=><br>CONTRAST 4 |
| 6. | Start the download. | ***ENTER*** | 1 L -> 1242.0 rpm O<br>DOWNLOAD =>=> |

### How to set the contrast of the display

| Step | Action | Press Key | Display |
|---|---|---|---|
| 1. | Enter the Function Mode. |   | 1 L -> 1242.0 rpm O<br>Motor Setup<br>Application Macro<br>Speed Control EXT1 |
| 2. | Enter the page that contains the upload, download and contrast functions. |  | 1 L -> 1242.0 rpm O<br>UPLOAD <=<=<br>DOWNLOAD =>=><br>CONTRAST 4 |
| 3. | Select a function (a flashing cursor indicates the selected function). |  | 1 L -> 1242.0 rpm O<br>UPLOAD <=<=<br>DOWNLOAD =>=><br>CONTRAST 4 |
| 4. | Enter the contrast setting function. | ***ENTER*** | 1 L -> 1242.0 rpm O<br>CONTRAST [4] |
| 5. | Adjust the contrast. |  | 1 L -> 1242.0 rpm<br>CONTRAST [6] |
| 6.a | Accept the selected value. | ***ENTER*** | 1 L -> 1242.0 rpm O<br>UPLOAD <=<=<br>DOWNLOAD =>=><br>CONTRAST 6 |
| 6.b | Cancel the new setting and retain the original value by pressing any of the mode selection keys.<br><br>The selected mode is entered. |   | 1 L -> 1242.0 rpm I<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |

## Drive selection mode

In normal use the features available in the Drive Selection Mode are not needed; the features are reserved for applications where several drives are connected to one panel link. (For more information, see the *Installation and Start-up Guide for the Panel Bus Connection Interface Module, NBCI*, [3AFY58919748 (English)].

In the Drive Selection Mode, the user can:

- Select the drive with which the panel communicates through the panel link.
- Change the identification number of a drive connected to the panel link.
- View the status of the drives connected on the panel link.

The panel enters the Drive Selection Mode when the user presses the ***DRIVE*** key.

Each on-line station must have an individual identification number (ID). By default, the ID number of the drive is 1.

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**Note:** The default ID number setting of the drive should not be changed unless the drive is to be connected to the panel link with other drives on-line.

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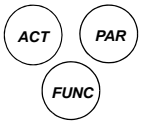
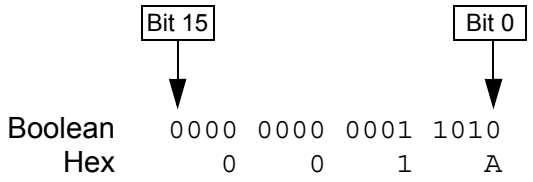
### How to select a drive and change its panel link ID number

| Step | Action | Press key | Display |
|---|---|---|---|
| 1. | To enter the Drive Selection Mode. |  | ACS800<br><br>ASAAA5000 xxxxxx<br>ID NUMBER 1 |
| 2. | To select the next drive/view.<br>The ID number of the station is changed by first pressing ***ENTER*** (the brackets round the ID number appear) and then adjusting the value with arrow buttons. The new value is accepted with ***ENTER***. The power of the drive must be switched off to validate its new ID number setting.<br>The status display of all devices connected to the Panel Link is shown after the last individual station. If all stations do not fit on the display at once, press the double-arrow up to view the rest of them. |  | ACS800<br><br>ASAAA5000 xxxxxx<br>ID NUMBER 1<br><br>1↻<br><br>Status Display Symbols:<br>↻ = Drive stopped, direction forward<br>↰ = Drive running, direction reverse<br>F = Drive tripped on a fault |
| 3. | To connect to the last displayed drive and to enter another mode, press one of the mode selection keys.<br><br>The selected mode is entered. |  | 1 L -> 1242.0 rpm I<br>FREQ 45.00 Hz<br>CURRENT 80.00 A<br>POWER 75.00 % |

## Reading and entering packed boolean values on the display

Some actual values and parameters are packed boolean, i.e. each individual bit has a defined meaning (explained at the corresponding signal or parameter). On the control panel, packed boolean values are read and entered in hexadecimal format.

In this example, bits 1, 3 and 4 of the packed boolean value are ON:



# Program features

## Chapter overview

The chapter describes program features. For each feature, there is a list of related user settings, actual signals, and fault and warning messages.

## Start-up Assistant

### Introduction

The assistant guides the user through the start-up procedure, helping the user to feed the requested data (parameter values) to the drive. The assistant also check that the entered values are valid, i.e. within the allowed range. At the first start, the drive suggests entering the first task of the assistant, Language Select, automatically.

The Start-up Assistant is divided into tasks. The user may activate the tasks either one after the other as the Start-up Assistant suggests, or independently. The user may also adjust the drive parameters in the conventional way without using the assistant at all.

See chapter *Control panel* on how to start the assistant, browse and exit.

**Note:** Option modules assistant is not supported from firmware version AS7R7363 onwards.

### The default order of the tasks

Depending on the selection made in the Application task (parameter 99.02), the Start-up Assistant decide which consequent tasks it suggests. The default tasks are shown in the table below.

| Application Selection | Default Tasks |
|---|---|
| FACTORY, SEQ CTRL | Language Select, Motor Set-up, Application, Option Modules, Speed Control EXT1, Start/Stop Control, Protections, Output Signals |
| HAND/AUTO | Language Select, Motor Set-up, Application, Option Modules, Speed Control EXT2, Start/Stop Control, Speed Control 1, Protections, Output Signals |
| T CTRL | Language Select, Motor Set-up, Application, Option Modules, Torque Control, Start/Stop Control, Speed Control EXT1, Protections, Output Signals |
| PID CTRL | Language Select, Motor Set-up, Application, Option Modules, PID Control, Start/Stop Control, Speed Control EXT1, Protections, Output Signals |

## List of tasks and the relevant drive parameters

| Name | Description | Set parameters |
|---|---|---|
| **Language Select** | Selecting the language | 99.01 |
| **Motor Set-up** | Setting the motor data | 99.05, 99.06, 99.09, 99.07, 99.08, 99.04 |
| | Performing the motor identification. (If the speed limits are not in the allowed range: Setting the limits). | 99.10 (20.8, 20.07) |
| **Application** | Selecting the application macro | 99.02, parameters associated to the macro |
| **Option Modules** | Activating the option modules | Group 98, 35, 52 |
| **Speed Control EXT1** | Selecting the source for the speed reference | 11.03 |
| | (If AI1 is used: Setting analogue input AI1 limits, scale, inversion) | (13.01, 13.02, 13.03, 13.04, 13.05, 30.01) |
| | Setting the reference limits | 11.04, 11.05 |
| | Setting the speed (frequency) limits | 20.02, 20.01, (20.08, 20.07) |
| | Setting acceleration and deceleration times | 22.02, 22.03 |
| | (Setting up the brake chopper if activated by parameter 27.01) | (Group 27, 20.05, 14.01) |
| | (If 99.02 is not SEQ CTRL: Setting constant speeds) | (Group 12) |
| **Speed Control EXT2** | Setting the source for the speed reference | 11.06 |
| | (If AI1 is used: Setting analogue input AI1 limits, scale, inversion) | (13.01, 13.02, 13.03, 13.04, 13.05, 30.01) |
| | Setting the reference limits | 11.08, 11.07 |
| **Torque Control** | Selecting the source for the torque reference | 11.06 |
| | (If AI1 is used: Setting analogue input AI1 limits, scale, inversion) | (13.01, 13.02, 13.03, 13.04, 13.05, 30.01) |
| | Setting the reference limits | 11.08, 11.07 |
| | Setting the torque ramp up and ramp down times | 24.01, 24.02 |
| **PID Control** | Selecting the source for the process reference | 11.06 |
| | (If AI1 is used: Setting analogue input AI1 limits, scale, inversion) | (13.01, 13.02, 13.03, 13.04, 13.05, 30.01) |
| | Setting the reference limits | 11.08, 11.07 |
| | Setting the speed (reference) limits | 20.02, 20.01 (20.08, 20.07) |
| | Setting the source and limits for the process actual value | 40.07, 40.09, 40.10 |
| **Start/Stop Control** | Selecting the source for start and stop signals of the two external control locations, EXT1 and EXT2 | 10.01, 10.02 |
| | Selecting between EXT1 and EXT2 | 11.02 |
| | Defining the direction control | 10.03 |
| | Defining the start and stop modes | 21.01, 21.02, 21.03 |
| | Selecting the use of Run Enable signal | 16.01, 21.07 |
| | Setting the ramp time for the Run Enable function | 22.07 |
| **Protections** | Setting the torque and current limits | 20.03, 20.04 |
| **Output Signals** | Selecting the signals indicated through the relay outputs RO1, RO2, RO3 and optional RO's (if installed) | Group 14 |
| | Selecting the signals indicated through the analogue output AO1, AO2 and optional AO's (if installed). Setting the minimum, maximum, scaling and inversion. | 15.01, 15.02, 15.03, 15.04, 15.05, (Group 96) |

### Contents of the assistant displays

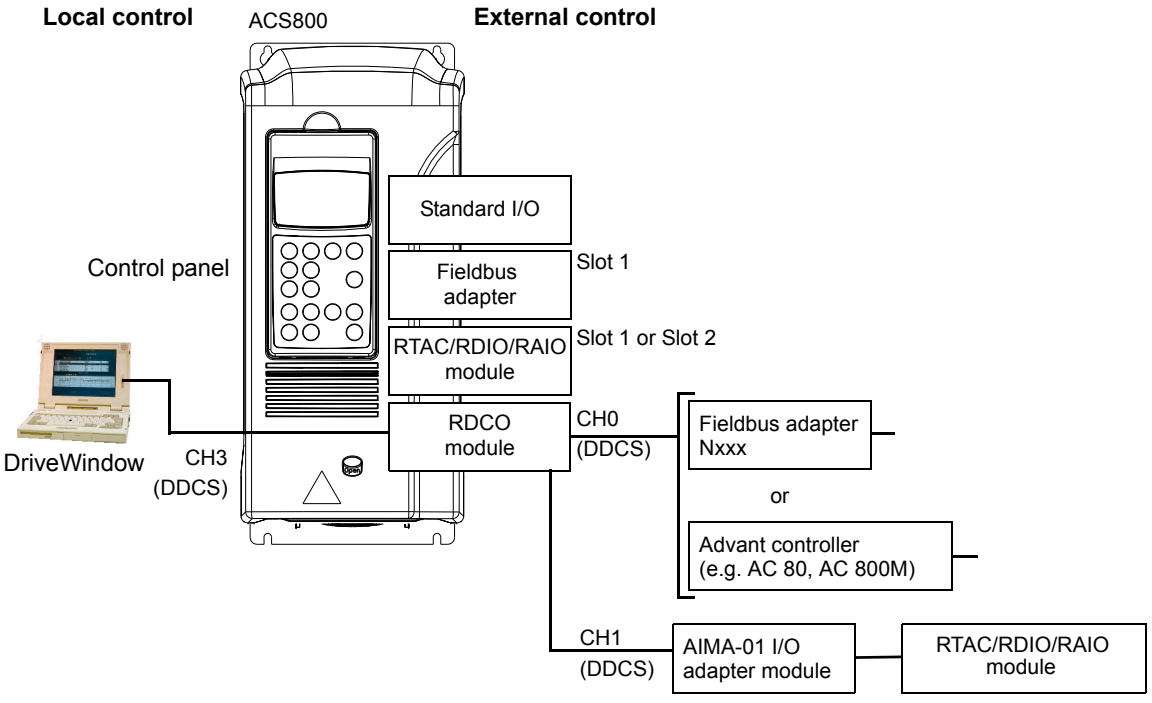
There are two types of displays in the Start-up Assistant: The main displays and the information displays. The main displays prompt the user to feed in information or answer a question. The assistant steps through the main displays. The information displays contain help texts for the main displays. The figure below shows a typical example of both and explanations of the contents.

| | Main Display | Information Display |
|---|---|---|
| 1<br>2<br>3<br>4 | Motor Setup 3/10<br>MOTOR NOM VOLTAGE?<br>[0 V]<br>ENTER:Ok RESET:Back | INFO P99.05<br>Set as given on the motor nameplate.<br>⏫ |

| | | |
|---|---|---|
| 1 | Name of the assistant, step number / total number of steps | Text INFO, index of parameter to be set |
| 2 | Request/question | Help text … |
| 3 | Feed-in field | … help text continued |
| 4 | Commands: accept value and step forward or cancel and step backwards | double arrow symbol (indicates that the text continues) |

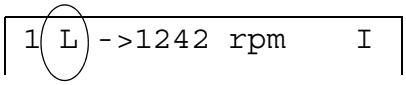
## Local control vs. external control

The drive can receive start, stop and direction commands and reference values from the control panel or through digital and analogue inputs. An optional fieldbus adapter enables control over an open fieldbus link. A PC equipped with DriveWindow can also control the drive.



### Local control

The control commands are given from the control panel keypad when the drive is in local control. L indicates local control on the panel display.

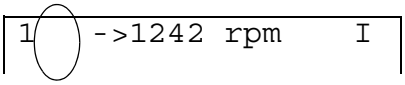



The control panel always overrides the external control signal sources when used in local mode.

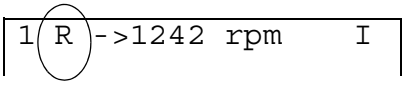
### External control

When the drive is in external control, the commands are given through the standard I/O terminals (digital and analogue inputs), optional I/O extension modules and/or the fieldbus interface. In addition, it is also possible to set the control panel as the source for the external control.

External control is indicated by a blank on the panel display or with an R in those special cases when the panel is defined as a source for external control.




External Control through the Input/ Output terminals, or through the fieldbus interfaces




External Control by control panel

The user can connect the control signals to two external control locations, EXT1 or EXT2. Depending on the user selection, either one is active at a time. This function operates on a 12 ms time level.

### Settings

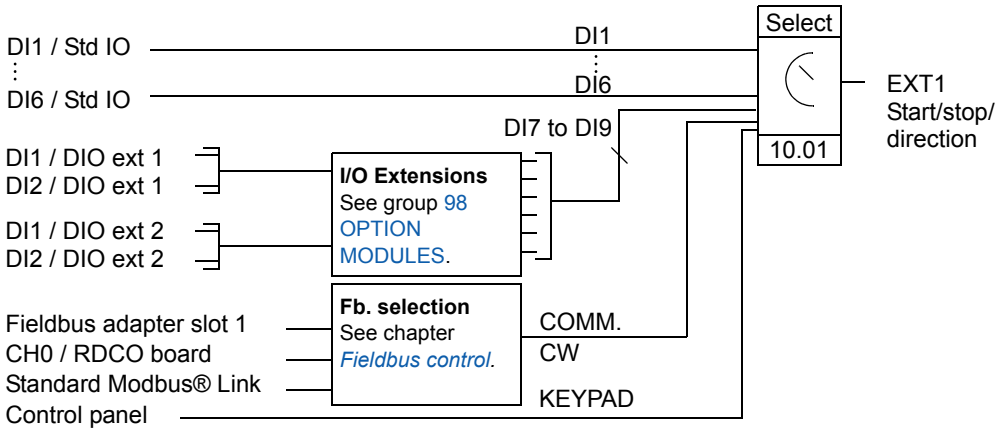
| **Panel key** | **Additional information** |
|---|---|
| LOC/REM | Selection between local and external control |
| **Parameter** | |
| 11.02 | Selection between EXT1 and EXT2 |
| 10.01 | Start, stop, direction source for EXT1 |
| 11.03 | Reference source for EXT1 |
| 10.02 | Start, stop, direction source for EXT2 |
| 11.06 | Reference source for EXT2 |
| Group 98 OPTION MODULES | Activation of the optional I/O and serial communication |

### Diagnostics

| **Actual signals** | **Additional information** |
|---|---|
| 01.11, 01.12 | EXT1 reference, EXT2 reference |
| 03.02 | EXT1/EXT2 selection bit in a packed boolean word |

### Block diagram: start, stop, direction source for EXT1

The figure below shows the parameters that select the interface for start, stop, and direction for external control location EXT1.

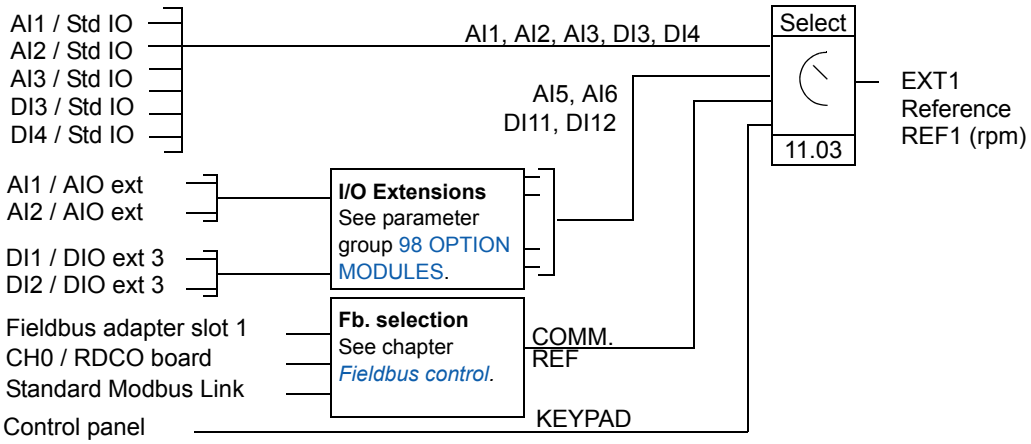



DI1 / Std IO = Digital input DI1 on the standard I/O terminal block

DI1 / DIO ext 1 = Digital input DI1 on the digital I/O extension module 1

### Block diagram: reference source for EXT1

The figure below shows the parameters that select the interface for the speed reference of external control location EXT1.




AI1 / Std IO = Analogue input AI1 on the standard I/O terminal block

AI1 / AIO ext = Analogue input AI1 on the analogue I/O extension module

# Reference types and processing

The drive can accept a variety of references in addition to the conventional analogue input signal and control panel signals.

- The drive reference can be given with two digital inputs: One digital input increases the speed, the other decreases it.
- The drive accepts a bipolar analogue speed reference. This feature allows both the speed and direction to be controlled with a single analogue input. The minimum signal is full speed reversed and the maximum signal is full speed forward.
- The drive can form a reference out of two analogue input signals by using mathematical functions: Addition, subtraction, multiplication, minimum selection, and maximum selection.
- The drive can form a reference out of an analogue input signal and a signal received through a serial communication interface by using mathematical functions: addition and multiplication.

It is possible to scale the external reference so that the signal minimum and maximum values correspond to a speed other than the minimum and maximum speed limits.

## Settings

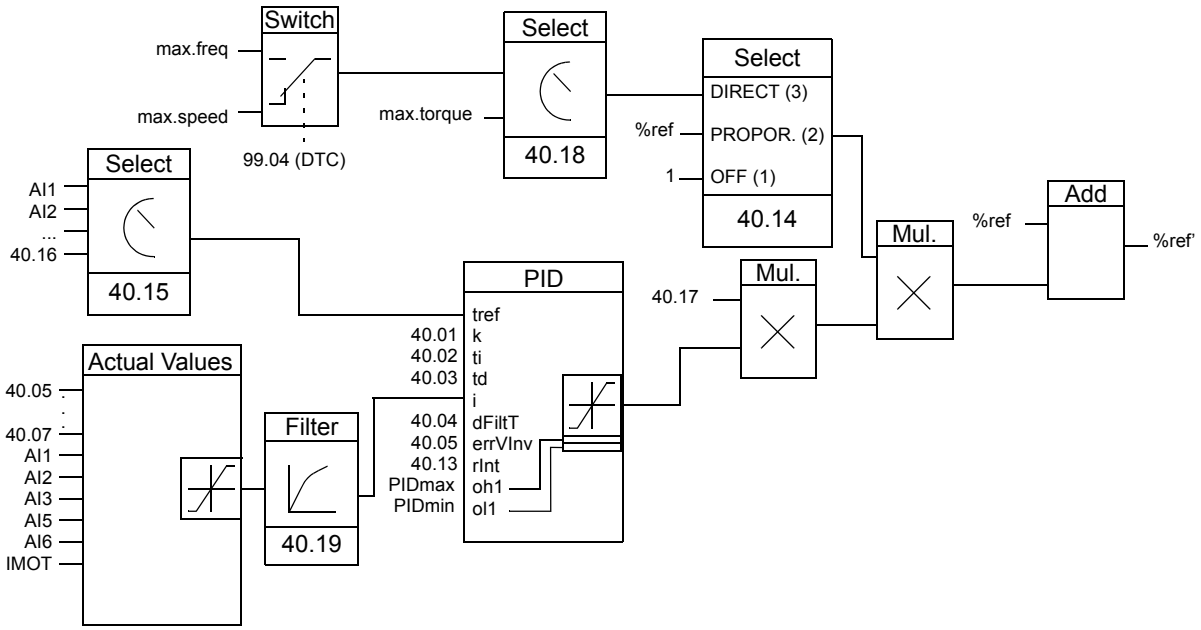
| Parameter | Additional information |
|---|---|
| Group 11 REFERENCE SELECT | External reference source, type and scaling |
| Group 20 LIMITS | Operating limits |
| Group 22 ACCEL/DECEL | Speed reference acceleration and deceleration ramps |
| Group 24 TORQUE CTRL | Torque reference ramp times |
| Group 32 SUPERVISION | Reference supervision |

## Diagnostics

| Actual signal | Additional information |
|---|---|
| 01.11, 01.12 | Values of external references |
| Group 02 ACTUAL SIGNALS | The reference values in different stages of the reference processing chain. |
| **Parameter** | |
| Group 14 RELAY OUTPUTS | Active reference / reference loss through a relay output |
| Group 15 ANALOGUE OUTPUTS | Reference value |

# Reference trimming

In reference trimming, the external %-reference (External reference REF2) is corrected depending on the measured value of a secondary application variable. The block diagram below illustrates the function.




%ref= The drive reference before trimming
%ref' = The drive reference after trimming
max. speed= Par. 20.02 (or 20.01 if the absolute value is greater)
max. freq = Par. 20.08 (or 20.07 if the absolute value is greater)
max. torq = Par. 20.14 (or 20.13 if the absolute value is greater)

## Settings

| Parameter | Additional information |
|---|---|
| 40.14…40.18 | Trimming function settings |
| 40.01…40.13, 40.19 | PID control block settings |
| Group 20 LIMITS | Drive operation limits |

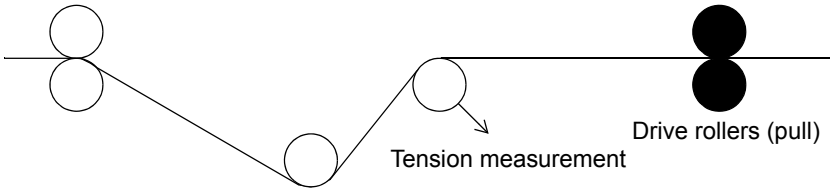
### Example

The drive runs a conveyor line. It is speed-controlled but the line tension also needs to be taken into account: If the measured tension exceeds the tension setpoint, the speed will be slightly decreased, and vice versa.

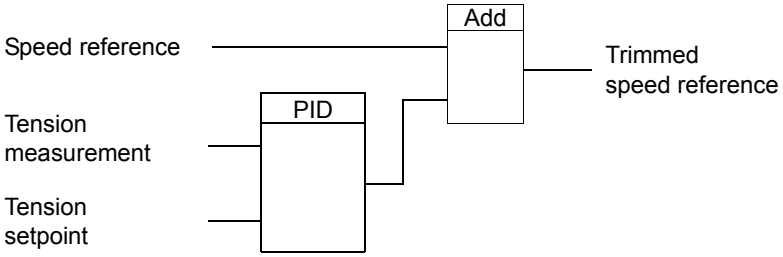
To accomplish the desired speed correction, the user:

- activates the trimming function and connects the tension setpoint and the measured tension to it
- tunes the trimming to a suitable level.

**Speed controlled conveyor line**




**Simplified block diagram**



# Programmable analogue inputs

The drive has three programmable analogue inputs: one voltage input (0/2 to 10 V or -10 to 10 V) and two current inputs (0/4 to 20 mA). Two extra inputs are available if an optional analogue I/O extension module is used. Each input can be inverted and filtered, and the maximum and minimum values can be adjusted.

## Update cycles in the Standard Control Program

| Input | Cycle |
|---|---|
| AI / standard | 6 ms |
| AI / extension | 6 ms (100 ms [1]) |

[1] Update cycle in the motor temperature measurement function. See group 35 MOT TEMP MEAS.

## Settings

| Parameter | Additional information |
|---|---|
| Group 11 REFERENCE SELECT | AI as a reference source |
| Group 13 ANALOGUE INPUTS | Processing of the standard inputs |
| 30.01 | Supervision of AI loss |
| Group 40 PID CONTROL | AI as a PID process control reference or actual values |
| 35.01 | AI in a motor temperature measurement |
| 40.15 | AI in a drive reference trimming |
| 42.07 | AI in a mechanical brake control function |
| 98.06 | Activation of optional analogue inputs |
| 98.13 | Optional AI signal type definition (bipolar or unipolar) |
| 98.14 | Optional AI signal type definition (bipolar or unipolar) |

## Diagnostics

| Actual value | Additional information |
|---|---|
| 01.18, 01.19, 01.20 | Values of standard inputs |
| 01.38, 01.39 | Value of optional inputs |
| Group 09 ACTUAL SIGNALS | Scaled analogue input values (integer values for function block programming) |

# Programmable analogue outputs

Two programmable current outputs (0/4 to 20 mA) are available as standard, and two outputs can be added by using an optional analogue I/O extension module. Analogue output signals can be inverted and filtered.

The analogue output signals can be proportional to motor speed, process speed (scaled motor speed), output frequency, output current, motor torque, motor power, etc.

It is possible to write a value to an analogue output through a serial communication link.

## Update cycles in the Standard Control Program

| Output | Cycle |
|---|---|
| AO / standard | 24 ms |
| AO / extension | 24 ms (1000 ms [1] ) |

[1] Update cycle in the motor temperature measurement function. See group 35 MOT TEMP MEAS.

## Settings

| Parameter | Additional information |
|---|---|
| Group 15 ANALOGUE OUTPUTS | AO value selection and processing (standard outputs) |
| 30.20 | Operation of an externally controlled AO in a communication break |
| 30.22 | Supervision of the use of optional AO |
| Group 35 MOT TEMP MEAS | AO in motor temperature measurement |
| Group 96 EXTERNAL AO | Optional AO value selection and processing |
| Group 98 OPTION MODULES | Activation of optional I/O |

## Diagnostics

| Actual value | Additional information |
|---|---|
| 01.22, 01.23 | Values of the standard outputs |
| 01.28, 01.29 | Values of the optional outputs |
| **Warning** | |
| IO CONFIG (FF8B) | Improper use of optional I/O |

# Programmable digital inputs

The drive has six programmable digital inputs as a standard. Six extra inputs are available if optional digital I/O extension modules are used.

## Update cycles in the Standard Control Program

| Input | Cycle |
|---|---|
| DI / standard | 6 ms |
| DI / extension | 12 ms |

## Settings

| Parameter | Additional information |
|---|---|
| Group 10 START/STOP/DIR | DI as start, stop, direction |
| Group 11 REFERENCE SELECT | DI in reference selection, or reference source |
| Group 12 CONSTANT SPEEDS | DI in constant speed selection |
| Group 16 SYST CTRL INPUTS | DI as external Run Enable, fault reset or user macro change signal |
| 22.01 | DI as acceleration and deceleration ramp selection signal |
| 30.03 | DI as external fault source |
| 30.05 | DI in motor overtemperature supervision function |
| 30.22 | Supervision of optional I/O use |
| 40.20 | DI as sleep function activation signal (in PID process control) |
| 42.02 | DI as mechanical brake acknowledgement signal |
| 98.03…96.05 | Activation of the optional digital I/O extension modules |
| 98.09…98.11 | Naming of the optional digital inputs in the application program |

## Diagnostics

| Actual value | Additional information |
|---|---|
| 01.17 | Values of the standard digital inputs |
| 01.40 | Values of the optional digital inputs |
| **Warning** | |
| IO CONFIG (FF8B) | Improper use of optional I/O |
| **Fault** | |
| I/O COMM ERR (7000) | Communication loss to I/O |

# Programmable relay outputs

As standard there are three programmable relay outputs. Six outputs can be added by using the optional digital I/O extension modules. By means of a parameter setting it is possible to choose which information to indicate through the relay output: ready, running, fault, warning, motor stall, etc.

It is possible to write a value to a relay output through a serial communication link.

## Update cycles in the Standard Control Program

| Output | Cycle |
|---|---|
| RO / standard | 100 ms |
| RO / extension | 100 ms |

## Settings

| Parameter | Additional information |
|---|---|
| Group 14 RELAY OUTPUTS | RO value selections and operation times |
| 30.20 | Operation of an externally controlled relay output on a communication break |
| Group 42 BRAKE CONTROL | RO in a mechanical brake control |
| Group 98 OPTION MODULES | Activation of optional relay outputs |

## Diagnostics

| Actual value | Additional information |
|---|---|
| 01.21 | Standard relay output states |
| 01.41 | Optional relays output states |

## Actual signals

Several actual signals are available:

- Drive output frequency, current, voltage and power
- Motor speed and torque
- Supply voltage and intermediate circuit DC voltage
- Active control location (Local, EXT1 or EXT2)
- Reference values
- Drive temperature
- Operating time counter (h), kWh counter
- Digital I/O and Analogue I/O status
- PID controller actual values (if the PID Control macro is selected)

Three signals can be shown simultaneously on the control panel display. It is also possible to read the values through the serial communication link or through the analogue outputs.

### Settings

| Parameter | Additional information |
|---|---|
| Group 15 ANALOGUE OUTPUTS | Selection of an actual signal to an analogue output |
| Group 92 D SET TR ADDR | Selection of an actual signal to a data set (serial communication) |

### Diagnostics

| Actual value | Additional information |
|---|---|
| Group 01 ACTUAL SIGNALS … 09 ACTUAL SIGNALS | Lists of actual signals |

## Motor identification

The performance of Direct Torque Control is based on an accurate motor model determined during the motor start-up.

A motor Identification Magnetisation is automatically done the first time the start command is given. During this first start-up, the motor is magnetised at zero speed for several seconds to allow the motor model to be created. This identification method is suitable for most applications.

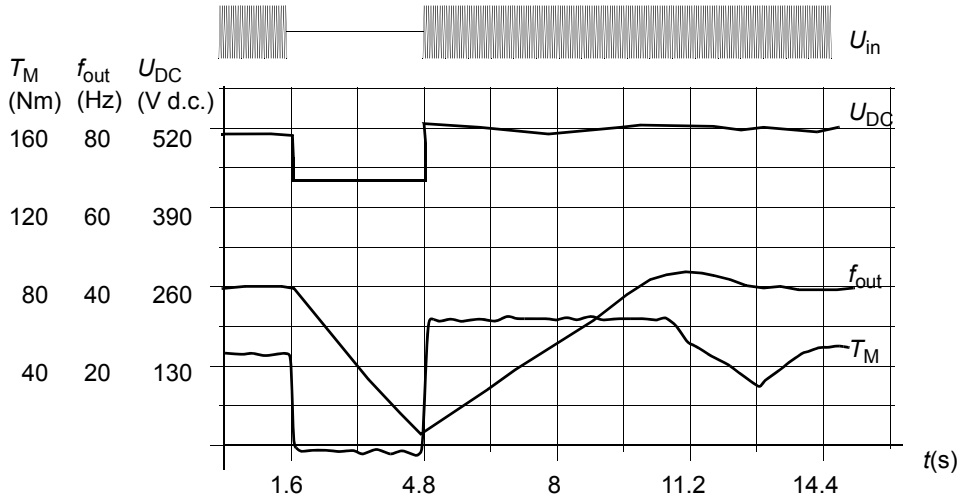
In demanding applications a separate Identification Run can be performed.

### Settings

Parameter 99.10.

## Power loss ride-through

If the incoming supply voltage is cut off, the drive will continue to operate by utilising the kinetic energy of the rotating motor. The drive will be fully operational as long as the motor rotates and generates energy to the drive. The drive can continue the operation after the break if the main contactor remained closed.




$U_{DC}$= Intermediate circuit voltage of the drive, $f_{out}$ = output frequency of the drive, $T_M$ = Motor torque

*Loss of supply voltage at nominal load ($f_{out}$ = 40 Hz). The intermediate circuit DC voltage drops to the minimum limit. The controller keeps the voltage steady as long as the supply voltage is switched off. The drive runs the motor in generator mode. The motor speed falls but the drive is operational as long as the motor has enough kinetic energy.*

---

**Note:** Cabinet assembled units equipped with main contactor option have a “hold circuit” that keeps the contactor control circuit closed during a short supply break. The allowed duration of the break is adjustable. The factory setting is five seconds.

---

## Automatic Start

Since the drive can detect the state of the motor within a few milliseconds, the starting is immediate under all conditions. There is no restart delay. E.g. the starting of turbining pumps or windmilling fans is easy.

### Settings

Parameter 21.01.

## Safe torque off (STO)

Safe torque off function disconnects the control voltage from the inverter power semiconductors, i.e. the drive output voltage is cut off. See the circuit diagrams delivered with the drive for the wirings to be made by the user.

**WARNING!** The Safe torque off function does not disconnect the voltage of the main and auxiliary circuits from the drive. Therefore, maintenance work on electrical parts may only be carried out after disconnecting the drive system from the input power line.

The Safe torque off function operates as follows:

- The operator gives an STO function activation command (for example, with a switch mounted on the control desk).
- The voltage supply of the ASTO-x1C board is disconnected.
- The drive application program receives an internal signal from the AINT board that an STO function activation command has been given. If the STO function activation command was given during run, the drive coasts to stop.
- The Safe torque off function is activated.
- Alarm START INHIBI is activated (03.08 Alarm Word 1 bit 0 value is 1).
- 03.03 AUX STATUS WORD bit 8 value is set to 1 (= Safe torque off function is active) within 3 seconds.

**Note:** Fault START INHIBI is generated (03.03 AUX STATUS WORD bit 8 value is 1) if the Safe torque off function is activated during motor run or if motor start command is given when the Safe torque off function is already active.

### Diagnostics

| Actual value | Additional information |
|---|---|
| 03.03 AUX STATUS WORD, bit 8 | Safe torque off function activation status |
| 03.08 ALARM WORD 1, bit 0 / 03.03 AUX STATUS WORD, bit 8 | Safe torque off function alarm/fault |

## Prevention of unexpected start-up (POUS)

The Prevention of unexpected start-up functions as Safe torque off described above, with the following exceptions:

- POUS must not be activated during run.
- POUS requires an AGPS-x1C board (not ASTO-x1C).

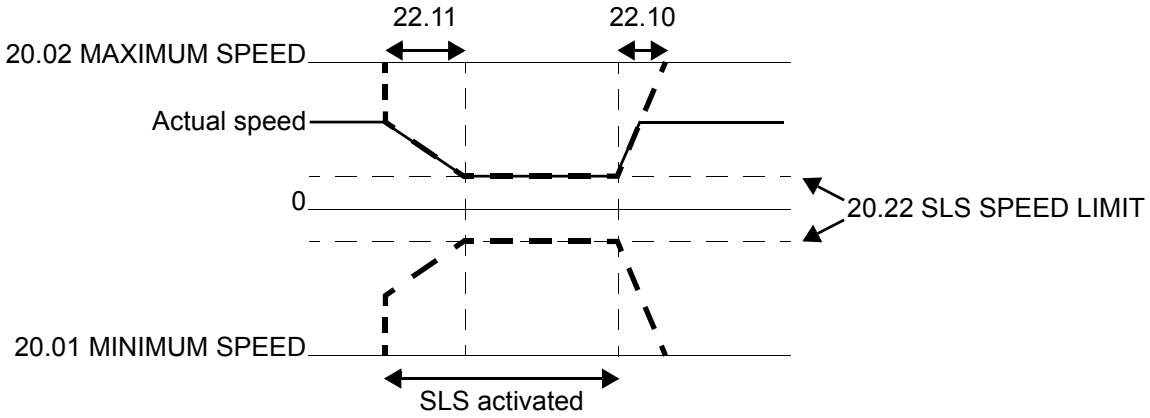
# Safely-limited speed (SLS) (AS7R firmware version only)

The SLS function limits the motor speed to a safe value.

**Note:** If used without a safety PLC, the SLS function does not fulfill the requirements for SIL classification as defined in EN IEC 61800-5-2.

When the SLS function is activated, speed limits are ramped from the values of 20.01 MINIMUM SPEED and 20.02 MAXIMUM SPEED to the value of 20.22 SLS SPEED LIMIT and its additive inverse, respectively. The ramping begins at the absolute value of the actual speed. If the actual speed is already below the SLS limit, the limit comes into effect immediately without ramping.

When the SLS function is deactivated, the speed limits are ramped up back to the values defined by 20.01 and 20.02, and the actual speed returns to the reference value if it was limited by this function.




## Settings

| Parameter | Additional information |
|---|---|
| 10.09 SLS ACTIVE | Selection of DI source |
| 20.22 SLS SPEED LIMIT | Safely-limited speed limit |
| 22.10 SLS ACCELER TIME | Time required for speed limit to ramp up from SLS to normal |
| 22.11 SLS DECELER TIME | Time required for speed limit to ramp down from current actual speed to SLS |

## Diagnostics and control

| Actual value | Additional information |
|---|---|
| 03.04 FREQ_LIMIT, bit 15 | SLS activation status |

See also *Safe speed functions for ACS800 cabinet-installed drives (+Q965/+Q966) Application guide* [3AUA0000090742 (English)].

**Note:** When SLS function is active, critical speed settings in parameter group 25 are not in effect.

## DC Magnetising

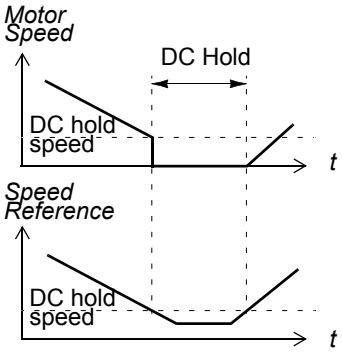
When DC Magnetising is activated, the drive automatically magnetises the motor before starting. This feature guarantees the highest possible breakaway torque, up to 200% of motor nominal torque. By adjusting the premagnetising time, it is possible to synchronise the motor start and e.g. a mechanical brake release. The Automatic Start feature and DC Magnetising cannot be activated at the same time.

### Settings

Parameters 21.01 and 21.02.

## DC Hold

By activating the motor DC Hold feature it is possible to lock the rotor at zero speed. When both the reference and the motor speed fall below the preset DC hold speed, the drive stops the motor and starts to inject DC into the motor. When the reference speed again exceeds the DC hold speed, the normal drive operation resumes.

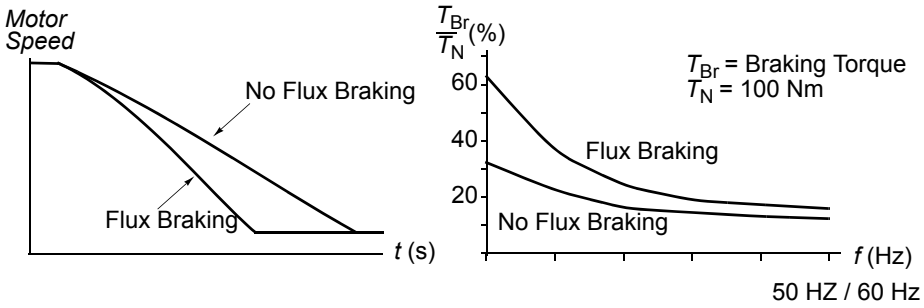


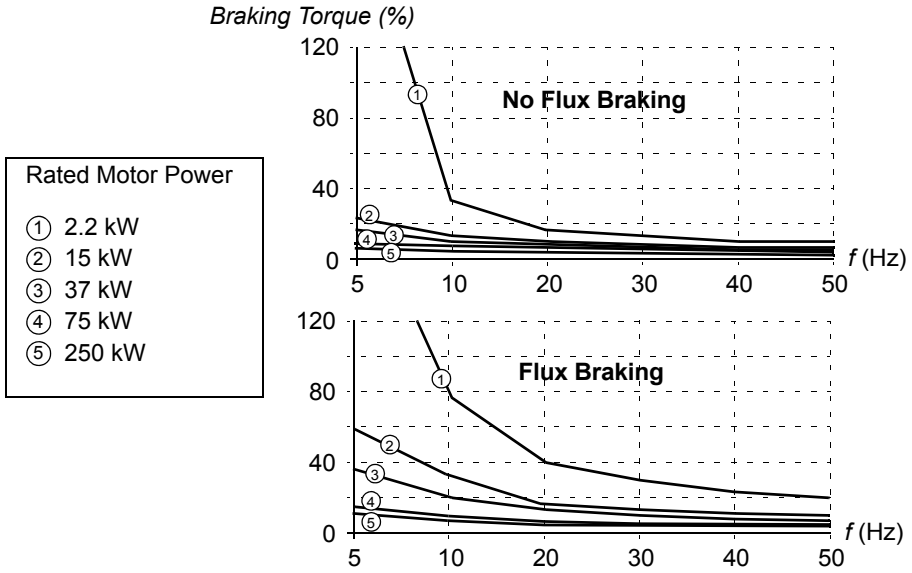

### Settings

Parameters 21.04, 21.05, and 21.06.

## Flux Braking

The drive can provide greater deceleration by raising the level of magnetisation in the motor. By increasing the motor flux, the energy generated by the motor during braking can be converted to motor thermal energy. This feature is useful in motor power ranges below 15 kW.






The drive monitors the motor status continuously, also during the Flux Braking. Therefore, Flux Braking can be used both for stopping the motor and for changing the speed. The other benefits of Flux Braking are:

- The braking starts immediately after a stop command is given. The function does not need to wait for the flux reduction before it can start the braking.
- The cooling of the motor is efficient. The stator current of the motor increases during the Flux Braking, not the rotor current. The stator cools much more efficiently than the rotor.

### Settings

Parameter 26.02.

## Flux Optimisation

Flux Optimisation reduces the total energy consumption and motor noise level when the drive operates below the nominal load. The total efficiency (motor and the drive) can be improved by 1% to 10%, depending on the load torque and speed.

### Settings

Parameter 26.01.

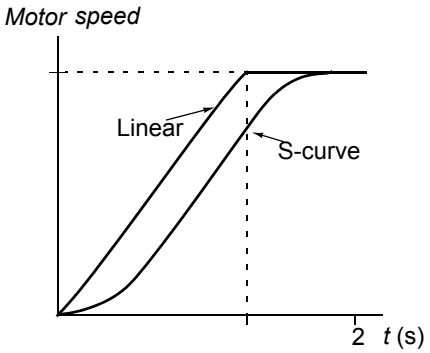
## Acceleration and deceleration ramps

Two user-selectable acceleration and deceleration ramps are available. It is possible to adjust the acceleration/deceleration times and the ramp shape. Switching between the two ramps can be controlled via a digital input.

The available ramp shape alternatives are Linear and S-curve.

**Linear**: Suitable for drives requiring steady or slow acceleration/deceleration.

**S-curve**: Ideal for conveyors carrying fragile loads, or other applications where a smooth transition is required when changing the speed.




### Settings

Parameter group 22 ACCEL/DECEL.

## Critical speeds

A Critical Speeds function is available for applications where it is necessary to avoid certain motor speeds or speed bands because of e.g. mechanical resonance problems.

### Settings

Parameter group 25 CRITICAL SPEEDS.

## Constant speeds

It is possible to predefine 15 constant speeds. Constant speeds are selected with digital inputs. Constant speed activation overrides the external speed reference.

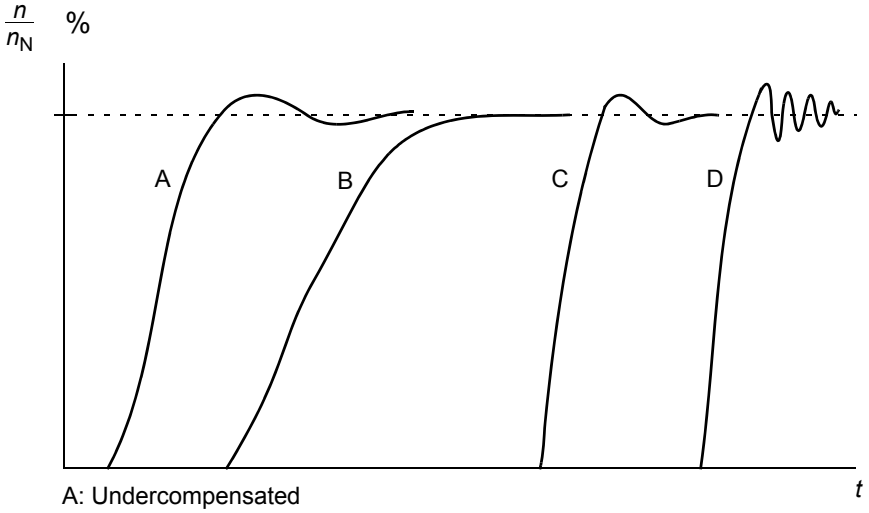
This function operates on a 6 ms time level.

### Settings

Parameter group 12 CONSTANT SPEEDS.

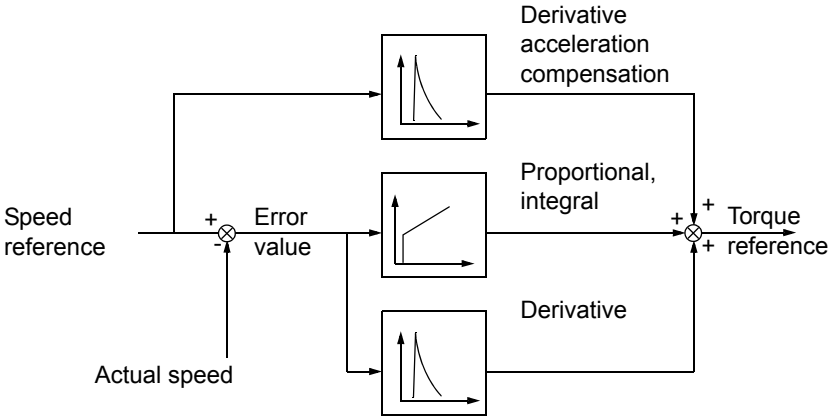
## Speed controller tuning

During the motor identification, the speed controller is automatically tuned. It is, however, possible to manually adjust the controller gain, integration time and derivation time, or let the drive perform a separate speed controller Autotune Run. In Autotune Run, the speed controller is tuned based on the load and inertia of the motor and the machine. The figure below shows speed responses at a speed reference step (typically, 1 to 20%).




A: Undercompensated
B: Normally tuned (autotuning)
C: Normally tuned (manually). Better dynamic performance than with B
D: Overcompensated speed controller

The figure below is a simplified block diagram of the speed controller. The controller output is the reference for the torque controller.




### Settings

Parameter group 23 SPEED CTRL and 20 LIMITS.

### Diagnostics

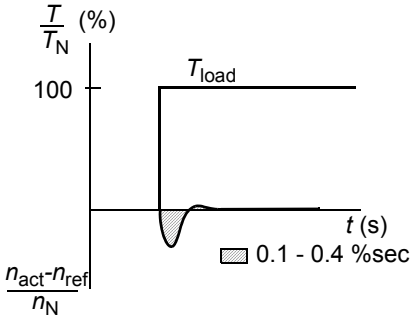
Actual signal 01.02.

## Speed control performance figures

The table below shows typical performance figures for speed control when Direct Torque Control is used.

| Speed Control | No Pulse Encoder | With Pulse Encoder |
|---|---|---|
| Static speed error, % of $n_N$ | ± 0.1 to 0.5% (10% of nominal slip) | ± 0.01% |
| Dynamic speed error | 0.4 %sec.* | 0.1 %sec.* |

*Dynamic speed error depends on speed controller tuning.



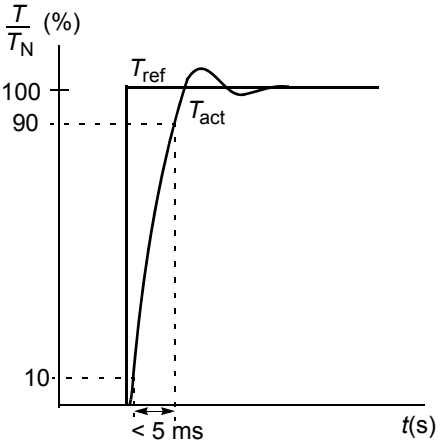

$T_N$ = rated motor torque
$n_N$ = rated motor speed
$n_{act}$ = actual speed
$n_{ref}$ = speed reference

## Torque control performance figures

The drive can perform precise torque control without any speed feedback from the motor shaft. The table below shows typical performance figures for torque control, when Direct Torque Control is used.

| Torque Control | No Pulse Encoder | With Pulse Encoder |
|---|---|---|
| Linearity error | ± 4%* | ± 3% |
| Repeatability error | ± 3%* | ± 1% |
| Torque rise time | 1 to 5 ms | 1 to 5 ms |

*When operated around zero frequency, the error may be greater.




$T_N$ = rated motor torque
$T_{ref}$ = torque reference
$T_{act}$ = actual torque

## Scalar control

It is possible to select Scalar Control as the motor control method instead of Direct Torque Control (DTC). In the Scalar Control mode, the drive is controlled with a frequency reference. The outstanding performance of the default motor control method, Direct Torque Control, is not achieved in Scalar Control.

It is recommended to activate the Scalar Control mode in the following special applications:

- In multimotor drives: 1) if the load is not equally shared between the motors, 2) if the motors are of different sizes, or 3) if the motors are going to be changed after the motor identification
- If the nominal current of the motor is less than 1/6 of the nominal output current of the drive
- If the drive is used without a motor connected (e.g. for test purposes)
- The drive runs a medium voltage motor via a step-up transformer.

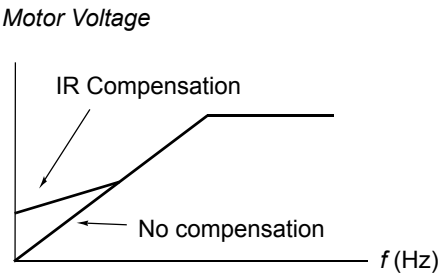
In the Scalar Control mode, some standard features are not available.

### Settings

Parameter 99.04.

## IR compensation for a scalar controlled drive

IR Compensation is active only when the motor control mode is Scalar (see section *Scalar control* on page *62*). When IR Compensation is activated, the drive gives an extra voltage boost to the motor at low speeds. IR Compensation is useful in applications that require high breakaway torque. In Direct Torque Control, no IR Compensation is possible/needed.




### Settings

Parameter 26.03.

## Hexagonal motor flux

Typically the drive controls the motor flux in such a way that the rotating flux vector follows a circular pattern. This is ideal in most applications. When operated above the field weakening point (FWP, typically 50 or 60 Hz), it is, however, not possible to reach 100% of the output voltage. The peak load capacity of the drive is lower than with the full voltage.

If hexagonal flux control is selected, the motor flux is controlled along a circular pattern below the field weakening point, and along a hexagonal pattern in the field weakening range. The applied pattern is changed gradually as the frequency increases from 100% to 120% of the FWP. Using the hexagonal flux pattern, the maximum output voltage can be reached; The peak load capacity is higher than with the circular flux pattern but the continuous load capacity is lower in the frequency range of FWP to 1.6 · FWP, due to increased losses.

### Settings

Parameter 26.05.

## Programmable protection functions

### AI<Min

AI<Min function defines the drive operation if an analogue input signal falls below the preset minimum limit.

*Settings*

Parameter 30.01.

### Panel Loss

Panel Loss function defines the operation of the drive if the control panel selected as control location for the drive stops communicating.

*Settings*

Parameter 30.02.

### External Fault

External Faults can be supervised by defining one digital input as a source for an external fault indication signal.

*Settings*

Parameter 30.03.

## Motor Thermal Protection

The motor can be protected against overheating by activating the Motor Thermal Protection function and by selecting one of the motor thermal protection modes available.

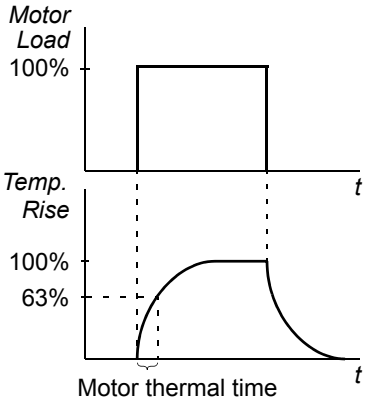
The Motor Thermal Protection modes are based either on a motor temperature thermal model or on an overtemperature indication from a motor thermistor.

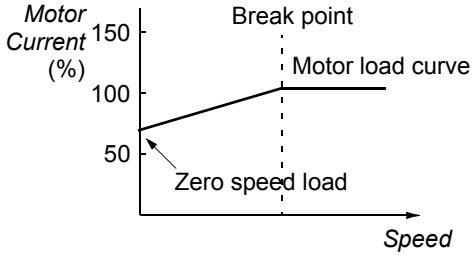
*Motor temperature thermal model*

The drive calculates the temperature of the motor on the basis of the following assumptions:

1) The motor is at the estimated temperature (value of 01.37 MOTOR TEMP EST saved at power switch off) when power is applied to the drive. When power is applied for the first time, the motor is at the ambient temperature (30°C).

2) Motor temperature is calculated using either the user-adjustable or automatically calculated motor thermal time and motor load curve (see the figures below). The load curve should be adjusted in case the ambient temperature exceeds 30°C.




*Use of the motor thermistor*

It is possible to detect motor overtemperature by connecting a motor thermistor (PTC) between the +24 VDC voltage supply offered by the drive and digital input DI6. In normal motor operation temperature, the thermistor resistance should be less than 1.5 kohm (current 5 mA). The drive stops the motor and gives a fault indication if the thermistor resistance exceeds 4 kohm. The installation must meet the regulations for protecting against contact.

*Settings*

Parameters 30.04 to 30.09.

---

**Note:** It is also possible to use the motor temperature measurement function. See sections *Motor temperature measurement through the standard I/O* on page *73* and *Motor temperature measurement through an analogue I/O extension* on page *75*.

---

### Stall Protection

The drive protects the motor in a stall situation. It is possible to adjust the supervision limits (torque, frequency, time) and choose how the drive reacts to a motor stall condition (warning indication / fault indication & stop the drive / no reaction).

The torque and current limits, which define the stall limit, must be set according to the maximum load of the used application. **Note:** Stall limit is restricted by internal current limit 03.04 TORQ_INV_CUR_LIM.

When the application reaches the stall limit and the output frequency of the drive is below the stall frequency: Fault is activated after the stall time delay.

*Settings*

Parameters 30.10 to 30.12.

Parameters 20.03, 20.13 and 20.14 (Define the stall limit.)

### Underload Protection

Loss of motor load may indicate a process malfunction. The drive provides an underload function to protect the machinery and process in such a serious fault condition. Supervision limits - underload curve and underload time - can be chosen as well as the action taken by the drive upon the underload condition (warning indication / fault indication & stop the drive / no reaction).

*Settings*

Parameters 30.13 to 30.15.

### Motor Phase Loss

The Phase Loss function monitors the status of the motor cable connection. The function is useful especially during the motor start: the drive detects if any of the motor phases is not connected and refuses to start. The Phase Loss function also supervises the motor connection status during normal operation.

*Settings*

Parameter 30.16.

### Earth Fault Protection

The earth fault protection detects earth faults in the motor or motor cable. The protection is based on sum current measurement.

- An earth fault in the supply cable does not activate the protection.
- In an earthed (grounded) supply, the protection activates in 200 microseconds.
- In an unearthed (ungrounded) supply, the supply capacitance should be 1 microfarad or more.
- The capacitive currents caused by shielded motor cables up to 300 metres do not activate the protection.
- Earth fault protection is deactivated when the drive is stopped.

**Note:** With parallel connected inverter modules, the earth fault indication is CUR UNBAL xx. See chapter *Fault tracing*.

*Settings*

Parameter 30.17.

### Communication Fault

The Communication Fault function supervises the communication between the drive and an external control device (e.g. a fieldbus adapter module).

*Settings*

Parameters 30.18 to 30.21.

### Supervision of optional IO

The function supervises the use of the optional analogue and digital inputs and outputs in the application program, and warns if the communication to the input/output is not operational.

*Settings*

Parameter 30.22.

## Preprogrammed faults

### Overcurrent

The overcurrent trip limit for the drive is 1.65 to 2.17 · $I_{max}$ depending on the drive type.

### DC overvoltage

The DC overvoltage trip limit is 1.3 × 1.35 × $U_{1max}$, where $U_{1max}$ is the maximum value of the supply voltage range. For 400 V units, $U_{1max}$ is 415 V. For 500 V units, $U_{1max}$ is 500 V. For 690 V units, $U_{1max}$ is 690 V. The actual voltage in the intermediate circuit corresponding to the supply voltage trip level is 728 V DC for 400 V units, 877 V DC for 500 V units, and 1210 V DC for 690 V units.

### DC undervoltage

The DC undervoltage trip limit is 0.6 × 1.35 × $U_{1min}$, where $U_{1min}$ is the minimum value of the supply voltage range. For 400 V and 500 V units, $U_{1min}$ is 380 V. For 690 V units, $U_{1min}$ is 525 V. The actual voltage in the intermediate circuit corresponding to the supply voltage trip level is 307 V DC for 400 V and 500 V units, and 425 V DC for 690 V units.

### Drive temperature

The drive supervises the inverter module temperature. There are two supervision limits: warning limit and fault trip limit.

### Enhanced drive temperature monitoring for ACS800, frame sizes R7 and R8

Traditionally, drive temperature monitoring is based on the power semiconductor (IGBT) temperature measurement which is compared with a fixed maximum IGBT temperature limit. However, certain abnormal conditions such as cooling fan failure, insufficient cooling air flow or excessive ambient temperature might cause overheating inside the converter module, which the traditional temperature monitoring alone does not detect. The Enhanced drive temperature monitoring improves the protection in these situations.

The function monitors the converter module temperature by checking cyclically that the measured IGBT temperature is not excessive considering the load current, ambient temperature, and other factors that affect the temperature rise inside the converter module. The calculation uses an experimentally defined equation that simulates the normal temperature changes in the module depending on the load. Drive generates a warning when the temperature exceeds the limit, and trips when temperature exceeds the limit by 5°C.

---

**Note:** The monitoring is available for ACS800-02, -04 and -07, frame sizes R7 and R8 with Standard Control Program version ASXR7360 (and later versions). For ACS800-U2, -U4 and -U7, frame sizes R7 and R8, the monitoring is available with Standard Control Program version ASXR730U (and later versions).

---

Types to which the enhanced drive temperature monitoring is available:

| | |
|---|---|
| ACS800-XX | -0080-2 |
| | -0100-2 |
| | -0120-2 |
| | -0140-2/3/7 |
| | -0170-2/3/5/7 |
| | -0210-2/3/5/7 |
| | -0230-2 |
| | -0260-2/3/5/7 |
| | -0270-5 |
| | -0300-2/5 |
| | -0320-3/5/7 |
| | -0400-3/5/7 |

-0440-3/5/7
-0490-3/5/7
-0550-5/7
-0610-5/7

*Settings*

| Parameter | Additional information |
|---|---|
| 95.10 TEMP INV AMBIENT | Ambient temperature |

*Diagnostics*

| Warning/Fault | Additional information |
|---|---|
| INV OVERTEMP | Excessive converter module temperature |

### Short circuit

There are separate protection circuits for supervising the motor cable and the inverter short circuits. If a short circuit occurs, the drive will not start and a fault indication is given.

### Input phase loss

Input phase loss protection circuits supervise the supply cable connection status by detecting intermediate circuit ripple. If a phase is lost, the ripple increases. The drive is stopped and a fault indication is given if the ripple exceeds 13%.

### Control board temperature

The drive supervises the control board temperature. A fault indication CTRL B TEMP is given, if the temperature exceeds 88°C.

### Overfrequency

If the drive output frequency exceeds the preset level, the drive is stopped and a fault indication is given. The preset level is 50 Hz over the operating range absolute maximum speed limit (Direct Torque Control mode active) or frequency limit (Scalar Control active).

### Internal fault

If the drive detects an internal fault, the drive is stopped and a fault indication is given.

## Operation limits

ACS800 has adjustable limits for speed, current (maximum), torque (maximum) and DC voltage.

### Settings

Parameter group 20 LIMITS.

## Power limit

Power limitation is used to protect the input bridge and the DC intermediate circuit. If the maximum allowed power is exceeded, the drive torque is automatically limited. Maximum overload and continuous power limits depend on the drive hardware. For specific values refer to the appropriate hardware manual.

## Automatic resets

The drive can automatically reset itself after overcurrent, overvoltage, undervoltage and “analogue input below a minimum” faults. The Automatic Resets must be activated by the user.

### Settings

Parameter group 31 AUTOMATIC RESET.

## Supervisions

The drive monitors whether certain user selectable variables are within the user-defined limits. The user may set limits for speed, current etc.

The supervision functions operate on a 100 ms time level.

### Settings

Parameter group 32 SUPERVISION.

### Diagnostics

| Actual Signals | Additional information |
|---|---|
| 03.02 | Supervision limit indicating bits in a packed boolean word |
| 03.04 | Supervision limit indicating bits in a packed boolean word |
| 03.14 | Supervision limit indicating bits in a packed boolean word |
| Group 14 RELAY OUTPUTS | Supervision limit indication through a relay output |

## Parameter lock

The user can prevent parameter adjustment by activating the parameter lock.

### Settings

Parameters 16.02 and 16.03.

# Process PID control

There is a built-in PID controller in the drive. The controller can be used to control process variables such as pressure, flow or fluid level.

When the process PID control is activated, a process reference (setpoint) is connected to the drive instead of a speed reference. An actual value (process feedback) is also brought back to the drive. The process PID control adjusts the drive speed in order to keep the measured process quantity (actual value) at the desired level (reference).

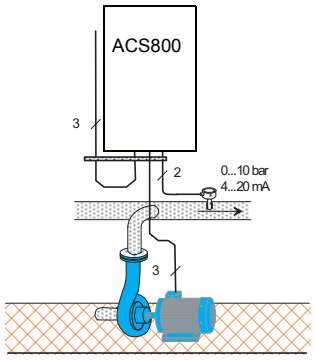
The control operates on a 24 ms time level.

## Block diagrams

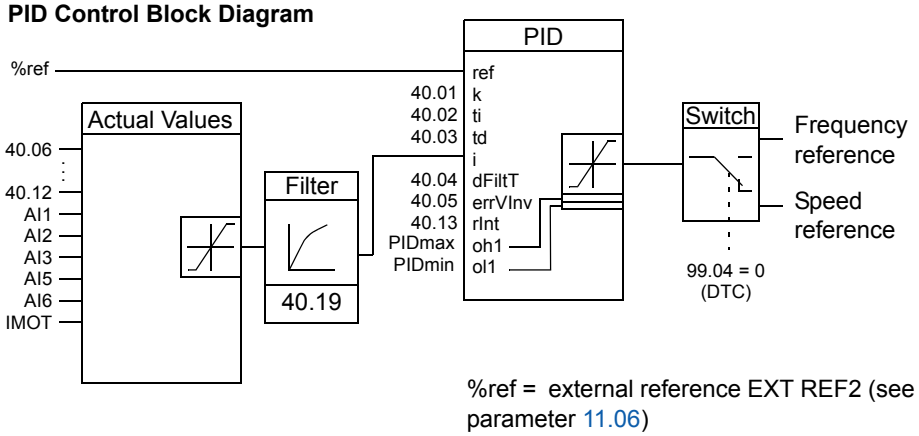
The block diagram below right illustrates the process PID control.

The figure on the left shows an application example: The controller adjusts the speed of a pressure boost pump according to the measured pressure and the set pressure reference.

**Example:**
Pressure boost pump




**PID Control Block Diagram**




%ref = external reference EXT REF2 (see parameter 11.06)

### Settings

| Parameter | Purpose |
|---|---|
| 99.02 | Process PID control activation |
| 40.01...40.13, 40.19, 40.25...40.27 | The settings of the process PID controller |
| 32.13...32.18 | The supervision limits for the process reference REF2 and the variables ACT1 and ACT2 |

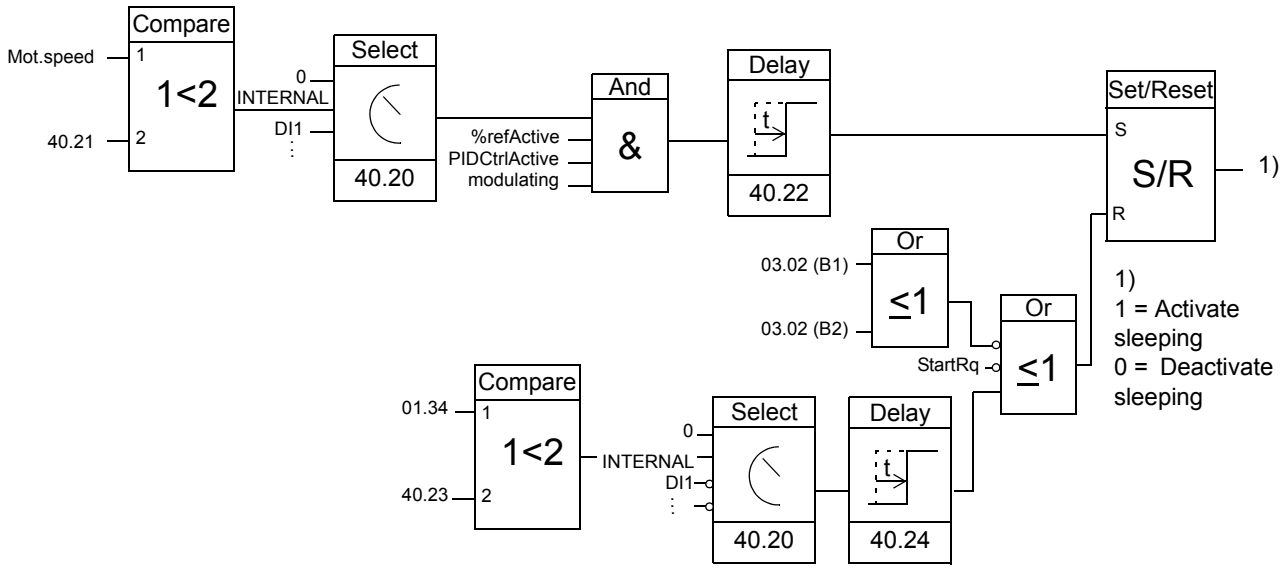
### Diagnostics

| Actual Signals | Purpose |
|---|---|
| 01.12, 01.24, 01.25, 01.26 and 01.34 | PID process controller reference, actual values and error value |
| Group 14 RELAY OUTPUTS | Supervision limit exceeded indication through a relay output |
| Group 15 ANALOGUE OUTPUTS | PID process controller values through standard analogue outputs |
| Group 96 EXTERNAL AO | PID process controller values through optional analogue outputs |

## Sleep function for the process PID control

The sleep function operates on a 100 ms time level.

The block diagram below illustrates the sleep function enable/disable logic. The sleep function can be put into use only when the process PID control is active.




Mot.speed: Actual speed of the motor

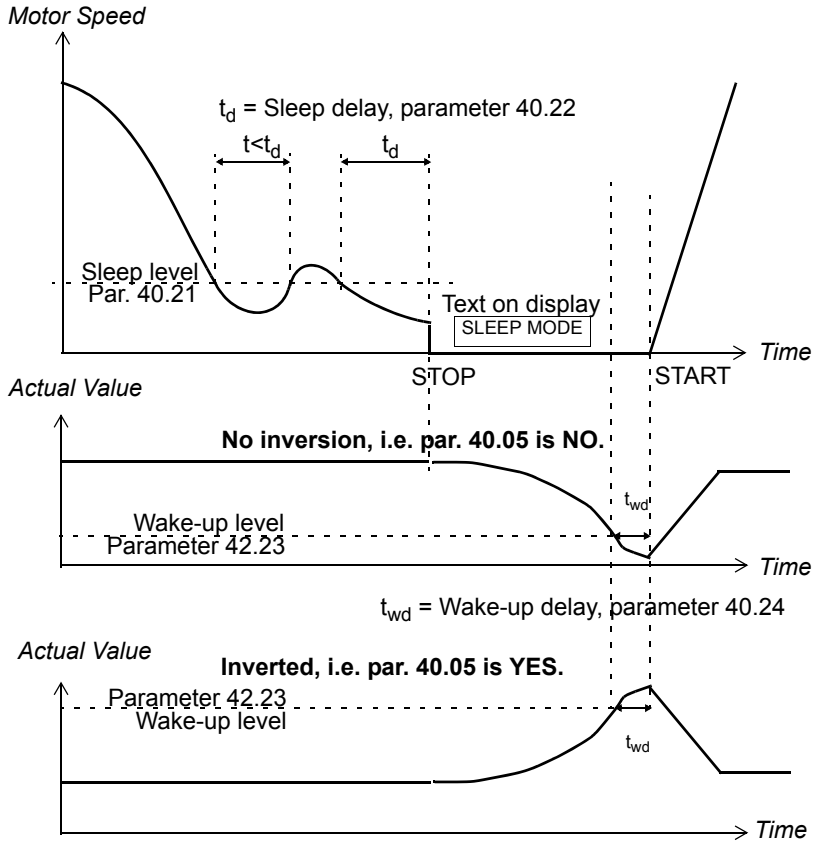
%refActive: The % reference (EXT REF2) is in use. See parameter 11.02.

PIDCtrlActive: 99.02 is PID CTRL

modulating: The inverter IGBT control is operating

### Example

The time scheme below visualises the operation of the sleep function.




Sleep function for a PID controlled pressure boost pump: The water consumption falls at night. As a consequence, the PID process controller decreases the motor speed. However, due to natural losses in the pipes and the low efficiency of the centrifugal pump at low speeds, the motor does not stop but keeps rotating. The sleep function detects the slow rotation, and stops the unnecessary pumping after the sleep delay has passed. The drive shifts into sleep mode, still monitoring the pressure. The pumping restarts when the pressure falls under the allowed minimum level and the wake-up delay has passed.

### Settings

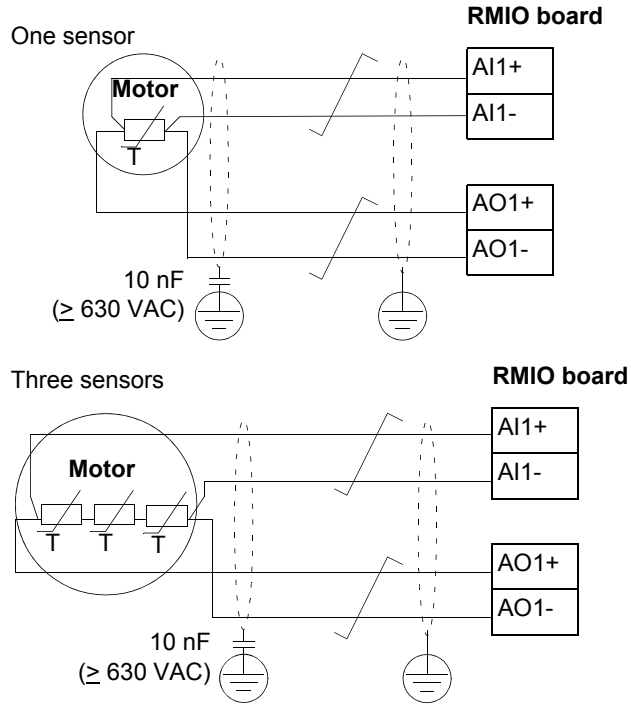
| Parameter | Additional information |
|---|---|
| 99.02 | Process PID control activation |
| 40.05 | Inversion |
| 40.20...40.24 | Sleep function settings |

### Diagnostics

Warning SLEEP MODE on the panel display.

## Motor temperature measurement through the standard I/O

This section describes the temperature measurement of one motor when the drive control board RMIO is used as the connection interface.




The minimum voltage of the capacitor must be 630 VAC.

**WARNING!** According to IEC 664, the connection of the motor temperature sensor to the RMIO board, requires double or reinforced insulation between motor live parts and the sensor. Reinforced insulation entails a clearance and creepage distance of 8 mm (400 / 500 VAC equipment). If the assembly does not fulfil the requirement:

- The RMIO board terminals must be protected against contact and they may not be connected to other equipment.

Or

- The temperature sensor must be isolated from the RMIO board terminals.

See also section *Motor Thermal Protection* on page *64*.

## Settings

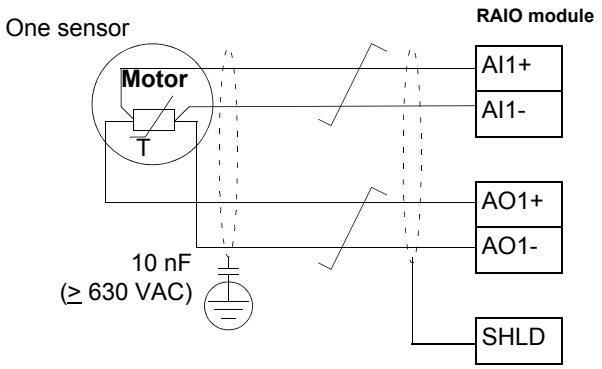
| Parameter | Additional information |
|---|---|
| 15.01 | Analogue output in a motor 1 temperature measurement. Set to M1 TEMP MEAS. |
| 35.01…35.03 | Settings of motor 1 temperature measurement |
| **Other** | |
| Parameters 13.01 to 13.05 (AI1 processing) and 15.02 to 15.05 (AO1 processing) are not effective. | |
| At the motor end the cable shield should be earthed through a 10 nF capacitor. If this is not possible, the shield is to be left unconnected. | |

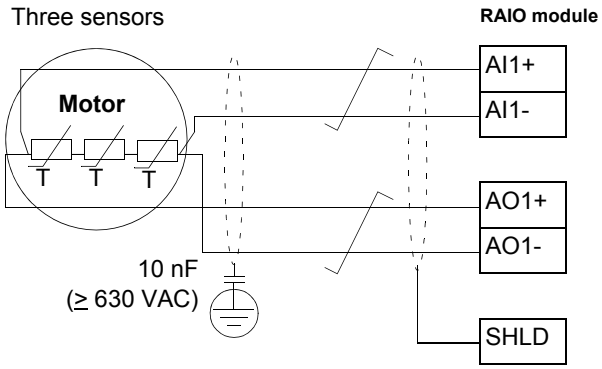
## Diagnostics

| Actual values | Additional information |
|---|---|
| 01.35 | Temperature value |
| **Warnings** | |
| MOTOR 1 TEMP (4312) | Measured motor temperature has exceeded the set alarm limit. |
| T MEAS ALM (FF91) | Motor temperature measurement is out of acceptable range. |
| **Faults** | |
| MOTOR 1 TEMP (4312) | Measured motor temperature has exceeded the set fault limit. |

## Motor temperature measurement through an analogue I/O extension

This section describes the motor temperature measurement of one motor when an optional analogue I/O extension module RAIO is used as the connection interface.




The minimum voltage of the capacitor must be 630 VAC.

**WARNING!** According to IEC 664, the connection of the motor temperature sensor to the RAIO module, requires double or reinforced insulation between motor live parts and the sensor. Reinforced insulation entails a clearance and creepage distance of 8 mm (400 / 500 VAC equipment). If the assembly does not fulfil the requirement:

- The RAIO module terminals must be protected against contact and they may not be connected to other equipment.

Or

- The temperature sensor must be isolated from the RAIO module terminals.

See also section *Motor Thermal Protection* on page *64*.

### Settings

| Parameter | Additional information |
|---|---|
| 35.01 … 35.03 | Settings of motor 1 temperature measurement |
| 98.12 | Activation of optional analogue I/O for motor temperature measurement |
| **Other** | |
| Parameters 13.16 to 13.20 (AI1 processing) and 96.01 to 96.05 (AO1 signal selection and processing) are not effective. | |
| At the motor end the cable shield should be earthed through a 10 nF capacitor. If this is not possible, the shield is to be left unconnected. | |

### Diagnostics

| Actual values | Additional information |
|---|---|
| 01.35 | Temperature value |
| **Warnings** | |
| MOTOR 1 TEMP (4312) | Measured motor temperature has exceeded the set alarm limit |
| T MEAS ALM (FF91) | Motor temperature measurement is out of acceptable range. |
| **Faults** | |
| MOTOR 1 TEMP (4312) | Measured motor temperature has exceeded the set fault limit |

## Adaptive Programming using the function blocks

Conventionally, the user can control the operation of the drive by parameters. Each parameter has a fixed set of choices or a setting range. The parameters make the programming easy, but the choices are limited. The user cannot customise the operation any further. The Adaptive Program makes freer customising possible without the need of a special programming tool or language:

- The program is built of standard function blocks included in the drive application program.
- The control panel is the programming tool.
- The user can document the program by drawing it on block diagram template sheets.

The maximum size of the Adaptive Program is 15 function blocks. The program may consist of several separate functions.

For more information, see the *Application Guide for Adaptive Program* [3AFE64527274 (English)].

### DriveAP

DriveAP is a Windows based tool for Adaptive Programming. With DriveAP it is possible to upload the Adaptive Program from the drive and edit it with PC.

For more information, see the *DriveAP User's Manual* [3AFE64540998 (English)].

# Control of a mechanical brake

The mechanical brake is used for holding the motor and driven machinery at zero speed when the drive is stopped, or not powered.

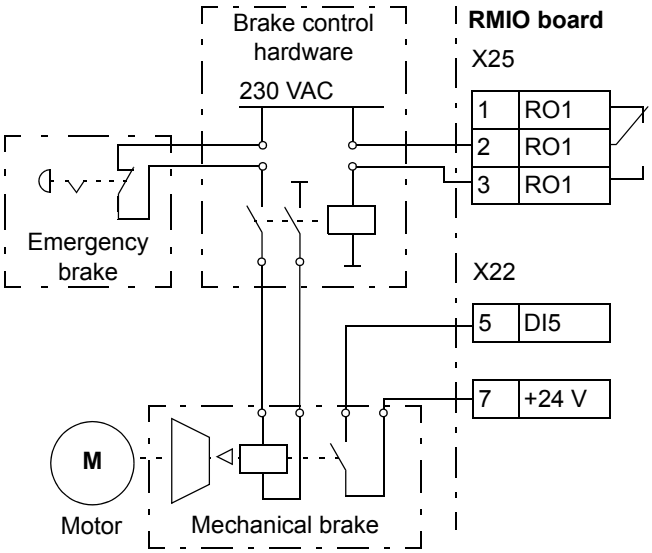
### Example

The figure below shows a brake control application example.

**WARNING!** Make sure that the machinery into which the drive with brake control function is integrated fulfils the personnel safety regulations. Note that the frequency converter (a Complete Drive Module or a Basic Drive Module, as defined in IEC 61800-2), is not considered as a safety device mentioned in the European Machinery Directive and related harmonised standards. Thus, the personnel safety of the complete machinery must not be based on a specific frequency converter feature (such as the brake control function), but it has to be implemented as defined in the application specific regulations.

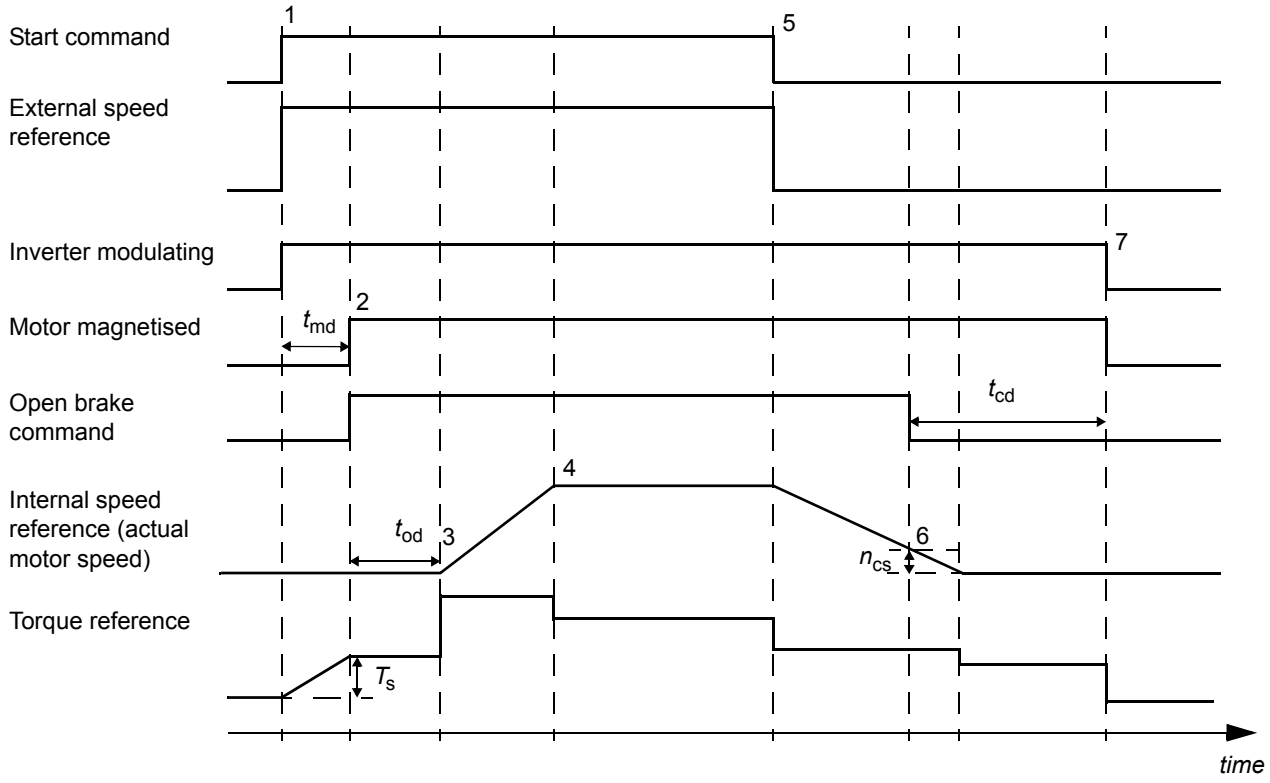
Brake control logic is integrated in the drive application program. The brake control hardware and wirings needs to be done by the user.

- Brake on/off control through relay output RO1.
- Brake supervision through digital input DI5 (optional).
- Emergency brake switch in the brake control circuit.



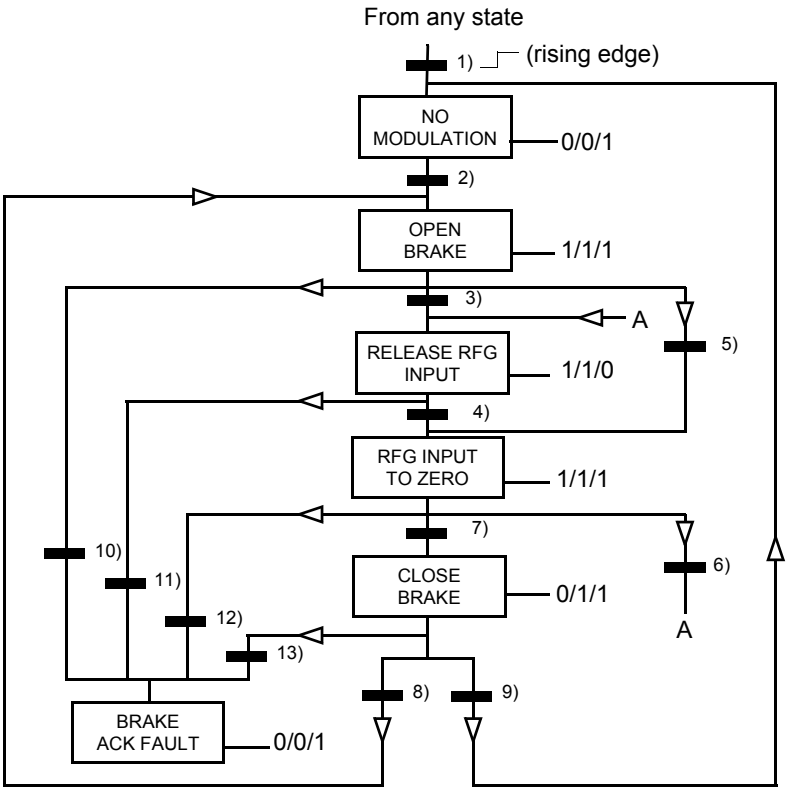
### Operation time scheme

The time scheme below illustrates the operation of the brake control function. See also the state machine on the following page.




| | |
|---|---|
| $T_s$ | Start torque at brake release (Parameter 42.07 and 42.08) |
| $t_{md}$ | Motor magnetising delay |
| $t_{od}$ | Brake open delay (Parameter 42.03) |
| $n_{cs}$ | Brake close speed (Parameter 42.05) |
| $t_{cd}$ | Brake close delay (Parameter 42.04) |

## State shifts




RFG = Ramp Function Generator in the speed control loop (reference handling).

State (Symbol NN X/Y/Z )

- NN: State name
- X/Y/Z: State outputs/operations
  - X = 1 Open the brake. The relay output set to brake on/off control energises.
  - Y = 1 Forced start. The function keeps the internal Start on until the brake is closed in spite of the status of the external Start signal.
  - Z = 1 Ramp in zero. Forces the used speed reference (internal) to zero along a ramp.

State change conditions (Symbol ▬ )

1) Brake control active 0 -> 1 OR Inverter is modulating = 0
2) Motor magnetised = 1 AND Drive running = 1
3) Brake acknowledgement = 1 AND Brake open delay passed AND Start = 1
4) Start = 0
5) Start = 0
6) Start = 1
7) |Actual motor speed| < Brake close speed AND Start = 0
8) Start = 1
9) Brake acknowledgement = 0 AND Brake close delay passed = 1 AND Start = 0

Only if parameter 42.02 ≠ OFF:

10) Brake acknowledgement = 0 AND Brake open delay passed =1
11) Brake acknowledgement = 0
12) Brake acknowledgement = 0
13) Brake acknowledgement = 1 AND Brake close delay passed = 1

### Settings

| Parameter | Additional information |
|---|---|
| 14.01 | Relay output for the brake control (set to BRAKE CTRL) |
| Group 42 BRAKE CONTROL | Brake function settings |

### Diagnostics

| Actual value | Additional information |
|---|---|
| 03.01 | Ramp in zero bit |
| 03.13 | The state of bit “brake open/close command” |
| **Warnings** | |
| BRAKE ACKN (FF74) | Unexpected state of brake acknowledge signal |
| **Faults** | |
| BRAKE ACKN (FF74) | Unexpected state of brake acknowledge signal |

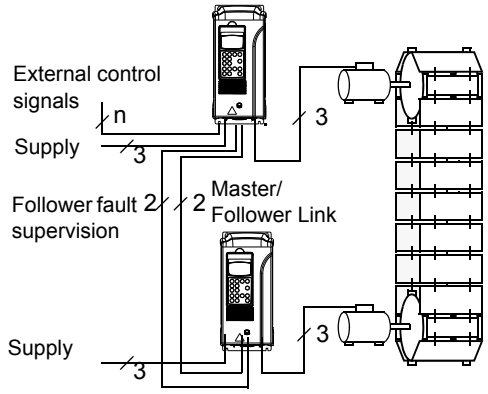
## Master/Follower use of several drives

In a Master/Follower application, the system is run by several drives, the motor shafts of which are coupled to each other. The master and follower drives communicate via a fibre optic link. The figures below illustrate two basic application types.

**M/F Application, Overview**

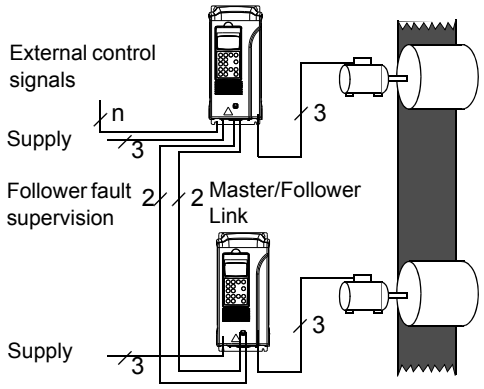
Solidly coupled motor shafts:

- Speed-controlled Master
- Follower follows the torque reference of the Master




Flexibly coupled motor shafts:

- Speed-controlled Master
- Follower follows the speed reference of the Master




### Settings and diagnostics

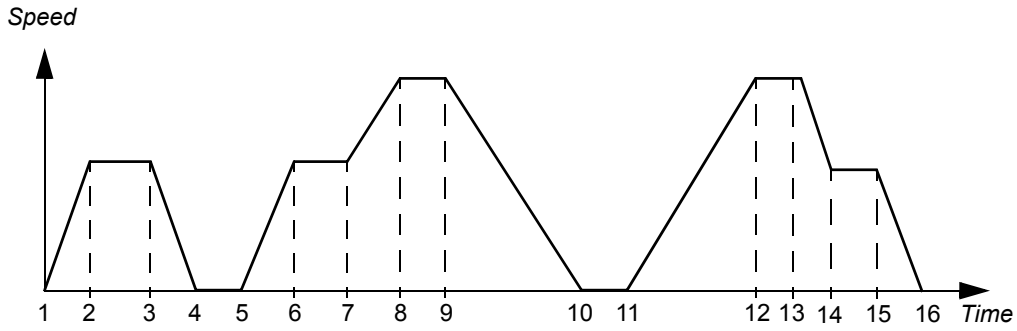
| Parameter | Additional information |
|---|---|
| Group 60 MASTER/ FOLLOWER | Master/Follower parameters |
| **Other** | |
| *Master/Follower Application Guide* [3AFE64590430 (English)] explains the functionality in further detail. | |

## Jogging

The jogging function is typically used to control a cyclical movement of a machine section. One push button controls the drive through the whole cycle: When it is on, the drive starts, accelerates to a preset speed at a preset rate. When it is off, the drive decelerates to zero speed at a preset rate.

The figure and table below describe the operation of the drive. They also represent how the drive shifts to normal operation (= jogging inactive) when the drive start command is switched on. Jog cmd = State of the jogging input, Start cmd = State of the drive start command.

The function operates on a 100 ms time level.




| Phase | Jog cmd | Start cmd | Description |
|---|---|---|---|
| 1-2 | 1 | 0 | Drive accelerates to the jogging speed along the acceleration ramp of the jogging function. |
| 2-3 | 1 | 0 | Drive runs at the jogging speed. |
| 3-4 | 0 | 0 | Drive decelerates to zero speed along the deceleration ramp of the jogging function. |
| 4-5 | 0 | 0 | Drive is stopped. |
| 5-6 | 1 | 0 | Drive accelerates to the jogging speed along the acceleration ramp of the jogging function. |
| 6-7 | 1 | 0 | Drive runs at the jogging speed. |
| 7-8 | x | 1 | Normal operation overrides the jogging. Drive accelerates to the speed reference along the active acceleration ramp. |
| 8-9 | x | 1 | Normal operation overrides the jogging. Drive follows the speed reference. |
| 9-10 | 0 | 0 | Drive decelerates to zero speed along the active deceleration ramp. |
| 10-11 | 0 | 0 | Drive is stopped. |
| 11-12 | x | 1 | Normal operation overrides the jogging. Drive accelerates to the speed reference along the active acceleration ramp. |
| 12-13 | x | 1 | Normal operation overrides the jogging. Drive follows he speed reference. |
| 13-14 | 1 | 0 | Drive decelerates to the jogging speed along the deceleration ramp of the jogging function. |
| 14-15 | 1 | 0 | Drive runs at the jogging speed. |
| 15-16 | 0 | 0 | Drive decelerates to zero speed along the deceleration ramp of the jogging function. |

x = State can be either 1 or 0.

**Note:** The jogging is not operational when:

- the drive start command is on, or
- the drive is in local control (L visible on the first row of the panel display).

**Note:** The jogging speed overrides the constant speeds.

**Note:** The ramp shape time is set to zero during the jogging.

### Settings

| Parameter | Additional information |
|---|---|
| 10.06 | Input for the on/off control of the jogging. |
| 12.15 | Jogging speed |
| 21.10 | Switch off delay for the inverter IGBT control. A delay keeps the inverter modulation live over a short standstill period enabling a smooth restart. |
| 22.04, 22.05 | Acceleration and deceleration times used during the jogging. |
| 22.06 | Acceleration and deceleration ramp shape time: Set to zero during the jogging. |

## Reduced Run function

Reduced Run function is available for parallel connected inverters. Reduced Run function makes it possible to continue the operation with limited current if an inverter module(s) is out of order. If one of the modules is broken, it must be removed. Parameter change is needed to continue the run with reduced current (95.03 INT CONFIG USER). For instructions on how to remove and reconnect an inverter module, see the appropriate drive hardware manual.

### Settings

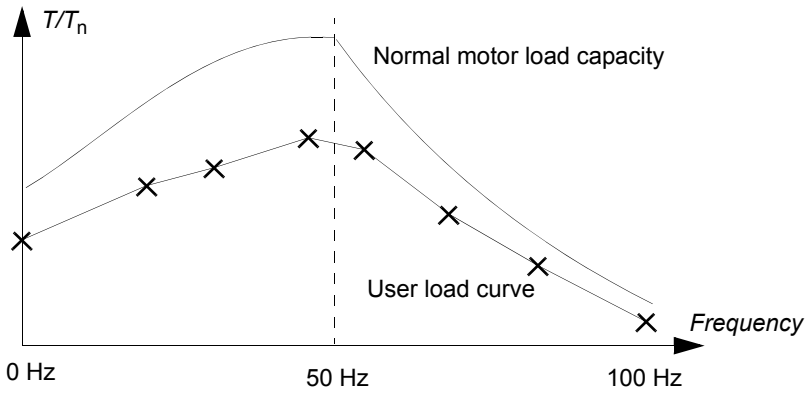
| Parameter | Additional information |
|---|---|
| 95.03 INT CONFIG USER | Number of existing parallel connected inverters |

### Diagnostics

| Actual value | Additional information |
|---|---|
| 04.01 | INT board fault |
| **Faults** | |
| INT CONFIG | Number of inverter modules is not equal to original number of inverters. |

## User load curve

Motor temperature rise can be limited by limiting the drive output current. The user can define a load curve (output current as a function of frequency). The load curve is defined by eight points by parameters 72.02...72.17. If the load curve is exceeded, a fault / warning / current limitation is activated.

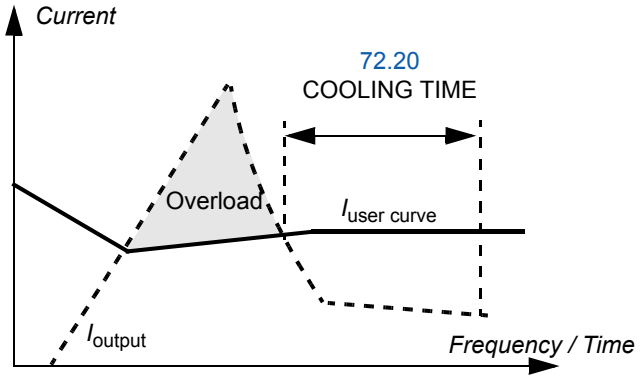



### Overload

Overload supervision can be applied to the user load curve by setting parameters 72.18 LOAD CURRENT LIMIT... 72.20 COOLING TIME according to the overload values defined by the motor manufacturer.

The supervision is based on an integrator, $\int I^2 dt$. Whenever the drive output current exceeds the user load curve, the integrator is started. When the integrator has reached the overload limit defined by parameters 72.18 and 72.19, the drive reacts as defined by parameter 72.01 OVERLOAD FUNC. The output of the integrator is set to zero if the current stays continuously below the user load curve for the cooling time defined by parameter 72.20 COOLING TIME.

If the overload time 72.19 LOAD THERMAL TIME is set to zero, the drive output current is limited to the user load curve.



### Settings

| Parameter | Additional information |
|---|---|
| Group 72 USER LOAD CURVE | User load curve |

### Diagnostics

| Actual value | Additional information |
|---|---|
| 02.20 | Measured motor current in percent of the user load curve current |
| **Warnings** | |
| USER L CURVE | Integrated motor current has exceeded load curve. |
| **Faults** | |
| USER L CURVE | Integrated motor current has exceeded load curve. |

# Application macros

## Chapter overview

This chapter describes the intended use, operation and the default control connections of the standard application macros. It also describes how to save a user macro, and how to recall it.

## Overview of macros

Application macros are preprogrammed parameter sets. While starting up the drive, the user typically selects one of the macros - the one that is best suited to his needs - by parameter 99.02, makes the essential changes and saves the result as a user macro.

There are five standard macros and two user macros. The table below contains a summary of the macros and describes suitable applications.

| Macro | Suitable Applications |
|---|---|
| Factory | Ordinary speed control applications where no, one, two or three constant speeds are used:<br>- Conveyors<br>- Speed-controlled pumps and fans<br>- Test benches with predefined constant speeds |
| Hand/Auto | Speed control applications. Switching between two external control devices is possible. |
| PID Control | Process control applications e.g. different closed loop control systems such as pressure control, level control, and flow control. For example:<br>- pressure boost pumps of municipal water supply systems<br>- level controlling pumps of water reservoirs<br>- pressure boost pumps of district heating systems<br>- material flow control on a conveyor line.<br>It is also possible to switch between process and speed control. |
| Torque Control | Torque control applications. Switching between torque and speed control is possible. |
| Sequential Control | Speed control applications in which speed reference, seven constant speeds and two acceleration and deceleration ramps can be used. |
| User | The user can save the customised standard macro i.e. the parameter settings including group 99, and the results of the motor identification into the permanent memory, and recall the data at a later time. Two user macros are essential when switching between two different motors is required |

## Note on external power supply

External +24 V power supply for the RMIO board is recommended if

- the application requires a fast start after connecting the input power supply
- fieldbus communication is required when the input power supply is disconnected.

The RMIO board can be supplied from an external power source via terminal X23 or X34 or via both X23 and X34. The internal power supply to terminal X34 can be left connected when using terminal X23.

**WARNING!** If the RMIO board is supplied from an external power source via terminal X34, the loose end of the cable removed from the RMIO board terminal must be secured mechanically to a location where it cannot come into contact with electrical parts. If the screw terminal plug of the cable is removed, the wire ends must be individually insulated.

### Parameter settings

In Standard Control Program, set parameter 16.09 CTRL BOARD SUPPLY to EXTERNAL 24V if the RMIO board is powered from an external supply.

## Factory macro

All drive commands and reference settings can be given from the control panel or from an external control location. The active control location is selected with the ***LOC/REM*** key of the panel. The drive is speed-controlled.

In external control, the control location is EXT1. The reference signal is connected to analogue input AI1 and Start/Stop and Direction signals are connected to digital inputs DI1 and DI2. By default, the direction is fixed to FORWARD (parameter 10.03). DI2 does not control the direction of rotation unless parameter 10.03 is changed to REQUEST.

Three constant speeds are selected by digital inputs DI5 and DI6. Two acceleration/deceleration ramps are preset. The acceleration and deceleration ramps are used according to the state of digital input DI4.

Two analogue signals (speed and current) and three relay output signals (ready, running and inverted fault) are available.

The default signals on the display of the control panel are FREQUENCY, CURRENT and POWER.

## Default control connections

The figure below shows the external control connections for the Factory macro. The markings of the standard I/O terminals on the RMIO board are shown.

1) Effective only if parameter 10.03 is switched to REQUEST by the user.

2) The US default settings differ as follows:

| | |
|---|---|
| DI1 | Start (Pulse: 0->1) |
| DI2 | Stop (Pulse: 1->0) |
| DI3 | Forward/Reverse |

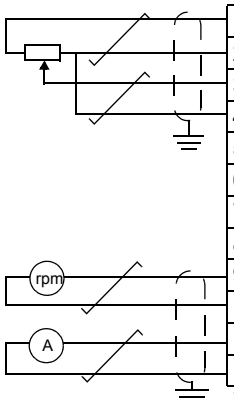
3) 0 = ramp times according to par. 22.02 and 22.03. 1 = ramp times according to par. 22.04 and 22.05.

4) See parameter group 12 CONSTANT SPEEDS:

| DI5 | DI6 | Operation |
|---|---|---|
| 0 | 0 | Set speed through AI1 |
| 1 | 0 | Speed 1 |
| 0 | 1 | Speed 2 |
| 1 | 1 | Speed 3 |

5) See parameter 21.09.

6) Total maximum current shared between this output and optional modules installed on the board.




X20

| | | |
|---|---|---|
| 1 | VREF | Reference voltage -10 VDC<br>1 kohm ≤ $R_L$ ≤ 10 kohm |
| 2 | GND | |

X21

| | | |
|---|---|---|
| 1 | VREF | Reference voltage 10 VDC<br>1 kohm ≤ $R_L$ ≤ 10 kohm |
| 2 | GND | |
| 3 | AI1+ | Speed reference 0(2) … 10 V, $R_{in}$ > 200 kohm |
| 4 | AI1- | |
| 5 | AI2+ | By default, not in use. 0(4) … 20 mA, $R_{in}$ = 100 ohm |
| 6 | AI2- | |
| 7 | AI3+ | By default, not in use. 0(4) … 20 mA, $R_{in}$ = 100 ohm |
| 8 | AI3- | |
| 9 | AO1+ | Motor speed 0(4) … 20 mA ≙ 0 … motor nom. speed, $R_L$ ≤ 700 ohm |
| 10 | AO1- | |
| 11 | AO2+ | Output current 0(4) … 20 mA ≙ 0 … motor nom. current, $R_L$ ≤ 700 ohm |
| 12 | AO2- | |

X22

| | | |
|---|---|---|
| 1 | DI1 | Stop/Start 2) |
| 2 | DI2 | Forward/reverse 1, 2) |
| 3 | DI3 | By default, not in use. 2) |
| 4 | DI4 | Acceleration & deceleration select 3) |
| 5 | DI5 | Constant speed select 4) |
| 6 | DI6 | Constant speed select 4) |
| 7 | +24 V | +24 VDC, max. 100 mA |
| 8 | +24 V | |
| 9 | DGND1 | Digital ground |
| 10 | DGND2 | Digital ground |
| 11 | DI IL | Start interlock (0 = stop) 5) |

X23

| | | |
|---|---|---|
| 1 | +24 V | Auxiliary voltage output and input, non-isolated, 24 V DC 250 mA 6) |
| 2 | GND | |

X25

| | | |
|---|---|---|
| 1 | RO11 | Relay output 1<br>**Ready** |
| 2 | RO12 | |
| 3 | RO13 | |

X26

| | | |
|---|---|---|
| 1 | RO21 | Relay output 2<br>**Running** |
| 2 | RO22 | |
| 3 | RO23 | |

X27

| | | |
|---|---|---|
| 1 | R031 | Relay output 3<br>**Inverted fault** |
| 2 | R032 | |
| 3 | R033 | |

Fault

## Hand/Auto macro

Start/Stop and Direction commands and reference settings can be given from one of two external control locations, EXT1 (Hand) or EXT2 (Auto). The Start/Stop/Direction commands of EXT1 (Hand) are connected to digital inputs DI1 and DI2, and the reference signal is connected to analogue input AI1. The Start/Stop/Direction commands of EXT2 (Auto) are connected to digital inputs DI5 and DI6, and the reference signal is connected to analogue input AI2. The selection between EXT1 and EXT2 is dependent on the status of digital input DI3. The drive is speed controlled. Speed reference and Start/Stop and Direction commands can be given from the control panel keypad also. One constant speed can be selected through digital input DI4.

Speed reference in Auto Control (EXT2) is given as a percentage of the maximum speed of the drive.

Two analogue and three relay output signals are available on terminal blocks. The default signals on the display of the control panel are FREQUENCY, CURRENT and CTRL LOC.

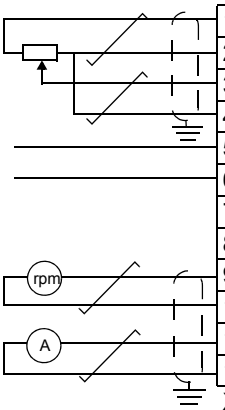
### Default control connections

The figure below shows the external control connections for the Hand/Auto macro. The markings of the standard I/O terminals on the RMIO board are shown.

[1] Selection between two external control locations, EXT1 and EXT2.

[2] See parameter 21.09.

[3] Total maximum current shared between this output and optional modules installed on the board.




| | | |
|---|---|---|
| X20 | | |
| 1 | VREF | Reference voltage -10 VDC |
| 2 | GND | 1 kohm ≤ $R_L$ ≤ 10 kohm |
| X21 | | |
| 1 | VREF | Reference voltage 10 VDC, kohm ≤ $R_L$ ≤ 10 kohm |
| 2 | GND | |
| 3 | AI1+ | Speed reference (Hand control). 0(2) … 10 V, $R_{in}$ > 200 kohm |
| 4 | AI1- | |
| 5 | AI2+ | Speed reference (Auto control). 0(4) … 20 mA, $R_{in}$ = 100 ohm |
| 6 | AI2- | |
| 7 | AI3+ | By default, not in use. 0(4) … 20 mA, $R_{in}$ = 100 ohm. |
| 8 | AI3- | |
| 9 | AO1+ | Motor speed 0(4) … 20 mA ≙ 0 … motor nom. speed, $R_L$ ≤ 700 ohm |
| 10 | AO1- | |
| 11 | AO2+ | Output current 0(4) … 20 mA ≙ 0 … motor nom. current, $R_L$ ≤ 700 ohm |
| 12 | AO2- | |
| X22 | | |
| 1 | DI1 | Stop/Start (Hand control) |
| 2 | DI2 | Forward/Reverse (Hand control) |
| 3 | DI3 | Hand/Auto control select [1] |
| 4 | DI4 | Constant speed 4: Par. 12.05 |
| 5 | DI5 | Forward/Reverse (Auto control) |
| 6 | DI6 | Stop/Start (Auto control) |
| 7 | +24 V | +24 VDC, max. 100 mA |
| 8 | +24 V | |
| 9 | DGND1 | Digital ground |
| 10 | DGND2 | Digital ground |
| 11 | DI IL | Start interlock (0 = stop) [2] |
| X23 | | |
| 1 | +24 V | Auxiliary voltage output and input, non-isolated, 24 V DC 250 mA [3] |
| 2 | GND | |
| X25 | | |
| 1 | RO11 | Relay output 1 **Ready** |
| 2 | RO12 | |
| 3 | RO13 | |
| X26 | | |
| 1 | RO21 | Relay output 2 **Running** |
| 2 | RO22 | |
| 3 | RO23 | |
| X27 | | |
| 1 | R031 | Relay output 3 **Inverted fault** |
| 2 | R032 | |
| 3 | R033 | |

Fault

# PID Control macro

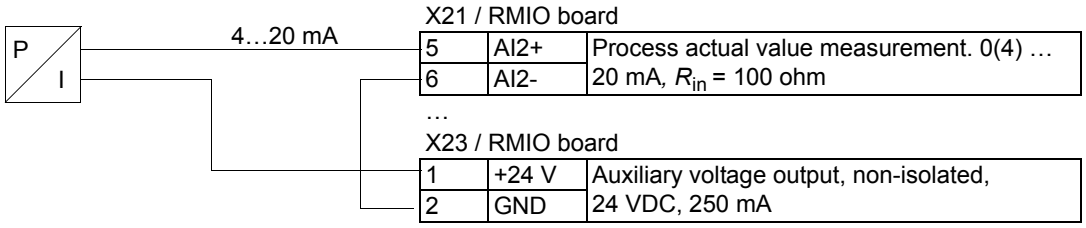
The PID Control macro is used for controlling a process variable – such as pressure or flow – by controlling the speed of the driven motor.

Process reference signal is connected to analogue input AI1 and process feedback signal to analogue input AI2.

Alternatively, a direct speed reference can be given to the drive through analogue input AI1. Then the PID controller is bypassed and the drive no longer controls the process variable. Selection between the direct speed control and the process variable control is done with digital input DI3.

Two analogue and three relay output signals are available on terminal blocks. The default signals on the display of the control panel are SPEED, ACTUAL VALUE1 and CONTROL DEVIATION.

### Connection example, 24 VDC / 4…20 mA two-wire sensor




**Note:** The sensor is supplied through its current output. Thus the output signal must be 4…20 mA, not 0…20 mA.

## Default control connections

The figure below shows the external control connections for the PID Control macro. The markings of the standard I/O terminals on the RMIO board are shown.

1) Selection between two external control locations, EXT1 and EXT2

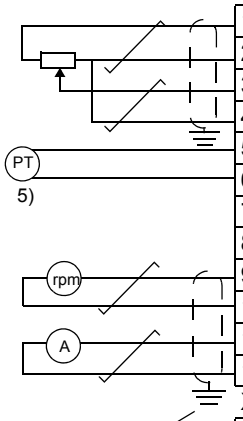
2) In use only when the speed control is active (DI3 = 0)

3) Off = Run Enable off. Drive will not start or stops. On = Run Enable on. Normal operation.

4) See parameter 21.09.

5) The sensor needs to be powered. See the manufacturer's instructions. A connection example of a two-wire 24 VDC / 4…20 mA sensor is shown on previous page.

6) Total maximum current shared between this output and optional modules installed on the board.




| | | |
|---|---|---|
| X20 | | |
| 1 | VREF | Reference voltage -10 VDC |
| 2 | GND | 1 kohm ≤ $R_L$ ≤ 10 kohm |
| X21 | | |
| 1 | VREF | Reference voltage 10 VDC |
| 2 | GND | 1 kohm ≤ $R_L$ ≤ 10 kohm |
| 3 | AI1+ | Speed ref. (speed cntrl) or process ref. (process cntrl). 0(2) … 10 V, $R_{in}$ > 200 kohm |
| 4 | AI1- | |
| 5 | AI2+ | Process actual value measurement. 0(4) … 20 mA, $R_{in}$ = 100 ohm |
| 6 | AI2- | |
| 7 | AI3+ | By default, not in use. 0(4) … 20 mA, $R_{in}$ = 100 ohm. |
| 8 | AI3- | |
| 9 | AO1+ | Motor speed 0(4) … 20 mA ≙ 0 … motor nom. speed, $R_L$ ≤ 700 ohm |
| 10 | AO1- | |
| 11 | AO2+ | Output current 0(4) … 20 mA ≙ 0 … motor nom. current, $R_L$ ≤ 700 ohm |
| 12 | AO2- | |
| X22 | | |
| 1 | DI1 | Stop/Start (speed control) |
| 2 | DI2 | By default, not in use. |
| 3 | DI3 | Speed / process control select 1) |
| 4 | DI4 | Constant speed 4: Par. 12.05 2) |
| 5 | DI5 | Run Enable. 3) |
| 6 | DI6 | Stop/Start (process control) |
| 7 | +24 V | +24 VDC, max. 100 mA |
| 8 | +24 V | |
| 9 | DGND1 | Digital ground |
| 10 | DGND2 | Digital ground |
| 11 | DI IL | Start interlock (0 = stop) 4) |
| X23 | | |
| 1 | +24 V | Auxiliary voltage output and input, non-isolated, 24 V DC 250 mA 6) |
| 2 | GND | |
| X25 | | |
| 1 | RO11 | Relay output 1 **Ready** |
| 2 | RO12 | |
| 3 | RO13 | |
| X26 | | |
| 1 | RO21 | Relay output 2 **Running** |
| 2 | RO22 | |
| 3 | RO23 | |
| X27 | | |
| 1 | R031 | Relay output 3 **Inverted fault** |
| 2 | R032 | |
| 3 | R033 | |

Fault

## Torque Control macro

Torque Control macro is used in applications in which torque control of the motor is required. Torque reference is given through analogue input AI2 as a current signal. By default, 0 mA corresponds to 0 %, and 20 mA to 100 % of the rated motor torque. The Start/Stop/Direction commands are given through digital inputs DI1 and DI2. The Run Enable signal is connected to DI6.

Through digital input DI3 it is possible to select speed control instead of torque control. It is also possible to change the external control location to local (i.e. to control panel) by pressing the ***LOC/REM*** key. The panel controls the speed by default. If torque control with panel is required, the value of parameter 11.01 should be changed to REF2 (%).

Two analogue and three relay output signals are available on terminal blocks. The default signals on the display of the control panel are SPEED, TORQUE and CTRL LOC.

## Default control connections

The figure below shows the external control connections for the Torque Control macro. The markings of the standard I/O terminals on the RMIO board are shown.

[1] Selection between external control locations EXT1 and EXT2

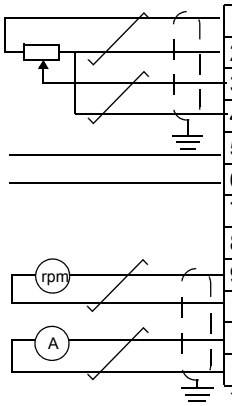
[2] In use only when the speed control is active (DI3 = 0)

[3] Off = Ramp times according to par. 22.02 and 22.03. On = Ramp times according to par. 22.04 and 22.05.

[4] Off = Run Enable off. Drive will not start or stops. On = Run Enable on. Normal operation.

[5] See parameter 21.09.

[6] Total maximum current shared between this output and optional modules installed on the board.




| | | | |
|---|---|---|---|
| X20 | | | |
| | 1 | VREF | Reference voltage -10 VDC<br>1 kohm ≤ $R_L$ ≤ 10 kohm |
| | 2 | GND | |
| X21 | | | |
| | 1 | VREF | Reference voltage 10 VDC<br>1 kohm ≤ $R_L$ ≤ 10 kohm |
| | 2 | GND | |
| | 3 | AI1+ | Speed reference. 0(2) … 10 V, $R_{in}$ > 200 kohm |
| | 4 | AI1- | |
| | 5 | AI2+ | Torque reference. 0(4) … 20 mA, $R_{in}$ = 100 ohm |
| | 6 | AI2- | |
| | 7 | AI3+ | By default, not in use. 0(4) … 20 mA, $R_{in}$ = 100 ohm |
| | 8 | AI3- | |
| | 9 | AO1+ | Motor speed 0(4) … 20 mA ≙ 0 … motor nom. speed, $R_L$ ≤ 700 ohm |
| | 10 | AO1- | |
| | 11 | AO2+ | Output current 0(4) … 20 mA ≙ 0 … motor nom. current, $R_L$ ≤ 700 ohm |
| | 12 | AO2- | |
| X22 | | | |
| | 1 | DI1 | Stop/Start |
| | 2 | DI2 | Forward/Reverse |
| | 3 | DI3 | Speed / torque control select [1] |
| | 4 | DI4 | Constant speed 4: Par. 12.05 [2] |
| | 5 | DI5 | Acceleration & deceleration select [3] |
| | 6 | DI6 | Run Enable [4] |
| | 7 | +24 V | +24 VDC, max. 100 mA |
| | 8 | +24 V | |
| | 9 | DGND1 | Digital ground |
| | 10 | DGND2 | Digital ground |
| | 11 | DI IL | Start interlock (0 = stop) [5] |
| X23 | | | |
| | 1 | +24 V | Auxiliary voltage output and input, non-isolated, 24 V DC 250 mA [6] |
| | 2 | GND | |
| X25 | | | |
| | 1 | RO11 | Relay output 1<br>**Ready** |
| | 2 | RO12 | |
| | 3 | RO13 | |
| X26 | | | |
| | 1 | RO21 | Relay output 2<br>**Running** |
| | 2 | RO22 | |
| | 3 | RO23 | |
| X27 | | | |
| | 1 | R031 | Relay output 3<br>**Inverted fault** |
| | 2 | R032 | |
| | 3 | R033 | |

Fault

## Sequential Control macro

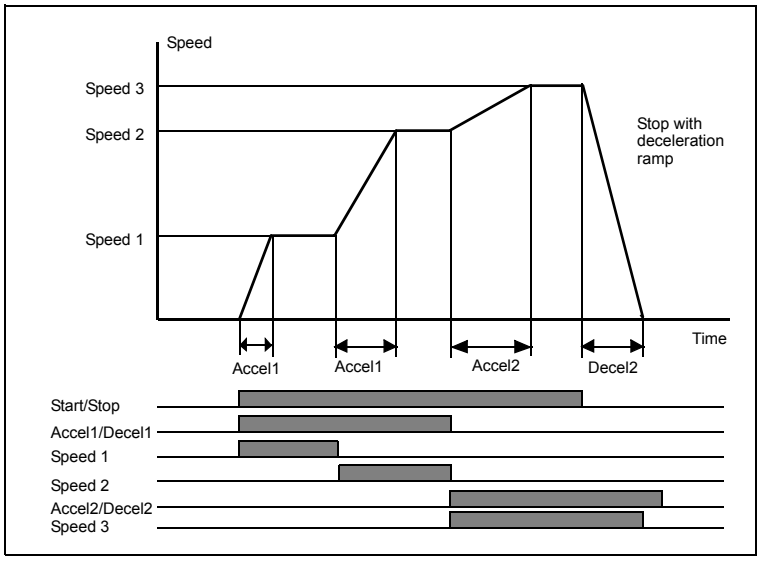
This macro offers seven preset constant speeds which can be activated by digital inputs DI4 to DI6. Two acceleration/deceleration ramps are preset. The acceleration and deceleration ramps are applied according to the state of digital input DI3. The Start/Stop and Direction commands are given through digital inputs DI1 and DI2.

External speed reference can be given through analogue input AI1. The reference is active only when all of the digital inputs DI4 to DI6 are 0 VDC. Giving operational commands and setting reference is possible also from the control panel.

Two analogue and three relay output signals are available on terminal blocks. Default stop mode is ramp. The default signals on the display of the control panel are FREQUENCY, CURRENT and POWER.

### Operation diagram

The figure below shows an example of the use of the macro.



## Default control connections

The figure below shows the external control connections for the Sequential Control macro. The markings of the standard I/O terminals on the RMIO board are shown.

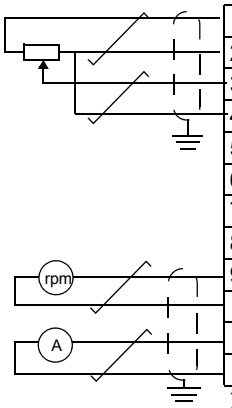
[1] Off = Ramp times according to par. 22.02 and 22.03. On = Ramp times according to par. 22.04 and 22.05.

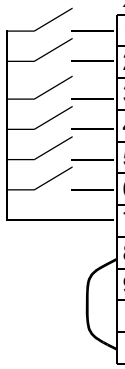
[2] See parameter group 12 CONSTANT SPEEDS:

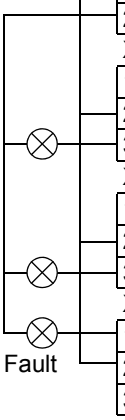
| DI4 | DI5 | DI6 | Operation |
|---|---|---|---|
| 0 | 0 | 0 | Set speed through AI1 |
| 1 | 0 | 0 | Speed 1 |
| 0 | 1 | 0 | Speed 2 |
| 1 | 1 | 0 | Speed 3 |
| 0 | 0 | 1 | Speed 4 |
| 1 | 0 | 1 | Speed 5 |
| 0 | 1 | 1 | Speed 6 |
| 1 | 1 | 1 | Speed 7 |

[3] See parameter 21.09.

[4] Total maximum current shared between this output and optional modules installed on the board.






X20

| | | |
|---|---|---|
| 1 | VREF | Reference voltage -10 VDC |
| 2 | GND | 1 kohm ≤ $R_L$ ≤ 10 kohm |

X21

| | | |
|---|---|---|
| 1 | VREF | Reference voltage 10 VDC |
| 2 | GND | 1 kohm ≤ $R_L$ ≤ 10 kohm |
| 3 | AI1+ | External speed reference 0(2) … 10 V, $R_{in}$ > 200 kohm |
| 4 | AI1- | |
| 5 | AI2+ | By default, not in use. 0(4) … 20 mA, $R_{in}$ = 100 ohm |
| 6 | AI2- | |
| 7 | AI3+ | By default, not in use. 0(4) … 20 mA, $R_{in}$ = 100 ohm |
| 8 | AI3- | |
| 9 | AO1+ | Motor speed 0(4) … 20 mA ≙ 0 … motor nom. speed, $R_L$ ≤ 700 ohm |
| 10 | AO1- | |
| 11 | AO2+ | Output current 0(4) … 20 mA ≙ 0 … motor nom. current, $R_L$ ≤ 700 ohm |
| 12 | AO2- | |

X22

| | | |
|---|---|---|
| 1 | DI1 | Stop/Start |
| 2 | DI2 | Forward/Reverse |
| 3 | DI3 | Acceleration & deceleration selection [1] |
| 4 | DI4 | Constant speed select [2] |
| 5 | DI5 | Constant speed select [2] |
| 6 | DI6 | Constant speed select [2] |
| 7 | +24 V | +24 VDC, max. 100 mA |
| 8 | +24 V | |
| 9 | DGND1 | Digital ground |
| 10 | DGND2 | Digital ground |
| 11 | DI IL | Start interlock (0 = stop) [3] |

X23

| | | |
|---|---|---|
| 1 | +24 V | Auxiliary voltage output and input, non-isolated, 24 V DC 250 mA [4] |
| 2 | GND | |

X25

| | | |
|---|---|---|
| 1 | RO11 | Relay output 1 |
| 2 | RO12 | **Ready** |
| 3 | RO13 | |

X26

| | | |
|---|---|---|
| 1 | RO21 | Relay output 2 |
| 2 | RO22 | **Running** |
| 3 | RO23 | |

X27

| | | |
|---|---|---|
| 1 | R031 | Relay output 3 |
| 2 | R032 | **Inverted fault** |
| 3 | R033 | |

## User macros

In addition to the standard application macros, it is possible to create two user macros. The user macro allows the user to save the parameter settings including Group 99, and the results of the motor identification into the permanent memory, and recall the data at a later time. The panel reference is also saved, if the macro is saved and loaded in Local control mode. Remote control location setting is saved into the user macro, but Local control location setting is not.

To create User Macro 1:

- Adjust the parameters. Perform the motor identification if not performed yet.
- Save the parameter settings and the results of the motor identification by changing parameter 99.02 to USER 1 SAVE (press ENTER). The storing takes 20 s to 1 min.

**Note:** If user macro save function is executed several times, drive memory fills up and file compression starts. File compression can last up to 10 minutes. Macro saving will be completed after the file compression. (Operation is indicated on the last row of the control panel display by blinking dots).

To recall the user macro:

- Change parameter 99.02 to USER 1 LOAD.
- Press ***ENTER*** to load.

The user macro can also be switched via digital inputs (see parameter 16.05).

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**Note:** User macro load restores also the motor settings in group 99 START-UP DATA and the results of the motor identification. Check that the settings correspond to the motor used.

---

**Example:** The user can switch the drive between two motors without having to adjust the motor parameters and to repeat the motor identification every time the motor is changed. The user needs only to adjust the settings and perform the motor identification once for both motors and then to save the data as two user macros. When the motor is changed, only the corresponding User macro needs to be loaded, and the drive is ready to operate.

# Actual signals and parameters

## Chapter overview

The chapter describes the actual signals and parameters and gives the fieldbus equivalent values for each signal/parameter. More data is given in chapter *Additional data: actual signals and parameters*.

## Terms and abbreviations

| Term | Definition |
|---|---|
| Absolute Maximum Frequency | Value of 20.08, or 20.07 if the absolute value of the minimum limit is greater than the maximum limit. |
| Absolute Maximum Speed | Value of parameter 20.02, or 20.01 if the absolute value of the minimum limit is higher than the maximum limit. |
| Actual signal | Signal measured or calculated by the drive. Can be monitored by the user. No user setting possible. |
| FbEq | Fieldbus equivalent: The scaling between the value shown on the panel and the integer used in serial communication. |
| Parameter | A user-adjustable operation instruction of the drive. |

| No. | Name/Value | Description | FbEq |
|---|---|---|---|
| **01 ACTUAL SIGNALS** | | Basic signals for monitoring of the drive. | |
| 01.01 | PROCESS VARIABLE | Process variable based on settings in parameter group 34 PROCESS VARIABLE. | 1 = 1 |
| 01.02 | SPEED | Calculated motor speed in rpm. Filter time setting by parameter 34.04. | -20000 = -100% 20000 = 100% of motor abs. max. speed |
| 01.03 | FREQUENCY | Calculated drive output frequency. | -100 = -1 Hz 100 = 1 Hz |
| 01.04 | CURRENT | Measured motor current. | 10 = 1 A |
| 01.05 | TORQUE | Calculated motor torque. 100 is the motor nominal torque. Filter time setting by parameter 34.05. | -10000 = -100% 10000 = 100% of motor nom. torque |
| 01.06 | POWER | Motor power. 100 is the nominal power. | -1000 = -100% 1000 = 100% of motor nom. power |
| 01.07 | DC BUS VOLTAGE V | Measured intermediate circuit voltage. | 1 = 1 V |
| 01.08 | MAINS VOLTAGE | Calculated supply voltage. | 1 = 1 V |
| 01.09 | OUTPUT VOLTAGE | Calculated motor voltage. | 1 = 1 V |
| 01.10 | ACS800 TEMP | Calculated IGBT temperature. | 10 = 1% |
| 01.11 | EXTERNAL REF 1 | External reference REF1 in rpm. (Hz if value of parameter 99.04 is SCALAR.) | 1 = 1 rpm |
| 01.12 | EXTERNAL REF 2 | External reference REF2. Depending on the use, 100% is the motor maximum speed, motor nominal torque, or maximum process reference. | 0 = 0% 10000 = 100% 1) |
| 01.13 | CTRL LOCATION | Active control location. (1,2) LOCAL; (3) EXT1; (4) EXT2. See section *Local control vs. external control* on page *43*. | See descr. |
| 01.14 | OP HOUR COUNTER | Elapsed time counter. Runs when the control board is powered. | 1 = 1 h |
| 01.15 | KILOWATT HOURS | kWh counter. Counts inverter output kWh during operation (motor side - generator side). | 1 = 100 kWh |
| 01.16 | APPL BLOCK OUTPUT | Application block output signal. E.g. the process PID controller output when the PID Control macro is active. | 0 = 0% 10000 = 100% |
| 01.17 | DI6-1 STATUS | Status of digital inputs. **Example:** 0000001 = DI1 is on, DI2 to DI6 are off. | |
| 01.18 | AI1 [V] | Value of analogue input AI1. | 1 = 0.001 V |
| 01.19 | AI2 [mA] | Value of analogue input AI2. | 1 = 0.001 mA |
| 01.20 | AI3 [mA] | Value of analogue input AI3. | 1 = 0.001 mA |
| 01.21 | RO3-1 STATUS | Status of relay outputs. **Example:** 001 = RO1 is energised, RO2 and RO3 are de-energised. | |
| 01.22 | AO1 [mA] | Value of analogue output AO1. | 1 =0.001 mA |

| No. | Name/Value | Description | FbEq |
|---|---|---|---|
| 01.23 | AO2 [mA] | Value of analogue output AO2. | 1 = 0.001 mA |
| 01.24 | ACTUAL VALUE 1 | Feedback signal for the process PID controller. Updated only when parameter 99.02 = PD CTRL | 0 = 0% 10000 = 100% |
| 01.25 | ACTUAL VALUE 2 | Feedback signal for the process PID controller. Updated only when parameter 99.02 = PID CTRL. | 0 = 0% 10000 = 100% |
| 01.26 | CONTROL DEVIATION | Deviation of the process PID controller, i.e. the difference between the reference value and the actual value. Updated only when parameter 99.02 = PID CTRL. | -10000 = -100% 10000 = 100% |
| 01.27 | APPLICATION MACRO | Active application macro (value of parameter 99.02). | See 99.02 |
| 01.28 | EXT AO1 [mA] | Value of output 1 of the analogue I/O extension module (optional). | 1 = 0.001 mA |
| 01.29 | EXT AO2 [mA] | Value of output 2 of the analogue I/O extension module (optional). | 1 = 0.001 mA |
| 01.30 | PP 1 TEMP | Measured heatsink temperature in inverter no. 1. | 1 = 1°C |
| 01.31 | PP 2 TEMP | Measured heatsink temperature in inverter no. 2 (used only in high power units with parallel inverters). | 1 = 1°C |
| 01.32 | PP 3 TEMP | Measured heatsink temperature in inverter no. 3 (used only in high power units with parallel inverters). | 1 = 1°C |
| 01.33 | PP 4 TEMP | Measured heatsink temperature in inverter no. 4 (used only in high power units with parallel inverters). | 1 = 1°C |
| 01.34 | ACTUAL VALUE | Process PID controller actual value. See parameter 40.06. | 0 = 0% 10000 = 100% |
| 01.35 | MOTOR 1 TEMP | Measured temperature of motor 1. See parameter 35.01. | 1 = 1°C/ohm |
| 01.36 | MOTOR 2 TEMP | Measured temperature of motor 2. See parameter 35.04. | 1 = 1°C/ohm |
| 01.37 | MOTOR TEMP EST | Estimated motor temperature. Signal value is saved at power switch off. | 1 = 1°C |
| 01.38 | AI5 [mA] | Value of analogue input AI5 read from AI1 of the analogue I/O extension module (optional). A voltage signal is also displayed in mA (instead of V). | 1 = 0.001 mA |
| 01.39 | AI6 [mA] | Value of analogue input AI6 read from AI2 of the analogue I/O extension module (optional). A voltage signal is also displayed in mA (instead of V). | 1 = 0.001 mA |
| 01.40 | DI7-12 STATUS | Status of digital inputs DI7 to DI12 read from the digital I/O extension modules (optional). E.g. value 000001: DI7 is on, DI8 to DI12 are off. | 1 = 1 |
| 01.41 | EXT RO STATUS | Status of the relay outputs on the digital I/O extension modules (optional). E.g. value 0000001: RO1 of module 1 is energised. Other relay outputs are de-energised. | 1 = 1 |
| 01.42 | PROCESS SPEED REL | Motor actual speed in percent of the Absolute Maximum Speed. If parameter 99.04 is SCALAR, the value is the relative actual output frequency. | 1 = 1 |
| 01.43 | MOTOR RUN TIME | Motor run time counter. The counter runs when the inverter modulates. Can be reset by parameter 34.06. | 1 = 10 h |
| 01.44 | FAN ON-TIME | Running time of the drive cooling fan.<br>**Note:** Resetting of the counter is recommended when the fan is replaced. For more information, contact your local ABB representative. | 1 = 10 h |
| 01.45 | CTRL BOARD TEMP | Control board temperature. | 1 = 1°C |
| 01.46 | SAVED KWH | Energy saved in kWh compared to direct-on-line motor connection.<br>See parameter group 45 ENERGY OPT on page *164*. | 1 = 100 kWh |
| 01.47 | SAVED GWH | Energy saved in GWh compared to direct-on-line motor connection. | 1 = 1 GWh |

| No. | Name/Value | Description | FbEq |
|---|---|---|---|
| 01.48 | SAVED AMOUNT | Monetary savings compared to direct-on-line motor connection. This value is a multiplication of parameters 01.46 SAVED KWH and 45.02 ENERGY TARIFF1.<br>See parameter group 45 ENERGY OPT on page *164*. | 1 = 100 cur |
| 01.49 | SAVED AMOUNT M | Monetary savings in millions compared to direct-on-line motor connection. | 1 = 1 Mcur |
| 01.50 | SAVED CO2 | Reduction in $CO_2$ emissions in kilograms compared to direct-on-line motor connection. This value is calculated by multiplying saved energy in megawatt-hours by 500 kg/MWh.<br>See parameter group 45 ENERGY OPT on page *164*. | 1 = 100 kg |
| 01.51 | SAVED CO2 KTON | Reduction in $CO_2$ emissions in kilotons compared to direct-on-line motor connection. | 1 = 1 kton |
| **02 ACTUAL SIGNALS** | | Speed and torque reference monitoring signals. | |
| 02.01 | SPEED REF 2 | Limited speed reference. 100% corresponds to the Absolute Maximum Speed of the motor. | 0 = 0% 20000 = 100% of motor absolute max. speed |
| 02.02 | SPEED REF 3 | Ramped and shaped speed reference. 100% corresponds to the Absolute Maximum Speed of the motor. | 20000 = 100% |
| 02.09 | TORQUE REF 2 | Speed controller output. 100% corresponds to the motor nominal torque. | 0 = 0% 10000 = 100% of motor nominal torque |
| 02.10 | TORQUE REF 3 | Torque reference. 100% corresponds to the motor nominal torque. | 10000 = 100% |
| 02.13 | TORQ USED REF | Torque reference after frequency, voltage and torque limiters. 100% corresponds to the motor nominal torque. | 10000 = 100% |
| 02.14 | FLUX REF | Flux reference in percent. | 10000 = 100% |
| 02.17 | SPEED ESTIMATED | Estimated motor speed. 100% corresponds to the Absolute Maximum Speed of the motor. | 20000 = 100% |
| 02.18 | SPEED MEASURED | Measured motor actual speed (zero when no encoder is used). 100% corresponds to the Absolute Maximum Speed of the motor. | 20000 = 100% |
| 02.19 | MOTOR ACCELERATIO | Calculated motor acceleration from signal 01.02 MOTOR SPEED. | 1=1 rpm/s. |
| 02.20 | USER CURRENT | Measured motor current in percent of the user load curve current. User load curve current is defined by parameters 72.02...72.09. See section *User load curve* on page *83*. | 10 = 1% |
| **03 ACTUAL SIGNALS** | | Data words for monitoring of fieldbus communication (each signal is a 16-bit data word). | 2) |
| 03.01 | MAIN CTRL WORD | A 16-bit data word. See section *03.01 MAIN CONTROL WORD* on page *211*. | |
| 03.02 | MAIN STATUS WORD | A 16-bit data word. See section *03.02 MAIN STATUS WORD* on page *212*. | |
| 03.03 | AUX STATUS WORD | A 16-bit data word. See section *03.03 AUXILIARY STATUS WORD* on page *219*. | |
| 03.04 | LIMIT WORD 1 | A 16-bit data word. See section *03.04 LIMIT WORD 1* on page *220*. | |
| 03.05 | FAULT WORD 1 | A 16-bit data word. See section *03.05 FAULT WORD 1* on page *220*. | |
| 03.06 | FAULT WORD 2 | A 16-bit data word. See section *03.06 FAULT WORD 2* on page *221*. | |

| No. | Name/Value | Description | FbEq |
|---|---|---|---|
| 03.07 | SYSTEM FAULT | A 16-bit data word. See section *03.07 SYSTEM FAULT WORD* on page *222*. | |
| 03.08 | ALARM WORD 1 | A 16-bit data word. See section *03.08 ALARM WORD 1* on page *222*. | |
| 03.09 | ALARM WORD 2 | A 16-bit data word. See section *03.09 ALARM WORD 2* on page *223*. | |
| 03.11 | FOLLOWER MCW | A 16-bit data word. For the contents, see *Master/Follower Application Guide* [3AFE64590430 (English)]. | |
| 03.13 | AUX STATUS WORD 3 | A 16-bit data word. See section *03.13 AUXILIARY STATUS WORD 3* on page *223*. | |
| 03.14 | AUX STATUS WORD 4 | A 16-bit data word. See section *03.14 AUXILIARY STATUS WORD 4* on page *224*. | |
| 03.15 | FAULT WORD 4 | A 16-bit data word. See section *03.15 FAULT WORD 4* on page *224*. | |
| 03.16 | ALARM WORD 4 | A 16-bit data word. See section *03.16 ALARM WORD 4* on page *225*. | |
| 03.17 | FAULT WORD 5 | A 16-bit data word. See section *03.17 FAULT WORD 5* on page *225*. | |
| 03.18 | ALARM WORD 5 | A 16-bit data word. See section *03.18 ALARM WORD 5* on page *226*. | |
| 03.19 | INT INIT FAULT | A 16-bit data word. See section *03.19 INT INIT FAULT* on page *226*. | |
| 03.20 | LATEST FAULT | Fieldbus code of the latest fault. See chapter *Fault tracing* for the codes. | |
| 03.21 | 2.LATEST FAULT | Fieldbus code of the 2nd latest fault. | |
| 03.22 | 3.LATEST FAULT | Fieldbus code of the 3rd latest fault. | |
| 03.23 | 4.LATEST FAULT | Fieldbus code of the 4th latest fault. | |
| 03.24 | 5.LATEST FAULT | Fieldbus code of the 5th latest fault. | |
| 03.25 | LATEST WARNING | Fieldbus code of the latest warning. | |
| 03.26 | 2.LATEST WARNING | Fieldbus code of the 2nd latest warning. | |
| 03.27 | 3.LATEST WARNING | Fieldbus code of the 3rd latest warning. | |
| 03.28 | 4.LATEST WARNING | Fieldbus code of the 4th latest warning. | |
| 03.29 | 5.LATEST WARNING | Fieldbus code of the 5th latest warning. | |
| 03.30 | LIMIT WORD INV | A 16-bit data word. See section *03.30 LIMIT WORD INV* on page *227*. | |
| 03.31 | ALARM WORD 6 | A 16-bit data word. See section *03.31 ALARM WORD 6* on page *227*. | |
| 03.32 | EXT IO STATUS | Status of emergency stop and step up modules. See section *03.32 EXT IO STATUS* on page *228*. | |
| 03.33 | FAULT WORD 6 | A 16-bit data word. See section *03.33 FAULT WORD 6* on page *228*. | |
| **04 ACTUAL SIGNALS** | | Signals for parallel connected inverters | 2) |
| 04.01 | FAULTED INT INFO | A 16-bit data word. See section *04.01 FAULTED INT INFO* on page *229*. | |
| 04.02 | INT SC INFO | A 16-bit data word. See section *04.02 INT SC INFO* on page *230*. | |
| **09 ACTUAL SIGNALS** | | Signals for the Adaptive Program | |
| 09.01 | AI1 SCALED | Value of analogue input AI1 scaled to an integer value. | 20000 = 10 V |
| 09.02 | AI2 SCALED | Value of analogue input AI2 scaled to an integer value. | 20000 = 20 mA |
| 09.03 | AI3 SCALED | Value of analogue input AI3 scaled to an integer value. | 20000 = 20 mA |
| 09.04 | AI5 SCALED | Value of analogue input AI5 scaled to an integer value. | 20000 = 20 mA |
| 09.05 | AI6 SCALED | Value of analogue input AI6 scaled to an integer value. | 20000 = 20 mA |

| No. | Name/Value | Description | FbEq |
|---|---|---|---|
| 09.06 | DS MCW | Control Word (CW) of the Main Reference data set received from the master station through the fieldbus interface | 0 ... 65535 (Decimal) |
| 09.07 | MASTER REF1 | Reference 1 (REF1) of the Main Reference data set received from the master station through the fieldbus interface | -32768 … 32767 |
| 09.08 | MASTER REF2 | Reference 2 (REF2) of the Main Reference data set received from the master station through the fieldbus interface | -32768 … 32767 |
| 09.09 | AUX DS VAL1 | Auxiliary data set value 1 received from the master station through the fieldbus interface | -32768 … 32767 |
| 09.10 | AUX DS VAL2 | Auxiliary data set value 2 received from the master station through the fieldbus interface | -32768 … 32767 |
| 09.11 | AUX DS VAL3 | Auxiliary data set value 3 received from the master station through the fieldbus interface | -32768 … 32767 |
| 09.12 | LCU ACT SIGNAL1 | Line-side converter signal selected by parameter 95.08. A 16-bit data word. | |
| 09.13 | LCU ACT SIGNAL2 | Line-side converter signal selected by parameter 95.09. A 16-bit data word. | |

1) Percent of motor maximum speed / nominal torque / maximum process reference (depending on the ACS800 macro selected).

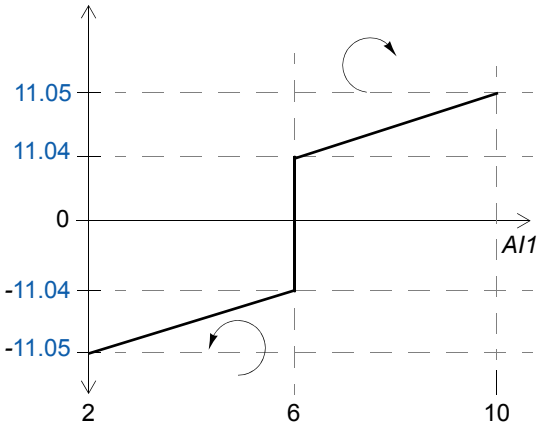
2) The contents of these data words are detailed in chapter *Fieldbus control*.

<table>
<tr><th>Index</th><th>Name/Selection</th><th>Description</th><th>FbEq</th></tr>
<tr><td colspan="2">10 START/STOP/DIR</td><td>The sources for external start, stop and direction control</td><td></td></tr>
<tr><td>10.01</td><td>EXT1 STRT/STP/DIR</td><td>Defines the connections and the source of the start, stop and direction commands for external control location 1 (EXT1).</td><td></td></tr>
<tr><td></td><td>NOT SEL</td><td>No start, stop and direction command source.</td><td>1</td></tr>
<tr><td></td><td>DI1</td><td>Start and stop through digital input DI1. 0 = stop; 1 = start. Direction is fixed according to parameter 10.3 DIRECTION.<br>  WARNING! After a fault reset, the drive will start if the start signal is on.</td><td>2</td></tr>
<tr><td></td><td>DI1,2</td><td>Start and stop through digital input DI1. 0 = stop, 1 = start. Direction through digital input DI2. 0 = forward, 1 = reverse. To control direction, parameter 10.03 DIRECTION must be REQUEST.<br>  WARNING! After a fault reset, the drive will start if the start signal is on.</td><td>3</td></tr>
<tr><td></td><td>DI1P,2P</td><td>Pulse start through digital input DI1. 0 -> 1: Start. Pulse stop through digital input DI2. 1 -> 0: Stop. Direction of rotation is fixed according to parameter 10.03 DIRECTION.</td><td>4</td></tr>
<tr><td></td><td>DI1P,2P,3</td><td>Pulse start through digital input DI1. 0 -> 1: Start. Pulse stop through digital input DI2. 1 -> 0: Stop. Direction through digital input DI3. 0 = forward, 1 = reverse. To control direction, parameter 10.03 DIRECTION must be REQUEST.</td><td>5</td></tr>
<tr><td></td><td>DI1P,2P,3P</td><td>Pulse start forward through digital input DI1. 0 -> 1: Start forward. Pulse start reverse through digital input DI2. 0 -> 1: Start reverse. Pulse stop through digital input DI3. 1 -> ”0”: stop. To control the direction, parameter 10.03 DIRECTION must be REQUEST.</td><td>6</td></tr>
<tr><td></td><td>DI6</td><td>See selection DI1.</td><td>7</td></tr>
<tr><td></td><td>DI6,5</td><td>See selection DI1,2. DI6: Start/stop, DI5: direction.</td><td>8</td></tr>
<tr><td></td><td>KEYPAD</td><td>Control panel. To control the direction, parameter 10.03 DIRECTION must be REQUEST.</td><td>9</td></tr>
<tr><td></td><td>COMM.CW</td><td>Fieldbus Control Word.</td><td>10</td></tr>
<tr><td></td><td>DI7</td><td>See selection DI1.</td><td>11</td></tr>
<tr><td></td><td>DI7,8</td><td>See selection DI1,2. DI7: start/stop, DI8: direction.</td><td>12</td></tr>
<tr><td></td><td>DI7P,8P</td><td>See selection DI1P,2P.</td><td>13</td></tr>
<tr><td></td><td>DI7P,8P,9</td><td>See selection DI1P,2P,3.</td><td>14</td></tr>
<tr><td></td><td>DI7P,8P,9P</td><td>See selection DI1P,2P,3P.</td><td>15</td></tr>
<tr><td></td><td>PARAM 10.04</td><td>Source selected by 10.04.</td><td>16</td></tr>
<tr><td></td><td>DI1 F, DI2 R</td><td>Start, stop and direction commands through digital inputs DI1 and DI2.<br><table><tr><th>DI1</th><th>DI2</th><th>Operation</th></tr><tr><td>0</td><td>0</td><td>Stop</td></tr><tr><td>1</td><td>0</td><td>Start forward</td></tr><tr><td>0</td><td>1</td><td>Start reverse</td></tr><tr><td>1</td><td>1</td><td>Stop</td></tr></table>Note: Parameter 10.03 DIRECTION must be REQUEST.</td><td>17</td></tr>
<tr><td>10.02</td><td>EXT2 STRT/STP/DIR</td><td>Defines the connections and the source of the start, stop and direction commands for external control location 2 (EXT2).</td><td></td></tr>
<tr><td></td><td>NOT SEL</td><td>See parameter 10.01.</td><td>1</td></tr>
</table>

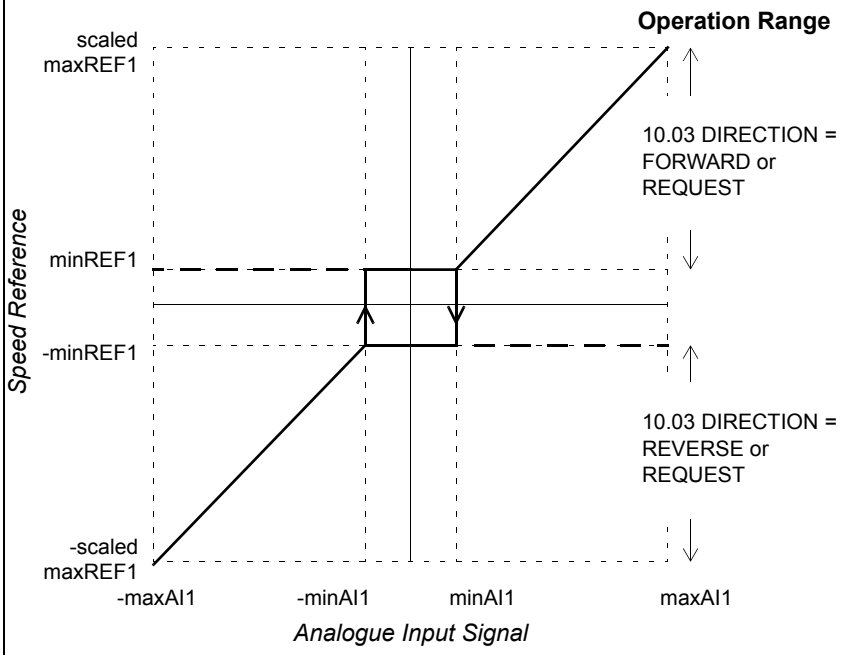
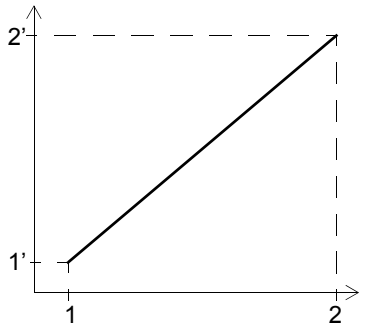
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | DI1 | See parameter 10.01. | 2 |
| | DI1,2 | See parameter 10.01. | 3 |
| | DI1P,2P | See parameter 10.01. | 4 |
| | DI1P,2P,3 | See parameter 10.01. | 5 |
| | DI1P,2P,3P | See parameter 10.01. | 6 |
| | DI6 | See parameter 10.01. | 7 |
| | DI6,5 | See parameter 10.01. | 8 |
| | KEYPAD | See parameter 10.01. | 9 |
| | COMM.CW | See parameter 10.01. | 10 |
| | DI7 | See parameter 10.01. | 11 |
| | DI7,8 | See parameter 10.01. | 12 |
| | DI7P,8P | See parameter 10.01. | 13 |
| | DI7P,8P,9 | See parameter 10.01. | 14 |
| | DI7P,8P,9P | See parameter 10.01. | 15 |
| | PARAM 10.05 | Source selected by 10.05. | 16 |
| | DI1 F, DI2 R | See parameter 10.01. | 17 |
| 10.03 | REF DIRECTION | Enables the control of rotation direction of the motor, or fixes the direction. | |
| | FORWARD | Fixed to forward | 1 |
| | REVERSE | Fixed to reverse | 2 |
| | REQUEST | Direction of rotation control allowed | 3 |
| 10.04 | EXT 1 STRT PTR | Defines the source or constant for value PAR 10.04 of parameter 10.01. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value:<br>- Parameter pointer: Inversion, group, index and bit fields. The bit number is effective only for blocks handling boolean inputs.<br>- Constant value: Inversion and constant fields. Inversion field must have value C to enable the constant setting. | - |
| 10.05 | EXT 2 STRT PTR | Defines the source or constant for value PAR 10.05 of parameter 10.02. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | - |
| 10.06 | JOG SPEED SELECT | Defines the signal that activates jogging function. The operation of the jogging is explained in section *Jogging* on page *81*. | |
| | NOT SEL | Not selected. | 1 |
| | DI3 | Digital input DI3. 0 = Jogging is inactive. 1 = Jogging is active. | 2 |
| | DI4 | See selection DI3. | 3 |
| | DI5 | See selection DI3. | 4 |
| | DI6 | See selection DI3. | 5 |
| | DI7 | See selection DI3. | 6 |
| | DI8 | See selection DI3. | 7 |
| | DI9 | See selection DI3. | 8 |
| | DI10 | See selection DI3. | 9 |
| | DI11 | See selection DI3. | 10 |
| | DI12 | See selection DI3. | 11 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 10.07 | NET CONTROL | When active, fieldbus overrides the selection of parameter 10.01. Fieldbus Control Word (except bit 11) is enabled when EXT1 is selected as the active control location.<br>**Note:** Only visible with the Generic Drive communication profile selected (98.07).<br>**Note:** The setting is not saved in the permanent memory (will reset to zero when power is switched off). | |
| | 0 | Inactive | 0 |
| | 1 | Active | 1 |
| 10.08 | NET REFERENCE | When active, fieldbus overrides the selection of parameter 11.03. Fieldbus reference REF1 is enabled when EXT1 is selected as the active control location.<br>**Note:** Only visible with the Generic Drive communication profile selected (98.07).<br>**Note:** The setting is not saved in the permanent memory (will reset to zero when power is switched off). | |
| | 0 | Inactive | 0 |
| | 1 | Active | 1 |
| 10.09 | SLS ACTIVE | Selects the source for the SLS (safely-limited speed) command.<br>**Note:** This parameter is available in AS7R firmware version only. | |
| | NO | No DI selected for the SLS function. | 1 |
| | DI1 | The SLS function is activated by a falling edge of DI1, i.e. when the value of DI1 becomes 0. | 2 |
| | DI2 | See selection DI1. | 3 |
| | DI3 | See selection DI1. | 4 |
| | DI4 | See selection DI1. | 5 |
| | DI5 | See selection DI1. | 6 |
| | DI6 | See selection DI1. | 7 |
| | DI7 | See selection DI1. | 8 |
| | DI8 | See selection DI1. | 9 |
| | DI9 | See selection DI1. | 10 |
| | DI10 | See selection DI1. | 11 |
| | DI11 | See selection DI1. | 12 |
| | DI12 | See selection DI1. | 13 |
| **11 REFERENCE SELECT** | | Panel reference type, external control location selection and external reference sources and limits | |
| 11.01 | KEYPAD REF SEL | Selects the type of the reference given from panel. | |
| | REF1 (rpm) | Speed reference in rpm. (Frequency reference (Hz) if parameter 99.04 is SCALAR.) | 1 |
| | REF2 (%) | %-reference. The use of REF2 vary depending on the application macro. For example, if the Torque Control macro is selected, REF2 is the torque reference. | 2 |
| 11.02 | EXT1/EXT2 SELECT | Defines the source from which the drive reads the signal that selects between the two external control locations, EXT1 or EXT2. | |
| | DI1 | Digital input DI1. 0 = EXT1, 1 = EXT2. | 1 |
| | DI2 | See selection DI1. | 2 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | DI3 | See selection DI1. | 3 |
| | DI4 | See selection DI1. | 4 |
| | DI5 | See selection DI1. | 5 |
| | DI6 | See selection DI1. | 6 |
| | EXT1 | EXT1 active. The control signal sources are defined by parameter 10.01 and 11.03. | 7 |
| | EXT2 | EXT2 active. The control signal sources are defined by parameter 10.02 and 11.06. | 8 |
| | COMM.CW | Fieldbus Control Word, bit 11. | 9 |
| | DI7 | See selection DI1. | 10 |
| | DI8 | See selection DI1. | 11 |
| | DI9 | See selection DI1. | 12 |
| | DI10 | See selection DI1. | 13 |
| | DI11 | See selection DI1. | 14 |
| | DI12 | See selection DI1. | 15 |
| | PARAM 11.09 | Source selected by parameter 11.09. | 16 |
| 11.03 | EXT REF1 SELECT | Selects the signal source for external reference REF1 | |
| | KEYPAD | Control panel. The first line on the display shows the reference value. | 1 |
| | AI1 | Analogue input AI1.<br>**Note:** If the signal is bipolar (±10 VDC), use the selection AI1 BIPOLAR. (The selection AI1 ignores the negative signal range.) | 2 |
| | AI2 | Analogue input AI2. | 3 |
| | AI3 | Analogue input AI3. | 4 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | AI1/JOYST | Unipolar analogue input AI1 as joystick. The minimum input signal runs the motor at the maximum reference in the reverse direction, the maximum input at the maximum reference in the forward direction.<br>**Note:** Parameter 10.03 must have the value REQUEST.<br>**WARNING!** Minimum reference for joystick must be higher than 0.5 V. Set parameter 13.01 to 2 V or to a value higher than 0.5 V and analogue signal loss detection parameter 30.01 to FAULT. The drive will stop in case the control signal is lost.<br>*Speed Reference (REF1)*<br>  <br><br>Par. 13.01 = 2 V, Par 13.02 = 10 V<br>**Note:** If the signal is bipolar (±10 VDC), use the selection AI1 BIPOLAR. The selection AI1/JOYST ignores the negative signal range. | 5 |
| | AI2/JOYST | See selection AI1/JOYST. | 6 |
| | AI1+AI3 | Summation of analogue input AI1 and AI3 | 7 |
| | AI2+AI3 | Summation of analogue input AI2 and AI3 | 8 |
| | AI1-AI3 | Subtraction of analogue input AI1 and AI3 | 9 |
| | AI2-AI3 | Subtraction of analogue input AI2 and AI3 | 10 |
| | AI1*AI3 | Multiplication of analogue input AI1 and AI3 | 11 |
| | AI2*AI3 | Multiplication of analogue input AI2 and AI3 | 12 |
| | MIN(AI1,AI3) | Minimum of analogue input AI1 and AI3 | 13 |
| | MIN(AI2,AI3) | Minimum of analogue input AI2 and AI3 | 14 |
| | MAX(AI1,AI3) | Maximum of analogue input AI1 and AI3 | 15 |
| | MAX(AI2,AI3) | Maximum of analogue input AI2 and AI3 | 16 |
| | DI3U,4D(R) | Digital input 3: Reference increase. Digital input DI4: Reference decrease. Stop command or power switch off resets the reference to zero. Parameter 22.04 defines the rate of the reference change. | 17 |
| | DI3U,4D | Digital input 3: Reference increase. Digital input DI4: Reference decrease. The program stores the active speed reference (not reset by a stop command or power switch-off). Parameter 22.04 defines the rate of the reference change. | 18 |
| | DI5U,6D | See selection DI3U,4D. | 19 |
| | COMM. REF | Fieldbus reference REF1 | 20 |
| | COM.REF1+AI1 | Summation of fieldbus reference REF1 and analogue input AI1 | 21 |
| | COM.REF1*AI1 | Multiplication of fieldbus reference REF1 and analogue input AI1 | 22 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | FAST COMM | As with the selection COMM. REF, except the following differences:<br>- shorter communication cycle time when transferring the reference to the core motor control program (6 ms -> 2 ms)<br>- the direction cannot be controlled through interfaces defined by parameters 10.01 or 10.02, nor with the control panel<br>- parameter group 25 CRITICAL SPEEDS is not effective<br>**Note:** If any of the following selections is true, the selection is not effective. Instead, the operation is according to COMM. REF.<br>- parameter 99.02 is PID<br>- parameter 99.04 is SCALAR<br>- parameter 40.14 has value PROPORTIONAL or DIRECT | 23 |
| | COM.REF1+AI5 | See selection COM.REF1+AI1 (AI5 used instead of AI1). | 24 |
| | COM.REF1*AI5 | See selection COM.REF1*AI1 (AI5 used instead of AI1). | 25 |
| | AI5 | Analogue input AI5 | 26 |
| | AI6 | Analogue input AI6 | 27 |
| | AI5/JOYST | See selection AI1/JOYST. | 28 |
| | AI6/JOYST | See selection AI1/JOYST. | 29 |
| | AI5+AI6 | Summation of analogue input AI5 and AI6. | 30 |
| | AI5-AI6 | Subtraction of analogue input AI5 and AI6. | 31 |
| | AI5*AI6 | Multiplication of analogue input AI5 and AI6. | 32 |
| | MIN(AI5,AI6) | Lower of analogue input AI5 and AI6. | 33 |
| | MAX(AI5,AI6) | Higher of analogue input AI5 and AI6. | 34 |
| | DI11U,12D(R) | See selection DI3U,4D(R). | 35 |
| | DI11U,12D | See selection DI3U,4D. | 36 |
| | PARAM 11.10 | Source selected by 11.10. | 37 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | AI1 BIPOLAR | Bipolar analogue input AI1 (-10 … 10 V). The figure below illustrates the use of the input as the speed reference.<br>  <br><br>minAI1 = 13.01 MINIMUM AI1<br>maxAI1 = 13.02 MAXIMUM AI1<br>scaled maxREF1 = 13.03 SCALE AI1 x 11.05 EXT REF1 MAXIMUM<br>minREF1 = 11.04 EXT REF1 MINIMUM | 38 |
| 11.04 | EXT REF1 MINIMUM | Defines the minimum value for external reference REF1 (absolute value).<br>Corresponds to the minimum setting of the source signal used. | |
| | 0 … 18000 rpm | Setting range in rpm. (Hz if parameter 99.04 is SCALAR.)<br>**Example:** Analogue input AI1 is selected as the reference source (value of parameter 11.03 is AI1). The reference minimum and maximum correspond the AI minimum and maximum settings as follows:<br>*EXT REF1 Range*<br>  <br><br>1 parameter 13.01<br>2 parameter 13.02<br>1' parameter 11.04<br>2' parameter 11.05<br>**Note:** If the reference is given through fieldbus, the scaling differs from that of an analogue signal. See chapter *Fieldbus control* for more information. | 1 … 18000 |

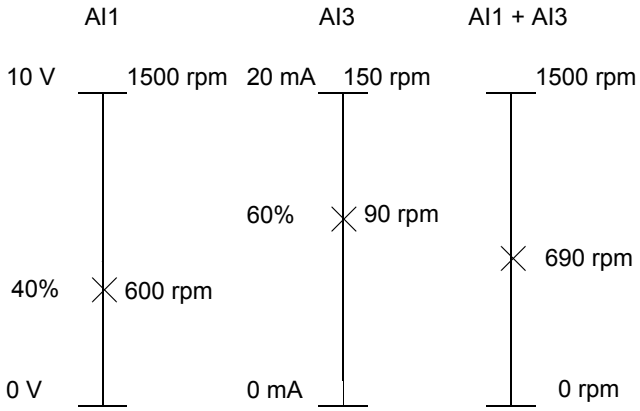
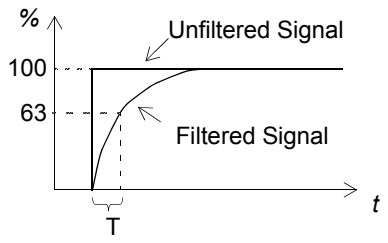
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 11.05 | EXT REF1 MAXIMUM | Defines the maximum value for external reference REF1 (absolute value).<br>Corresponds to the maximum setting of the used source signal. | |
| | 0 … 18000 rpm | Setting range. (Hz if value of parameter 99.04 is SCALAR.)<br>See parameter 11.04. | 1 … 18000 |
| 11.06 | EXT REF2 SELECT | Selects the signal source for external reference REF2. REF2 is a<br>- speed reference in percent of the Absolute Maximum Speed if parameter 99.02 = FACTORY, HAND/AUTO or SEQ CTRL.<br>- torque reference in percent of the motor nominal torque if parameter 99.02 = TORQUE.<br>- process reference in percent of the maximum process quantity if parameter 99.02 = PID CTRL.<br>- frequency reference in percent of the Absolute Maximum Frequency if parameter 99.04 = SCALAR. | |
| | KEYPAD | See parameter 11.03. | 1 |
| | AI1 | See parameter 11.03.<br>**Note:** If the signal is bipolar (±10 VDC), use the selection AI1 BIPOLAR. The selection AI1 ignores the negative signal range. | 2 |
| | AI2 | See parameter 11.03. | 3 |
| | AI3 | See parameter 11.03. | 4 |
| | AI1/JOYST | See parameter 11.03. | 5 |
| | AI2/JOYST | See parameter 11.03. | 6 |
| | AI1+AI3 | See parameter 11.03. | 7 |
| | AI2+AI3 | See parameter 11.03. | 8 |
| | AI1-AI3 | See parameter 11.03. | 9 |
| | AI2-AI3 | See parameter 11.03. | 10 |
| | AI1*AI3 | See parameter 11.03. | 11 |
| | AI2*AI3 | See parameter 11.03. | 12 |
| | MIN(AI1,AI3) | See parameter 11.03. | 13 |
| | MIN(AI2,AI3) | See parameter 11.03. | 14 |
| | MAX(AI1,AI3) | See parameter 11.03. | 15 |
| | MAX(AI2,AI3) | See parameter 11.03. | 16 |
| | DI3U,4D(R) | See parameter 11.03. | 17 |
| | DI3U,4D | See parameter 11.03. | 18 |
| | DI5U,6D | See parameter 11.03. | 19 |
| | COMM. REF | See parameter 11.03. | 20 |
| | COM.REF2+AI1 | See parameter 11.03. | 21 |
| | COM.REF2*AI1 | See parameter 11.03. | 22 |
| | FAST COMM | See parameter 11.03. | 23 |
| | COM.REF2+AI5 | See parameter 11.03. | 24 |
| | COM.REF2*AI5 | See parameter 11.03. | 25 |
| | AI5 | See parameter 11.03. | 26 |
| | AI6 | See parameter 11.03. | 27 |
| | AI5/JOYST | See parameter 11.03. | 28 |
| | AI6/JOYST | See parameter 11.03. | 29 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | AI5+AI6 | See parameter 11.03. | 30 |
| | AI5-AI6 | See parameter 11.03. | 31 |
| | AI5*AI6 | See parameter 11.03. | 32 |
| | MIN(AI5,AI6) | See parameter 11.03. | 33 |
| | MAX(AI5,AI6) | See parameter 11.03. | 34 |
| | DI11U,12D(R) | See parameter 11.03. | 35 |
| | DI11U,12D | See parameter 11.03. | 36 |
| | PARAM 11.11 | Source selected by 11.11. | 37 |
| | AI1 BIPOLAR | See parameter 11.03. | 38 |
| 11.07 | EXT REF2 MINIMUM | Defines the minimum value for external reference REF2 (absolute value).<br>Corresponds to the minimum setting of the source signal used. | |
| | 0 … 100% | Setting range in percent. Correspondence to the source signal limits:<br>- Source is an analogue input: See example for parameter 11.04.<br>- Source is a serial link: See chapter *Fieldbus control*. | 0 … 10000 |
| 11.08 | EXT REF2 MAXIMUM | Defines the maximum value for external reference REF2 (absolute value). Corresponds to the maximum setting of the source signal used. | |
| | 0 … 600% | Setting range. Correspondence to the source signal limits:<br>- Source is an analogue input: See parameter 11.04.<br>- Source is a serial link: See chapter *Fieldbus control*. | 0 … 6000 |
| 11.09 | EXT 1/2 SEL PTR | Defines the source or constant for value PAR 11.09 of parameter 11.02. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | - |
| 11.10 | EXT 1 REF PTR | Defines the source or constant for value PAR 11.10 of parameter 11.03. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | - |
| 11.11 | EXT 2 REF PTR | Defines the source or constant for value PAR 11.11 of parameter 11.06. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | - |
| **12 CONSTANT SPEEDS** | | Constant speed selection and values. An active constant speed overrides the drive speed reference. See section *Constant speeds* on page *59*.<br>**Note:** If parameter 99.04 is SCALAR, only speeds 1 to 5 and speed 15 are in use. | |
| 12.01 | CONST SPEED SEL | Activates the constant speeds or selects the activation signal. | |
| | NOT SEL | No constant speeds in use | 1 |
| | DI1(SPEED1) | Speed defined by parameter 12.02 is activated through digital input DI1.<br>1 = active, 0 = inactive. | 2 |
| | DI2(SPEED2) | Speed defined by parameter 12.03 is activated through digital input DI2.<br>1 = active, 0 = inactive. | 3 |
| | DI3(SPEED3) | Speed defined by parameter 12.04 is activated through digital input DI3.<br>1 = active, 0 = inactive. | 4 |
| | DI4(SPEED4) | Speed defined by parameter 12.05 is activated through digital input DI4.<br>1 = active, 0 = inactive. | 5 |

<table>
<tr><th>Index</th><th>Name/Selection</th><th>Description</th><th>FbEq</th></tr>
<tr><td></td><td>DI5(SPEED5)</td><td>Speed defined by parameter 12.06 is activated through digital input DI5.<br>1 = active, 0 = inactive.</td><td>6</td></tr>
<tr><td></td><td>DI6(SPEED6)</td><td>Speed defined by parameter 12.07 is activated through digital input DI6.<br>1 = active, 0 = inactive.</td><td>7</td></tr>
<tr><td></td><td>DI1,2</td><td>Constant speed selection through digital input DI1 and DI2.<br><table><tr><th>DI1</th><th>DI2</th><th>Constant speed in use</th></tr><tr><td>0</td><td>0</td><td>No constant speed</td></tr><tr><td>1</td><td>0</td><td>Speed defined by parameter 12.02</td></tr><tr><td>0</td><td>1</td><td>Speed defined by parameter 12.03</td></tr><tr><td>1</td><td>1</td><td>Speed defined by parameter 12.04</td></tr></table></td><td>8</td></tr>
<tr><td></td><td>DI3,4</td><td>See selection DI1,2.</td><td>9</td></tr>
<tr><td></td><td>DI5,6</td><td>See selection DI1,2.</td><td>10</td></tr>
<tr><td></td><td>DI1,2,3</td><td>Constant speed selection through digital input DI1, DI2 and DI3.<br><table><tr><th>DI1</th><th>DI2</th><th>DI3</th><th>Constant speed in use</th></tr><tr><td>0</td><td>0</td><td>0</td><td>No constant speed</td></tr><tr><td>1</td><td>0</td><td>0</td><td>Speed defined by parameter 12.02</td></tr><tr><td>0</td><td>1</td><td>0</td><td>Speed defined by parameter 12.03</td></tr><tr><td>1</td><td>1</td><td>0</td><td>Speed defined by parameter 12.04</td></tr><tr><td>0</td><td>0</td><td>1</td><td>Speed defined by parameter 12.05</td></tr><tr><td>1</td><td>0</td><td>1</td><td>Speed defined by parameter 12.06</td></tr><tr><td>0</td><td>1</td><td>1</td><td>Speed defined by parameter 12.07</td></tr><tr><td>1</td><td>1</td><td>1</td><td>Speed defined by parameter 12.08</td></tr></table></td><td>11</td></tr>
<tr><td></td><td>DI3,4,5</td><td>See selection DI1,2,3.</td><td>12</td></tr>
<tr><td></td><td>DI4,5,6</td><td>See selection DI1,2,3.</td><td>13</td></tr>
<tr><td></td><td>DI3,4,5,6</td><td>Constant speed selection through digital input DI3, 4, 5 and 6<br><table><tr><th>DI1</th><th>DI2</th><th>DI3</th><th>DI4</th><th>Constant speed in use</th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>No constant speed</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>Speed defined by parameter 12.02</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td><td>Speed defined by parameter 12.03</td></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td><td>Speed defined by parameter 12.04</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>Speed defined by parameter 12.05</td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td><td>Speed defined by parameter 12.06</td></tr><tr><td>0</td><td>1</td><td>1</td><td>0</td><td>Speed defined by parameter 12.07</td></tr><tr><td>1</td><td>1</td><td>1</td><td>0</td><td>Speed defined by parameter 12.08</td></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>Speed defined by parameter 12.09</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td><td>Speed defined by parameter 12.10</td></tr><tr><td>0</td><td>1</td><td>0</td><td>1</td><td>Speed defined by parameter 12.11</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td><td>Speed defined by parameter 12.12</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td><td>Speed defined by parameter 12.13</td></tr><tr><td>1</td><td>0</td><td>1</td><td>1</td><td>Speed defined by parameter 12.14</td></tr><tr><td>0</td><td>1</td><td>1</td><td>1</td><td>Speed defined by parameter 12.15</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>Speed defined by parameter 12.16</td></tr></table></td><td>14</td></tr>
<tr><td></td><td>DI7(SPEED1)</td><td>Speed defined by parameter 12.02 is activated through digital input DI7.<br>1 = active, 0 = inactive.</td><td>15</td></tr>
<tr><td></td><td>DI8(SPEED2)</td><td>Speed defined by parameter 12.03 is activated through digital input DI8.<br>1 = active, 0 = inactive.</td><td>16</td></tr>
</table>

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | DI9(SPEED3) | Speed defined by parameter 12.04 is activated through digital input DI9.<br>1 = active, 0 = inactive. | 17 |
| | DI10(SPEED4) | Speed defined by parameter 12.05 is activated through digital input DI10.<br>1 = active, 0 = inactive. | 18 |
| | DI11(SPEED5) | Speed defined by parameter 12.06 is activated through digital input DI11.<br>1 = active, 0 = inactive. | 19 |
| | DI12 (SPEED6) | Speed defined by parameter 12.07 is activated through digital input DI12.<br>1 = active, 0 = inactive. | 20 |
| | DI7,8 | See selection DI1,2. | 21 |
| | DI9,10 | See selection DI1,2. | 22 |
| | DI11,12 | See selection DI1,2. | 23 |
| 12.02 | CONST SPEED 1 | Defines speed 1. An absolute value. Does not include the direction information. | |
| | 0 … 18000 rpm | Setting range | 0 … 18000 |
| 12.03 | CONST SPEED 2 | Defines speed 2. An absolute value. Does not include the direction information. | |
| | 0 … 18000 rpm | Setting range | 0 … 18000 |
| 12.04 | CONST SPEED 3 | Defines speed 3. An absolute value. Does not include the direction information. | |
| | 0 … 18000 rpm | Setting range | 0 … 18000 |
| 12.05 | CONST SPEED 4 | Defines speed 4. An absolute value. Does not include the direction information. | |
| | 0 … 18000 rpm | Setting range | 0 … 18000 |
| 12.06 | CONST SPEED 5 | Defines speed 5. An absolute value. Does not include the direction information. | |
| | 0 … 18000 rpm | Setting range | 0 … 18000 |
| 12.07 | CONST SPEED 6 | Defines speed 6. An absolute value. Does not include the direction information. | |
| | 0 … 18000 rpm | Setting range | 0 … 18000 |
| 12.08 | CONST SPEED 7 | Defines speed 7. An absolute value. Does not include the direction information. | |
| | 0 … 18000 rpm | Setting range | 0 … 18000 |
| 12.09 | CONST SPEED 8 | Defines speed 8. An absolute value. Does not include the direction information. | |
| | 0 … 18000 rpm | Setting range | 0 … 18000 |
| 12.10 | CONST SPEED 9 | Defines speed 9. An absolute value. Does not include the direction information. | |
| | 0 … 18000 rpm | Setting range | 0 … 18000 |
| 12.11 | CONST SPEED 10 | Defines speed 10. An absolute value. Does not include the direction information. | |
| | 0 … 18000 rpm | Setting range | 0 … 18000 |
| 12.12 | CONST SPEED 11 | Defines speed 11. An absolute value. Does not include the direction information. | |
| | 0 … 18000 rpm | Setting range | 0 … 18000 |
| 12.13 | CONST SPEED 12 | Defines speed 12. An absolute value. Does not include the direction information.<br>**Note:** If inching is in use, the parameter defines the inching 1 speed. The sign is taken into account. See chapter *Fieldbus control*. | |
| | -18000 … 18000 rpm | Setting range | -18000 … 18000 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 12.14 | CONST SPEED 13 | Defines speed 13. An absolute value. Does not include the direction information.<br>**Note:** If inching is in use, the parameter defines the inching 2 speed. The sign is taken into account. See chapter *Fieldbus control*. | |
| | -18000 … 18000 rpm | Setting range | -18000 … 18000 |
| 12.15 | CONST SPEED 14 | Defines speed 14. An absolute value. Does not include the direction information.<br>**Note:** If the jogging function is in use, the parameter defines the jogging speed. The sign is not taken into account. See section *Jogging* on page *81*. | |
| | 0 … 18000 rpm | Setting range | 0 … 18000 |
| 12.16 | CONST SPEED 15 | Defines speed 15 or Fault speed. The program considers the sign when used as a fault speed by parameter 30.01 and 30.02. | |
| | -18000 … 18000 rpm | Setting range | -18000 … 18000 |
| **13 ANALOGUE INPUTS** | | The analogue input signal processing. See section *Programmable analogue inputs* on page *49*. | |
| 13.01 | MINIMUM AI1 | Defines the minimum value for analogue input AI1. When used as a reference, the value corresponds to the reference minimum setting.<br>**Example:** If AI1 is selected as the source for external reference REF1, this value corresponds to the value of parameter 11.04. | |
| | 0 V | Zero volts. **Note:** The program cannot detect a loss of analogue input signal. | 1 |
| | 2 V | Two volts | 2 |
| | TUNED VALUE | The value measured by the tuning function. See the selection TUNE. | 3 |
| | TUNE | The value measurement triggering. Procedure:<br>- Connect the minimum signal to input.<br>- Set the parameter to TUNE.<br>**Note:** The readable range in tuning is 0 … 10 V. | 4 |
| 13.02 | MAXIMUM AI1 | Defines the maximum value for analogue input AI1. When used as a reference, the value corresponds to the reference maximum setting.<br>**Example:** If AI1 is selected as the source for external reference REF1, this value corresponds to the value of parameter 11.05. | |
| | 10 V | Ten volts (DC). | 1 |
| | TUNED VALUE | The value measured by the tuning function. See the selection TUNE. | 2 |
| | TUNE | Triggering of the tuning function. Procedure:<br>- Connect the maximum signal to input.<br>- Set the parameter to TUNE.<br>**Note:** The readable range in tuning is 0 … 10 V. | 3 |

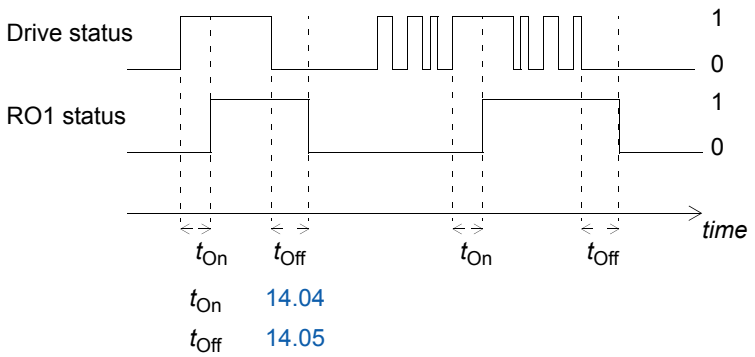
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 13.03 | SCALE AI1 | Scales analogue input AI1.<br>**Example:** The effect on speed reference REF1 when:<br>- REF1 source selection (parameter 11.03) = AI1+AI3<br>- REF1 maximum value setting (parameter 11.05) = 1500 rpm<br>- Actual AI1 value = 4 V (40% of the full scale value)<br>- Actual AI3 value = 12 mA (60% of the full scale value)<br>- AI1 scaling = 100%, AI3 scaling = 10%<br>  | |
| | 0 … 1000% | Scaling range | 0 … 32767 |
| 13.04 | FILTER AI1 | Defines the filter time constant for analogue input AI1.<br>  <br>$O = I \cdot (1 - e^{-t/T})$<br>I = filter input (step)<br>O = filter output<br>t = time<br>T = filter time constant<br>**Note:** The signal is also filtered due to the signal interface hardware (10 ms time constant). This cannot be changed by any parameter. | |
| | 0.00 … 10.00 s | Filter time constant | 0 … 1000 |
| 13.05 | INVERT AI1 | Activates/deactivates the inversion of analogue input AI1. | |
| | NO | No inversion | 0 |
| | YES | Inversion active. The maximum value of the analogue input signal corresponds to the minimum reference and vice versa. | 65535 |
| 13.06 | MINIMUM AI2 | See parameter 13.01. | |
| | 0 mA | See parameter 13.01. | 1 |
| | 4 mA | See parameter 13.01. | 2 |
| | TUNED VALUE | See parameter 13.01. | 3 |
| | TUNE | See parameter 13.01. | 4 |
| 13.07 | MAXIMUM AI2 | See parameter 13.02. | |
| | 20 mA | See parameter 13.02. | 1 |
| | TUNED VALUE | See parameter 13.02. | 2 |
| | TUNE | See parameter 13.02. | 3 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 13.08 | SCALE AI2 | See parameter 13.03. | |
| | 0 … 1000% | See parameter 13.03. | 0 … 32767 |
| 13.09 | FILTER AI2 | See parameter 13.04. | |
| | 0.00 … 10.00 s | See parameter 13.04. | 0 … 1000 |
| 13.10 | INVERT AI2 | See parameter 13.05. | |
| | NO | See parameter 13.05. | 0 |
| | YES | See parameter 13.05. | 65535 |
| 13.11 | MINIMUM AI3 | See parameter 13.01. | |
| | 0 mA | See parameter 13.01. | 1 |
| | 4 mA | See parameter 13.01. | 2 |
| | TUNED VALUE | See parameter 13.01. | 3 |
| | TUNE | See parameter 13.01. | 4 |
| 13.12 | MAXIMUM AI3 | See parameter 13.02. | |
| | 20 mA | See parameter 13.02. | 1 |
| | TUNED VALUE | See parameter 13.02. | 2 |
| | TUNE | See parameter 13.02. | 3 |
| 13.13 | SCALE AI3 | See parameter 13.03. | |
| | 0 … 1000% | See parameter 13.03. | 0 … 32767 |
| 13.14 | FILTER AI3 | See parameter 13.04. | |
| | 0.00 … 10.00 s | See parameter 13.04. | 0 … 1000 |
| 13.15 | INVERT AI3 | See parameter 13.05. | |
| | NO | See parameter 13.05. | 0 |
| | YES | See parameter 13.05. | 65535 |
| 13.16 | MINIMUM AI5 | See parameter 13.01.<br>**Note:** If RAIO-01 is used with voltage input signal, 20 mA corresponds to 10 V. | |
| | 0 mA | See parameter 13.01. | 1 |
| | 4 mA | See parameter 13.01. | 2 |
| | TUNED VALUE | See parameter 13.01. | 3 |
| | TUNE | See parameter 13.01. | 4 |
| 13.17 | MAXIMUM AI5 | See parameter 13.02.<br>**Note:** If RAIO-01 is used with voltage input signal, 20 mA corresponds to 10 V. | |
| | 20 mA | See parameter 13.02. | 1 |
| | TUNED VALUE | See parameter 13.02. | 2 |
| | TUNE | See parameter 13.02. | 3 |
| 13.18 | SCALE AI5 | See parameter 13.03. | |
| | 0 … 1000% | See parameter 13.03. | 0 … 32767 |
| 13.19 | FILTER AI5 | See parameter 13.04. | |
| | 0.00 … 10.00 s | See parameter 13.04. | 0 … 1000 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 13.20 | INVERT AI5 | See parameter 13.05. | |
| | NO | See parameter 13.05. | 0 |
| | YES | See parameter 13.05. | 65535 |
| 13.21 | MINIMUM AI6 | See parameter 13.01.<br>**Note:** If RAIO-01 is used with voltage input signal, 20 mA corresponds to 10 V. | |
| | 0 mA | See parameter 13.01. | 1 |
| | 4 mA | See parameter 13.01. | 2 |
| | TUNED VALUE | See parameter 13.01. | 3 |
| | TUNE | See parameter 13.01. | 4 |
| 13.22 | MAXIMUM AI6 | See parameter 13.02.<br>**Note:** If RAIO-01 is used with voltage input signal, 20 mA corresponds to 10 V. | |
| | 20 mA | See parameter 13.02. | 1 |
| | TUNED VALUE | See parameter 13.02. | 2 |
| | TUNE | See parameter 13.02. | 3 |
| 13.23 | SCALE AI6 | See parameter 13.03. | |
| | 0 … 1000% | See parameter 13.03. | 0 … 32767 |
| 13.24 | FILTER AI6 | See parameter 13.04. | |
| | 0.00 … 10.00 s | See parameter 13.04. | 0 … 1000 |
| 13.25 | INVERT AI6 | See parameter 13.05. | |
| | NO | See parameter 13.05. | 0 |
| | YES | See parameter 13.05. | 65535 |
| **14 RELAY OUTPUTS** | | Status information indicated through the relay outputs, and the relay operating delays. See section *Programmable relay outputs* on page *52*. | |
| 14.01 | RELAY RO1 OUTPUT | Selects a drive status indicated through relay output RO1. The relay energises when the status meets the setting. | |
| | NOT USED | Not used. | 1 |
| | READY | Ready to function: Run Enable signal on, no fault. | 2 |
| | RUNNING | Running: Start signal on, Run Enable signal on, no active fault. | 3 |
| | FAULT | Fault | 4 |
| | FAULT(-1) | Inverted fault. Relay is de-energised on a fault trip. | 5 |
| | FAULT(RST) | Fault. Automatic reset after the autoreset delay. See parameter group 31 AUTOMATIC RESET. | 6 |
| | STALL WARN | Warning by the stall protection function. See parameter 30.10. | 7 |
| | STALL FLT | Fault trip by the stall protection function. See parameter 30.10. | 8 |
| | MOT TEMP WRN | Warning trip of the motor temperature supervision function. See parameter 30.04. | 9 |
| | MOT TEMP FLT | Fault trip of the motor temperature supervision function. See parameter 30.04. | 10 |
| | ACS TEMP WRN | Warning by the drive temperature supervision function. The warning limit depends on the used inverter type. | 11 |
| | ACS TEMP FLT | Fault trip by the drive temperature supervision function. Trip limit is 100%. | 12 |
| | FAULT/WARN | Fault or warning active | 13 |
| | WARNING | Warning active | 14 |
| | REVERSED | Motor rotates in reverse direction. | 15 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | EXT CTRL | Drive is under external control. | 16 |
| | REF 2 SEL | External reference REF 2 is in use. | 17 |
| | CONST SPEED | A constant speed is in use. See parameter group 12 CONSTANT SPEEDS. | 18 |
| | DC OVERVOLT | The intermediate circuit DC voltage has exceeded the overvoltage limit. | 19 |
| | DC UNDERVOLT | The intermediate circuit DC voltage has fallen below the undervoltage limit. | 20 |
| | SPEED 1 LIM | Motor speed at supervision limit 1. See parameters 32.01 and 32.02. | 21 |
| | SPEED 2 LIM | Motor speed at supervision limit 2. See parameters 32.03 and 32.04. | 22 |
| | CURRENT LIM | Motor current at the supervision limit. See parameters 32.05 and 32.06. | 23 |
| | REF 1 LIM | External reference REF1 at the supervision limit. See parameters 32.11 and 32.12. | 24 |
| | REF 2 LIM | External reference REF2 at the supervision limit. See parameters 32.13 and 32.14. | 25 |
| | TORQUE 1 LIM | Motor torque at supervision limit 1. See parameters 32.07 and 32.08. | 26 |
| | TORQUE 2 LIM | Motor torque at supervision limit 2. See parameters 32.09 and 32.10. | 27 |
| | STARTED | The drive has received the start command. | 28 |
| | LOSS OF REF | The drive has no reference. | 29 |
| | AT SPEED | The actual value has reached the reference value. In speed control, the speed error is less or equal to 10% of the nominal motor speed. | 30 |
| | ACT 1 LIM | Process PID controller variable ACT1 at the supervision limit. See parameters 32.15 and 32.16. | 31 |
| | ACT 2 LIM | Process PID controller variable ACT2 at the supervision limit. See parameters 32.17 and 32.18. | 32 |
| | COMM.REF3(13) | The relay is controlled by fieldbus reference REF3. See chapter *Fieldbus control*. | 33 |
| | PARAM 14.16 | Source selected by parameter 14.16. | 34 |
| | BRAKE CTRL | On/Off control of a mechanical brake. See parameter group 42 BRAKE CONTROL and section *Control of a mechanical brake* on page 77. | 35 |
| | BC SHORT CIR | Drive trips on a brake chopper fault. See chapter *Fault tracing*. | 36 |
| 14.02 | RELAY RO2 OUTPUT | Selects the drive status to be indicated through relay output RO2. The relay energises when the status meets the setting. | |
| | NOT USED | See parameter 14.01. | 1 |
| | READY | See parameter 14.01. | 2 |
| | RUNNING | See parameter 14.01. | 3 |
| | FAULT | See parameter 14.01. | 4 |
| | FAULT(-1) | See parameter 14.01. | 5 |
| | FAULT(RST) | See parameter 14.01. | 6 |
| | STALL WARN | See parameter 14.01. | 7 |
| | STALL FLT | See parameter 14.01. | 8 |
| | MOT TEMP WRN | See parameter 14.01. | 9 |
| | MOT TEMP FLT | See parameter 14.01. | 10 |
| | ACS TEMP WRN | See parameter 14.01. | 11 |
| | ACS TEMP FLT | See parameter 14.01. | 12 |
| | FAULT/WARN | See parameter 14.01. | 13 |
| | WARNING | See parameter 14.01. | 14 |

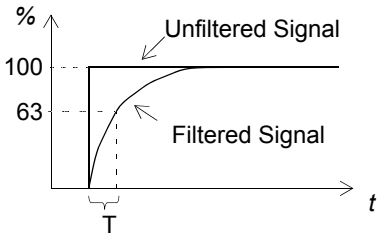
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | REVERSED | See parameter 14.01. | 15 |
| | EXT CTRL | See parameter 14.01. | 16 |
| | REF 2 SEL | See parameter 14.01. | 17 |
| | CONST SPEED | See parameter 14.01. | 18 |
| | DC OVERVOLT | See parameter 14.01. | 19 |
| | DC UNDERVOLT | See parameter 14.01. | 20 |
| | SPEED 1 LIM | See parameter 14.01. | 21 |
| | SPEED 2 LIM | See parameter 14.01. | 22 |
| | CURRENT LIM | See parameter 14.01. | 23 |
| | REF 1 LIM | See parameter 14.01. | 24 |
| | REF 2 LIM | See parameter 14.01. | 25 |
| | TORQUE 1 LIM | See parameter 14.01. | 26 |
| | TORQUE 2 LIM | See parameter 14.01. | 27 |
| | STARTED | See parameter 14.01. | 28 |
| | LOSS OF REF | See parameter 14.01. | 29 |
| | AT SPEED | See parameter 14.01. | 30 |
| | ACT 1 LIM | See parameter 14.01. | 31 |
| | ACT 2 LIM | See parameter 14.01. | 32 |
| | COMM. REF3(14) | See parameter 14.01. | 33 |
| | PARAM 14.17 | Source selected by parameter 14.17. | 34 |
| | BRAKE CTRL | See parameter 14.01. | 35 |
| | BC SHORT CIR | See parameter 14.01. | 36 |
| 14.03 | RELAY RO3 OUTPUT | Selects the drive status to be indicated through relay output RO3. The relay energises when the status meets the setting. | |
| | NOT USED | See parameter 14.01. | 1 |
| | READY | See parameter 14.01. | 2 |
| | RUNNING | See parameter 14.01. | 3 |
| | FAULT | See parameter 14.01. | 4 |
| | FAULT(-1) | See parameter 14.01. | 5 |
| | FAULT(RST) | See parameter 14.01. | 6 |
| | STALL WARN | See parameter 14.01. | 7 |
| | STALL FLT | See parameter 14.01. | 8 |
| | MOT TEMP WRN | See parameter 14.01. | 9 |
| | MOT TEMP FLT | See parameter 14.01. | 10 |
| | ACS TEMP WRN | See parameter 14.01. | 11 |
| | ACS TEMP FLT | See parameter 14.01. | 12 |
| | FAULT/WARN | See parameter 14.01. | 13 |
| | WARNING | See parameter 14.01. | 14 |
| | REVERSED | See parameter 14.01. | 15 |
| | EXT CTRL | See parameter 14.01. | 16 |
| | REF 2 SEL | See parameter 14.01. | 17 |
| | CONST SPEED | See parameter 14.01. | 18 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | DC OVERVOLT | See parameter 14.01. | 19 |
| | DC UNDERVOLT | See parameter 14.01. | 20 |
| | SPEED 1 LIM | See parameter 14.01. | 21 |
| | SPEED 2 LIM | See parameter 14.01. | 22 |
| | CURRENT LIM | See parameter 14.01. | 23 |
| | REF 1 LIM | See parameter 14.01. | 24 |
| | REF 2 LIM | See parameter 14.01. | 25 |
| | TORQUE 1 LIM | See parameter 14.01. | 26 |
| | TORQUE 2 LIM | See parameter 14.01. | 27 |
| | STARTED | See parameter 14.01. | 28 |
| | LOSS OF REF | See parameter 14.01. | 29 |
| | AT SPEED | See parameter 14.01. | 30 |
| | MAGN READY | The motor is magnetised and ready to give nominal torque (nominal magnetising of the motor has been reached). | 31 |
| | USER 2 SEL | User Macro 2 is in use. | 32 |
| | COMM. REF3(15) | See parameter 14.01. | 33 |
| | PARAM 14.18 | Source selected by parameter 14.18. | 34 |
| | BRAKE CTRL | See parameter 14.01. | 35 |
| | BC SHORT CIR | See parameter 14.01. | 36 |
| 14.04 | RO1 TON DELAY | Defines the operation delay for the relay RO1. | |
| | 0.0 … 3600.0 s | Setting range. The figure below illustrates the operation (on) and release (off) delays for relay output RO1.<br>  <br><br>$t_{On}$ 14.04<br>$t_{Off}$ 14.05 | 0 … 36000 |
| 14.05 | RO1 TOFF DELAY | Defines the release delay for relay output RO1. | |
| | 0.0 … 3600.0 s | See parameter 14.04. | 0 … 36000 |
| 14.06 | RO2 TON DELAY | Defines the operation delay for relay output RO2. | |
| | 0.0 … 3600.0 s | See parameter 14.04. | 0 … 36000 |
| 14.07 | RO2 TOFF DELAY | Defines the release delay for relay output RO2. | |
| | 0.0 … 3600.0 s | See parameter 14.04. | 0 … 36000 |
| 14.08 | RO3 TON DELAY | Defines the operation delay for relay output RO3. | |
| | 0.0 … 3600.0 s | See parameter 14.04. | 0 … 36000 |
| 14.09 | RO3 TOFF DELAY | Defines the release delay of relay output RO3. | |
| | 0.0 … 3600.0 s | See parameter 14.04. | 0 … 36000 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 14.10 | DIO MOD1 RO1 | Selects the drive status indicated through relay output RO1 of digital I/O extension module 1 (optional, see parameter 98.03). | |
| | READY | See parameter 14.01. | 1 |
| | RUNNING | See parameter 14.01. | 2 |
| | FAULT | See parameter 14.01. | 3 |
| | WARNING | See parameter 14.01. | 4 |
| | REF 2 SEL | See parameter 14.01. | 5 |
| | AT SPEED | See parameter 14.01. | 6 |
| | PARAM 14.19 | Source selected by parameter 14.19. | 7 |
| 14.11 | DIO MOD1 RO2 | Selects the drive status indicated through relay output RO2 of digital I/O extension module 1 (optional, see parameter 98.03). | |
| | READY | See parameter 14.01. | 1 |
| | RUNNING | See parameter 14.01. | 2 |
| | FAULT | See parameter 14.01. | 3 |
| | WARNING | See parameter 14.01. | 4 |
| | REF 2 SEL | See parameter 14.01. | 5 |
| | AT SPEED | See parameter 14.01. | 6 |
| | PARAM 14.20 | Source selected by parameter 14.20. | 7 |
| 14.12 | DIO MOD2 RO1 | Selects the drive status indicated through relay output RO1 of digital I/O extension module 2 (optional, see parameter 98.04). | |
| | READY | See parameter 14.01. | 1 |
| | RUNNING | See parameter 14.01. | 2 |
| | FAULT | See parameter 14.01. | 3 |
| | WARNING | See parameter 14.01. | 4 |
| | REF 2 SEL | See parameter 14.01. | 5 |
| | AT SPEED | See parameter 14.01. | 6 |
| | PARAM 14.21 | Source selected by parameter 14.21. | 7 |
| 14.13 | DIO MOD2 RO2 | Selects the drive status indicated through relay output RO2 of digital I/O extension module 2 (optional, see parameter 98.04). | |
| | READY | See parameter 14.01. | 1 |
| | RUNNING | See parameter 14.01. | 2 |
| | FAULT | See parameter 14.01. | 3 |
| | WARNING | See parameter 14.01. | 4 |
| | REF 2 SEL | See parameter 14.01. | 5 |
| | AT SPEED | See parameter 14.01. | 6 |
| | PARAM 14.22 | Source selected by parameter 14.22. | 7 |
| 14.14 | DIO MOD3 RO1 | Selects the drive status indicated through relay output RO1 of digital I/O extension module 3 (optional, see parameter 98.05). | |
| | READY | See parameter 14.01. | 1 |
| | RUNNING | See parameter 14.01. | 2 |
| | FAULT | See parameter 14.01. | 3 |
| | WARNING | See parameter 14.01. | 4 |
| | REF 2 SEL | See parameter 14.01. | 5 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | AT SPEED | See parameter 14.01. | 6 |
| | PARAM 14.23 | Source selected by parameter 14.23. | 7 |
| 14.15 | DIO MOD3 RO2 | Selects the drive status indicated through relay output RO2 of digital I/O extension module no. 3 (optional, see parameter 98.05). | |
| | READY | See parameter 14.01. | 1 |
| | RUNNING | See parameter 14.01. | 2 |
| | FAULT | See parameter 14.01. | 3 |
| | WARNING | See parameter 14.01. | 4 |
| | REF 2 SEL | See parameter 14.01. | 5 |
| | AT SPEED | See parameter 14.01. | 6 |
| | PARAM 14.24 | Source selected by parameter 14.24. | 7 |
| 14.16 | RO PTR1 | Defines the source or constant for value PAR 14.16 of parameter 14.01. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | - |
| 14.17 | RO PTR2 | Defines the source or constant for value PAR 14.17 of parameter 14.02. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | - |
| 14.18 | RO PTR3 | Defines the source or constant for value PAR 14.18 of parameter 14.03. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | - |
| 14.19 | RO PTR4 | Defines the source or constant for value PAR 14.19 of parameter 14.10. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | - |
| 14.20 | RO PTR5 | Defines the source or constant for value PAR 14.20 of parameter 14.11. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | - |
| 14.21 | RO PTR6 | Defines the source or constant for value PAR 14.21 of parameter 14.12. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | - |
| 14.22 | RO PTR7 | Defines the source or constant for value PAR 14.22 of parameter 14.13. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | - |
| 14.23 | RO PTR8 | Defines the source or constant for value PAR 14.23 of parameter 14.14. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | - |
| 14.24 | RO PTR9 | Defines the source or constant for value PAR 14.24 of parameter 14.15. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | - |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| **15 ANALOGUE OUTPUTS** | | Selection of the actual signals to be indicated through the analogue outputs. Output signal processing. See section *Programmable analogue outputs* on page *50*. | |
| 15.01 | ANALOGUE OUTPUT1 | Connects a drive signal to analogue output AO1. | |
| | NOT USED | Not in use | 1 |
| | P SPEED | Value of a user-defined process quantity derived from the motor speed. See parameter group 34 PROCESS VARIABLE for scaling and unit selection (%; m/s; rpm). The updating interval is 100 ms. | 2 |
| | SPEED | Motor speed (signal 01.02 SPEED). 20 mA = motor nominal speed. The updating interval is 24 ms. The value is filtered with the filter time constant defined by parameter 34.04 MOTOR SP FILT TIM. | 3 |
| | FREQUENCY | Output frequency. 20 mA = motor nominal frequency. The updating interval is 24 ms. | 4 |
| | CURRENT | Output current. 20 mA = motor nominal current. The updating interval is 24 ms. | 5 |
| | TORQUE | Motor torque. 20 mA = 100% of motor nominal rating. The updating interval is 24 ms. | 6 |
| | POWER | Motor power. 20 mA = 100% of motor nominal rating. The updating interval is 100 ms. | 7 |
| | DC BUS VOLT | DC bus voltage. 20 mA = 100% of the reference value. The reference value is 540 VDC. (= 1.35 · 400 V) for 380...415 VAC supply voltage rating and 675 VDC (= 1.35 · 500 V) for 380...500 VAC supply. The updating interval is 24 ms. | 8 |
| | OUTPUT VOLT | Motor voltage. 20 mA = motor rated voltage. The updating interval is 100 ms. | 9 |
| | APPL OUTPUT | The reference which is given as an output from the application. For example, if the PID Control macro is in use, this is the output of the process PID controller. The updating interval is 24 ms. | 10 |
| | REFERENCE | Active reference that the drive is currently following. 20 mA = 100 % of the active reference. The updating interval is 24 ms. | 11 |
| | CONTROL DEV | The difference between the reference and the actual value of the process PID controller. 0/4 mA = -100%, 10/12 mA = 0%, 20 mA = 100%. The updating interval is 24 ms. | 12 |
| | ACTUAL 1 | Value of variable ACT1 used in the process PID control. 20 mA = value of parameter 40.10. The updating interval is 24 ms. | 13 |
| | ACTUAL 2 | Value of variable ACT2 used in the process PID control. 20 mA = value of parameter 40.12. The updating interval is 24 ms. | 14 |
| | COMM.REF4 | The value is read from fieldbus reference REF4. See chapter *Fieldbus control*. | 15 |
| | M1 TEMP MEAS | Analogue output is a current source in a motor temperature measuring circuit. Depending on the sensor type, the output is 9.1 mA (Pt 100) or 1.6 mA (PTC). For more information, see parameter 35.01 and section *Motor temperature measurement through the standard I/O* on page *73*.<br>**Note:** The settings of parameters 15.02 to 15.05 are not effective. | 16 |
| | PARAM 15.11 | Source selected by 15.11 | 17 |
| 15.02 | INVERT AO1 | Inverts the analogue output AO1 signal. The analogue signal is at the minimum level when the indicated drive signal is at its maximum level and vice versa. | |
| | NO | Inversion off | 0 |
| | YES | Inversion on | 65535 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 15.03 | MINIMUM AO1 | Defines the minimum value of the analogue output signal AO1. | |
| | 0 mA | Zero mA | 1 |
| | 4 mA | Four mA | 2 |
| 15.04 | FILTER AO1 | Defines the filtering time constant for analogue output AO1. | |
| | 0.00 … 10.00 s | Filter time constant<br>  <br><br>$O = I \cdot (1 - e^{-t/T})$<br>I = filter input (step)<br>O = filter output<br>t = time<br>T = filter time constant<br>**Note:** Even if you select 0 s as the minimum value, the signal is still filtered with a time constant of 10 ms due to the signal interface hardware. This cannot be changed by any parameters. | 0 … 1000 |
| 15.05 | SCALE AO1 | Scales the analogue output AO1 signal. | |
| | 10 … 1000% | Scaling factor. If the value is 100%, the reference value of the drive signal corresponds to 20 mA.<br>**Example:** The nominal motor current is 7.5 A and the measured maximum current at maximum load 5 A. The motor current 0 to 5 A needs to be read as 0 to 20 mA analogue signal through AO1. The required settings are:<br>1. AO1 is set to CURRENT by parameter 15.01.<br>2. AO1 minimum is set to 0 mA by parameter 15.03.<br>3. The measured maximum motor current is scaled to correspond to 20 mA analogue output signal by setting the scaling factor (k) to 150%. The value is defined as follows: The reference value of the output signal CURRENT is the motor nominal current i.e. 7.5 A (see parameter 15.01). To make the measured maximum motor current correspond to 20 mA, it should be scaled equal to the reference value before it is converted to an analogue output signal. Equation:<br>$k \cdot 5\ A = 7.5\ A \Rightarrow k = 1.5 = 150\%$ | 100 … 10000 |
| 15.06 | ANALOGUE OUTPUT2 | See parameter 15.01. | |
| | NOT USED | See parameter 15.01. | 1 |
| | P SPEED | See parameter 15.01. | 2 |
| | SPEED | See parameter 15.01. | 3 |
| | FREQUENCY | See parameter 15.01. | 4 |
| | CURRENT | See parameter 15.01. | 5 |
| | TORQUE | See parameter 15.01. | 6 |
| | POWER | See parameter 15.01. | 7 |
| | DC BUS VOLT | See parameter 15.01. | 8 |
| | OUTPUT VOLT | See parameter 15.01. | 9 |
| | APPL OUTPUT | See parameter 15.01. | 10 |
| | REFERENCE | See parameter 15.01. | 11 |
| | CONTROL DEV | See parameter 15.01. | 12 |
| | ACTUAL 1 | See parameter 15.01. | 13 |

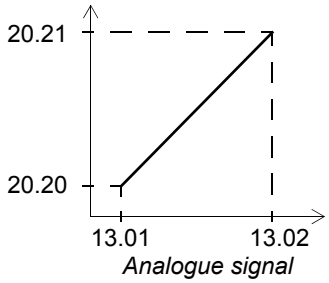
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | ACTUAL 2 | See parameter 15.01. | 14 |
| | COMM.REF5 | The value is read from fieldbus reference REF5. See chapter *Fieldbus control*. | 15 |
| | PARAM 15.12 | Source selected by 15.12 | 16 |
| 15.07 | INVERT AO2 | See parameter 15.02. | |
| | NO | See parameter 15.02. | 0 |
| | YES | See parameter 15.02. | 65535 |
| 15.08 | MINIMUM AO2 | See parameter 15.03. | |
| | 0 mA | See parameter 15.03. | 1 |
| | 4 mA | See parameter 15.03. | 2 |
| 15.09 | FILTER AO2 | See parameter 15.04. | |
| | 0.00 … 10.00 s | See parameter 15.04. | 0 … 1000 |
| 15.10 | SCALE AO2 | See parameter 15.05. | |
| | 10 … 1000% | See parameter 15.05. | 100 … 10000 |
| 15.11 | AO1 PTR | Defines the source or constant for value PAR 15.11 of parameter 15.01. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | 1000 = 1 mA |
| 15.12 | AO2 PTR | Defines the source or constant for value PAR 15.12 of parameter 15.06. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | 1000 = 1 mA |
| **16 SYST CTRL INPUTS** | | Run Enable, parameter lock etc. | |
| 16.01 | RUN ENABLE | Sets the Run Enable signal on, or selects a source for the external Run Enable signal. If Run Enable signal is switched off, the drive will not start or stops if it is running. The stop mode is set by parameter 21.07. | |
| | YES | Run Enable signal is on. | 1 |
| | DI1 | External signal required through digital input DI1. 1 = Run Enable. | 2 |
| | DI2 | See selection DI1. | 3 |
| | DI3 | See selection DI1. | 4 |
| | DI4 | See selection DI1. | 5 |
| | DI5 | See selection DI1. | 6 |
| | DI6 | See selection DI1. | 7 |
| | COMM.CW | External signal required through the Fieldbus Control Word (bit 3). | 8 |
| | DI7 | See selection DI1. | 9 |
| | DI8 | See selection DI1. | 10 |
| | DI9 | See selection DI1. | 11 |
| | DI10 | See selection DI1. | 12 |
| | DI11 | See selection DI1. | 13 |
| | DI12 | See selection DI1. | 14 |
| | PARAM 16.08 | Source selected by parameter 16.08. | 15 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 16.02 | PARAMETER LOCK | Selects the state of the parameter lock. The lock prevents parameter changing. | |
| | OPEN | The lock is open. Parameter values can be changed. | 0 |
| | LOCKED | Locked. Parameter values cannot be changed from the control panel. The lock can be opened by entering the valid code to parameter 16.03. | 65535 |
| 16.03 | PASS CODE | Selects the pass code for the parameter lock (see parameter 16.02). | |
| | 0 … 30000 | Setting 358 opens the lock. The value reverts back to 0 automatically. | 0 … 30000 |
| 16.04 | FAULT RESET SEL | Selects the source for the fault reset signal. The signal resets the drive after a fault trip if the cause of the fault no longer exists. | |
| | NOT SEL | Fault reset only from the control panel keypad (RESET key). | 1 |
| | DI1 | Reset through digital input DI1 or by control panel:<br>- If the drive is in external control mode: Reset by a rising edge of DI1.<br>- If the drive is in local control mode: Reset by the RESET key of the control panel. | 2 |
| | DI2 | See selection DI1. | 3 |
| | DI3 | See selection DI1. | 4 |
| | DI4 | See selection DI1. | 5 |
| | DI5 | See selection DI1. | 6 |
| | DI6 | See selection DI1. | 7 |
| | COMM.CW | Reset through the fieldbus Control Word (bit 7), or by the RESET key of the control panel.<br>**Note:** Reset through fieldbus Control Word (bit 7) is enabled automatically and it is independent of parameter 16.04 setting if parameter 10.01 or 10.02 is set to COMM.CW. | 8 |
| | ON STOP | Reset along with the stop signal received through a digital input, or by the RESET key of the control panel. | 9 |
| | DI7 | See selection DI1. | 10 |
| | DI8 | See selection DI1. | 11 |
| | DI9 | See selection DI1. | 12 |
| | DI10 | See selection DI1. | 13 |
| | DI11 | See selection DI1. | 14 |
| | DI12 | See selection DI1. | 15 |
| | PARAM 16.11 | Source selected by parameter 16.11. | 16 |
| 16.05 | USER MACRO IO CHG | Enables the change of the User Macro through a digital input. See parameter 99.02. The change is only allowed when the drive is stopped. During the change, the drive will not start.<br>**Note:** Always save the User Macro by parameter 99.02 after changing any parameter settings, or reperforming the motor identification. The last settings saved by the user are loaded into use whenever the power is switched off and on again or the macro is changed. Any unsaved changes will be lost.<br>**Note:** The value of this parameter is not included in the User Macro. A setting once made remains despite the User Macro change.<br>**Note:** Selection of User Macro 2 can be supervised via relay output RO3. See parameter 14.03 for more information. | |
| | NOT SEL | User macro change is not possible through a digital input. | 1 |
| | DI1 | Falling edge of digital input DI1: User Macro 1 is loaded into use. Rising edge of digital input DI1: User Macro 2 is loaded into use. | 2 |

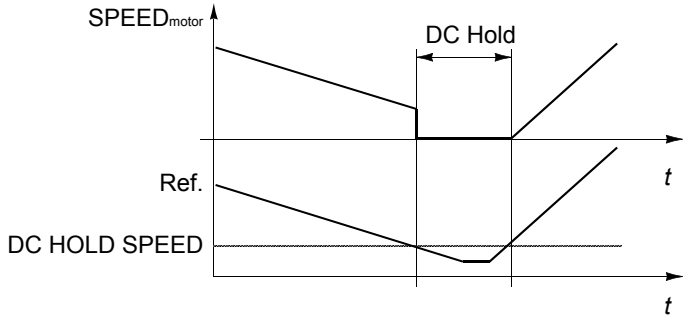
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | DI2 | See selection DI1. | 3 |
| | DI3 | See selection DI1. | 4 |
| | DI4 | See selection DI1. | 5 |
| | DI5 | See selection DI1. | 6 |
| | DI6 | See selection DI1. | 7 |
| | DI7 | See selection DI1. | 8 |
| | DI8 | See selection DI1. | 9 |
| | DI9 | See selection DI1. | 10 |
| | DI10 | See selection DI1. | 11 |
| | DI11 | See selection DI1. | 12 |
| | DI12 | See selection DI1. | 13 |
| 16.06 | LOCAL LOCK | Disables entering local control mode (***LOC/REM*** key of the panel).<br>**WARNING!** Before activating, ensure that the control panel is not needed for stopping the drive! | |
| | OFF | Local control allowed. | 0 |
| | ON | Local control disabled. | 65535 |
| 16.07 | PARAMETER SAVE | Saves the valid parameter values to the permanent memory.<br>**Note:** A new parameter value of a standard macro is saved automatically when changed from the panel but not when altered through a fieldbus connection. | |
| | DONE | Saving completed | 0 |
| | SAVE.. | Saving in progress | 1 |
| 16.08 | RUN ENA PTR | Defines the source or constant for value PAR 16.08 of parameter 16.01 | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | - |
| 16.09 | CTRL BOARD SUPPLY | Defines the source of the control board power supply.<br>**Note:** If an external supply is used but this parameter has value INTERNAL, the drive trips on a fault at power switch off. | |
| | INTERNAL 24V | Internal (default). | 1 |
| | EXTERNAL 24V | External. The control board is powered from an external supply. | 2 |
| 16.10 | ASSIST SEL | Enables the Start-up Assistant. | |
| | OFF | Assistant disabled. | 0 |
| | ON | Assistant enabled. | 65535 |
| 16.11 | FAULT RESET PTR | Defines the source or constant for selection PARAM 16.11 of parameter 16.04. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | - |
| 16.12 | RESET COUNTER | Resets the cooling fan running time counter or kWh counter. | |
| | NO | No reset. | 0 |
| | FAN ON-TIME | Resets the running time counter of the drive cooling fan indicated with 01.44 FAN ON-TIME. | 1 |
| | kWh | kWh counter reset. See parameter 01.15 KILOWATT HOURS. | 2 |

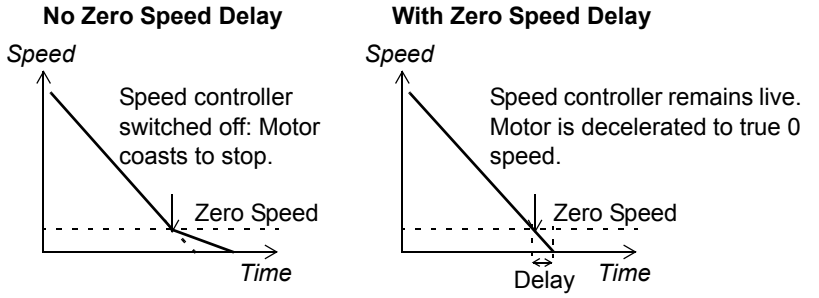
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| **20 LIMITS** | | Drive operation limits. See also section *Speed controller tuning* on page *60*. | |
| 20.01 | MINIMUM SPEED | Defines the allowed minimum speed. The limit cannot be set if parameter 99.04 = SCALAR.<br>**Note:** The limit is linked to the motor nominal speed setting i.e. parameter 99.08. If 99.08 is changed, the default speed limit will also change. | |
| | -18000 / (no. of pole pairs) … par. 20.02 rpm | Minimum speed limit.<br>**Note:** If the value is positive, the motor cannot be run in the reverse direction. | 1 = 1 rpm |
| 20.02 | MAXIMUM SPEED | Defines the allowed maximum speed. The value cannot be set if parameter 99.04 = SCALAR.<br>**Note:** The limit is linked to the motor nominal speed setting i.e. parameter 99.08. If 99.08 is changed, the default speed limit will also change. | |
| | par. 20.01 … 18000 / (no. of pole pairs) rpm | Maximum speed limit | 1 = 1 rpm |
| 20.03 | MAXIMUM CURRENT | Defines the allowed maximum motor current. | |
| | 0.0 … x.x A | Current limit | 0 …10·x.x |
| 20.04 | TORQ MAX LIM1 | Defines the maximum torque limit 1 for the drive. | |
| | 0.0 … 600.0% | Value of limit in percent of motor nominal torque. | 0 … 60000 |
| 20.05 | OVERVOLTAGE CTRL | Activates or deactivates the overvoltage control of the intermediate DC link.<br>Fast braking of a high inertia load causes the voltage to rise to the overvoltage control limit. To prevent the DC voltage from exceeding the limit, the overvoltage controller automatically decreases the braking torque.<br>**Note:** If a brake chopper and resistor are connected to the drive, the controller must be off (selection NO) to allow chopper operation. | |
| | OFF | Overvoltage control deactivated. | 0 |
| | ON | Overvoltage control activated. | 65535 |
| 20.06 | UNDERVOLTAGE CTRL | Activates or deactivates the undervoltage control of the intermediate DC link.<br>If the DC voltage drops due to input power cut off, the undervoltage controller will automatically decrease the motor speed in order to keep the voltage above the lower limit. By decreasing the motor speed, the inertia of the load will cause regeneration back into the drive, keeping the DC link charged and preventing an undervoltage trip until the motor coasts to stop. This will act as a power-loss ride-through functionality in systems with a high inertia, such as a centrifuge or a fan. | |
| | OFF | Undervoltage control deactivated. | 0 |
| | ON | Undervoltage control activated. | 65535 |
| 20.07 | MINIMUM FREQ | Defines the minimum limit for the drive output frequency. The limit can be set only parameter 99.04 = SCALAR. | |
| | -300.00 … 50 Hz | Minimum frequency limit.<br>**Note:** If the value is positive, the motor cannot be run in the reverse direction. | -30000 … 5000 |
| 20.08 | MAXIMUM FREQ | Defines the maximum limit for the drive output frequency. The limit can be set only if parameter 99.04 = SCALAR | |
| | -50 … 300.00 Hz | Maximum frequency limit | -5000 … 30000 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 20.11 | P MOTORING LIM | Defines the allowed maximum power fed by the inverter to the motor. | |
| | 0 … 600% | Power limit in percent of the motor nominal power | 0 … 60000 |
| 20.12 | P GENERATING LIM | Defines the allowed maximum power fed by the motor to the inverter. | |
| | -600 … 0% | Power limit in percent of the motor nominal power | -60000 … 0 |
| 20.13 | MIN TORQ SEL | Selects the minimum torque limit for the drive. The update interval is 100 ms. | |
| | MIN LIM1 | Value of parameter 20.15. | 1 |
| | DI1 | Digital input DI1. 0: Value of parameter 20.15. 1: Value of parameter 20.16. | 2 |
| | DI2 | See selection DI1. | 3 |
| | DI3 | See selection DI1. | 4 |
| | DI4 | See selection DI1. | 5 |
| | DI5 | See selection DI1. | 6 |
| | DI6 | See selection DI1. | 7 |
| | DI7 | See selection DI1. | 8 |
| | DI8 | See selection DI1. | 9 |
| | DI9 | See selection DI1. | 10 |
| | DI10 | See selection DI1. | 11 |
| | DI11 | See selection DI1. | 12 |
| | DI12 | See selection DI1. | 13 |
| | AI1 | Analogue input AI1. See parameter 20.20 on how the signal is converted to a torque limit. | 14 |
| | AI2 | See selection AI1. | 15 |
| | AI3 | See selection AI1. | 16 |
| | AI5 | See selection AI1. | 17 |
| | AI6 | See selection AI1. | 18 |
| | PARAM 20.18 | Limit given by 20.18 | 19 |
| | NEG MAX TORQ | Inverted maximum torque limit defined by parameter 20.14 | 20 |
| 20.14 | MAX TORQ SEL | Defines the maximum torque limit for the drive. The update interval is 100 ms. | |
| | MAX LIM1 | Value of parameter 20.04. | 1 |
| | DI1 | Digital input DI1. 0: Value of parameter 20.04. 1: Value of parameter 20.17. | 2 |
| | DI2 | See selection DI1. | 3 |
| | DI3 | See selection DI1. | 4 |
| | DI4 | See selection DI1. | 5 |
| | DI5 | See selection DI1. | 6 |
| | DI6 | See selection DI1. | 7 |
| | DI7 | See selection DI1. | 8 |
| | DI8 | See selection DI1. | 9 |
| | DI9 | See selection DI1. | 10 |
| | DI10 | See selection DI1. | 11 |
| | DI11 | See selection DI1. | 12 |
| | DI12 | See selection DI1. | 13 |
| | AI1 | Analogue input AI1. See parameter 20.20 on how the signal is converted to a torque limit. | 14 |

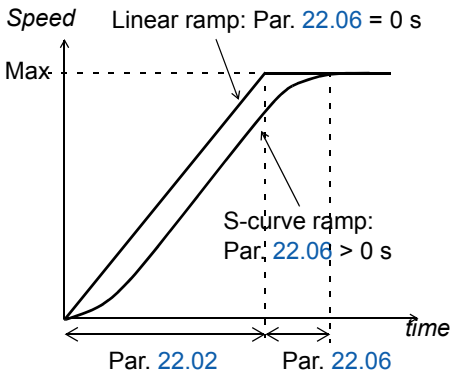
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | AI2 | See selection AI1. | 15 |
| | AI3 | See selection AI1. | 16 |
| | AI5 | See selection AI1. | 17 |
| | AI6 | See selection AI1. | 18 |
| | PARAM 20.19 | Limit given by 20.19 | 19 |
| 20.15 | TORQ MIN LIM1 | Defines the minimum torque limit 1 for the drive. | |
| | -600.0 … 0.0% | Value of limit in percent of motor nominal torque | -60000 … 0 |
| 20.16 | TORQ MIN LIM2 | Defines the minimum torque limit 2 for the drive. | |
| | -600.0 … 0.0% | Value of limit in percent of motor nominal torque | -60000 … 0 |
| 20.17 | TORQ MAX LIM2 | Defines the maximum torque limit 2 for the drive. | |
| | 0.0 … 600.0% | Value of limit in percent of motor nominal torque | 0 … 60000 |
| 20.18 | TORQ MIN PTR | Defines the source or constant for value PAR 20.18 of parameter 20.13 | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. | 100 = 1% |
| 20.19 | TORQ MAX PTR | Defines the source or constant for value PAR 20.19 of parameter 20.14 | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. FbEq for the torque value is 100 = 1%. | 100 = 1% |
| 20.20 | MIN AI SCALE | Defines how an analogue signal (mA or V) is converted to a torque minimum or maximum limit (%). The figure below illustrate the converting, when analogue input AI1 has been set the source for a torque limit by parameter 20.13 or 20.14.<br>*Torque limit*<br>  <br>13.01 Minimum setting for AI1<br>13.02 Maximum setting for AI1<br>20.20 Minimum torque<br>20.21 Maximum torque | |
| | 0.0 … 600.0% | %-value that corresponds to the minimum setting of the analogue input. | 100 = 1% |
| 20.21 | MAX AI SCALE | See parameter 20.20. | |
| | 0.0 … 600.0% | %-value that corresponds to the maximum setting of the analogue input. | 100 = 1% |
| 20.22 | SLS SPEED LIMIT | Defines the safely-limited speed limit (SLS). When the SLS function is activated the speed limits are ramped to 20.22 SLS SPEED LIMIT. The speed of the deceleration to SLS is defined by parameter 22.11 and acceleration from SLS to the original speed is defined by parameter 22.10.<br>**Note:** This parameter is available in AS7R firmware version only. | 20000 = 1500 rpm |
| | 0…9000 rpm (0…4 times sync speed) | | |
| **21 START/STOP** | | Start and stop modes of the motor. | |
| 21.01 | START FUNCTION | Selects the motor starting method. See also section *Automatic Start* on page *54*. | |

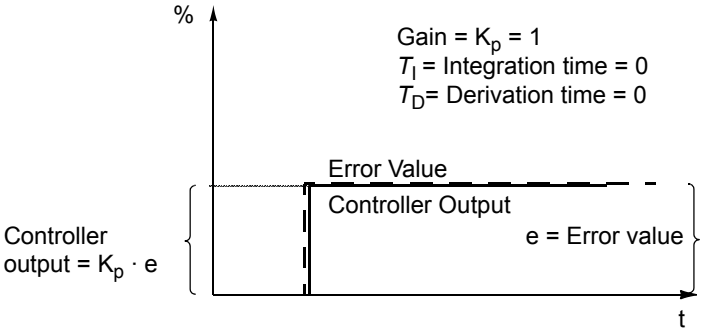
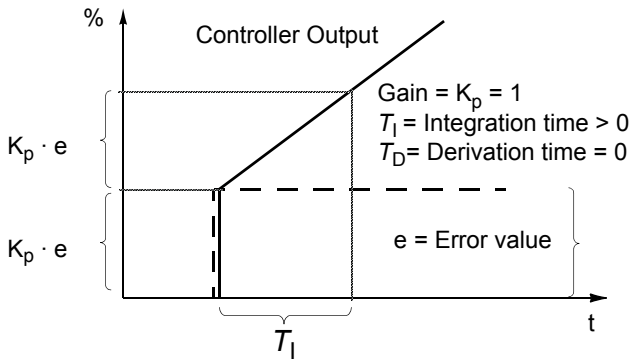
<table>
<tr><th>Index</th><th>Name/Selection</th><th>Description</th><th>FbEq</th></tr>
<tr><td></td><td>AUTO</td><td>Automatic start guarantees optimal motor start in most cases. It includes the flying start function (starting to a rotating machine) and the automatic restart function (stopped motor can be restarted immediately without waiting the motor flux to die away). The drive motor control program identifies the flux as well as the mechanical state of the motor and starts the motor instantly under all conditions.<br>Note: If parameter 99.04 = SCALAR, no flying start or automatic restart is possible by default. The flying start feature needs to be activated separately by parameter 21.08.</td><td>1</td></tr>
<tr><td></td><td>DC MAGN</td><td>DC magnetising should be selected if a high break-away torque is required. The drive pre-magnetises the motor before the start. The pre-magnetising time is determined automatically, being typically 200 ms to 2 s depending on the motor size. DC MAGN guarantees the highest possible break-away torque.<br>Note: Starting to a rotating machine is not possible when DC magnetising is selected.<br>Note: DC magnetising cannot be selected if parameter 99.04 = SCALAR.</td><td>2</td></tr>
<tr><td></td><td>CNST DC MAGN</td><td>Constant DC magnetising should be selected instead of DC magnetising if constant pre-magnetising time is required (e.g. if the motor start must be simultaneous with a mechanical brake release). This selection also guarantees the highest possible break-away torque when the pre-magnetising time is set long enough. The pre-magnetising time is defined by parameter 21.02.<br>Note: Starting to a rotating machine is not possible when DC magnetising is selected.<br>Note: DC magnetising cannot be selected if parameter 99.04 = SCALAR.<br>  WARNING! The drive will start after the set magnetising time has passed although the motor magnetisation is not completed. Ensure always in applications where a full break-away torque is essential, that the constant magnetising time is long enough to allow generation of full magnetisation and torque.</td><td>3</td></tr>
<tr><td>21.02</td><td>CONST MAGN TIME</td><td>Defines the magnetising time in the constant magnetising mode. See parameter 21.01. After the start command, the drive automatically pre-magnetises the motor the set time.</td><td></td></tr>
<tr><td></td><td>30.0 … 10000.0 ms</td><td>Magnetising time. To ensure full magnetising, set this value to the same value as or higher than the rotor time constant. If not known, use the rule-of-thumb value given in the table below:<br><table><tr><th>Motor Rated Power</th><th>Constant Magnetising Time</th></tr><tr><td>< 10 kW</td><td>≥ 100 to 200 ms</td></tr><tr><td>10 to 200 kW</td><td>≥ 200 to 1000 ms</td></tr><tr><td>200 to 1000 kW</td><td>≥ 1000 to 2000 ms</td></tr></table></td><td>30 … 10000</td></tr>
<tr><td>21.03</td><td>STOP FUNCTION</td><td>Selects the motor stop function.</td><td></td></tr>
<tr><td></td><td>COAST</td><td>Stop by cutting of the motor power supply. The motor coasts to a stop.<br>  WARNING! If the mechanical brake control function is on, the application program uses ramp stop in spite of the selection COAST (see parameter group 42 BRAKE CONTROL).</td><td>1</td></tr>
<tr><td></td><td>RAMP</td><td>Stop along a ramp. See parameter group 22 ACCEL/DECEL.</td><td>2</td></tr>
</table>

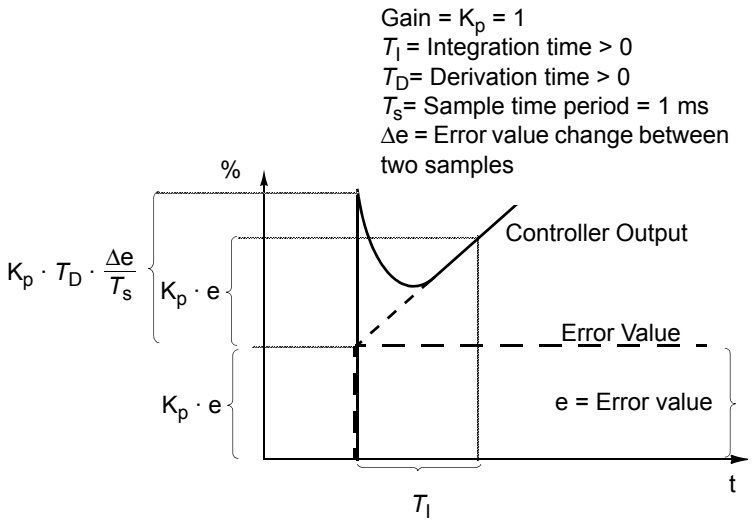
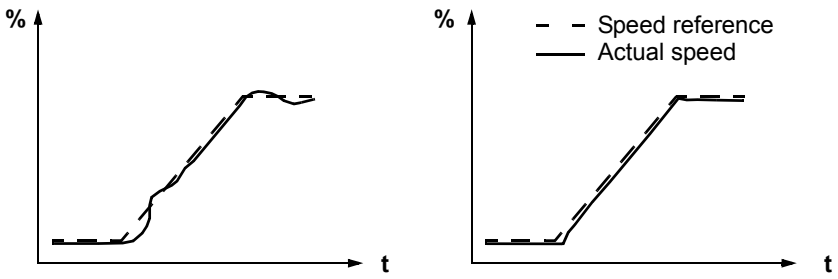
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 21.04 | DC HOLD | Activates/deactivates the DC hold function. DC Hold is not possible if parameter 99.04 = SCALAR.<br>When both the reference and the speed drop below the value of parameter 21.05, the drive will stop generating sinusoidal current and start to inject DC into the motor. The current is set by parameter 21.06. When the reference speed exceeds parameter 21.05, normal drive operation continues.<br>  <br>**Note:** DC Hold has no effect if the start signal is switched off.<br>**Note:** Injecting DC current into the motor causes the motor to heat up. In applications where long DC hold times are required, externally ventilated motors should be used. If the DC hold period is long, the DC hold cannot prevent the motor shaft from rotating if a constant load is applied to the motor.<br>See section *DC Hold* on page *57*. | |
| | NO | Inactive | 0 |
| | YES | Active | 65535 |
| 21.05 | DC HOLD SPEED | Defines the DC Hold speed. See parameter 21.04. | |
| | 0 … 3000 rpm | Speed in rpm | 0 … 3000 |
| 21.06 | DC HOLD CURR | Defines the DC hold current. See parameter 21.04. | |
| | 0 … 100% | Current in percent of the motor nominal current | 0 … 100 |
| 21.07 | RUN ENABLE FUNC | Selects the stop mode applied when the Run Enable signal is switched off. The Run Enable signal is put into use by parameter 16.01.<br>**Note:** The setting overrides the normal stop mode setting (parameter 21.03) when the Run Enable signal is switched off.<br>**WARNING!** The drive will restart after the Run Enable signal restores (if the start signal is on). | |
| | RAMP STOP | The application program stops the drive along the deceleration ramp defined in group 22 ACCEL/DECEL. | 1 |
| | COAST STOP | The application program stops the drive by cutting off the motor power supply (the inverter IGBTs are blocked). The motor rotates freely to zero speed.<br>**WARNING!** If the brake control function is on, the application program uses ramp stop in spite of the selection COAST STOP (see parameter group 42 BRAKE CONTROL). | 2 |
| | OFF2 STOP | The application program stops the drive by cutting off the motor power supply (the inverter IGBTs are blocked). The motor rotates freely to zero speed. The drive will restart only when the Run Enable signal is on and the start signal is switched on (the program receives the rising edge of the start signal). | 3 |

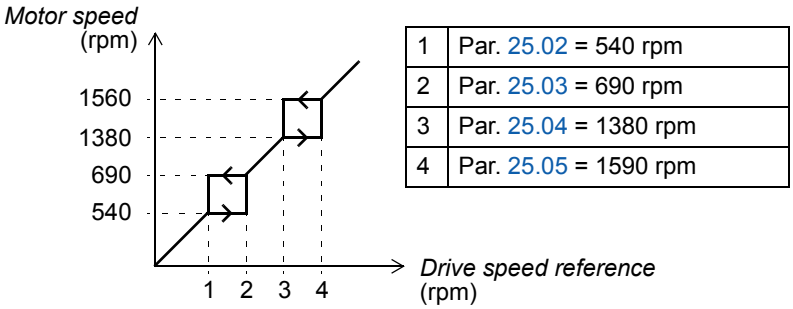
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | OFF3 STOP | The application program stops the drive along the ramp defined by parameter 22.07. The drive will restart only when the Run Enable is on and the start signal is switched on (the program receives the rising edge of the start signal). | 4 |
| 21.08 | SCALAR FLY START | Activates the flying start feature in the scalar control mode. See parameters 21.01 and 99.04. | |
| | NO | Inactive | 0 |
| | YES | Active | 65535 |
| 21.09 | START INTRL FUNC | Defines how the Start Interlock input on RMIO board affects the drive operation. | |
| | OFF2 STOP | Drive running: 1 = Normal operation. 0 = Stop by coasting.<br>Drive stopped: 1 = Start allowed. 0 = No start allowed.<br>Restart after OFF2 STOP: Input is back to 1 and the drive receives rising edge of the Start signal. | 1 |
| | OFF3 STOP | Drive running: 1 = Normal operation. 0 = Stop by ramp. The ramp time is defined by parameter 22.07 EM STOP RAMP.<br>Drive stopped: 1 = Normal start. 0 = No start allowed.<br>Restart after OFF3 STOP: Start Interlock input = 1 and the drive receives rising edge of the Start signal. | 2 |
| 21.10 | ZERO SPEED DELAY | Defines the delay for the zero speed delay function. The function is useful in applications where a smooth and quick restarting is essential. During the delay the drive knows accurately the rotor position.<br>  <br>**No Zero Speed Delay**<br>The drive receives a stop command and decelerates along a ramp. When the motor actual speed falls below an internal limit (called Zero Speed), the speed controller is switched off. The inverter modulation is stopped and the motor coasts to standstill.<br>**With Zero Speed Delay**<br>The drive receives a stop command and decelerates along a ramp. When the actual motor speed falls below an internal limit (called Zero Speed), the zero speed delay function activates. During the delay the functions keeps the speed controller live: the inverter modulates, motor is magnetised and the drive is ready for a quick restart. | |
| | 0.0 … 60.0 s | Delay time | 10 = 1 s |
| **22 ACCEL/DECEL** | | Acceleration and deceleration times. See section *Acceleration and deceleration ramps* on page *59*. | |
| 22.01 | ACC/DEC SEL | Selects the active acceleration/deceleration time pair. | |
| | ACC/DEC 1 | Acceleration time 1 and deceleration time 1 are used. See parameters 22.02 and 22.03. | 1 |

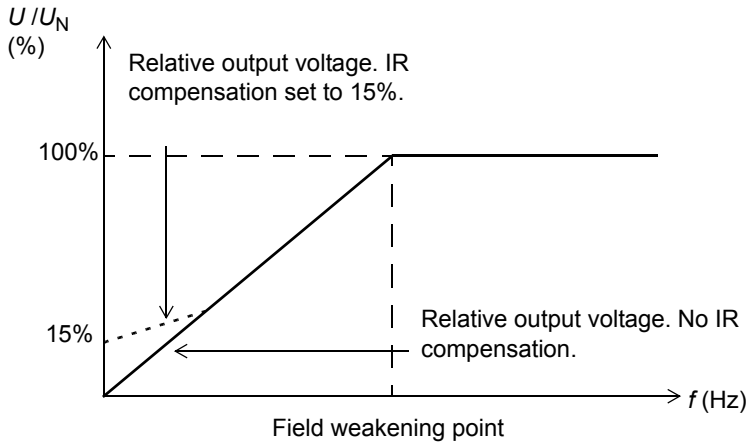
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | ACC/DEC 2 | Acceleration time 2 and deceleration time 2 are used. See parameters 22.04 and 22.05. | 2 |
| | DI1 | Acceleration/deceleration time pair selection through digital input DI1. 0 = Acceleration time 1 and deceleration time 1 are in use. 1 = Acceleration time 2 and deceleration time 2 are in use. | 3 |
| | DI2 | See selection DI1. | 4 |
| | DI3 | See selection DI1. | 5 |
| | DI4 | See selection DI1. | 6 |
| | DI5 | See selection DI1. | 7 |
| | DI6 | See selection DI1. | 8 |
| | DI7 | See selection DI1. | 9 |
| | DI8 | See selection DI1. | 10 |
| | DI9 | See selection DI1. | 11 |
| | DI10 | See selection DI1. | 12 |
| | DI11 | See selection DI1. | 13 |
| | DI12 | See selection DI1. | 14 |
| | PAR 22.08&09 | Acceleration and deceleration times given by parameters 22.08 and 22.09 | 15 |
| 22.02 | ACCEL TIME 1 | Defines the acceleration time 1 i.e. the time required for the speed to change from zero to the maximum speed.<br>- If the speed reference increases faster than the set acceleration rate, the motor speed will follow the acceleration rate.<br>- If the speed reference increases slower than the set acceleration rate, the motor speed will follow the reference signal.<br>- If the acceleration time is set too short, the drive will automatically prolong the acceleration in order not to exceed the drive operating limits. | |
| | 0.00 … 1800.00 s | Acceleration time | 0 … 18000 |
| 22.03 | DECEL TIME 1 | Defines the deceleration time 1 i.e. the time required for the speed to change from the maximum (see parameter 20.02) to zero.<br>- If the speed reference decreases slower than the set deceleration rate, the motor speed will follow the reference signal.<br>- If the reference changes faster than the set deceleration rate, the motor speed will follow the deceleration rate.<br>- If the deceleration time is set too short, the drive will automatically prolong the deceleration in order not to exceed drive operating limits. If there is any doubt about the deceleration time being too short, ensure that the DC overvoltage control is on (parameter 20.05).<br>**Note:** If a short deceleration time is needed for a high inertia application, the drive should be equipped with an electric braking option e.g. with a brake chopper and a brake resistor. | |
| | 0.00 … 1800.00 s | Deceleration time | 0 … 18000 |
| 22.04 | ACCEL TIME 2 | See parameter 22.02. | |
| | 0.00 … 1800.00 s | See parameter 22.02. | 0 … 18000 |
| 22.05 | DECEL TIME 2 | See parameter 22.03. | |
| | 0.00 … 1800.00 s | See parameter 22.03. | 0 … 18000 |

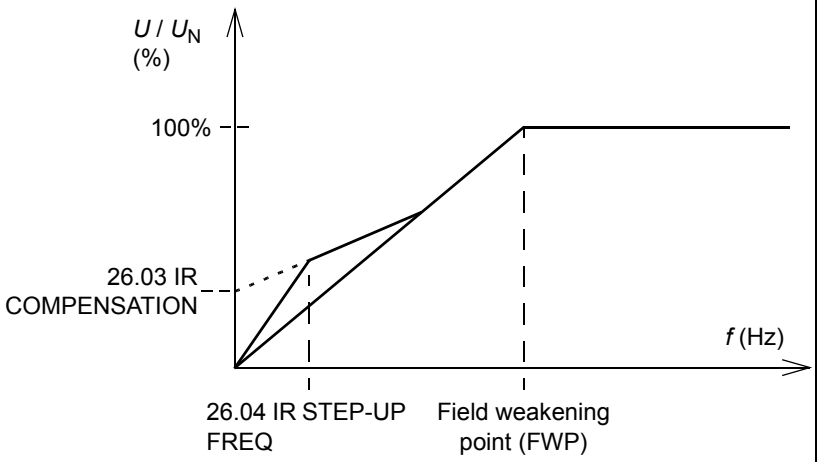
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 22.06 | ACC/DEC RAMP SHPE | Selects the shape of the acceleration/deceleration ramp.<br>See also section *Jogging* on page *81*. | |
| | 0.00 … 1000.00 s | 0.00 s: Linear ramp. Suitable for steady acceleration or deceleration and for slow ramps.<br>0.01 … 1000.00 s: S-curve ramp. S-curve ramps are ideal for conveyors carrying fragile loads, or other applications where a smooth transition is required when changing from one speed to another. The S curve consists of symmetrical curves at both ends of the ramp and a linear part in between.<br>A rule of thumb<br>A suitable relation between the ramp shape time and the acceleration ramp time is 1/5.<br>  | 0 … 100000 |
| 22.07 | EM STOP RAMP TIME | Defines the time inside which the drive is stopped if<br>- the drive receives an emergency stop command or<br>- the Run Enable signal is switched off and the Run Enable function has value OFF3 (see parameter 21.07).<br>The emergency stop command can be given through a fieldbus or an Emergency Stop module (optional). Consult the local ABB representative for more information on the optional module and the related settings of the Standard Control Program. | |
| | 0.00 … 2000.00 s | Deceleration time | 0 … 200000 |
| 22.08 | ACC PTR | Defines the source or constant for value PAR 22.08&09 of parameter 22.01. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | 100 = 1 s |
| 22.09 | DEC PTR | Defines the source or constant for value PAR 22.08&09 of parameter 22.01 | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | 100 = 1 s |
| 22.10 | SLS ACCELER TIME | Defines the time required for the speed limits to ramp up from the safely-limited speed defined by parameter 20.22 to the speed limits defined by parameters 20.01 MINIMUM SPEED and 20.02 MAXIMUM SPEED when the SLS function is deactivated.<br>**Note:** This parameter is available in AS7R firmware version only. | 100 = 1 s |
| | 0…1800 s | Speed ramp time. | |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 22.11 | SLS DECELER TIME | Defines the time required for the speed limits to ramp down from the value defined by parameters 20.01 MINIMUM SPEED and 20.02 MAXIMUM SPEED to the safely-limited speed defined by parameter 20.22 when the SLS function is activated.<br>If the speed is already lower than the safely-limited speed, the speed does not change.<br>**Note:** This parameter is available in AS7R firmware version only. | 100 = 1 s |
| | 0…1800 s | Speed ramp time. | |
| **23 SPEED CTRL** | | Speed controller variables. The parameters are not visible if parameter 99.04 = SCALAR. See section *Speed controller tuning* on page *60*. | |
| 23.01 | GAIN | Defines a relative gain for the speed controller. Great gain may cause speed oscillation.<br>The figure below shows the speed controller output after an error step when the error remains constant.<br>  | |
| | 0.0 … 250.0 | Gain | 0 … 25000 |
| 23.02 | INTEGRATION TIME | Defines an integration time for the speed controller. The integration time defines the rate at which the controller output changes when the error value is constant. The shorter the integration time, the faster the continuous error value is corrected. Too short an integration time makes the control unstable.<br>The figure below shows the speed controller output after an error step when the error remains constant.<br>  | |
| | 0.01 … 999.97 s | Integration time | 10 … 999970 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 23.03 | DERIVATION TIME | Defines the derivation time for the speed controller. Derivative action boosts the controller output if the error value changes. The longer the derivation time, the more the speed controller output is boosted during the change. If the derivation time is set to zero, the controller works as a PI controller, otherwise as a PID controller.<br>The derivation makes the control more responsive for disturbances.<br>**Note:** Changing this parameter is recommended only if a pulse encoder is used.<br>The figure below shows the speed controller output after an error step when the error remains constant.<br>  | |
| | 0.0 … 9999.8 ms | Derivation time value. | 1 = 1 ms |
| 23.04 | ACC COMPENSATION | Defines the derivation time for acceleration/(deceleration) compensation. In order to compensate inertia during acceleration a derivative of the reference is added to the output of the speed controller. The principle of a derivative action is described for parameter 23.03.<br>**Note:** As a general rule, set this parameter to the value between 50 and 100% of the sum of the mechanical time constants of the motor and the driven machine. (The speed controller Autotune Run does this automatically, see parameter 23.06.)<br>The figure below shows the speed responses when a high inertia load is accelerated along a ramp.<br>**No Acceleration Compensation** **Acceleration Compensation**<br>  | |
| | 0.00 … 999.98 s | Derivation time | 0 … 9999 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 23.05 | SLIP GAIN | Defines the slip gain for the motor slip compensation control. 100% means full slip compensation; 0% means no slip compensation. The default value is 100%. Other values can be used if a static speed error is detected despite of the full slip compensation.<br>**Example:** 1000 rpm constant speed reference is given to the drive. Despite of the full slip compensation (SLIP GAIN = 100%), a manual tachometer measurement from the motor axis gives a speed value of 998 rpm. The static speed error is 1000 rpm - 998 rpm = 2 rpm. To compensate the error, the slip gain should be increased. At the 106% gain value, no static speed error exists. | |
| | 0.0 … 400.0% | Slip gain value. | 0 … 400 |
| 23.06 | AUTOTUNE RUN | Start automatic tuning of the speed controller. Instructions:<br>- Run the motor at a constant speed of 20 to 40% of the rated speed.<br>- Change the autotuning parameter 23.06 to YES.<br>**Note:** The motor load must be connected to the motor. | |
| | NO | No autotuning. | 0 |
| | YES | Activates the speed controller autotuning. Automatically reverts to NO. | 65535 |
| 23.07 | SP ACT FILT TIME | Defines the time constant of the actual speed filter, i.e. time within the actual speed has reached 63% of the nominal speed. | |
| | 0...1000000 ms | Time constant | 1 = 1 ms |
| **24 TORQUE CTRL** | | Torque control variables.<br>Visible only if parameter 99.02 = T CNTRL and parameter 99.04 = DTC. | |
| 24.01 | TORQ RAMP UP | Defines the torque reference ramp up time. | |
| | 0.00 … 120.00 s | Time for the reference to increase from zero to the nominal motor torque. | 0 … 12000 |
| 24.02 | TORQ RAMP DOWN | Defines the torque reference ramp down time. | |
| | 0.00 … 120.00 s | Time for the reference to decrease from the nominal motor torque to zero. | 0 … 12000 |
| **25 CRITICAL SPEEDS** | | Speed bands within which the drive is not allowed to operate. See section *Critical speeds* on page *59*. | |
| 25.01 | CRIT SPEED SELECT | Activates/deactivates the critical speeds function.<br>**Example:** A fan has vibrations in the range of 540 to 690 rpm and 1380 to 1560 rpm. To make the drive to jump over the vibration speed ranges:<br>- activate the critical speeds function,<br>- set the critical speed ranges as in the figure below.<br>  <br>1 Par. 25.02 = 540 rpm<br>2 Par. 25.03 = 690 rpm<br>3 Par. 25.04 = 1380 rpm<br>4 Par. 25.05 = 1590 rpm<br>**Note:** If parameter 99.02 = PID CTRL, the critical speeds are not in use. | |
| | OFF | Inactive | 0 |
| | ON | Active. | 65535 |

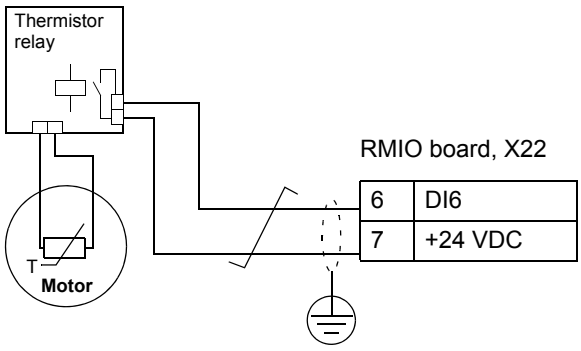
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 25.02 | CRIT SPEED 1 LOW | Defines the minimum limit for critical speed range 1. | |
| | 0 … 18000 rpm | Minimum limit. The value cannot be above the maximum (parameter 25.03).<br>**Note:** If parameter 99.04 = SCALAR, the unit is Hz. | 0 … 18000 |
| 25.03 | CRIT SPEED 1 HIGH | Defines the maximum limit for critical speed range 1. | |
| | 0 … 18000 rpm | Maximum limit. The value cannot be below the minimum (parameter 25.02).<br>**Note:** If parameter 99.04 = SCALAR, the unit is Hz. | 0 … 18000 |
| 25.04 | CRIT SPEED 2 LOW | See parameter 25.02. | |
| | 0 … 18000 rpm | See parameter 25.02. | 0 … 18000 |
| 25.05 | CRIT SPEED 2 HIGH | See parameter 25.03. | |
| | 0 … 18000 rpm | See parameter 25.03. | 0 … 18000 |
| 25.06 | CRIT SPEED 3 LOW | See parameter 25.02. | |
| | 0 … 18000 rpm | See parameter 25.02. | 0 … 18000 |
| 25.07 | CRIT SPEED 3 HIGH | See parameter 25.03. | |
| | 0 … 18000 rpm | See parameter 25.03. | 0 … 18000 |
| **26 MOTOR CONTROL** | | | |
| 26.01 | FLUX OPTIMIZATION | Activates/deactivates the flux optimisation function. See section *Flux Optimisation* on page *58*.<br>**Note:** The function cannot be used if parameter 99.04 = SCALAR. | |
| | NO | Inactive | 0 |
| | YES | Active | 65535 |
| 26.02 | FLUX BRAKING | Activates/deactivates the flux braking function.<br>**Note:** The function cannot be used if parameter 99.04 = SCALAR.<br>See section *Flux Braking* on page *57*. | |
| | NO | Inactive | 0 |
| | YES | Active | 65535 |
| 26.03 | IR-COMPENSATION | Defines the relative output voltage boost at zero speed (IR compensation). The function is useful in applications with high break-away torque, but no DTC motor control cannot be applied. The figure below illustrates the IR compensation. See section *IR compensation for a scalar controlled drive* on page *62*.<br>**Note:** The function can be used only if parameter 99.04 is SCALAR.<br>  | |
| | 0 … 30% | Voltage boost at zero speed in percent of the motor nominal voltage | 0 … 3000 |

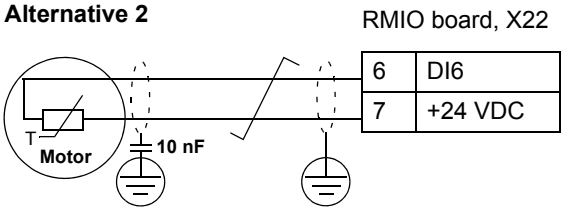
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 26.04 | IR STEP-UP FREQ | Defines the frequency at which the step-up IR compensation reaches the IR compensation used in scalar control (26.03 IR COMPENSATION).<br>A voltage boost is used in step-up applications to achieve higher break-away torque. Since voltage cannot be fed to the transformer at 0 Hz, special IR compensation is used in step-up applications. Full IR compensation starts around slip frequency. The figure below illustrates the step-up IR compensation.<br>  <br><br>For more information, see the *Sine Filters User's Manual for ACS800 Drives* [3AFE68389178 (English)]. | 100 = 1 |
| | 0...50 Hz | Frequency | |
| 26.05 | HEX FIELD WEAKEN | Selects whether motor flux is controlled along a circular or a hexagonal pattern in the field weakening area of the frequency range (above 50/60 Hz). See section *Hexagonal motor flux* on page 63. | |
| | OFF | The rotating flux vector follows a circular pattern. Optimal selection in most applications: Minimal losses at constant load. Maximal instantaneous torque is not available in the field weakening range of the speed. | 0 |
| | ON | Motor flux follows a circular pattern below the field weakening point (typically 50 or 60 Hz) and a hexagonal pattern in the field weakening range. Optimal selection in the applications that require maximal instantaneous torque in the field weakening range of the speed. The losses at constant operation are higher than with the selection NO. | 65535 |
| 26.06 | FLUX REF PTR | Selects the source for the flux reference, or sets the flux reference value. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. The range of the flux is 25 … 140%. With constant value settings 100% = C.10000. Typically there is no need to change this value. | 100 = 1% |
| 26.07 | FLYSTART CUR REF [%] | Defines the current reference used with flying start (start to a rotating motor) when no pulse encoder is used.<br>If flying start fails (i.e. drive is unable to detect motor speed 01.02 SPEED): Monitor signals 01.02 SPEED and 01.04 CURRENT with DriveWindow PC tool and increase the reference in steps of 5% until the flying start function is successfully performed (i.e. drive is able to detect 01.02 SPEED).<br>See also parameter 26.08 FLYSTART INIT DLY. | 1 = 1% |
| | 0…100% | Value in percent | |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 26.08 | FLYSTART INIT DLY | Defines together with the motor characteristics the delay before the speed value estimated at the beginning of flying start is connected to the speed reference ramp output. Increase the delay, if the motor starts to rotate in the wrong direction or if the motor starts to rotate with the wrong speed reference.<br>See also parameter 26.07 FLYSTART CUR REF [%]. | 1 = 1 |
| | 0…60 | Delay | |
| 26.09 | FS METHOD | Activates the flux correction at low frequencies, < 3 Hz, when the torque exceeds 30%. Effective in the motoring and generating modes. | 1 = 1 |
| | 1 = ON | Active | |
| | 0 = OFF | Inactive | |
| **27 BRAKE CHOPPER** | | Control of the brake chopper. | |
| 27.01 | BRAKE CHOPPER CTL | Activates the brake chopper control.<br>**Note:** If an external chopper (e.g. NBRA-xxx) is used, parameter must be disabled. | |
| | OFF | Inactive | 0 |
| | ON | Active. **Note:** Ensure the brake chopper and resistor are installed and the overvoltage control is switched off (parameter 20.05). | 65535 |
| 27.02 | BR OVERLOAD FUNC | Activates the overload protection of the brake resistor. The user-adjustable variables are parameters 27.04 and 27.05. | |
| | NO | Inactive | 0 |
| | WARNING | Active. If the drive detects an overload, it generates a warning. | 1 |
| | FAULT | Active. If the drive detects an overload, it trips on a fault. | 2 |
| 27.03 | BR RESISTANCE | Defines the resistance value of the brake resistor. The value is used for brake chopper protection. | |
| | 0.00 … 100.00 ohm | Resistance value | 0 … 100 |
| 27.04 | BR THERM TCONST | Defines the thermal time constant of the brake resistor. The value is used in the overload protection. See parameter 27.02.<br>With type SACE brake resistors, the parameter setting must be 200 s.<br>With type SAFUR brake resistors, the parameter setting must be 555 s. | |
| | 0.000 … 10000.000 s | Time constant | 1 = 1 |
| 27.05 | MAX CONT BR POWER | Defines the maximum continuous braking power which will raise the resistor temperature to the maximum allowed value. The value is used in the overload protection. See parameter 27.02. | |
| | 0.00 …10000 kW | Power | 1 = 1 |
| 27.06 | BC CTRL MODE | Selects the control mode of the braking chopper. | |
| | AS GENERATOR | Chopper operation is allowed when the DC voltage exceeds the braking limit, the inverter bridge modulates and the motor generates power to the drive.<br>The selection prevents the operation in case the intermediate circuit DC voltage rises due to abnormally high supply voltage level. Long time supply voltage rise would damage the chopper. | 0 |
| | COMMON DC | Chopper operation is allowed always when the DC voltage exceeds the braking limit. The selection is to be used in applications where several inverters are connected to the same intermediate circuit (DC bus).<br>**WARNING!** Excessive supply voltage will raise the intermediate circuit voltage above the operation limit of the chopper. If the voltage remains abnormally high for a long period, the braking chopper will be overloaded and damaged. | 65535 |

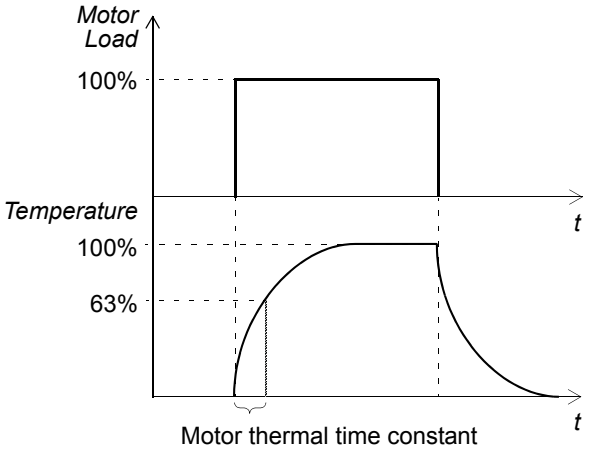
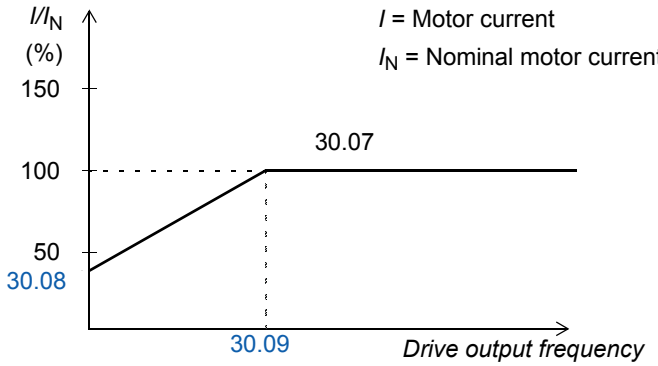
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| **30 FAULT FUNCTIONS** | | Programmable protection functions | |
| 30.01 | AI<MIN FUNCTION | Selects how the drive reacts when an analogue input signal falls below the set minimum limit.<br>**Note:** The analogue input minimum setting must be set to 0.5 V (1 mA) or above (see parameter group 13 ANALOGUE INPUTS). | |
| | FAULT | The drive trips on a fault and the motor coasts to stop. | 1 |
| | NO | Inactive | 2 |
| | CONST SP 15 | The drive generates a warning AI < MIN FUNC (8110) and sets the speed to the value defined by parameter 12.16.<br>**WARNING!** Make sure that it is safe to continue operation in case the analogue input signal is lost. | 3 |
| | LAST SPEED | The drive generates a warning AI < MIN FUNC (8110) and freezes the speed to the level the drive was operating at. The speed is determined by the average speed over the previous 10 seconds.<br>**WARNING!** Make sure that it is safe to continue operation in case the analogue input signal is lost. | 4 |
| 30.02 | PANEL LOSS | Selects how the drive reacts to a control panel communication break. | |
| | FAULT | Drive trips on a fault and the motor coasts to a stop. | 1 |
| | CONST SP 15 | The drive generates a warning and sets the speed to the speed defined by parameter 12.16.<br>**WARNING!** Make sure that it is safe to continue operation in case of a panel communication break. | 2 |
| | LAST SPEED | The drive generates a warning and freezes the speed to the level the drive was operating at. The speed is determined by the average speed over the previous 10 seconds.<br>**WARNING!** Make sure that it is safe to continue operation in case of a panel communication break. | 3 |
| 30.03 | EXTERNAL FAULT | Selects an interface for an external fault signal. See section *External Fault* on page *63*. | |
| | NOT SEL | Inactive | 1 |
| | DI1 | External fault indication is given through digital input DI1. 0: Fault trip. Motor coasts to stop. 1: No external fault. | 2 |
| | DI2 | See selection DI1. | 3 |
| | DI3 | See selection DI1. | 4 |
| | DI4 | See selection DI1. | 5 |
| | DI5 | See selection DI1. | 6 |
| | DI6 | See selection DI1. | 7 |
| | DI7 | See selection DI1. | 8 |
| | DI8 | See selection DI1. | 9 |
| | DI9 | See selection DI1. | 10 |
| | DI10 | See selection DI1. | 11 |
| | DI11 | See selection DI1. | 12 |
| | DI12 | See selection DI1. | 13 |

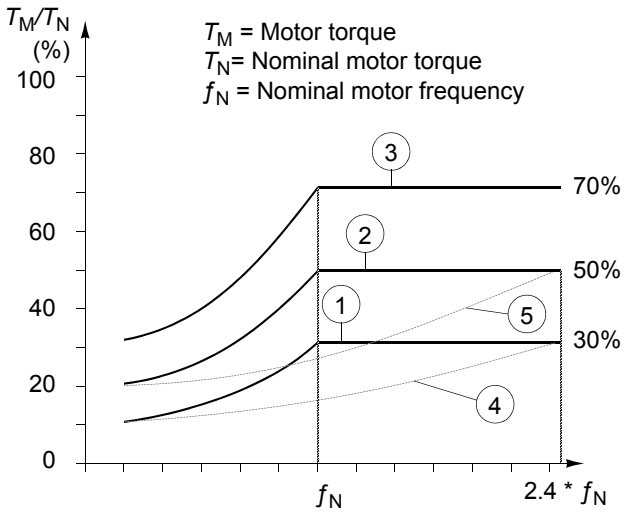
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 30.04 | MOTOR THERM PROT | Selects how the drive reacts when the motor overtemperature is detected by the function defined by parameter 30.05. See section *Motor Thermal Protection* on page *64*. | |
| | FAULT | The drive generates a warning when the temperature exceeds the warning level (95% of the allowed maximum value). The drive trips on a fault when the temperature exceeds the fault level (100% of the allowed maximum value). | 1 |
| | WARNING | The drive generates a warning when the temperature exceeds the warning level (95% of the allowed maximum value). | 2 |
| | NO | Inactive | 3 |
| 30.05 | MOT THERM P MODE | Selects the thermal protection mode of the motor. When overtemperature is detected, the drive reacts as defined by parameter 30.04. | |
| | DTC | The protection is based on the calculated motor thermal model. The following assumptions are used in the calculation:<br>- The motor is at the estimated temperature (value of 01.37 MOTOR TEMP EST saved at power switch off) when the power is switched on. With the first power switch on, the motor is at the ambient temperature (30°C).<br>- The motor temperature increases if it operates in the region above the load curve.<br>- The motor temperature decreases if it operates in the region below the curve. This applies only if the motor is overheated.<br>- The motor thermal time constant is an approximate value for a standard self-ventilated squirrel-cage motor.<br>It is possible to finetune the model by parameter 30.07.<br>**Note:** The model cannot be used with high power motors (parameter 99.06 is higher than 800 A).<br>⚠ **WARNING!** The model does not protect the motor if it does not cool properly due to dust and dirt. | 1 |
| | USER MODE | The protection is based on the user-defined motor thermal model and the following basic assumptions:<br>- The motor is at the estimated temperature (value of 01.37 MOTOR TEMP EST saved at power switch off) when the power is switched on. With the first power switch on, the motor is at the ambient temperature (30°C).<br>- The motor temperature increases if it operates in the region above the motor load curve.<br>- The motor temperature decreases if it operates in the region below the curve. This applies only if the motor is overheated.<br>The user-defined thermal model uses the motor thermal time constant (parameter 30.06) and the motor load curve (parameters 30.07, 30.08 and 30.09). User tuning is typically needed only if the ambient temperature differs from the normal operating temperature specified for the motor.<br>⚠ **WARNING!** The model does not protect the motor if it does not cool properly due to dust and dirt. | 2 |

<table>
<tr><th>Index</th><th>Name/Selection</th><th>Description</th><th>FbEq</th></tr>
<tr><td></td><td>TEMP SENSOR</td><td>Motor thermal protection is activated through digital input DI6. A motor thermistor, or a break contact of a thermistor relay, must be connected to digital input DI6. The drive reads the DI6 states as follows:<br><br><table><tr><th>DI6 Status (Thermistor resistance)</th><th>Temperature</th></tr><tr><td>1 (0 … 1.5 kohm)</td><td>Normal</td></tr><tr><td>0 (4 kohm or higher)</td><td>Overtemperature</td></tr></table><br>WARNING! According to IEC 664, the connection of the motor thermistor to the digital input requires double or reinforced insulation between motor live parts and the thermistor. Reinforced insulation entails a clearance and creeping distance of 8 mm (400 / 500 VAC equipment). If the thermistor assembly does not fulfil the requirement, the other I/O terminals of the drive must be protected against contact, or a thermistor relay must be used to isolate the thermistor from the digital input.<br><br>WARNING! Digital input DI6 may be selected for another use. Change these settings before selecting TEMP SENSOR. In other words, ensure that digital input DI6 is not selected by any other parameter.<br><br>The figure below shows the alternative thermistor connections. At the motor end the cable shield should be earthed through a 10 nF capacitor. If this is not possible, the shield is to be left unconnected.<br><br>Alternative 1<br> 

<br>Alternative 2<br> 

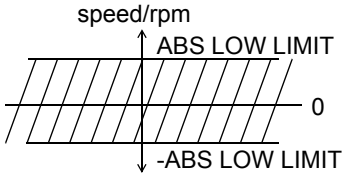
<br>Note: If the motor nominal current is above 800 A, the user defined motor thermal model is used instead of the calculated model and the user must define parameters 30.06, 30.07, 30.08 and 30.09.</td><td>3</td></tr>
</table>

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 30.06 | MOTOR THERM TIME | Defines the thermal time constant for the user-defined thermal model (see the selection USER MODE of parameter 30.05).<br>  | |
| | 256.0 … 9999.8 s | Time constant | 256 … 9999 |
| 30.07 | MOTOR LOAD CURVE | Defines the load curve together by parameters 30.08 and 30.09. The load curve is used in the user-defined thermal model (see the selection USER MODE of parameter 30.05).<br>  | |
| | 50.0 … 150.0% | Allowed continuous motor load in percent of the nominal motor current. | 50 … 150 |
| 30.08 | ZERO SPEED LOAD | Defines the load curve together with parameters 30.07 and 30.09. | |
| | 25.0 … 150.0% | Allowed continuous motor load at zero speed in percent of the nominal motor current | 25 … 150 |
| 30.09 | BREAK POINT | Defines the load curve together with parameters 30.07 and 30.08. | |
| | 1.0 … 300.0 Hz | Drive output frequency at 100% load | 100 … 30000 |

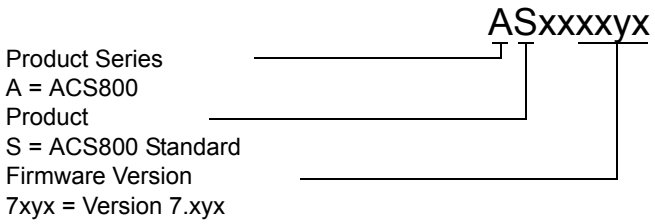
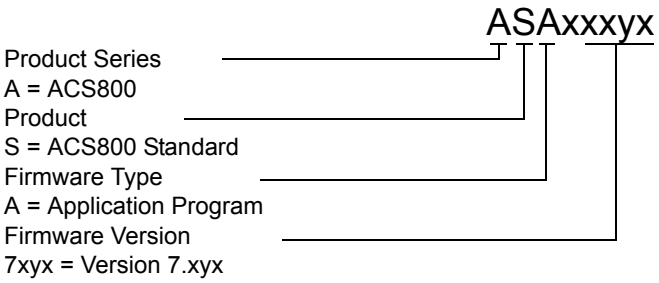
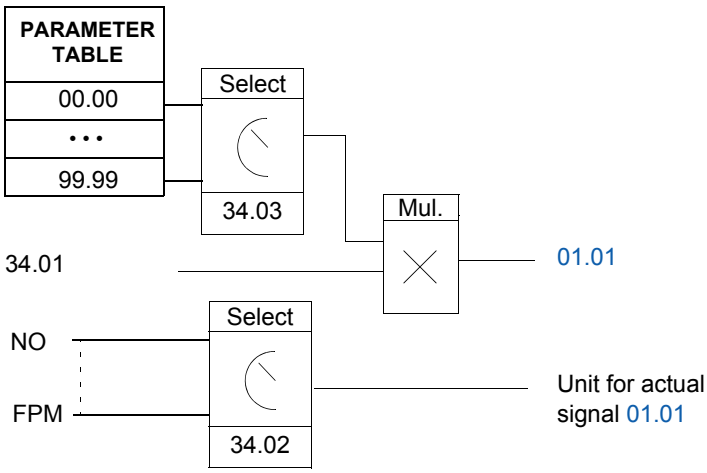
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 30.10 | STALL FUNCTION | Selects how the drive reacts to a motor stall condition. The protection wakes up if:<br>- the drive is at stall limit (defined by parameters 20.03, 20.13 and 20.14)<br>- the output frequency is below the level set by parameter 30.11 and<br>- the conditions above have been valid longer than the time set by parameter 30.12.<br>**Note:** Stall limit is restricted by internal current limit 03.04 TORQ_INV_CUR_LIM.<br>See section *Stall Protection* on page *65*. | |
| | FAULT | The drive trips on a fault. | 1 |
| | WARNING | The drive generates a warning. The indication disappears in half of the time set by parameter 30.12. | 2 |
| | NO | Protection is inactive. | 3 |
| 30.11 | STALL FREQ HI | Defines the frequency limit for the stall function. See parameter 30.10. | |
| | 0.5 … 50.0 Hz | Stall frequency | 50 … 5000 |
| 30.12 | STALL TIME | Defines the time for the stall function. See parameter 30.10. | |
| | 10.00 … 400.00 s | Stall time | 10 … 400 |
| 30.13 | UNDERLOAD FUNC | Selects how the drive reacts to underload. The protection wakes up if:<br>- the motor torque falls below the curve selected by parameter 30.15,<br>- output frequency is higher than 10% of the nominal motor frequency and<br>- the above conditions have been valid longer than the time set by parameter 30.14.<br>See section *Underload Protection* on page *65*. | |
| | NO | Protection is inactive. | 1 |
| | WARNING | The drive generates a warning. | 2 |
| | FAULT | The drive trips on a fault. | 3 |
| 30.14 | UNDERLOAD TIME | Time limit for the underload function. See parameter 30.13. | |
| | 0 … 600 s | Underload time | 0 … 600 |
| 30.15 | UNDERLOAD CURVE | Selects the load curve for the underload function. See parameter 30.13.<br>  | |
| | 1 … 5 | Number of the load curve | 1 … 5 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 30.16 | MOTOR PHASE LOSS | Activates the motor phase loss supervision function.<br>See section *Motor Phase Loss* on page *65*. | |
| | NO | Inactive | 0 |
| | FAULT | Active. The drive trips on a fault. | 65535 |
| 30.17 | EARTH FAULT | Selects how the drive reacts when an earth fault is detected in the motor or the motor cable. See section *Earth Fault Protection* on page *66*.<br>**Note:** With parallel connected R8i inverter modules (ACS800 multidrive and large ACS800-07 units) only the selection FAULT is valid. | |
| | WARNING | The drive generates a warning. | 0 |
| | FAULT | The drive trips on a fault. | 65535 |
| 30.18 | COMM FLT FUNC | Selects how the drive reacts in a fieldbus communication break, i.e. when the drive fails to receive the Main Reference Data Set or the Auxiliary Reference Data Set. The time delays are given by parameters 30.19 and 30.21. | |
| | FAULT | Protection is active. The drive trips on a fault and the motor coasts to a stop. | 1 |
| | NO | Protection is inactive. | 2 |
| | CONST SP 15 | Protection is active. The drive generates a warning and sets the speed to the value defined by parameter 12.16.<br>**WARNING**! Make sure that it is safe to continue operation in case of a communication break. | 3 |
| | LAST SPEED | Protection is active. The drive generates a warning and freezes the speed to the level the drive was operating at. The speed is determined by the average speed over the previous 10 seconds.<br>**WARNING**! Make sure that it is safe to continue operation in case of a communication break. | 4 |
| 30.19 | MAIN REF DS T-OUT | Defines the time delay for the Main Reference data set supervision. See parameter 30.18. | |
| | 0.1 … 60.0 s | Time delay | 10 … 6000 |
| 30.20 | COMM FLT RO/AO | Selects the operation of the fieldbus controlled relay output and analogue output in a communication break. See groups 14 RELAY OUTPUTS and 15 ANALOGUE OUTPUTS and chapter *Fieldbus control*. The delay for the supervision function is given by parameter 30.21. | |
| | ZERO | Relay output is de-energised. Analogue output is set to zero. | 0 |
| | LAST VALUE | The relay output keeps the last state before the communication loss. The analogue output gives the last value before the communication loss.<br>**WARNING**! After the communication recovers, the update of the relay and the analogue outputs starts immediately without fault message resetting. | 65535 |
| 30.21 | AUX DS T-OUT | Defines the delay time for the Auxiliary Reference data set supervision. See parameter 30.18. The drive automatically activates the supervision 60 seconds after power switch-on if the value is other than zero.<br>**Note:** The delay also applies for the function defined by parameter 30.20. | |
| | 0.0 … 60.0 s | Time delay. 0.0 s = The function is inactive. | 0 … 6000 |

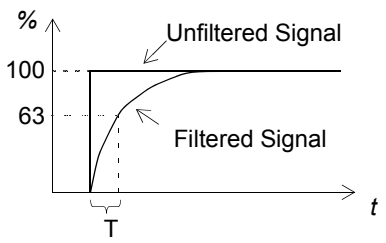
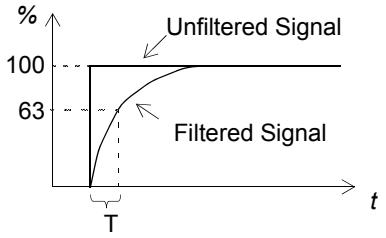
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 30.22 | IO CONFIG FUNC | Selects how the drive reacts in case an optional input or output channel has been selected as a signal interface, but the communication to the appropriate analogue or digital I/O extension module has not been set up accordingly in parameter group 98 OPTION MODULES.<br>**Example:** The supervision function wakes up if parameter 16.01 is set to DI7, but 98.03 is set to NO. | |
| | NO | Inactive. | 1 |
| | WARNING | Active. The drive generates a warning. | 2 |
| 30.23 | LIMIT WARNING | Activates/deactivates limit alarms INV CUR LIM, DC BUS LIM, MOT CUR LIM, MOT TORQ LIM and/or MOT POW LIM. For more information, see chapter *Fault tracing*. | |
| | 0...255 | Value in decimal. As default none of the alarms are active, i.e. parameter value is 0.<br>bit 0 INV_CUR_LIM_IND<br>bit 1 DC_VOLT_LIM_IND<br>bit 2 MOT_CUR_LIM_IND<br>bit 3 MOT_TORQ_LIM_IND<br>bit 4 MOT_POW_LIM_IND<br>**Example:** When parameter value is set to 3 (bit 0 and 1 values are 1), alarms INV CUR LIM and DC BUS LIM are active. | - |
| **31 AUTOMATIC RESET** | | Automatic fault reset.<br>Automatic resets are possible only for certain fault types and when the automatic reset function is activated for that fault type.<br>The automatic reset function is not operational if the drive is in local control (L visible on the first row of the panel display).<br>See section *Automatic resets* on page 69. | |
| 31.01 | NUMBER OF TRIALS | Defines the number of automatic fault resets the drive performs within the time defined by parameter 31.02. | |
| | 0 … 5 | Number of the automatic resets | 0 |
| 31.02 | TRIAL TIME | Defines the time for the automatic fault reset function. See parameter 31.01. | |
| | 1.0 … 180.0 s | Allowed resetting time | 100 … 18000 |
| 31.03 | DELAY TIME | Defines the time that the drive will wait after a fault before attempting an automatic reset. See parameter 31.01. | |
| | 0.0 … 3.0 s | Resetting delay | 0 … 300 |
| 31.04 | OVERCURRENT | Activates/deactivates the automatic reset for the overcurrent fault. | |
| | NO | Inactive | 0 |
| | YES | Active | 65535 |
| 31.05 | OVERVOLTAGE | Activates/deactivates the automatic reset for the intermediate link overvoltage fault. | |
| | NO | Inactive | 0 |
| | YES | Active | 65535 |
| 31.06 | UNDERVOLTAGE | Activates/deactivates the automatic reset for the intermediate link undervoltage fault. | |
| | NO | Inactive | 0 |
| | YES | Active | 65535 |
| 31.07 | AI SIGNAL<MIN | Activates/deactivates the automatic reset for the fault AI SIGNAL<MIN (analogue input signal under the allowed minimum level). | |

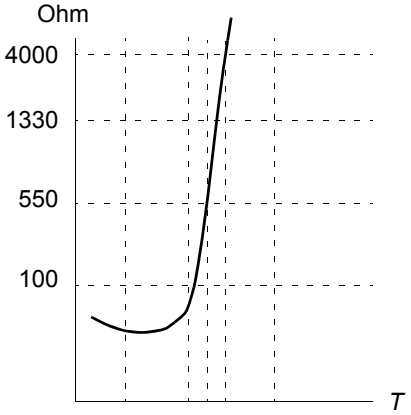
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | NO | Inactive | 0 |
| | YES | Active.<br>**WARNING!** The drive may restart even after a long stop if the analogue input signal is restored. Ensure that the use of this feature will not cause danger. | 65535 |
| 31.08 | LINE CONV | Activates/deactivates the automatic reset for the fault LINE CONV (FF51) (fault on line side converter). | |
| | NO | Inactive | 0 |
| | YES | Active | 65535 |
| **32 SUPERVISION** | | Supervision limits. A relay output can be used to indicate when the value is above/below the limit. See section *Supervisions* on page *69*. | |
| 32.01 | SPEED1 FUNCTION | Activates/deactivates the speed supervision function and selects the type of the supervision limit. | |
| | NO | Supervision is not used. | 1 |
| | LOW LIMIT | Supervision wakes up if the value is below the limit. | 2 |
| | HIGH LIMIT | Supervision wakes up if the value is above the limit. | 3 |
| | ABS LOW LIMIT | Supervision wakes up if the value is below the set limit. The limit is supervised in both rotating directions. The figure below illustrates the principle.<br>  | 4 |
| 32.02 | SPEED1 LIMIT | Defines the speed supervision limit. See parameter 32.01. | |
| | - 18000 … 18000 rpm | Value of the limit | - 18000 … 18000 |
| 32.03 | SPEED2 FUNCTION | See parameter 32.01. | |
| | NO | See parameter 32.01. | 1 |
| | LOW LIMIT | See parameter 32.01. | 2 |
| | HIGH LIMIT | See parameter 32.01. | 3 |
| | ABS LOW LIMIT | See parameter 32.01. | 4 |
| 32.04 | SPEED2 LIMIT | See parameter 32.01. | |
| | - 18000 … 18000 rpm | See parameter 32.01. | - 18000 … 18000 |
| 32.05 | CURRENT FUNCTION | Activates/deactivates the motor current supervision function and selects the type of the supervision limit. | |
| | NO | See parameter 32.01. | 1 |
| | LOW LIMIT | See parameter 32.01. | 2 |
| | HIGH LIMIT | See parameter 32.01. | 3 |
| 32.06 | CURRENT LIMIT | Defines the limit for the motor current supervision (see parameter 32.05). | |
| | 0 … 1000 A | Value of the limit | 0 … 1000 |
| 32.07 | TORQUE 1 FUNCTION | Activates/deactivates the motor torque supervision function and selects the type of the supervision limit. | |
| | NO | See parameter 32.01. | 1 |
| | LOW LIMIT | See parameter 32.01. | 2 |

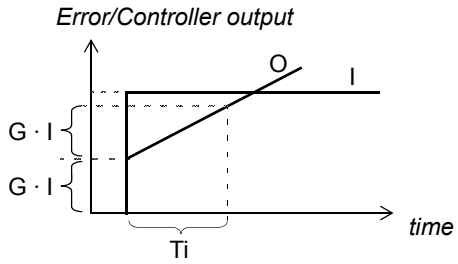
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | HIGH LIMIT | See parameter 32.01. | 3 |
| 32.08 | TORQUE 1 LIMIT | Defines the limit for the motor torque supervision (see parameter 32.07). | |
| | -600 … 600% | Value of the limit in percent of the motor nominal torque | -6000 … 6000 |
| 32.09 | TORQUE 2 FUNCTION | Activates/deactivates the motor torque supervision function and selects the type of the supervision limit. | |
| | NO | See parameter 32.01. | 1 |
| | LOW LIMIT | See parameter 32.01. | 2 |
| | HIGH LIMIT | See parameter 32.01. | 3 |
| 32.10 | TORQUE 2 LIMIT | Defines the limit for the motor torque supervision (see parameter 32.09). | |
| | -600 … 600% | Value of the limit in percent of motor nominal torque | -6000 … 6000 |
| 32.11 | REF1 FUNCTION | Activates/deactivates the external reference REF1 supervision function and selects the type of the supervision limit. | |
| | NO | See parameter 32.01. | 1 |
| | LOW LIMIT | See parameter 32.01. | 2 |
| | HIGH LIMIT | See parameter 32.01. | 3 |
| 32.12 | REF1 LIMIT | Defines the limit for REF1 supervision (see parameter 32.11). | |
| | 0 … 18000 rpm | Value of the limit | 0 … 18000 |
| 32.13 | REF2 FUNCTION | Activates/deactivates external reference REF2 supervision function and selects the type of the supervision limit. | |
| | NO | See parameter 32.01. | 1 |
| | LOW LIMIT | See parameter 32.01. | 2 |
| | HIGH LIMIT | See parameter 32.01. | 3 |
| 32.14 | REF2 LIMIT | Defines the limit for REF2 supervision (see parameter 32.13). | |
| | 0 … 600% | Value of the limit | 0 … 6000 |
| 32.15 | ACT1 FUNCTION | Activates/deactivates the supervision function for variable ACT1 of the process PID controller and selects the type of the supervision limit. | |
| | NO | See parameter 32.01. | 1 |
| | LOW LIMIT | See parameter 32.01. | 2 |
| | HIGH LIMIT | See parameter 32.01. | 3 |
| 32.16 | ACT1 LIMIT | Defines the limit for ACT1 supervision (see parameter 32.15). | |
| | 0 … 200% | Value of the limit | 0 … 2000 |
| 32.17 | ACT2 FUNCTION | Activates/deactivates the supervision function for variable ACT2 of the process PID controller and selects the type of the supervision limit. | |
| | NO | See parameter 32.01. | 1 |
| | LOW LIMIT | See parameter 32.01. | 2 |
| | HIGH LIMIT | See parameter 32.01. | 3 |
| 32.18 | ACT2 LIMIT | Defines the limit for ACT2 supervision (see parameter 32.17). | |
| | 0 … 200% | Value of the limit | 0 … 2000 |
| **33 INFORMATION** | | Program versions, test date | |
| 33.01 | SOFTWARE VERSION | Displays the type and the version of the firmware package in the drive. **Note:** Parameter setting cannot be changed by the user. | |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | | Decoding key:<br>  | |
| 33.02 | APPL SW VERSION | Displays the type and the version of the application program.<br>**Note:** Parameter setting cannot be changed by the user. | |
| | | Decoding key:<br>  | |
| 33.03 | TEST DATE | Displays the test date.<br>**Note:** Parameter setting cannot be changed by the user. | |
| | | Date value in format DDMMYY (day, month, year) | - |
| 33.04 | BOARD TYPE | Shows the control board type. **Note:** RMIO-1x boards have different type of FLASH memory chips than RMIO-0x. Only software version ASXR7300 or later will operate with the RMIO-1x boards. | |
| **34 PROCESS VARIABLE** | | - user variable and unit<br>- filtering for the actual signals speed and torque<br>- reset of the run time counter | |
| 34.01 | SCALE | Scales the selected drive variable into a desired user-defined variable, which is stored as an actual signal 01.01. The block diagram below illustrates the use of the parameters that define actual signal 01.01.<br>  | |
| | 0.00…100000.00% | Scaling factor | 0…100000 |

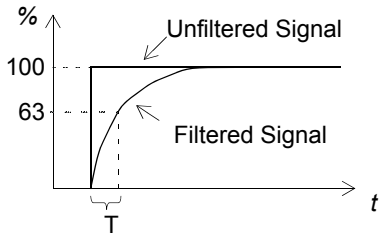
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 34.02 | P VAR UNIT | Selects the unit for the process variable. See parameter 34.01. | |
| | NO | No unit is selected. | 1 |
| | rpm | revolutions per minute | 2 |
| | % | percent | 3 |
| | m/s | metres per second | 4 |
| | A | ampere | 5 |
| | V | volt | 6 |
| | Hz | hertz | 7 |
| | s | second | 8 |
| | h | hour | 9 |
| | kh | kilohour | 10 |
| | C | celsius | 11 |
| | lft | pounds per foot | 12 |
| | mA | milliampere | 13 |
| | mV | millivolt | 14 |
| | kW | kilowatt | 15 |
| | W | watt | 16 |
| | kWh | kilowatt hour | 17 |
| | F | fahrenheit | 18 |
| | hp | horsepower | 19 |
| | MWh | megawatt hour | 20 |
| | m3h | cubic metres per hour | 21 |
| | l/s | litres per second | 22 |
| | bar | bar | 23 |
| | kPa | kilopascal | 24 |
| | GPM | gallons per minute | 25 |
| | PSI | pounds per square inch | 26 |
| | CFM | cubic feet per minute | 27 |
| | ft | foot | 28 |
| | MGD | millions of gallons per day | 29 |
| | iHg | inches of mercury | 30 |
| | FPM | feet per minute | 31 |
| | lbs | pound | 32 |
| 34.03 | SELECT P VAR | Selects the drive variable scaled into a desired process variable. See parameter 34.01. | |
| | 0 … 9999 | Parameter index | 0 … 9999 |
| 34.04 | MOTOR SP FILT TIM | Defines a filter time constant for actual signal 01.02 SPEED. The time constant has an effect on all functions in which signal SPEED is used.<br>The actual speed value is used e.g. in speed supervision (parameter group 32 SUPERVISION) as an analogue output value (group 15 ANALOGUE OUTPUTS) or as an actual signal shown on the control panel display or PC screen. | |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | 0 … 20000 ms | Filter time constant<br>  <br>$O = I \cdot (1 - e^{-t/T})$<br>I = filter input (step)<br>O = filter output<br>t = time<br>T = filter time constant | 0 … 20000 |
| 34.05 | TORQ ACT FILT TIM | Defines a filter time for the actual signal torque (actual signal 01.05). Affects also on the torque supervision (parameters 32.07 and 32.09) and the torque read through an analogue output. | |
| | 0 … 20000 ms | Filter time constant<br>  <br>$O = I \cdot (1 - e^{-t/T})$<br>I = filter input (step)<br>O = filter output<br>t = time<br>T = filter time constant | 0 … 20000 |
| 34.06 | RESET RUN TIME | Resets the motor running time counter (actual signal 01.43). | |
| | NO | No reset. | 0 |
| | YES | Reset. The counter restarts from zero. | 65535 |
| **35 MOT TEMP MEAS** | | Motor temperature measurement. For the function description see sections *Motor temperature measurement through the standard I/O* on page *73* and *Motor temperature measurement through an analogue I/O extension* on page *75*. | |
| 35.01 | MOT 1 TEMP AI1 SEL | Activates the motor 1 temperature measurement function and selects the sensor type.<br>**Note:** If an optional analogue I/O extension module RAIO is used for the temperature measurement and 35.01 MOT 1 TEMP AI1 SEL and/or 35.04 MOT 2 TEMP AI2 SEL are set to 1xPT100, analogue extension module input signal range must be set to 0...2 V (instead of 0...10 V) with DIP switches. | |
| | NOT IN USE | The function is inactive. | 1 |
| | 1xPT100 | The function is active. The temperature is measured with one Pt 100 sensor. Analogue output AO1 feeds constant current through the sensor. The sensor resistance increases as the motor temperature rises, as does the voltage over the sensor. The temperature measurement function reads the voltage through analogue input AI1 and converts it to degrees centigrade. | 2 |
| | 2XPT100 | The function is active. Temperature is measured using two Pt 100 sensors. See selection 1xPT100. | 3 |
| | 3XPT100 | The function is active. Temperature is measured using three Pt 100 sensors. See selection 1xPT100. | 4 |

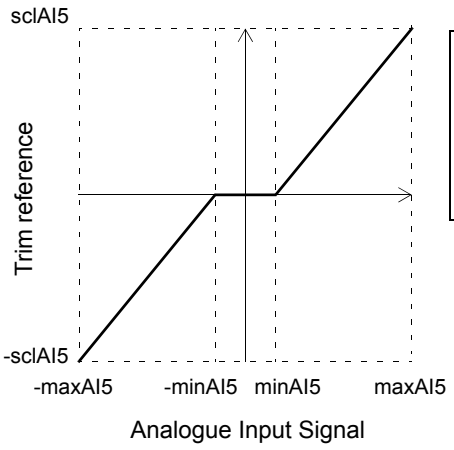
<table>
<tr><th>Index</th><th>Name/Selection</th><th>Description</th><th>FbEq</th></tr>
<tr><td></td><td>1...3 PTC</td><td>The function is active. The temperature is supervised using one to three PTC sensors or one to three KTY84-1xx silicon temperature sensors. Analogue output AO1 feeds constant current through the sensor(s). The resistance of the sensor increases sharply as the motor temperature rises over the sensor reference temperature ($T_{ref}$), as does the voltage over the resistor. The temperature measurement function reads the voltage through analogue input AI1 and converts it into ohms. The figure below shows typical PTC sensor resistance values as a function of the motor operating temperature.<br><table><tr><th>Temperature</th><th>Resistance</th></tr><tr><td>Normal</td><td>0 … 1.5 kohm</td></tr><tr><td>Excessive</td><td>≥ 4 kohm</td></tr></table> 
</td><td>5</td></tr>
<tr><td>35.02</td><td>MOT 1 TEMP ALM L</td><td>Defines the alarm limit for motor 1 temperature measurement. The alarm indication is given when the limit is exceeded.</td><td></td></tr>
<tr><td></td><td>-10 … 5000 ohm/°C (PTC/Pt100)</td><td>Limit in °C or ohms. °C: parameter 35.01 is 1xPT100, 2XPT100, 3XPT100. Ohm: parameter 35.01 is 1...3 PTC.</td><td>-10 … 5000</td></tr>
<tr><td>35.03</td><td>MOT 1 TEMP FLT L</td><td>Defines the fault trip limit for motor 1 temperature measurement. The fault indication is given when the limit is exceeded.</td><td></td></tr>
<tr><td></td><td>-10 … 5000 ohm/°C (PTC/Pt100)</td><td>Limit in °C or ohms. °C: parameter 35.01 is 1xPT100, 2XPT100, 3XPT100. Ohm: parameter 35.01 is 1...3 PTC.</td><td>-10 … 5000</td></tr>
<tr><td>35.04</td><td>MOT 2 TEMP AI2 SEL</td><td>Activates the motor 2 temperature measurement function and selects the sensor type. Two motors can be protected only by using an optional analogue extension module. Parameter 98.12 needs to be activated.<br>Note: If 98.12 is activated, the analogue I/O extension is also used for motor 1 temperature measurement (the standard I/O terminals are not in use).<br>Note: If an optional analogue I/O extension module RAIO is used for the temperature measurement and 35.01 MOT 1 TEMP AI1 SEL and/or 35.04 MOT 2 TEMP AI2 SEL are set to 1xPT100, analogue extension module input signal range must be set to 0...2 V (instead of 0...10 V) with DIP switches.</td><td></td></tr>
<tr><td></td><td>NOT IN USE</td><td>See 35.01.</td><td>1</td></tr>
<tr><td></td><td>1xPT100</td><td>See 35.01.</td><td>2</td></tr>
<tr><td></td><td>2XPT100</td><td>See 35.01.</td><td>3</td></tr>
<tr><td></td><td>3XPT100</td><td>See 35.01.</td><td>4</td></tr>
<tr><td></td><td>1...3 PTC</td><td>See 35.01.</td><td>5</td></tr>
<tr><td>35.05</td><td>MOT 2 TEMP ALM L</td><td>Defines the alarm limit for the motor 2 temperature measurement function. The alarm indication is given when the limit is exceeded.</td><td></td></tr>
<tr><td></td><td>-10 … 5000 ohm/°C (PTC/Pt100)</td><td>See 35.02.</td><td>-10 … 5000</td></tr>
</table>

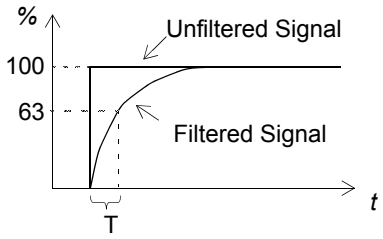
<table>
<tr><th>Index</th><th>Name/Selection</th><th>Description</th><th>FbEq</th></tr>
<tr><td>35.06</td><td>MOT 2 TEMP FLT L</td><td>Defines the fault trip limit for the motor 2 temperature measurement function. The fault indication is given when the limit is exceeded.</td><td></td></tr>
<tr><td></td><td>-10 … 5000 ohm/°C (PTC/Pt100)</td><td>See 35.03.</td><td>-10 … 5000</td></tr>
<tr><td>35.07</td><td>MOT MOD COMPENSAT</td><td>Selects whether measured motor 1 temperature is used in the motor model compensation.</td><td></td></tr>
<tr><td></td><td>NO</td><td>The function is inactive.</td><td>1</td></tr>
<tr><td></td><td>YES</td><td>The temperature is used in the motor model compensation.<br>Note: Selection is effective only when Pt 100 sensor(s) are used.</td><td>2</td></tr>
<tr><td></td><td>YES PAR35.08</td><td>Motor temperature is brought from the automation system to the drive.</td><td>3</td></tr>
<tr><td>35.08</td><td>MOT MOD COMP PTR</td><td>The source for the motor temperature feedback when parameter 35.07 has been set to value YES PAR35.08.</td><td></td></tr>
<tr><td></td><td>-255.255.31 … +255.255.31 / C.-32768 … C.32767</td><td>Parameter index or a constant value.<br>Example: Connection pointer via 85.01 CONSTANT1:<br>35.08 MOT MOD COMP PTR = +.085.001.00.</td><td>-</td></tr>
<tr><td colspan="2">40 PID CONTROL</td><td>- process PID control (99.02 = PID CTRL)<br>- speed or torque reference trimming (99.02 is not PID CTRL)<br>- sleep function for the process PID control (99.02 = PID CTRL)<br>For more information, see section Process PID control on page 70.</td><td></td></tr>
<tr><td>40.01</td><td>PID GAIN</td><td>Defines the gain of the process PID controller.</td><td></td></tr>
<tr><td></td><td>0.1 … 100.0</td><td>Gain value. The table below lists a few examples of the gain settings and the resulting speed changes when<br>- a 10% or 50% error value is connected to the controller (error = process reference - process actual value).<br>- motor maximum speed is 1500 rpm (parameter 20.02)<br><table><tr><th>PID Gain</th><th>Speed Change: 10% Error</th><th>Speed Change: 50% Error</th></tr><tr><td>0.5</td><td>75 rpm</td><td>375 rpm</td></tr><tr><td>1.0</td><td>150 rpm</td><td>750 rpm</td></tr><tr><td>3.0</td><td>450 rpm</td><td>1500 rpm (limited)</td></tr></table></td><td>10 … 10000</td></tr>
<tr><td>40.02</td><td>PID INTEG TIME</td><td>Defines the integration time for the process PID controller.<br> 

I = controller input (error)<br>O = controller output<br>G = gain<br>t = time<br>Ti = integration time</td><td></td></tr>
<tr><td></td><td>0.02 … 320.00 s</td><td>Integration time</td><td>2 … 32000</td></tr>
</table>

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 40.03 | PID DERIV TIME | Defines the derivation time of the process PID controller. The derivative component at the controller output is calculated on basis of two consecutive error values ($E_{K-1}$ and $E_K$) according to the following formula:<br>PID DERIV TIME · ($E_K$ - $E_{K-1}$)/$T_S$, in which<br>$T_S$ = 12 ms sample time.<br>E = Error = Process reference - process actual value | |
| | 0.00 … 10.00 s | Derivation time. | 0 … 1000 |
| 40.04 | PID DERIV FILTER | Defines the time constant of the 1-pole filter used to smooth the derivative component of the process PID controller. | |
| | 0.04 … 10.00 s | Filter time constant.<br>  <br><br>$O = I \cdot (1 - e^{-t/T})$<br>I = filter input (step)<br>O = filter output<br>t = time<br>T = filter time constant | 4 … 1000 |
| 40.05 | ERROR VALUE INV | Inverts the error at the process PID controller input (error = process reference - process actual value). | |
| | NO | No inversion | 0 |
| | YES | Inversion.<br>With sleep function, the drive operation is as follows:<br>The drive enters the sleep mode when the motor speed is below the sleep level (02.02 < 40.21) and when the process PID control actual value is smaller than the wake-up level (01.34 < 40.23).<br>The drive wakes up when the process PID actual value is greater than the wake-up level (01.34 > 40.23).<br>See also section *Sleep function for the process PID control* on page *71*. | 65535 |
| 40.06 | ACTUAL VALUE SEL | Selects the process actual value for the process PID controller: The sources for the variable ACT1 and ACT2 are further defined by parameters 40.07 and 40.08. | |
| | ACT1 | ACT1 | 1 |
| | ACT1-ACT2 | Subtraction of ACT1 and ACT 2. | 2 |
| | ACT1+ACT2 | Addition of ACT1 and ACT2 | 3 |
| | ACT1*ACT2 | Multiplication of ACT1 and ACT2 | 4 |
| | ACT1/ACT2 | Division of ACT1 and ACT2 | 5 |
| | MIN(A1,A2) | Selects the smaller of ACT1 and ACT2 | 6 |
| | MAX(A1,A2) | Selects the higher of ACT1 and ACT2 | 7 |
| | sqrt(A1-A2) | Square root of the subtraction of ACT1 and ACT2 | 8 |
| | sqA1+sqA2 | Addition of the square root of ACT1 and the square root of ACT2 | 9 |
| 40.07 | ACTUAL1 INPUT SEL | Selects the source for the variable ACT1. See parameter 40.06. | |
| | AI1 | Analogue input AI1 | 1 |
| | AI2 | Analogue input AI2 | 2 |
| | AI3 | Analogue input AI3 | 3 |
| | AI5 | Analogue input AI5 | 4 |

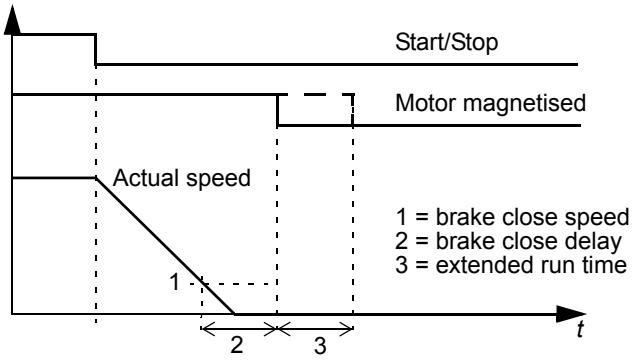
<table>
<tr><th>Index</th><th>Name/Selection</th><th>Description</th><th>FbEq</th></tr>
<tr><td></td><td>AI6</td><td>Analogue input AI6</td><td>5</td></tr>
<tr><td></td><td>PARAM 40.25</td><td>Source selected by parameter 40.25.</td><td>6</td></tr>
<tr><td>40.08</td><td>ACTUAL2 INPUT SEL</td><td>Selects the source for the variable ACT2. See parameter 40.06.</td><td></td></tr>
<tr><td></td><td>AI1</td><td>Analogue input AI1</td><td>1</td></tr>
<tr><td></td><td>AI2</td><td>Analogue input AI2</td><td>2</td></tr>
<tr><td></td><td>AI3</td><td>Analogue input AI3</td><td>3</td></tr>
<tr><td></td><td>AI5</td><td>Analogue input AI5</td><td>4</td></tr>
<tr><td></td><td>AI6</td><td>Analogue input AI6</td><td>5</td></tr>
<tr><td>40.09</td><td>ACT1 MINIMUM</td><td>Defines the minimum value for the variable ACT1 if an analogue input is selected as a source for ACT1. See parameter 40.07. The minimum and maximum (40.10) settings of ACT1 define how the voltage/current signal received from the measuring device is converted to a percentage value used by the process PID controller.</td><td></td></tr>
<tr><td></td><td>-1000 … 1000%</td><td>Minimum value in percent of the set analogue input range. The equation below instructs how to calculate the value when analogue input AI1 is used as a variable ACT1.<br>$\text{ACT1 MINIMUM} = \frac{\text{AI1min} - 13.01}{13.02 - 13.01} \cdot 100\%$<br><table><tr><td>AI1min</td><td>The voltage value received from the measuring device when the measured process actual value is at the desired minimum level.</td></tr><tr><td>13.01</td><td>AI1 minimum (parameter setting)</td></tr><tr><td>13.02</td><td>AI1 maximum (parameter setting)</td></tr></table></td><td>-10000 … 10000</td></tr>
<tr><td>40.10</td><td>ACT1 MAXIMUM</td><td>Defines the maximum value for the variable ACT1 if an analogue input is selected as a source for ACT1. See parameter 40.07. The minimum (40.09) and maximum settings of ACT1 define how the voltage/current signal received from the measuring device is converted to a percentage value used by the process PID controller.</td><td></td></tr>
<tr><td></td><td>-1000 … 1000%</td><td>Maximum value in percent of the set analogue input signal range. The equation below instructs how to calculate the value when analogue input AI1 is used as a variable ACT1.<br>$\text{ACT1 MAXIMUM} = \frac{\text{AI1max} - 13.01}{13.02 - 13.01} \cdot 100\%$<br><table><tr><td>AI1max</td><td>The voltage value received from the measuring device when the measured process actual value is at the desired maximum level.</td></tr><tr><td>13.01</td><td>AI1 minimum (parameter setting)</td></tr><tr><td>13.02</td><td>AI1 maximum (parameter setting)</td></tr></table></td><td>-10000 … 10000</td></tr>
<tr><td>40.11</td><td>ACT2 MINIMUM</td><td>See parameter 40.09.</td><td></td></tr>
<tr><td></td><td>-1000 … 1000%</td><td>See parameter 40.09.</td><td>-10000 … 10000</td></tr>
</table>

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 40.12 | ACT2 MAXIMUM | See parameter 40.10. | |
| | -1000 … 1000% | See parameter 40.10. | -10000 … 10000 |
| 40.13 | PID INTEGRATION | Activates the integration of the process PID controller. | |
| | OFF | Inactive | 1 |
| | ON | Active | 2 |
| 40.14 | TRIM MODE | Activates the trim function and selects between the direct and proportional trimming. Using the trim it is possible to combine a corrective factor to the drive reference. See section *Reference trimming* on page *47*.<br>**Example:** A speed-controlled conveyor line where the line tension also needs to be considered: The speed reference is slightly adjusted (trimmed) depending on the value of the measured line tension.<br>Not visible when parameter 99.02 = PID CTRL. | |
| | OFF | The trim function is deactivated. | 1 |
| | PROPORTIONAL | The trim function is active. The trimming factor is relative to the external %-reference (REF2). See parameter 11.06. | 2 |
| | DIRECT | The trim function is active. The trimming factor is relative to a fixed maximum limit used in the reference control loop (maximum speed, frequency or torque). | 3 |
| 40.15 | TRIM REF SEL | Selects the signal source for the trim reference. Not visible when parameter 99.02 = PID CTRL.<br>**Example:** AI5 as a trim reference<br>  <br>minAI5 = parameter 13.16<br>maxAI5 = parameter 13.17<br>sclAI5 = parameter 13.18<br>AI5 be used only with an optional I/O extension module. | |
| | AI1 | Analogue input AI1 | 1 |
| | AI2 | Analogue input AI2 | 2 |
| | AI3 | Analogue input AI3 | 3 |
| | AI5 | Analogue input AI5 | 4 |
| | AI6 | Analogue input AI5 | 5 |
| | PAR 40.16 | Value of parameter 40.16 is used as the trim reference. | 6 |
| | PAR 40.28 | Value of parameter 40.28 is used as the trim reference. | 7 |
| 40.16 | TRIM REFERENCE | Defines the trim reference value when parameter 40.15 has the value PAR 40.16 selected. Not visible when parameter 99.02 = PID CTRL. | |
| | -100.0 … 100.0% | Trim reference | - 10000 … 10000 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 40.17 | TRIM RANGE ADJUST | Defines the multiplier for the PID controller output used as the trimming factor. Not visible when parameter 99.02 = PID CTRL. | |
| | -100.0 … 100.0% | Multiplying factor | - 10000 … 10000 |
| 40.18 | TRIM SELECTION | Selects whether the trimming is used for correcting the speed or torque reference.<br>Not visible when parameter 99.02 = PID CTRL. | |
| | SPEED TRIM | Speed reference trimming | 1 |
| | TORQUE TRIM | Torque reference trimming | 2 |
| | DIRECT SPD T | Speed reference trimming. Trim reference is added to the speed reference after ramp calculations. Trimming is not effective during ramp stop, emergency stop or at speed defined by parameter 30.18 in a fieldbus communication break. | 3 |
| 40.19 | ACTUAL FILT TIME | Defines the time constant for the filter through which the actual signals are connected to the process PID controller. | |
| | 0.04 … 10.00 s | Filter time constant.<br>  <br>$O = I \cdot (1 - e^{-t/T})$<br>I = filter input (step)<br>O = filter output<br>t = time<br>T = filter time constant | 4 … 1000 |
| 40.20 | SLEEP SELECTION | Activates the sleep function and selects the source for the activation input.<br>Visible only when parameter 99.02 = PID CTRL.<br>See section *Sleep function for the process PID control* on page *71*. | |
| | OFF | Inactive | 1 |
| | INTERNAL | Activated and deactivated automatically as defined by parameters 40.21 and 40.23. | 2 |
| | DI1 | The function is activated/deactivated through digital input DI1.<br>Activation: Digital input DI1 = 1. Deactivation: DI1 = 0.<br>The internal sleep criteria set by parameters 40.21 and 40.23 are not effective. The sleep start and stop delays are effective (parameter 40.22 and 40.24). | 3 |
| | DI2 | See selection DI1. | 4 |
| | DI3 | See selection DI1. | 5 |
| | DI4 | See selection DI1. | 6 |
| | DI5 | See selection DI1. | 7 |
| | DI6 | See selection DI1. | 8 |
| | DI7 | See selection DI1. | 9 |
| | DI8 | See selection DI1. | 10 |
| | DI9 | See selection DI1. | 11 |
| | DI10 | See selection DI1. | 12 |
| | DI11 | See selection DI1. | 13 |
| | DI12 | See selection DI1. | 14 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 40.21 | SLEEP LEVEL | Defines the start limit for the sleep function. If the motor speed is below a set level (40.21) longer than the sleep delay (40.22), the drive shifts to the sleeping mode: the motor is stopped and the control panel shows the warning message “SLEEP MODE”.<br>Visible only when parameter 99.02 = PID CTRL. | |
| | 0.0 … 7200.0 rpm | Sleep start level | 0 … 7200 |
| 40.22 | SLEEP DELAY | Defines the delay for the sleep start function. See parameter 40.21. When the motor speed falls below the sleep level, the counter starts. When the motor speed exceeds the sleep level, the counter resets.<br>Visible only when parameter 99.02 = PID CTRL. | |
| | 0.0 … 3600.0 s | Sleep start delay | 0 … 36000 |
| 40.23 | WAKE UP LEVEL | Defines the wake-up limit for the sleep function. The drive wakes up if the process actual value is below a set level (40.23) longer than the wake-up delay (40.24).<br>Visible only when parameter 99.02 = PID CTRL. | |
| | 0.0 … 100.0% | The wake-up level in percent of the actual process value. | 0 … 10000 |
| 40.24 | WAKE UP DELAY | Defines the wake-up delay for the sleep function. See parameter 40.23. When the process actual value falls below the wake-up level, the wake-up counter starts. When the process actual value exceeds the wake-up level, the counter resets.<br>Visible only when parameter 99.02 = PID CTRL. | |
| | 0.0 … 3600.0 s | Wake-up delay | 0 …36000 |
| 40.25 | ACTUAL1 PTR | Defines the source or constant for value PAR 40.25 of parameter 40.07. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | 100 = 1% |
| 40.26 | PID MINIMUM | Defines the minimum limit for the PID controller output. Using the minimum and maximum limits, it is possible to restrict the operation to a certain speed range.<br>**Example:** The process PID control is restricted to the forward rotation direction of the motor by setting the PID minimum limit to 0% and the maximum to 100%. | |
| | -100 … 100% | Limit in percent of the Absolute Maximum Speed of the motor | 100 = 1% |
| 40.27 | PID MAXIMUM | Defines the maximum limit for the PID controller output. Using the minimum and maximum limits, it is possible to restrict the operation to a certain speed range. See parameter 40.26. | |
| | -100 … 100% | Limit in percent of the Absolute Maximum Speed of the motor | 100 = 1% |
| 40.28 | TRIM REF PTR | Defines the trim reference value when parameter 40.15 has been set to value PAR 40.28. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value:<br>- Parameter pointer: Inversion, group, index and bit fields. The bit number is effective only for blocks handling boolean inputs.<br>- Constant value: Inversion and constant fields. Inversion field must have value C to enable the constant setting. | 100 = 1% |
| **42 BRAKE CONTROL** | | Control of a mechanical brake. The function operates on a 100 ms time level. For the function description, see section *Control of a mechanical brake* on page 77. | |
| 42.01 | BRAKE CTRL | Activates the brake control function. | |
| | OFF | Inactive | 1 |

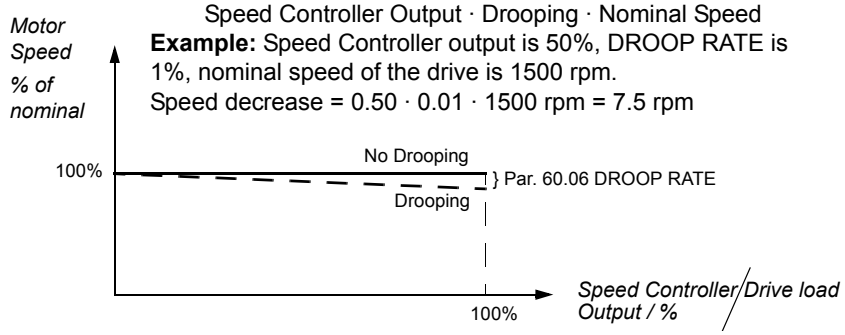
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | ON | Active | 2 |
| 42.02 | BRAKE ACKNOWLEDGE | Activates the external brake on/off supervision and selects the source for the signal. The use of the external on/off supervision signal is optional. | |
| | OFF | Inactive | 1 |
| | DI5 | Active. Digital input DI5 is the signal source. DI5 = 1: The brake is open. DI5 = 0: the brake is closed. | 2 |
| | DI6 | See selection DI5. | 3 |
| | DI11 | See selection DI5. | 4 |
| | DI12 | See selection DI5. | 5 |
| 42.03 | BRAKE OPEN DELAY | Defines the brake open delay (= the delay between the internal open brake command and the release of the motor speed control). The delay counter starts when the drive has magnetised the motor and risen the motor torque to the level required at the brake release (parameters 42.07 and 42.08). Simultaneously with the counter start, the brake function energises the relay output controlling the brake and the brake starts opening. | |
| | 0.0 … 5.0 s | Delay time. Set the delay the same as the mechanical opening delay of the brake specified the brake manufacturer. | 0 … 500 |
| 42.04 | BRAKE CLOSE DELAY | Defines the brake close delay. The delay counter starts when the motor actual speed has fallen below the set level (parameter 42.05) after the drive has received the stop command. Simultaneously with the counter start, the brake control function de-energises the relay output controlling the brake and the brake starts closing. During the delay, the brake function keeps the motor live preventing the motor speed from falling below zero. | |
| | 0.0 … 60.0 s | Delay time. Set the delay time to the same value as the mechanical make-up time of the brake (= operating delay when closing) specified by the brake manufacturer. | 0 … 6000 |
| 42.05 | ABS BRAKE CLS SPD | Defines the brake close speed. See parameter 42.04. | |
| | 0 … 1000 rpm | Speed (an absolute value) | 0 …100000 |
| 42.06 | BRAKE FAULT FUNC | Defines how the drive reacts in case the status of the optional external brake acknowledgement signal does not meet the status presumed by the brake control function. | |
| | FAULT | The drive trips on a fault: fault indication and drive stops the motor. | 1 |
| | WARNING | The drive generates a warning. | 2 |
| 42.07 | START TORQ REF SEL | Selects the source for the motor starting torque reference applied at the brake release. The value is read in percent of the motor nominal torque. | |
| | NO | No source selected. This is the default value. | 1 |
| | AI1 | Analogue input AI1 | 2 |
| | AI2 | Analogue input AI2 | 3 |
| | AI3 | Analogue input AI3 | 4 |
| | AI5 | Analogue input AI5 | 5 |
| | AI6 | Analogue input AI6 | 6 |
| | PAR 42.08 | Defined by parameter 42.08. | 7 |
| | MEMORY | The motor torque stored at the previous brake close command. | 8 |
| 42.08 | START TORQ REF | Defines the motor starting torque at brake release if parameter 42.07 has value PAR 40.28. | |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | -300 … 300% | Torque value in percent of the motor nominal torque | -30000 … 30000 |
| 42.09 | EXTEND RUN T | Defines an extended run time for the brake control function at stop. During the delay, the motor is kept magnetised and ready for an immediate restart. | |
| | 0.0 … 60.0 s | 0.0 s = Normal stop routine of the brake control function: The motor magnetisation is switched off after the brake close delay has passed.<br>0.1 … 60.0 s = Extended stop routine of the brake control function: The motor magnetisation is switched off after the brake close delay and the extended run time have passed. During the extended run time, a zero torque reference is applied, and the motor is ready for a immediate restart.<br>  | 100 = 1 s |
| 42.10 | LOW REF BRK HOLD | Activates a brake hold function and defines the hold delay for it. The function stabilises the operation of the brake control application when the motor operates near zero speed and there is no measured speed feedback available (pulse encoder). | |
| | 0.0 … 60.0 s | 0.0 s = inactive.<br>0.1 s … 60.0 s = active. When the absolute value of the motor speed reference falls below the brake close speed:<br>- The brake hold delay counter starts.<br>- The brake is closed according to normal stop routine of the brake control function.<br>During the delay, the function keeps the brake closed despite of the speed reference value and the value of start command. When the set delay has passed, the normal operation resumes. | 100 = 1 s |
| **45 ENERGY OPT** | | Energy optimization settings | |
| 45.02 | ENERGY TARIFF1 | Price of energy per kWh. Used for reference when savings are calculated. See parameters 01.46 SAVED KWH, 01.48 SAVED AMOUNT and 01.50 SAVED CO2. | |
| | 0.0000…1024.0000 | Price of energy per kWh. | 1 = 0.001 |
| 45.06 | E TARIFF UNIT | Specifies the currency used for the savings calculation. | |
| | LOCAL | The currency is determined by the setting of parameter 99.01 Language. | 0 |
| | EUR | Euro | 1 |
| | USD | US dollar | 2 |
| 45.08 | PUMP REF POWER | Pump power when connected directly to supply. Used for reference when energy savings are calculated. See parameters 01.46 SAVED KWH, 01.48 SAVED AMOUNT and 01.50 SAVED CO2. | |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | 0… 950% | Pump power in percent of nominal motor power. **Note:** The maximum value depends on the motor and is calculated in power-up or when the motor power changes. | 1000 = 100% |
| 45.09 | ENERGY RESET | Resets the energy counters 01.46 SAVED KWH, 01.47 SAVED GWH, 01.48 SAVED AMOUNT, 01.49 SAVED AMOUNT M, 01.50 SAVED CO2 and 01.51 SAVED CO2 KTON. | |
| | DONE | Reset not requested (normal operation). | 0 |
| | RESET | Reset energy counters. The value reverts automatically to DONE. | 1 |
| **50 ENCODER MODULE** | | Encoder connection. Visible only when a pulse encoder module (optional) is installed and activated by parameter 98.01.<br>The settings will remain the same even though the application macro is changed. | |
| 50.01 | PULSE NR | States the number of encoder pulses per one revolution. | |
| | 0 … 29999 ppr | Pulse number in pulses per round (ppr) | 0 … 29999 |
| 50.02 | SPEED MEAS MODE | Defines how the encoder pulses are calculated. | |
| | A ¯_ B DIR | Channel A: positive edges calculated for speed. Channel B: direction. | 0 |
| | A ¯_¯ | Channel A: positive and negative edges calculated for speed. Channel B: not used. | 1 |
| | A ¯_¯ B DIR | Channel A: positive and negative edges are calculated for speed. Channel B: direction. | 2 |
| | A ¯_¯ B ¯_¯ | All edges of the signals are calculated. | 3 |
| 50.03 | ENCODER FAULT | Defines the operation of the drive if a failure is detected in communication between the pulse encoder and the pulse encoder interface module, or between the module and the drive. Encoder supervision function activates if either of the following conditions is valid:<br>-The difference between estimated and measured speed is greater than 20% of the motor nominal speed.<br>- No pulses are received from the encoder within the defined time (see parameter 50.04) and the drive is simultaneously at current or torque limit. | |
| | WARNING | The drive generates a warning indication. | 0 |
| | FAULT | The drive trips on a fault, gives a fault indication and stops the motor. | 65535 |
| 50.04 | ENCODER DELAY | Defines the time delay for the encoder supervision function (See parameter 50.03). | |
| | 0 … 50000 ms | Time delay | 0 … 50000 |
| 50.05 | ENCODER DDCS CH | Defines the fibre optic channel of the control board from which the drive program reads the signals coming from the pulse encoder interface module.<br>The setting is valid only if the module is connected to the drive via the DDCS link (i.e. not to the option slot of the drive). | |
| | CH 1 | Signals via channel 1 (CH1). The pulse encoder interface module must be connected to CH1 instead of CH2 in applications where CH2 is reserved by a Master station (e.g. a Master/Follower application). See also parameter 70.03. | 1 |
| | CH 2 | Signals via channel 2 (CH2). Can be used in most cases. | 2 |
| 50.06 | SPEED FB SEL | Defines the speed feedback value used in control. | |
| | INTERNAL | Calculated speed estimate | 65535 |
| | ENCODER | Actual speed measured with an encoder | 0 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 50.07 | ENC CABLE CHECK | Selects the drive operation when encoder signal is missing.<br>**Note:** Monitoring is only for RTAC-03. For more information, see *RTAC-03 Pulse Encoder Interface Module User's Manual* [3AFE68650500 (English)]. | |
| | NO | No action | 0 |
| | WARNING | Drive generates warning ENC CABLE. | 1 |
| | FAULT | Drive trips on fault ENC CABLE. | 2 |
| **51 COMM MODULE DATA** | | The parameters are visible and need to be adjusted, only when a fieldbus adapter module (optional) is installed and activated by parameter 98.02. For details on the parameters, refer to the manual of the fieldbus module and chapter *Fieldbus control*.<br>These parameter settings will remain the same even though the macro is changed. | |
| **52 STANDARD MODBUS** | | The settings for the Standard Modbus Link. See chapter *Fieldbus control*. | |
| 52.01 | STATION NUMBER | Defines the address of the device. Two units with the same address are not allowed on-line. | |
| | 1 … 247 | Address | 1 = 1 |
| 52.02 | BAUDRATE | Defines the transfer rate of the link. | |
| | 600 | 600 bit/s | 1 |
| | 1200 | 1200 bit/s | 2 |
| | 2400 | 2400 bit/s | 3 |
| | 4800 | 4800 bit/s | 4 |
| | 9600 | 9600 bit/s | 5 |
| | 19200 | 19200 bit/s | 6 |
| 52.03 | PARITY | Defines the use of parity and stop bit(s). The same setting must be used in all on-line stations. | |
| | NONE1STOPBIT | No parity bit, one stop bit | 1 |
| | NONE2STOPBIT | No parity bit, two stop bits | 2 |
| | ODD | Odd parity indication bit, one stop bit | 3 |
| | EVEN | Even parity indication bit, one stop bit | 4 |
| **60 MASTER/ FOLLOWER** | | Master/Follower application. For more information, see section *Master/ Follower use of several drives* on page *80* and a separate *Master/Follower Application Guide* [3AFE64590430 (English)]. | |
| 60.01 | MASTER LINK MODE | Defines the role of the drive on the Master/Follower link.<br>**Note:** Two Master stations are not allowed on-line. If a Follower drive is changed to be a Master drive (or vice versa) by this parameter, the RMIO board must be powered up again for the M/F link to work properly. | |
| | NOT IN USE | The Master/Follower link is not active. | 1 |
| | MASTER | Master drive | 2 |
| | FOLLOWER | Follower drive | 3 |
| | STANDBY | Follower drive which reads the control signals through a fieldbus interface, not from the Master/Follower link as usual. | 4 |
| 60.02 | TORQUE SELECTOR | Selects the reference used in motor torque control. Typically, the value needs to be changed only in the Follower station(s).<br>The parameter is visible only when parameter 99.02 = T CTRL.<br>External control location 2 (EXT2) must be active to enable torque selector. | |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | ZERO | This selection forces the output of the torque selector to zero. | 1 |
| | SPEED | The follower speed controller output is used as a reference for motor torque control. The drive is speed-controlled. SPEED can be used both in the Follower and in the Master if<br>- the motor shafts of the Master and Follower are connected flexibly. (A slight speed difference between the Master and the Follower is possible/allowed.)<br>- drooping is used (see parameter 60.06). | 2 |
| | TORQUE | The drive is torque-controlled. The selection is used in the Follower(s) when the motor shafts of the Master and Follower are coupled solidly to each other by gearing, a chain or other means of mechanical power transmission and no speed difference between the drives is allowed or possible.<br>**Note:** If TORQUE is selected, the drive does not restrict the speed variation as long as the speed is within the limits defined by parameters 20.01 and 20.02. More definite speed supervision is often needed. In those cases, the selection ADD should be used instead of TORQUE. | 3 |
| | MINIMUM | The torque selector compares the direct torque reference and the speed controller output, and the smaller of them is used as the reference for the motor torque control. MINIMUM is selected in special cases only. | 4 |
| | MAXIMUM | The torque selector compares the direct torque reference and the speed controller output and the greater of them is used as the reference for the motor torque control. MAXIMUM is selected in special cases only. | 5 |
| | ADD | The torque selector adds the speed controller output to the direct torque reference. The drive is torque-controlled in the normal operating range. The selection ADD, together with the window control, forms a speed supervision function for a torque-controlled Follower drive. See parameter 60.03. | 6 |
| 60.03 | WINDOW SEL ON | Activates the Window control function. The Window control, together with selection ADD at parameter 60.02, forms a speed supervision function for a torque-controlled drive. The parameter is visible only when parameter 99.02 is T CTRL. External control location 2 (EXT2) must be active to enable window control. | |
| | NO | Inactive | 0 |
| | YES | Window control is active. Selection YES is used only when parameter 60.02 has value ADD. Window control supervises the speed error value (Speed Reference - Actual Speed). In the normal operating range, window control keeps the speed controller input at zero. The speed controller is evoked only if:<br>- the speed error exceeds the value of parameter 60.04 or<br>- the absolute value of the negative speed error exceeds the value of parameter 60.05.<br>When the speed error moves outside the window, the exceeding part of the error value is connected to the speed controller. The speed controller produces a reference term relative to the input and gain of the speed controller (parameter 23.01) which the torque selector adds to the torque reference. The result is used as the internal torque reference for the drive.<br>**Example:** In a load loss condition, the internal torque reference of the drive is decreased to prevent an excessive rise of the motor speed. If window control were inactivated, the motor speed would rise until a speed limit of the drive were reached. | 65535 |
| 60.04 | WINDOW WIDTH POS | Defines the supervision window width above the speed reference. See parameter 60.03. The parameter is visible only when parameter 99.02 is T CTRL. | |
| | 0 … 1500 rpm | Positive window width | 0… 20000 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 60.05 | WINDOW WIDTH NEG | Defines the supervision window width below the speed reference. See parameter 60.03. The parameter is visible only when parameter 99.02 is T CTRL. | |
| | 0 … 1500 rpm | Negative window width | 0… 20000 |
| 60.06 | DROOP RATE | Defines the droop rate. The parameter value needs to be changed only if both the Master and the Follower are speed-controlled:<br>- External control location 1 (EXT1) is selected (see parameter 11.02 or<br>- External control location 2 (EXT2) is selected (see parameter 11.02) and parameter 60.02 is set to SPEED.<br>The droop rate needs to be set both for the Master and the Follower. The correct droop rate for a process must be found out case by case in practice.<br>The drooping prevents a conflict between the Master and the Follower by allowing a slight speed difference between them. The drooping slightly decreases the drive speed as the drive load increases. The actual speed decrease at a certain operating point depends on the droop rate setting and the drive load ( = torque reference / speed controller output). At 100% speed controller output, drooping is at its nominal level, i.e. equal to the value of the DROOP RATE. The drooping effect decreases linearly to zero along with the decreasing load.<br>**Speed Decrease =**<br>Speed Controller Output · Drooping · Nominal Speed<br>**Example:** Speed Controller output is 50%, DROOP RATE is 1%, nominal speed of the drive is 1500 rpm.<br>Speed decrease = 0.50 · 0.01 · 1500 rpm = 7.5 rpm<br>  <br> | |
| | 0 … 100% | Droop rate in percent of the motor nominal speed | 0 … 1000 |
| 60.07 | MASTER SIGNAL 2 | Selects the signal that is sent by the Master to the Follower(s) as *Reference 1* (speed reference). | |
| | 0000 … 9999 | Parameter index | 0000 … 9999 |
| 60.08 | MASTER SIGNAL 3 | Selects the signal that is sent by the Master to the Follower(s) as *Reference 2* (torque reference). | |
| | 0000 … 9999 | Parameter index | 0000 … 9999 |
| **70 DDCS CONTROL** | | Settings for the fibre optic channels 0, 1 and 3. | |
| 70.01 | CHANNEL 0 ADDR | Defines the node address for channel 0. No two nodes on-line may have the same address. The setting needs to be changed when a master station is connected to channel 0 and it does not automatically change the address of the slave. Examples of such masters are an ABB Advant Controller or another drive. | |
| | 1 … 125 | Address. | 1 … 125 |
| 70.02 | CHANNEL 3 ADDR | Node address for channel 3. No two nodes on-line may have the same address. Typically the setting needs to be changed when the drive is connected in a ring which consists of several drives and a PC with the DriveWindow program running. | |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | 1 … 254 | Address. | 1 … 254 |
| 70.03 | CH1 BAUD RATE | The communication speed of channel 1. Typically the setting needs to be changed only if the pulse encoder interface module is connected to channel 1 instead of channel 2. Then the speed must be changed to 4 Mbit/s. See also parameter 50.05. | |
| | 8 Mbit/s | 8 megabits per second | 0 |
| | 4 Mbit/s | 4 megabits per second | 1 |
| | 2 Mbit/s | 2 megabits per second | 2 |
| | 1 Mbit/s | 1 megabits per second | 3 |
| 70.04 | CH0 DDCS HW CONN | Selects the topology of the channel 0 link. | |
| | RING | Devices are connected in ring topology. | 0 |
| | STAR | Devices are connected in a star topology. | 65535 |
| 70.05 | CH2 HW CONNECTION | Selects the topology of the DDCS channel CH2 link. | 1 = 1 |
| | 0 = RING | Devices are connected in a ring. Forwarding of messages is enabled. | |
| | 1 = STAR | Devices are connected in a star. Forwarding of messages is disabled. This selection is used with NDBU branching units. | |
| **72 USER LOAD CURVE** | | See section *User load curve* on page *83*. | |
| 72.01 | OVERLOAD FUNC | Activates the user load curve and selects how the drive reacts when the user load curve has been exceeded. | |
| | NO | User load curve is inactive. | 0 |
| | WARNING | The drive generates a warning USER L CURVE. Drive output current is not limited. | 1 |
| | FAULT | The drive trips on a fault USER L CURVE. | 2 |
| | LIMIT | Drive output current is limited to $I_{user\ curve}$. | 3 |
| | LIMIT / WARN | Drive output current is limited to $I_{user\ curve}$ and the drive generates a warning USER L CURVE. | 4 |
| 72.02 | LOAD CURRENT 1 | Defines the first current point of the load curve at the frequency defined by par. 72.10 LOAD FREQ 1. | |
| | 0...800% | Value in percent of the nominal motor current | 1 = 1 |
| 72.03 | LOAD CURRENT 2 | Defines the second current point of the load curve at the frequency defined by par. 72.11 LOAD FREQ 2. | |
| | 0...800% | Value in percent of the nominal motor current | 1 = 1 |
| 72.04 | LOAD CURRENT 3 | Defines the third current point of the load curve at the frequency defined by par. 72.12 LOAD FREQ 3. | |
| | 0...800% | Value in percent of the nominal motor current | 1 = 1 |
| 72.05 | LOAD CURRENT 4 | Defines the fourth current point of the load curve at the frequency defined by par. 72.13 LOAD FREQ 4. | |
| | 0...800% | Value in percent of the nominal motor current | 1 = 1 |
| 72.06 | LOAD CURRENT 5 | Defines the fifth current point of the load curve at the frequency defined by par. 72.14 LOAD FREQ 5. | |
| | 0...800% | Value in percent of the nominal motor current | 1 = 1 |
| 72.07 | LOAD CURRENT 6 | Defines the sixth current point of the load curve at the frequency defined by par. 72.15 LOAD FREQ 6. | |
| | 0...800% | Value in percent of the nominal motor current | 1 = 1 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 72.08 | LOAD CURRENT 7 | Defines the seventh current point of the load curve at the frequency defined by par. 72.16 LOAD FREQ 7. | |
| | 0...800% | Value in percent of the nominal motor current | 1 = 1 |
| 72.09 | LOAD CURRENT 8 | Defines the eighth current point of the load curve at the frequency defined by par. 72.17 LOAD FREQ 8. | |
| | 0...800% | Value in percent of the nominal motor current | 1 = 1 |
| 72.10 | LOAD FREQ 1 | Defines the first frequency point of the load curve. | |
| | 0... par. 72.11 % | Value in percent of the nominal motor frequency | 1 = 1 |
| 72.11 | LOAD FREQ 2 | Defines the second frequency point of the load curve. | |
| | par. 72.10...<br>par. 72.12 % | Value in percent of the nominal motor frequency | 1 = 1 |
| 72.12 | LOAD FREQ 3 | Defines the third frequency point of the load curve. | |
| | par. 72.11...<br>par. 72.13 % | Value in percent of the nominal motor frequency | 1 = 1 |
| 72.13 | LOAD FREQ 4 | Defines the fourth frequency point of the load curve. | |
| | par. 72.12...<br>par. 72.14 % | Value in percent of the nominal motor frequency | 1 = 1 |
| 72.14 | LOAD FREQ 5 | Defines the fifth frequency point of the load curve. | |
| | par. 72.13...<br>par. 72.15 % | Value in percent of the nominal motor frequency | 1 = 1 |
| 72.15 | LOAD FREQ 6 | Defines the sixth frequency point of the load curve. | |
| | par. 72.14...<br>par. 72.16 % | Value in percent of the nominal motor frequency | 1 = 1 |
| 72.16 | LOAD FREQ 7 | Defines the seventh frequency point of the load curve. | |
| | par. 72.15...<br>par. 72.17 % | Value in percent of the nominal motor frequency | 1 = 1 |
| 72.17 | LOAD FREQ 8 | Defines the eight frequency point of the load curve. | |
| | par. 72.16...600% | Value in percent of the nominal motor frequency | 1 = 1 |
| 72.18 | LOAD CURRENT LIMIT | Defines the overload current. Value is used by the overload integrator ($\int I^2 dt$).<br>If the continuous motor load capacity (i.e. the defined user load curve) is not 100% at the nominal frequency, calculate the overload current using the following equation:<br>$72.18\ \text{LOAD CURRENT LIMIT} = \sqrt{I^2_{\text{overload}} - I^2_{\text{user curve}} + 100^2}$<br>where $I_{\text{overload}}$ is the motor overload and $I_{\text{user curve}}$ is the current defined by the user load curve at the nominal frequency. User load curve is defined by parameters 72.02...72.17.<br>**Example:** Motor overload capacity is 150% of the nominal current for 10 s / 10 min and the continuous load capacity is 80% at the nominal frequency:<br>$72.18\ \text{LOAD CURRENT LIMIT} = \sqrt{150^2 - 80^2 + 100^2} = 162\%$<br>72.19 LOAD THERMAL TIME = 10 s<br>72.20 LOAD COOLING TIME = 590 s | |
| | 100...800% | Value in percent of the nominal motor current (99.06 MOTOR NOM CURRENT) | 10 = 1% |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 72.19 | LOAD THERMAL TIME | Defines the overload time. Value is used by the overload integrator ($\int I^2 dt$). See the example given for par. 72.18 LOAD CURRENT LIMIT. | 10 = 1 s |
| | 0.0...9999.9 s | Time. If the value is set to zero, the drive output current is limited to the user load curve defined by parameters 72.02...72.17. | |
| 72.20 | LOAD COOLING TIME | Defines the cooling time. The output of the overload integrator is set to zero if the current stays continuously below the user load curve for the defined cooling time. See the example given for par. 72.18 LOAD CURRENT LIMIT. | |
| | 0...9999 s | Time | 1 = 1 s |
| **83 ADAPT PROG CTRL** | | Control of the Adaptive Program execution. For more information, see the *Adaptive Program Application Guide* [3AFE64527274 (English)]. | |
| 83.01 | ADAPT PROG CMD | Selects the operation mode for the Adaptive Program. | |
| | STOP | Stop. The program cannot be edited. | 1 |
| | RUN | Run. The program cannot be edited. | 2 |
| | EDIT | Stop to edit mode. Program can be edited. | 3 |
| 83.02 | EDIT COMMAND | Selects the command for the block placed in the location defined by parameter 83.03. The program must be in editing mode (see parameter 83.01). | |
| | NO | Home value. The value automatically restores to NO after an editing command has been executed. | 1 |
| | PUSH | Shifts the block in location defined by parameter 83.03 and the following blocks one location up. A new block can be placed in the emptied location by programming the Block Parameter Set as usual.<br>**Example:** A new block needs to be placed in between the current block number four (parameters 84.20 … 84.25) and five (parameters 84.25 … 84.29).<br>In order to do this:<br>- Shift the program to the editing mode by parameter 83.01.<br>- Select location number five as the desired location for the new block by parameter 83.03.<br>- Shift the block in location number 5 and the following blocks one location forward by parameter 83.02. (selection PUSH)<br>- Program the emptied location number 5 by parameters 84.25 to 84.29 as usual. | 2 |
| | DELETE | Deletes the block in location defined by parameter 83.03 and shifts the following blocks one step down. | 3 |
| | PROTECT | Activation of the Adaptive Program protection. Activate as follows:<br>- Ensure the Adaptive Program operation mode is START or STOP (parameter 83.01).<br>- Set the passcode (parameter 83.05).<br>- Change parameter 83.02 to PROTECT.<br>When activated:<br>- All parameters in group 84 excluding the block output parameters are hidden (read protected).<br>- It is not possible to switch the program to the editing mode (parameter 83.01).<br>- Parameter 83.05 is set to 0. | 4 |

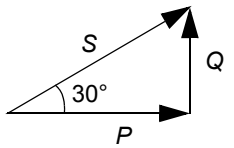
<table>
<tr><th>Index</th><th>Name/Selection</th><th>Description</th><th>FbEq</th></tr>
<tr><td></td><td>UNPROTECT</td><td>Inactivation of the Adaptive Program protection. Inactivate as follows:<br>- Ensure the Adaptive Program operation mode is START or STOP (parameter 83.01).<br>- Set the passcode (parameter 83.05).<br>- Change parameter 83.02 to UNPROTECT.<br>Note: If the passcode is lost, it is possible to reset the protection also by changing the application macro setting (parameter 99.02).</td><td>5</td></tr>
<tr><td>83.03</td><td>EDIT BLOCK</td><td>Defines the block location number for the command selected by parameter 83.02.</td><td></td></tr>
<tr><td></td><td>1 … 15</td><td>Block location number</td><td>1 = 1</td></tr>
<tr><td>83.04</td><td>TIMELEVEL SEL</td><td>Selects the execution cycle time for the Adaptive Program. The setting is valid for all blocks.</td><td></td></tr>
<tr><td></td><td>12 ms</td><td>12 milliseconds</td><td>1</td></tr>
<tr><td></td><td>100 ms</td><td>100 milliseconds</td><td>2</td></tr>
<tr><td></td><td>1000 ms</td><td>1000 milliseconds</td><td>3</td></tr>
<tr><td>83.05</td><td>PASSCODE</td><td>Sets the passcode for the Adaptive Program protection. The passcode is needed at activation and inactivation of the protection. See parameter 83.02.</td><td></td></tr>
<tr><td></td><td>0 …</td><td>Passcode. The setting restores to 0 after the protection is activated/inactivated.<br>Note: When activating, write down the passcode and store it in a safe place.</td><td></td></tr>
<tr><td colspan="2">84 ADAPTIVE PROGRAM</td><td>- selections of the function blocks and their input connections.<br>- diagnostics<br>For more information, see the Adaptive Program Application Guide [3AFE64527274 (English)].</td><td></td></tr>
<tr><td>84.01</td><td>STATUS</td><td>Shows the value of the Adaptive Program status word. The table below shows the alternative bit states and the corresponding values on the panel display.
<table>
<tr><th>Bit</th><th>Display</th><th>Meaning</th></tr>
<tr><td>0</td><td>1</td><td>Stopped</td></tr>
<tr><td>1</td><td>2</td><td>Running</td></tr>
<tr><td>2</td><td>4</td><td>Faulted</td></tr>
<tr><td>3</td><td>8</td><td>Editing</td></tr>
<tr><td>4</td><td>10</td><td>Checking</td></tr>
<tr><td>5</td><td>20</td><td>Pushing</td></tr>
<tr><td>6</td><td>40</td><td>Popping</td></tr>
<tr><td>8</td><td>100</td><td>Initialising</td></tr>
</table></td><td></td></tr>
<tr><td>84.02</td><td>FAULTED PAR</td><td>Points out the faulted parameter in the Adaptive Program.</td><td>-</td></tr>
<tr><td>84.05</td><td>BLOCK1</td><td>Selects the function block for Block Parameter Set 1. See the Adaptive Program Application Guide [3AFE64527274 (English)].</td><td></td></tr>
<tr><td></td><td>ABS</td><td></td><td>11</td></tr>
<tr><td></td><td>ADD</td><td></td><td>10</td></tr>
<tr><td></td><td>AND</td><td></td><td>2</td></tr>
<tr><td></td><td>BITWISE</td><td></td><td>26</td></tr>
<tr><td></td><td>COMPARE</td><td></td><td>16</td></tr>
<tr><td></td><td>COUNT</td><td></td><td>21</td></tr>
<tr><td></td><td>DPOT</td><td></td><td>23</td></tr>
<tr><td></td><td>EVENT</td><td></td><td>20</td></tr>
</table>

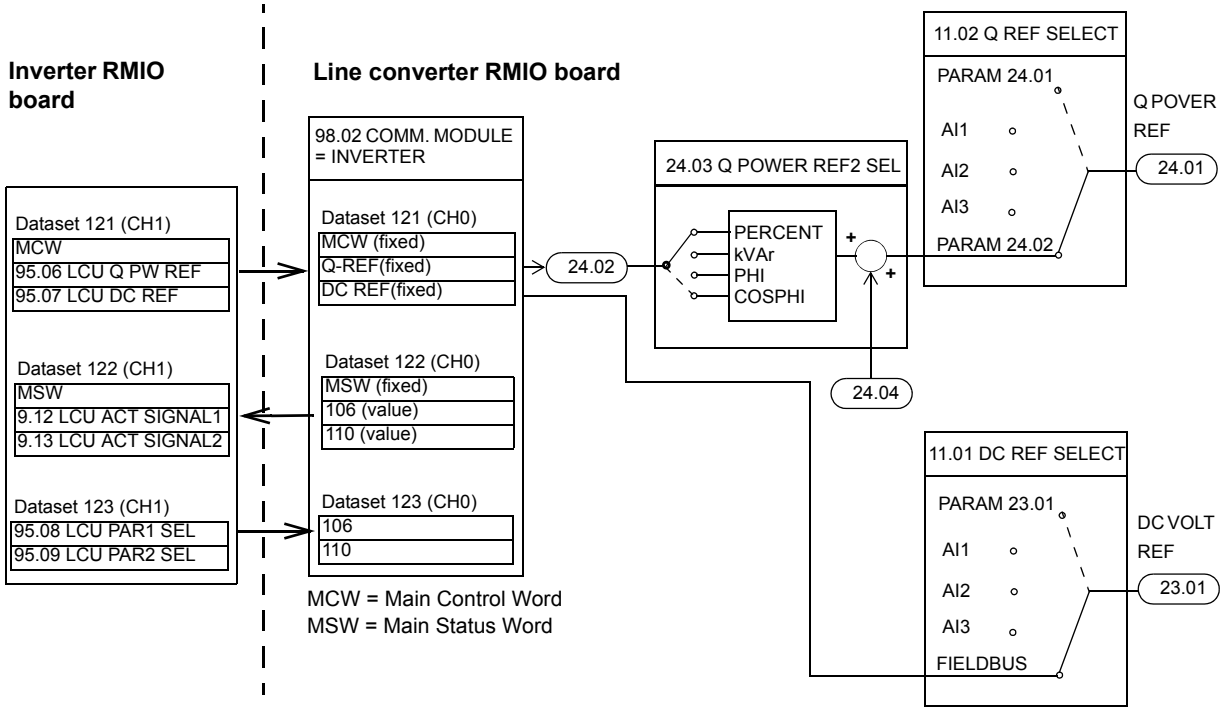
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | FILTER | | 13 |
| | MASK-SET | | 24 |
| | MAX | | 17 |
| | MIN | | 18 |
| | MULDIV | | 12 |
| | NO | | 1 |
| | OR | | 3 |
| | PI | | 14 |
| | PI-BAL | | 15 |
| | PI BIPOLAR | | 25 |
| | RAMP | | 22 |
| | SR | | 5 |
| | SWITCH-B | | 7 |
| | SWITCH-I | | 19 |
| | TOFF | | 9 |
| | TON | | 8 |
| | TRIGG | | 6 |
| | XOR | | 4 |
| 84.06 | INPUT1 | Selects the source for input I1 of Block Parameter Set 1. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value:<br>- Parameter pointer: Inversion, group, index and bit fields. The bit number is effective only for blocks handling boolean inputs.<br>- Constant value: Inversion and constant fields. Inversion field must have value C to enable the constant setting.<br>**Example:** The state of digital input DI2 is connected to Input 1 as follows:<br>- Set the source selection parameter (84.06) to +.01.17.01. (The application program stores the state of digital input DI2 to bit 1 of actual signal 01.17.)<br>- If you need an inverted value, switch the sign of the pointer value (-01.17.01.). | - |
| 84.07 | INPUT2 | See parameter 84.06. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | See parameter 84.06. | - |
| 84.08 | INPUT3 | See parameter 84.06. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | See parameter 84.06. | - |
| 84.09 | OUTPUT | Stores and displays the output of Block Parameter Set 1. | |
| … | … | | |
| 84.79 | OUTPUT | Stores the output of Block Parameter Set 15. | - |
| **85 USER CONSTANTS** | | Storage of the Adaptive Program constants and messages. For more information, see the *Adaptive Program Application Guide* [3AFE64527274 (English)]. | |
| 85.01 | CONSTANT1 | Sets a constant for the Adaptive Program. | |
| | -8388608 to 8388607 | Integer value | 1 = 1 |

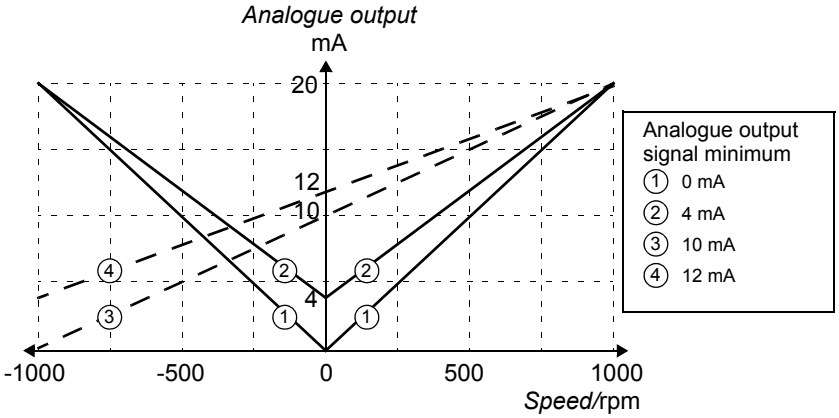
| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 85.02 | CONSTANT2 | Sets a constant for the Adaptive Program. | |
| | -8388608 to 8388607 | Integer value | 1 = 1 |
| 85.03 | CONSTANT3 | Sets a constant for the Adaptive Program. | |
| | -8388608 to 8388607 | Integer value | 1 = 1 |
| 85.04 | CONSTANT4 | Sets a constant for the Adaptive Program. | |
| | -8388608 to 8388607 | Integer value | 1 = 1 |
| 85.05 | CONSTANT5 | Sets a constant for the Adaptive Program. | |
| | -8388608 to 8388607 | Integer value | 1 = 1 |
| 85.06 | CONSTANT6 | Sets a constant for the Adaptive Program. | |
| | -8388608 to 8388607 | Integer value | 1 = 1 |
| 85.07 | CONSTANT7 | Sets a constant for the Adaptive Program. | |
| | -8388608 to 8388607 | Integer value | 1 = 1 |
| 85.08 | CONSTANT8 | Sets a constant for the Adaptive Program. | |
| | -8388608 to 8388607 | Integer value | 1 = 1 |
| 85.09 | CONSTANT9 | Sets a constant for the Adaptive Program. | |
| | -8388608 to 8388607 | Integer value | 1 = 1 |
| 85.10 | CONSTANT10 | Sets a constant for the Adaptive Program. | |
| | -8388608 to 8388607 | Integer value | 1 = 1 |
| 85.11 | STRING1 | Stores a message to be used in the Adaptive Program (EVENT block). | |
| | MESSAGE1 | Message | - |
| 85.12 | STRING2 | Stores a message to be used in the Adaptive Program (EVENT block). | |
| | MESSAGE2 | Message | - |
| 85.13 | STRING3 | Stores a message to be used in the Adaptive Program (EVENT block). | |
| | MESSAGE3 | Message | - |
| 85.14 | STRING4 | Stores a message to be used in the Adaptive Program (EVENT block). | |
| | MESSAGE4 | Message | - |
| 85.15 | STRING5 | Stores a message to be used in the Adaptive Program (EVENT block). | |
| | MESSAGE5 | Message | - |
| **90 D SET REC ADDR** | | - Addresses into which the received fieldbus data sets are written.<br>- Numbers of the main and auxiliary data sets.<br>The parameters are visible only when a fieldbus communication is activated by parameter 98.02. For more information, see chapter *Fieldbus control*. | |
| 90.01 | AUX DS REF3 | Selects the address into which the value of fieldbus reference REF3 is written. | |
| | 0 … 8999 | Parameter index | |
| 90.02 | AUX DS REF4 | Selects the address into which the value of fieldbus reference REF4 is written. | |
| | 0 … 8999 | Parameter index | |
| 90.03 | AUX DS REF5 | Selects the address into which the value of fieldbus reference REF5 is written. | |
| | 0 … 8999 | Parameter index | |
| 90.04 | MAIN DS SOURCE | Defines the data set from which the drive reads the Control Word, Reference REF1 and Reference REF2. | |
| | 1 … 255 | Data set number | |
| 90.05 | AUX DS SOURCE | Defines the data set from which the drive reads References REF3, REF4 and REF5. | |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | 1 … 255 | Data set number | |
| **92 D SET TR ADDR** | | Main and Auxiliary Data Sets which the drive sends to the fieldbus master station.<br>The parameters are visible only when a fieldbus communication is activated by parameter 98.02. For more information, see chapter *Fieldbus control*. | |
| 92.01 | MAIN DS STATUS WORD | Stores the address from which the Main Status Word is read from. Fixed value, not visible. | |
| | 302 (fixed) | Parameter index | |
| 92.02 | MAIN DS ACT1 | Selects the address from which the Actual Signal 1 is read to the Main Data Set. | |
| | 0 … 9999 | Parameter index | |
| 92.03 | MAIN DS ACT2 | Selects the address from which the Actual Signal 2 is read to the Main Data Set. | |
| | 0 … 9999 | Parameter index | |
| 92.04 | AUX DS ACT3 | Selects the address from which the Actual Signal 3 is read to the Auxiliary Data Set. | |
| | 0 … 9999 | Parameter index | |
| 92.05 | AUX DS ACT4 | Selects the address from which the Actual Signal 4 is read to the Auxiliary Data Set. | |
| | 0 … 9999 | Parameter index | |
| 92.06 | AUX DS ACT5 | Selects the address from which the Actual Signal 5 is read to the Auxiliary Data Set. | |
| | 0 … 9999 | Parameter index | |
| 92.07 | MSW B10 PTR | Selects the address from which the 03.02 Main Status Word bit 10 is read from. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value:<br>- Parameter pointer: Inversion, group, index and bit fields. The bit number is effective only for blocks handling boolean inputs.<br>- Constant value: Inversion and constant fields. Inversion field must have value C to enable the constant setting. | |
| 92.08 | MSW B13 PTR | Selects the address from which the 03.02 Main Status Word bit 13 is read from. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value:<br>- Parameter pointer: Inversion, group, index and bit fields. The bit number is effective only for blocks handling boolean inputs.<br>- Constant value: Inversion and constant fields. Inversion field must have value C to enable the constant setting. | |
| 92.09 | MSW B14 PTR | Selects the address from which the 03.02 Main Status Word bit 14 is read from. | |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value:<br>- Parameter pointer: Inversion, group, index and bit fields. The bit number is effective only for blocks handling boolean inputs.<br>- Constant value: Inversion and constant fields. Inversion field must have value C to enable the constant setting. | |
| **95 HARDWARE SPECIF** | | Fan speed control, sine filter application etc. | |
| 95.01 | FAN SPD CTRL MODE | Selects the speed control of the optional inverter cooling fan. | |
| | CONST 50 Hz | Fan is running at constant frequency of 50 Hz when powered. | 0 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | RUN/STOP | Drive stopped: Fan is running at constant frequency of 10 Hz.<br>Drive running: Fan is running at constant frequency of 50 Hz. | 1 |
| | CONTROLLED | The speed of the fan is determined from IGBT temperature vs. fan speed curve. | 2 |
| 95.02 | FUSE SWITCH CTRL | Activates the inverter DC switch (switch fuse) monitoring function. The monitoring must be active when the Switch Fuse Control Board (ASFC) is in use and connected to the inverter AINT board, i.e. in all frame R8i inverters equipped with the DC switch. The function must be inactive in units that do not use the ASFC board with the DC switch, i.e. for frame R2i…R7i inverters and all single drive units where no DC switch exists. The default setting (ON or OFF) for each unit is set accordingly at the factory as default.<br>ACS800 IGBT pulses are always blocked when the program detects that the DC switch is opened or inverter charging is ongoing (at power switch on). The application program generates alarm INV DISABLED if the DC switch is opened when the inverter is stopped. The inverter trips to fault INV DISABLED if the DC switch is opened when the inverter is running. | |
| | OFF | Inactive | 0 |
| | ON | Active | 1 |
| 95.03 | INT CONFIG USER | Number of parallel connected inverter modules. Activates the Reduced Run function. See section *Reduced Run function* on page *82*. | |
| | 1...12 | Number of parallel connected inverter modules | |
| 95.04 | EX/SIN REQUEST | Activates the sine filter or Ex-motor application. | |
| | NO | Inactive | 1 |
| | EX | Ex-motor application. Used with motors which comply with the ATEX directive. | 2 |
| | SIN | Sine filter application. See the *Sine Filters User's Manual for ACS800 Drives* [3AFE68389178 (English)]. | 3 |
| | EX&SIN | EX-motor and sine filter applications. See the *Sine Filters User's Manual for ACS800 Drives* [3AFE68389178 (English)].<br>**Note:** This selection is not supported from firmware version AS7R7363 onwards. | 4 |
| 95.05 | ENA INC SW FREQ | Activates the minimum switching frequency limitation for Ex-motor applications. Parameter is visible if parameter 95.04 EX/SIN REQUEST is set to EX. | |
| | NO | Inactive | 0 |
| | YES | Active. Minimum switching frequency limit is set to 2 kHz. Used with motors with an ATEX certification based on 2 kHz minimum switching frequency. | 1 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 95.06 | LCU Q PW REF | Defines the reference value for the line-side converter (i.e. IGBT supply unit) reactive power generation. Line-side converter can generate reactive power to the supply network. This reference is written into line-side converter unit parameter 24.02 Q POWER REF2. For more information, see *IGBT Supply Control Program 7.x Firmware manual* [3AFE68315735 (English)].<br>**Example 1:** When parameter 24.03 Q POWER REF2 SEL is set to PERCENT, value 10000 of parameter 24.02 Q POWER REF2 equals to value 100% of parameter 24.01 Q POWER REF (i.e. 100% of the converter nominal power given in signal 04.06 CONV NOM POWER).<br>**Example 2:** When parameter 24.03 Q POWER REF2 SEL is set to kVAr, value 1000 of parameter 24.02 Q POWER REF2 equals to parameter 24.01 Q POWER REF value calculated with the following equation: 100 · (1000 kVAr divided by converter nominal power in kVAr)%.<br>**Example 3:** When parameter 24.03 Q POWER REF2 SEL is set to PHI, value 3000 of parameter 24.02 POWER REF2 equals approximately to parameter 24.01 Q POWER REF value calculated with the following equation:<br>$\cos(30) = \frac{P}{S} = \frac{P}{\sqrt{P^2 + Q^2}}$<br>  <br>Positive reference 30° denotes capacitive load.<br>Negative reference 30° denotes inductive load.<br>P = signal 01.09 POWER value<br>Parameter 24.03 values are converter to degrees by the line-side converter application program: -3000...30000 ≙ -30°...30°. Value -10000/10000 equals to -30°/30°, since the range is limited to -3000/3000. | |
| | -10000...10000 | Reference value. | See par. description. |
| 95.07 | LCU DC REF | Defines the intermediate circuit DC voltage reference for the line-side converter (i.e. IGBT supply unit). This reference is written into line-side converter parameter 23.01 DC VOLT REF. For more information, *see IGBT Supply Control Program 7.x Firmware manual* [3AFE68315735 (English)]. | |
| | 0...1100 V | Voltage | 1 = 1 V |
| 95.08 | LCU PAR1 SEL | Selects the line-side converter address from which the actual signal 09.12 LCU ACT SIGNAL1 is read from. | |
| | 0…9999 | Line-side converter parameter index. Default value 106 = line-side converter parameter 01.06 LINE CURRENT. For more information, see *IGBT Supply Control Program 7.x Firmware manual* [3AFE68315735 (English)]. | 0…9999 |
| 95.09 | LCU PAR2 SEL | Selects the line-side converter address from which the actual signal 09.13 LCU ACT SIGNAL2 is read from. | |
| | 0…9999 | Line-side converter parameter index. Default value 110 = line side converter parameter 01.10 DC VOLTAGE. For more information, see *IGBT Supply Control Program 7.x Firmware manual* [3AFE68315735 (English)]. | 0…9999 |
| 95.10 | TEMP INV AMBIENT | Defines the ambient temperature for the Enhanced drive temperature monitoring function. See *Enhanced drive temperature monitoring for ACS800, frame sizes R7 and R8* on page 67.<br>**Note:** If ambient temperature exceeds 40°C, the drive load capacity decreases. See the derating instructions in the appropriate hardware manual. | |
| | 20...50°C | Temperature | 10 = 1°C |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 95.11 | SUPPLY CTRL MODE | Enables/disables the control and data transfer of line-side converter unit (LSU) by inverter unit (INU). The parameter 98.02 COMM.MODULE in LSU must have the value INU COM LIM. | |
| | NONE | Line-side converter control disabled. | 0 |
| | LINE CONV | Limited control from the inverter RMIO board DDCS channel CH1. | 65535 |
| | |  | |
| 95.12 | LCU RUN PTR | Selection of run command for line-side converter. When 95.11 SUPPLY CTRL MODE is set to LINE CONV, starting of modulation can be assigned freely to a parameter or signal using bit pointer.<br>**Note:** This parameter is available in AS7R firmware version only. | |
| | -255.255.31… +255.255.31 / C.-32768…C.32767 | Parameter index or a constant value:<br>- Parameter pointer: Inversion, group, index and bit fields. The bit number is effective only for blocks handling boolean inputs.<br>- Constant value: Inversion and constant fields. Inversion field must have value C to enable the constant setting. | - |
| **96 EXTERNAL AO** | | Output signal selection and processing for the analogue extension module (optional).<br>The parameters are visible only when the module is installed and activated by parameter 98.06. | |
| 96.01 | EXT AO1 | Selects the signal connected to analogue output AO1 of the analogue I/O extension module. | |
| | NOT USED | See parameter 15.01. | 1 |
| | P SPEED | See parameter 15.01. | 2 |
| | SPEED | See parameter 15.01. | 3 |
| | FREQUENCY | See parameter 15.01. | 4 |
| | CURRENT | See parameter 15.01. | 5 |
| | TORQUE | See parameter 15.01. | 6 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | POWER | See parameter 15.01. | 7 |
| | DC BUS VOLT | See parameter 15.01. | 8 |
| | OUTPUT VOLT | See parameter 15.01. | 9 |
| | APPL OUTPUT | See parameter 15.01. | 10 |
| | REFERENCE | See parameter 15.01. | 11 |
| | CONTROL DEV | See parameter 15.01. | 12 |
| | ACTUAL 1 | See parameter 15.01. | 13 |
| | ACTUAL 2 | See parameter 15.01. | 14 |
| | COM.REF4 | See parameter 15.01. | 15 |
| | PARAM 96.11 | Source selected by parameter 96.11. | 16 |
| 96.02 | INVERT EXT AO1 | Activates the inversion of analogue output AO1 of the analogue I/O extension module. | |
| | NO | Inactive | 0 |
| | YES | Active. The analogue signal is at a minimum level when the drive signal indicated is at its maximum and vice versa. | 65535 |
| 96.03 | MINIMUM EXT AO1 | Defines the minimum value for the analogue output AO1 of the analogue I/O extension module.<br>**Note:** Actually, the setting 10 mA or 12 mA does not set the AO1 minimum but fixes 10/12 mA to actual signal value zero.<br>**Example:** Motor speed is read through the analogue output.<br>- The motor nominal speed is 1000 rpm (parameter 99.08).<br>- 96.02 is NO.<br>- 96.05 is 100%.<br>The analogue output value as a function of the speed is shown below.<br>  | |
| | 0 mA | 0 mA | 1 |
| | 4 mA | 4 mA | 2 |
| | 10 mA | 10 mA | 3 |
| | 12 mA | 12 mA | 4 |
| 96.04 | FILTER EXT AO1 | Defines the filtering time constant for analogue output AO1 of the analogue I/O extension module. See parameter 15.04. | |
| | 0.00 … 10.00 s | Filtering time constant | 0 … 1000 |
| 96.05 | SCALE EXT AO1 | Defines the scaling factor for analogue output AO1 of the analogue I/O extension module. See parameter 15.05. | |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | 10 … 1000% | Scaling factor | 100 … 10000 |
| 96.06 | EXT AO2 | Selects the signal connected to analogue output AO2 of the analogue I/O extension module. | |
| | NOT USED | See parameter 15.01. | 1 |
| | P SPEED | See parameter 15.01. | 2 |
| | SPEED | See parameter 15.01. | 3 |
| | FREQUENCY | See parameter 15.01. | 4 |
| | CURRENT | See parameter 15.01. | 5 |
| | TORQUE | See parameter 15.01. | 6 |
| | POWER | See parameter 15.01. | 7 |
| | DC BUS VOLT | See parameter 15.01. | 8 |
| | OUTPUT VOLT | See parameter 15.01. | 9 |
| | APPL OUTPUT | See parameter 15.01. | 10 |
| | REFERENCE | See parameter 15.01. | 11 |
| | CONTROL DEV | See parameter 15.01. | 12 |
| | ACTUAL 1 | See parameter 15.01. | 13 |
| | ACTUAL 2 | See parameter 15.01. | 14 |
| | COM.REF5 | See parameter 15.06. | 15 |
| | PARAM 96.12 | Source selected by parameter 96.12. | 16 |
| 96.07 | INVERT EXT AO2 | Activates the inversion of analogue output AO2 of the analogue I/O extension module. The analogue signal is at its minimum level when the drive signal indicated is at its maximum and vice versa. | |
| | NO | Inactive | 0 |
| | YES | Active | 65535 |
| 96.08 | MINIMUM EXT AO2 | Defines the minimum value for analogue output AO2 of the analogue I/O extension module. See parameter 96.03. | |
| | 0 mA | 0 mA | 1 |
| | 4 mA | 4 mA | 2 |
| | 10 mA | 10 mA | 3 |
| | 12 mA | 12 mA | 4 |
| 96.09 | FILTER EXT AO2 | Defines the filtering time constant for analogue output AO2 of the analogue I/O extension module. See parameter 15.04. | |
| | 0.00 … 10.00 s | Filtering time constant | 0 … 1000 |
| 96.10 | SCALE EXT AO2 | Defines the scaling factor for analogue output AO2 of the analogue I/O extension module. See parameter 15.05. | |
| | 10 … 1000% | Scaling factor | 100 … 10000 |
| 96.11 | EXT AO1 PTR | Defines the source or constant for value PAR 96.11 of parameter 96.01. | 1000 = 1 mA |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | - |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 96.12 | EXT AO2 PTR | Defines the source or constant for value PAR 96.12 of parameter 96.06. | 1000 = 1 mA |
| | -255.255.31 … +255.255.31 / C.-32768 … C.32767 | Parameter index or a constant value. See parameter 10.04 for information on the difference. | - |
| **98 OPTION MODULES** | | Activation of the option modules.<br>The parameter settings will remain the same even though the application macro is changed (parameter 99.02). | |
| 98.01 | ENCODER MODULE | Activates the communication to the optional pulse encoder module. See also parameter group 50 ENCODER MODULE. | |
| | NTAC | Communication active. Module type: NTAC module. Connection interface: Fibre optic DDCS link.<br>**Note:** Module node number must be set to 16. For directions, see the *NTAC-0x/NDIO-0x/NAIO-0x Module Installation and Start-up Guide* [3AFY58919730 (English)]. | 0 |
| | NO | Inactive | 1 |
| | RTAC-SLOT1 | Communication active. Module type: RTAC. Connection interface: Option slot 1 of the drive. | 2 |
| | RTAC-SLOT2 | Communication active. Module type: RTAC. Connection interface: Option slot 2 of the drive. | 3 |
| | RTAC-DDCS | Communication active. Module type: RTAC. Connection interface: Optional I/O module adapter (AIMA) that communicates with the drive through a fibre optic DDCS link.<br>**Note:** Module node number must be set to 16. For directions, see the *RTAC-01 Pulse Encoder Interface User's Manual* [3AFE64486853 (English)]. | 4 |
| | RRIA-SLOT1 | Communication active. Module type: RRIA. Connection interface: option slot 1 of the drive. | 5 |
| | RRIA-SLOT2 | Communication active. Module type: RRIA. Connection interface: option slot 2 of the drive. | 6 |
| | RRIA-DDCS | Communication active. Module type: RRIA. Connection interface: Optional I/O module adapter (AIMA) that communicates with the drive through a fibre optic DDCS link.<br>**Note:** Module node number must be set to 16. For directions, see *RRIA-01 Resolver Interface Module User's Manual* [3AFE68570760 (English)]. | 7 |
| | RTAC03-SLOT1 | Communication active. Module type: RTAC-03. Connection interface: Option slot 1 of the drive. | |
| | RTAC03-SLOT2 | Communication active. Module type: RTAC-03. Connection interface: Option slot 2 of the drive. | |
| | RTAC03-DDCS | Communication active. Module type: RTAC-03. Connection interface: Optional I/O module adapter (AIMA) that communicates with the drive through a fibre optic DDCS link.<br>**Note:** Module node number must be set to 16. For directions, see the *RTAC-03 Pulse Encoder Interface User's Manual* [3AFE68650500 (English)]. | |
| 98.02 | COMM. MODULE LINK | Activates the external serial communication and selects the interface. See chapter *Fieldbus control*. | |
| | NO | No communication | 1 |
| | FIELDBUS | The drive communicates through an Rxxx type fieldbus adapter connected to slot 1 or through an Nxxx type fieldbus adapter connected to RMIO board channel CH0. See also parameter group 51 COMM MODULE DATA. | 2 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | ADVANT | The drive communicates with an ABB Advant OCS system via CH0 on the RDCO board (optional). See also parameter group 70 DDCS CONTROL. | 3 |
| | STD MODBUS | The drive communicates with a Modbus controller via the Modbus Adapter Module (RMBA) in option slot 1 of the drive. See also parameter 52 STANDARD MODBUS. | 4 |
| | CUSTOMISED | The drive communicates via a customer specified link. The control sources are defined by parameters 90.04 and 90.05. | 5 |
| 98.03 | DI/O EXT MODULE 1 | Activates the communication to the digital I/O extension module 1 (optional) and defines the type and connection interface of the module.<br>Module inputs: See parameter 98.09 for the use of the inputs in the drive application program.<br>Module outputs: See parameters 14.10 and 14.11 for selecting the drive states that are indicated through the relay outputs. | |
| | NDIO | Communication active. Module type: NDIO module. Connection interface: Fibre optic DDCS link.<br>**Note:** Module node number must be set to 2. For directions, see the *NTAC-0x/NDIO-0x/NAIO-0x Module Installation and Start-up Guide* [3AFY58919730 (English)]. | 1 |
| | NO | Inactive | 2 |
| | RDIO-SLOT1 | Communication active. Module type: RDIO. Connection interface: Option slot 1 of the drive. | 3 |
| | RDIO-SLOT2 | Communication active. Module type: RDIO. Connection interface: Option slot 2 of the drive. | 4 |
| | RDIO-DDCS | Communication active. Module type: RDIO. Connection interface: Optional I/O module adapter (AIMA) that communicates with the drive through a fibre optic DDCS link.<br>**Note:** Module node number must be set to 2. For directions, see the *RDIO Module User's Manual* [3AFE64485733 (English)]. | 5 |
| 98.04 | DI/O EXT MODULE 2 | Activates the communication to the digital I/O extension module 2 (optional) and defines the type and connection interface of the module.<br>Module inputs: See parameter 98.10 for the use of the inputs in the drive application program.<br>Module outputs: See parameters 14.12 and 14.13 for selecting the drive states that are indicated through the relay outputs. | |
| | NDIO | Communication active. Module type: NDIO module. Connection interface: Fibre optic DDCS link.<br>**Note:** Module node number must be set to 3. For directions, see the *NTAC-0x/NDIO-0x/NAIO-0x Module Installation and Start-up Guide* [3AFY58919730 (English)]. | 1 |
| | NO | Inactive | 2 |
| | RDIO-SLOT1 | Communication active. Module type: RDIO. Connection interface: Option slot 1 of the drive. | 3 |
| | RDIO-SLOT2 | Communication active. Module type: RDIO. Connection interface: Option slot 2 of the drive. | 4 |
| | RDIO-DDCS | Communication active. Module type: RDIO. Connection interface: Optional I/O module adapter (AIMA) that communicates with the drive through a fibre optic DDCS link.<br>**Note:** Module node number must be set to 3. For directions, see the *RDIO Module User's Manual* [3AFE64485733 (English)]. | 5 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 98.05 | DI/O EXT MODULE 3 | Activates the communication to the digital I/O extension module 3 (optional) and defines the type and connection interface of the module.<br>Module inputs: See parameter 98.11 for the use of the inputs in the drive application program.<br>Module outputs: See parameters 14.14 and 14.15 for selecting the drive states that are indicated through the relay outputs. | |
| | NDIO | Communication active. Module type: NDIO module. Connection interface: Fibre optic DDCS link.<br>**Note:** Module node number must be set to 4. For directions, see the *NTAC-0x/NDIO-0x/NAIO-0x Module Installation and Start-up Guide* [3AFY58919730 (English)]. | 1 |
| | NO | Inactive | 2 |
| | RDIO-SLOT1 | Communication active. Module type: RDIO. Connection interface: Option slot 1 of the drive. | 3 |
| | RDIO-SLOT2 | Communication active. Module type: RDIO. Connection interface: Option slot 2 of the drive. | 4 |
| | RDIO-DDCS | Communication active. Module type: RDIO. Connection interface: Optional I/O module adapter (AIMA) that communicates with the drive through a fibre optic DDCS link.<br>**Note:** Module node number must be set to 4. For directions, see the *RDIO Module User's Manual* [3AFE64485733 (English)]. | 5 |
| 98.06 | AI/O EXT MODULE | Activates the communication to the analogue I/O extension module (optional), and defines the type and connection interface of the module.<br>Module inputs:<br>- Values AI5 and AI6 in the drive application program are connected to module inputs 1 and 2.<br>- See parameters 98.13 and 98.14 for the signal type definitions.<br>Module outputs:<br>- See parameters 96.01 and 96.06 for selecting the drive signals that are indicated through module outputs 1 and 2. | |
| | NAIO | Communication active. Module type: NAIO. Connection interface: Fibre optic DDCS link.<br>**Note:** Module node number must be set to 5. For directions, see the *NTAC-0x/NDIO-0x/NAIO-0x Module Installation and Start-up Guide* [3AFY58919730 (English)]. | 1 |
| | NO | Communication inactive | 2 |
| | RAIO-SLOT1 | Communication active. Module type: RAIO. Connection interface: Option slot 1 of the drive. | 3 |
| | RAIO-SLOT2 | Communication active. Module type: RAIO. Connection interface: Option slot 2 of the drive. | 4 |
| | RAIO-DDCS | Communication active. Module type: RAIO. Connection interface: Optional I/O module adapter (AIMA) that communicates with the drive through a fibre optic DDCS link.<br>**Note:** Module node number must be set to 5. For directions, see the *RAIO Module User's Manual* [3AFE64484567 (English)]. | 5 |
| 98.07 | COMM PROFILE | Defines the profile on which the communication with the fieldbus or another drive is based. Visible only when fieldbus communication is activated by parameter 98.02. | |
| | ABB DRIVES | ABB Drives profile | 1 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | GENERIC | Generic drive profile. Typically used with the fieldbus modules that have the type designation of form **R**xxx (installed in the option slot of the drive). | 2 |
| | CSA 2.8/3.0 | Communication profile used by application program versions 2.8 and 3.0. | 3 |
| 98.09 | DI/O EXT1 DI FUNC | Defines the naming of the inputs of digital I/O extension module 1 in the drive application program. See parameter 98.03. | |
| | DI7,8 | DI1 and DI2 of the module extend the number of input channels. The module inputs are named DI7 and DI8. | 1 |
| | REPL DI1,2 | DI1 and DI2 of the module replace the standard input channels DI1 and DI2. The inputs are named DI1 and DI2. | 2 |
| | DI7,8,9 | DI1, DI2 and DI3 of the module extend the number of input channels. The module inputs are named DI7, DI8 and DI9. | 3 |
| | REPL DI1,2,3 | DI1, DI2 and DI3 of the module replace the standard input channels DI1, DI2 and DI3. The inputs are named DI1, DI2 and DI3. | 4 |
| 98.10 | DI/O EXT2 DI FUNC | Defines the naming of the inputs of digital I/O extension module 2 in the drive application program. See parameter 98.04. | |
| | DI9,10 | DI1 and DI2 of the module extend the number of input channels. The module inputs are named DI9 and DI10. | 1 |
| | REPL DI3,4 | DI1 and DI2 of the module replace the standard input channels DI3 and DI4. The inputs are named DI3 and DI4. | 2 |
| | DI10,11,12 | DI1, DI2 and DI3 of the module extend the number of input channels. The module inputs are named DI10, DI11 and DI12. | 3 |
| | REPL DI4,5,6 | DI1, DI2 and DI3 of the module replace the standard input channels DI1, DI2 and DI3. The inputs are named DI4, DI5 and DI6. | 4 |
| 98.11 | DI/O EXT3 DI FUNC | Defines the naming of the inputs of digital I/O extension module 3 in the drive application program. See parameter 98.05. | |
| | DI11,12 | DI1 and DI2 of the module extend the number of input channels. The module inputs are named DI11 and DI12. | 1 |
| | REPL DI5,6 | DI1 and DI2 of the module replace the standard input channels DI5 and DI6. The inputs are named DI5 and DI6. | 2 |

<table>
<tr><th>Index</th><th>Name/Selection</th><th>Description</th><th>FbEq</th></tr>
<tr><td>98.12</td><td>AI/O MOTOR TEMP</td><td>Activates the communication to the analogue I/O extension module and reserves the module for the use of the motor temperature measurement function. The parameter also defines the type and connection interface of the module.<br>For more information on the temperature measurement function, see parameter group 35 MOT TEMP MEAS and section Motor temperature measurement through an analogue I/O extension on page 75.<br>The use of the analogue inputs (AI) and outputs (AO) of the module is shown in the table below.<br><br>
<table>
<tr><td colspan="2">Motor 1 temperature measurement</td></tr>
<tr><td>AO1</td><td>Feeds a constant current to motor 1 temperature sensor. The current value depends on the setting of parameter 35.01:<br>- AO1 is 9.1 mA with selection 1xPT100<br>- AO1 is 1.6 mA with selection 1...3 PTC</td></tr>
<tr><td>AI1</td><td>Measures voltage over motor 1 temperature sensor.</td></tr>
<tr><td colspan="2">Motor 2 temperature measurement</td></tr>
<tr><td>AO2</td><td>Feeds a constant current to motor 2 temperature sensor. The current value depends on the setting of parameter 35.04:<br>- AO2 is 9.1 mA with selection 1xPT100,<br>- AO2 is 1.6 mA with selection 1...3 PTC</td></tr>
<tr><td>AI2</td><td>Measures voltage over motor 2 temperature sensor.</td></tr>
</table>
<br>Before setting the drive parameters, ensure the module hardware settings are appropriate for the motor temperature measurement:<br>1. The module node number is 9.<br>2. The input signal type selections are the following:<br>- for one Pt 100 sensor measurement, set the range to 0 … 2 V.<br>- for two to three Pt 100 sensors or one to three PTC sensors, set the range to 0 … 10 V.<br>3. The operation mode selection is unipolar.</td><td></td></tr>
<tr><td></td><td>NAIO</td><td>Communication active. Module type: NAIO. Connection interface: Fibre optic DDCS link.<br>Note: Make the module hardware settings as described above. For instructions, see the NTAC-0x/NDIO-0x/NAIO-0x Module Installation and Start-up Guide [3AFY58919730 (English)].</td><td>1</td></tr>
<tr><td></td><td>NO</td><td>Inactive</td><td>2</td></tr>
<tr><td></td><td>RAIO-SLOT1</td><td>Communication active. Module type: RAIO. Connection interface: Option slot 1 of the drive.<br>Note: Make the module hardware settings as described above. The node number is not required. For directions, see the RAIO Module User’s Manual [3AFE64484567 (English)].</td><td>3</td></tr>
<tr><td></td><td>RAIO-SLOT2</td><td>Communication active. Module type: RAIO. Connection interface: Option slot 2 of the drive.<br>Note: Make the module hardware settings as described above. The node number is not required. For directions, see the RAIO Module User’s Manual [3AFE64484567 (English)].</td><td>4</td></tr>
</table>

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | RAIO-DDCS | Communication active. Module type: RAIO. Connection interface: Optional I/O module adapter (AIMA) that communicates with the drive through a fibre optic DDCS link.<br>**Note:** Set the module node number to 9. For directions, see the *RAIO Module User's Manual* [3AFE64484567 (English)]. | 5 |
| 98.13 | AI/O EXT AI1 FUNC | Defines the signal type for input 1 of the analogue I/O extension module (AI5 in the drive application program). The setting must match the signal connected to the module.<br>**Note:** The communication must be activated by parameter 98.06. | |
| | UNIPOLAR AI5 | Unipolar | 1 |
| | BIPOLAR AI5 | Bipolar | 2 |
| 98.14 | AI/O EXT AI2 FUNC | Defines the signal type for input 2 of the analogue I/O extension module (AI6 in the drive application program). The setting must match the signal connected to the module.<br>**Note:** The communication must be activated by parameter 98.06. | |
| | UNIPOLAR AI6 | Unipolar | 1 |
| | BIPOLAR AI6 | Bipolar | 2 |
| 98.16 | SIN FILT SUPERV | Activates the communication to the digital I/O extension module and reserves the module for the use of the sine-filter temperature measurement.<br>Parameter is visible if parameter 95.04 is set to SIN or EX&SIN. Parameter value is automatically set to NO, when parameter 95.04 value is changed.<br>**Note:** This parameter is used only in special applications. | |
| | NDIO | Module type: NDIO module. Connection interface: Fibre optic DDCS link.<br>**Note:** Module node number must be set to 8. For directions see the *NTAC-0x/ NDIO-0x/NAIO-0x Module Installation and Start-up Guide* [3AFY58919730 (English)]. | 1 |
| | NO | Supervision disabled. | 2 |
| | RDIO-SLOT1 | Module type: RDIO. Connection interface: Option slot 1 of the drive. | 3 |
| | RDIO-SLOT2 | Module type: RDIO. Connection interface: Option slot 2 of the drive. | 4 |
| | RDIO-DDCS | Module type: RDIO. Connection interface: Optional I/O module adapter (AIMA) that communicates with the drive through a fibre optic DDCS link.<br>**Note:** Module node number must be set to 8. For directions, see the *RDIO Module User's Manual* [3AFE64485733 (English)]. | 5 |
| **99 START-UP DATA** | | Language selection. Definition of motor set-up data. | |
| 99.01 | LANGUAGE | Selects the display language. | |
| | ENGLISH | British English | 0 |
| | ENGLISH AM | American English. If selected, the unit of power used is HP instead of kW. | 1 |
| | DEUTSCH | German | 2 |
| | ITALIANO | Italian | 3 |
| | ESPANOL | Spanish | 4 |
| | PORTUGUES | Portuguese | 5 |
| | NEDERLANDS | Dutch | 6 |
| | FRANCAIS | French | 7 |
| | DANSK | Danish | 8 |
| | SUOMI | Finnish | 9 |
| | SVENSKA | Swedish | 10 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | CESKY | Czech | 11 |
| | POLSKI/LOC1 | Polish | 12 |
| | PO-RUS/LOC2 | Russian | 13 |
| 99.02 | APPLICATION MACRO | Selects the application macro. See chapter *Application macros* for more information.<br>**Note:** When you change the default parameter values of a macro, the new settings become valid immediately and stay valid even if the power of the drive is switched off and on. However, backup of the default parameter settings (factory settings) of each standard macro is still available. See parameter 99.03. | |
| | FACTORY | Factory for basic applications | 1 |
| | HAND/AUTO | Two control devices are connected to the drive:<br>- device 1 communicates through the interface defined by external control location EXT1.<br>- device 2 communicates through the interface defined by external control location EXT2.<br>- EXT1 or EXT2 is active at a time. Switching through a digital input. | 2 |
| | PID-CTRL | PID control. For application in which the drive controls a process value. E.g. pressure control by the drive running the pressure boost pump. Measured pressure and the pressure reference are connected to the drive.<br>See sections *Process PID control* on page *70* and *Sleep function for the process PID control* on page *71*. | 3 |
| | T-CTRL | Torque Control macro | 4 |
| | SEQ CTRL | Sequential Control macro. For applications that are frequently run through a pre-defined speed pattern (constant speeds and acceleration and deceleration ramps). | 5 |
| | USER 1 LOAD | User 1 macro loaded into use. Before loading, check that the saved parameter settings and the motor model are suitable for the application. | 6 |
| | USER 1 SAVE | Save User 1 macro. Stores the current parameter settings and the motor model.<br>**Note:** There are parameters that are not included in the macros. See parameter 99.03. | 7 |
| | USER 2 LOAD | User 2 macro loaded into use. Before loading, check that the saved parameter settings and the motor model are suitable for the application. | 8 |
| | USER 2 SAVE | Save User 2 macro. Stores the current parameter settings and the motor model.<br>**Note:** There are parameters that are not included in the macros. See parameter 99.03. | 9 |
| 99.03 | APPLIC RESTORE | Restores the original settings of the active application macro (99.02).<br>- If a standard macro (Factory, ... , Sequential Control) is active, the parameter values are restored to the default settings (factory settings). Exceptions: parameter settings in parameter group 99 remain unchanged. The motor model remains unchanged.<br>- If User Macro 1 or 2 is active, the parameter values are restored to the last saved values. In addition, the last saved motor model are restored. Exceptions: Settings of parameters 16.05 and 99.02 remain unchanged.<br>**Note:** The parameter settings and the motor model are restored according to the same principles when a macro is changed to another. | |
| | NO | No action | 0 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| | YES | Restoring | 65535 |
| 99.04 | MOTOR CTRL MODE | Selects the motor control mode. | |
| | DTC | Direct Torque Control mode is suitable for most applications. | 0 |
| | SCALAR | Scalar control is suitable in special cases where the DTC cannot be applied. The scalar control mode is recommended:<br>- for multimotor drives with variable number of motors<br>- when the nominal current of the motor is less than 1/6 of the nominal output current of the drive (inverter)<br>- the drive is used for test purposes with no motor connected.<br>**Note:** The outstanding motor control accuracy of the DTC cannot be achieved in scalar control. The differences between the scalar and DTC control modes are pointed out in this manual in relevant parameter lists. There are some standard features that are disabled in the scalar control mode: Motor Identification Run (group 99 START-UP DATA), Speed Limits (group 20 LIMITS), Torque Limit (group 20 LIMITS), DC Hold (group 21 START/STOP), DC Magnetizing (group 21 START/STOP), Speed Controller Tuning (group 23 SPEED CTRL), Torque Control (group 24 TORQUE CTRL), Flux Optimization (group 26 MOTOR CONTROL), Flux Braking (group 26 MOTOR CONTROL), Underload Function (group 30 FAULT FUNCTIONS), Motor Phase Loss Protection (group 30 FAULT FUNCTIONS), Motor Stall Protection (group 30 FAULT FUNCTIONS).<br>For more information, see section *Scalar control* on page *62*. | 65535 |
| 99.05 | MOTOR NOM VOLTAGE | Defines the nominal motor voltage. Must be equal to the value on the motor rating plate. | |
| | 1/2 … 2 · UN | Voltage. Allowed range is 1/2 … 2 · $U_N$ of the drive.<br>**Note:** The stress on the motor insulations is always dependent on the drive supply voltage. This also applies to the case where the motor voltage rating is lower than the rating of the drive and the supply of the drive. | 1 = 1 V |
| 99.06 | MOTOR NOM CURRENT | Defines the nominal motor current. Must be equal to the value on the motor rating plate. If several motors are connected to the inverter, enter the total current of the motors.<br>**Note:** Correct motor run requires that the magnetizing current of the motor does not exceed 90 percent of the nominal current of the inverter. | |
| | 0 … 2 · $I_{2hd}$ | Allowed range: approx. 1/6 … 2 · $I_{2hd}$ of ACS800 (parameter 99.04 = DTC).<br>Allowed range: approx. 0 … 2 · $I_{2hd}$ of ACS800 (parameter 99.04 = SCALAR). | 1 = 0.1 A |
| 99.07 | MOTOR NOM FREQ | Defines the nominal motor frequency. | |
| | 8 … 300 Hz | Nominal frequency (50 or 60 Hz typically) | 800 … 30000 |
| 99.08 | MOTOR NOM SPEED | Defines the nominal motor speed. Must be equal to the value on the motor rating plate. The motor synchronous speed or another approximate value must not be given instead!<br>**Note:** If the value of parameter 99.08 is changed, the speed limits in parameter group 20 LIMITS change automatically as well. | |
| | 1 … 18000 rpm | Nominal motor speed | 1 … 18000 |
| 99.09 | MOTOR NOM POWER | Defines the nominal motor power. Set exactly as on the motor rating plate. If several motors are connected to the inverter, enter the total power of the motors. | |
| | 0 … 9000 kW | Nominal motor power | 0 … 90000 |

| Index | Name/Selection | Description | FbEq |
|---|---|---|---|
| 99.10 | MOTOR ID RUN MODE | Selects the type of the motor identification. During the identification, the drive will identify the characteristics of the motor for optimum motor control. The ID Run Procedure is described in chapter *Start-up and control through the I/O*.<br>**Note:** The ID Run (STANDARD or REDUCED) should be selected if:<br>- The operation point is near zero speed, and/or<br>- Operation at torque range above the motor nominal torque within a wide speed range and without any measured speed feedback is required.<br>**Note:** The ID Run (STANDARD or REDUCED) cannot be performed if parameter 99.04 = SCALAR.<br>See section *Motor identification* on page *53*. | |
| | ID MAGN | No ID Run. The motor model is calculated at first start by magnetising the motor for 20 to 60 s at zero speed. This can be selected in most applications. | 1 |
| | STANDARD | Standard ID Run. Guarantees the best possible control accuracy. The ID Run takes about one minute.<br>**Note:** The motor must be de-coupled from the driven equipment.<br>**Note:** Check the direction of rotation of the motor before starting the ID Run. During the run, the motor will rotate in the forward direction.<br>**WARNING!** The motor will run at up to approximately 50 … 80% of the nominal speed during the ID Run. ENSURE THAT IT IS SAFE TO RUN THE MOTOR BEFORE PERFORMING THE ID RUN! | 2 |
| | REDUCED | Reduced ID Run. Should be selected instead of the Standard ID Run:<br>- if mechanical losses are higher than 20% (i.e. the motor cannot be de-coupled from the driven equipment)<br>- if flux reduction is not allowed while the motor is running (i.e. in case of a motor with an integrated brake supplied from the motor terminals).<br>**Note:** Check the direction of rotation of the motor before starting the ID Run. During the run, the motor will rotate in the forward direction.<br>**WARNING!** The motor will run at up to approximately 50 … 80% of the nominal speed during the ID Run. ENSURE THAT IT IS SAFE TO RUN THE MOTOR BEFORE PERFORMING THE ID RUN! | 3 |
| 99.11 | DEVICE NAME | Defines the name for the drive or application. The name is visible on the control panel display in the Drive Selection Mode. **Note:** The name can be typed only by using a drive PC tool. | |

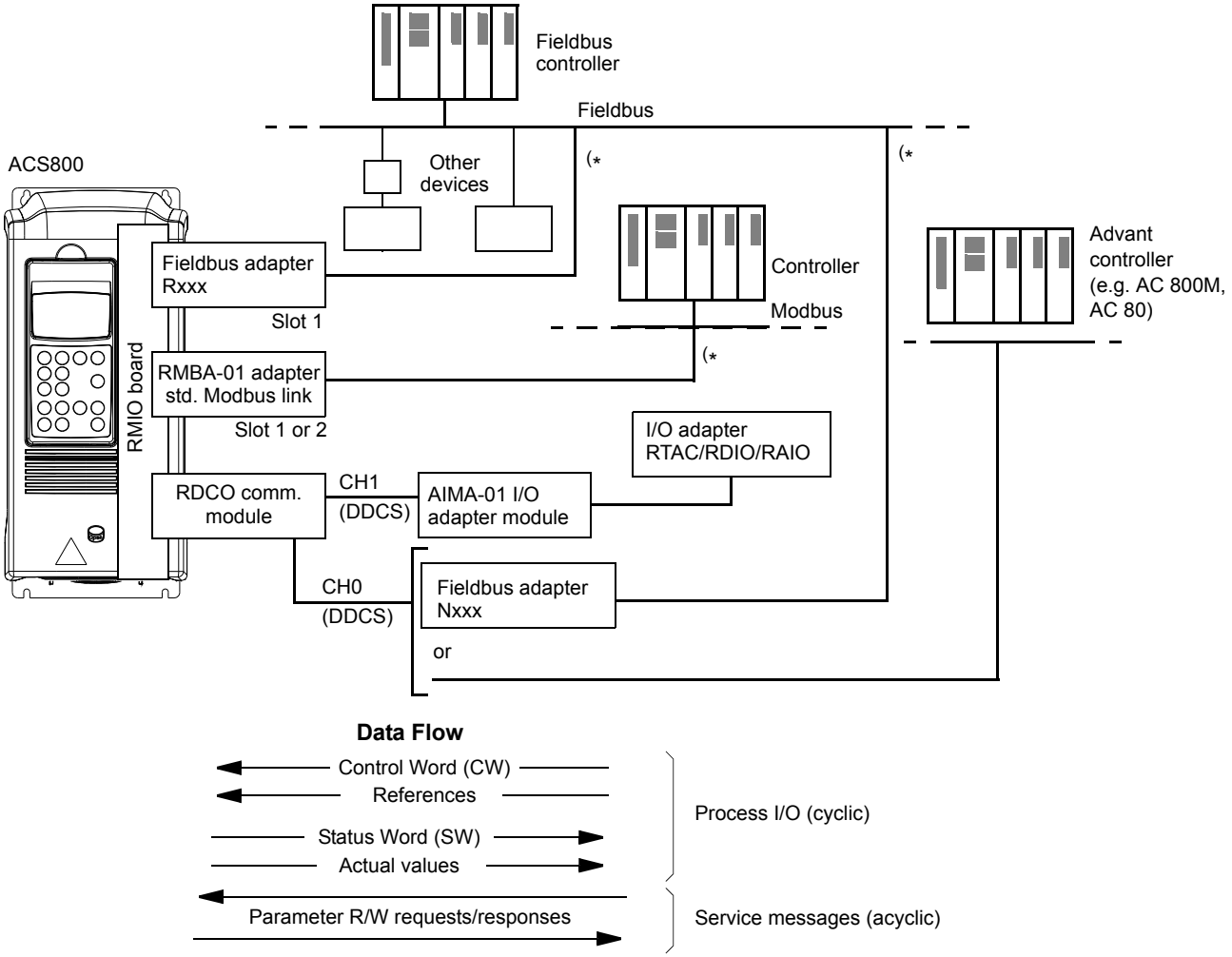
# Fieldbus control

## Chapter overview

The chapter describes how the drive can be controlled by external devices over a communication network.

## System overview

The drive can be connected to an external control system – usually a fieldbus controller – via an adapter module. The drive can be set to receive all of its control information through the external control interface, or the control can be distributed between the external control interface and other available sources, for example digital and analogue inputs. The following diagram shows the control interfaces and I/O connections of the drive.

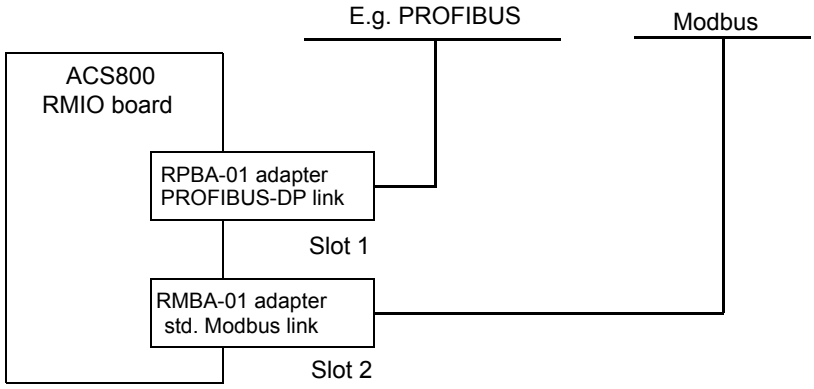



(* Either an Rxxx **or** Nxxx, **and** an RMBA-01 adapter can be connected to the drive simultaneously.

### Redundant fieldbus control

It is possible to connect two fieldbuses to the drive with the following adapter configuration:

- Type Rxxx fieldbus adapter module (not RMBA-01) is installed in drive slot 1.
- RMBA-01 Modbus Adapter module is installed in drive slot 2.




The control (i.e. the Main Reference data set, see section *The fieldbus control interface* on page *202*) is activated by setting parameter 98.02 to FIELDBUS or STD MODBUS.

In case there is a communication problem with one fieldbus, the control can be switched to the other fieldbus. Switching between the buses can be controlled e.g. with adaptive programming. Parameters and signals can be read by both fieldbuses, but simultaneous cyclical writing to the same parameter is forbidden.

## Setting up communication through a fieldbus adapter module

Fieldbus adapters for several communication protocols are available (e.g. PROFIBUS® and Modbus®). Rxxx type fieldbus adapter modules are mounted in expansion slot 1 of the drive. Nxxx type fieldbus adapter modules are connected to channel CH0 of the RDCO module.

**Note:** For instructions on setting up an RMBA-01 module, see section *Setting up communication through the Standard Modbus Link* on page *195*.

Before configuring the drive for fieldbus control, the adapter module must be mechanically and electrically installed according to the instructions given in the hardware manual of the drive, and the module manual.

The following table lists the parameters which need to be defined when setting up communication through a fieldbus adapter.

| Parameter | Alternative settings | Setting for fieldbus control | Function/Information |
|---|---|---|---|
| COMMUNICATION INITIALISATION | | | |
| 98.02 | NO<br>FIELDBUS<br>ADVANT<br>STD MODBUS<br>CUSTOMISED | FIELDBUS | Initialises communication between drive and fieldbus adapter module. Activates module set-up parameters (Group 51). |
| 98.07 | ABB DRIVES<br>GENERIC<br>CSA 2.8/3.0 | ABB DRIVES<br>GENERIC or<br>CSA 2.8/3.0 | Selects the communication profile used by the drive. See section *Communication profiles* on page *210*. |
| ADAPTER MODULE CONFIGURATION | | | |
| 51.01 MODULE TYPE | – | – | Displays the type of the fieldbus adapter module. |
| 51.02 (FIELDBUS PARAMETER 2) | These parameters are adapter module-specific. For more information, see the module manual. Note that not all of these parameters are necessarily visible. | | |
| • • • | | | |
| 51.26 (FIELDBUS PARAMETER 26) | | | |
| 51.27 FBA PAR REFRESH* | **(0)** DONE<br>**(1)** REFRESH | – | Validates any changed adapter module configuration parameter settings. After refreshing, the value reverts automatically to DONE. |
| 51.28 FILE CPI FW REV* | xyz (binary coded decimal | – | Displays the required CPI firmware revision of the fieldbus adapter as defined in the configuration file stored in the memory of the drive. The CPI firmware version of the fieldbus adapter (refer to par. 51.32) must contain the same or a later CPI version to be compatible. **x** = major revision number; **y** = minor revision number; **z** = correction number. Example: **107** = revision 1.07. |

| Parameter | Alternative settings | Setting for fieldbus control | Function/Information |
|---|---|---|---|
| 51.29 FILE CONFIG ID* | xyz (binary coded decimal) | – | Displays the fieldbus adapter module configuration file identification stored in the memory of the drive. This information is drive application program-dependent. |
| 51.30 FILE CONFIG REV* | xyz (binary coded decimal) | – | Displays the fieldbus adapter module configuration file revision stored in the memory of the drive. **x** = major revision number; **y** = minor revision number; **z** = correction number. Example: **1** = revision 0.01. |
| 51.31 FBA STATUS* | **(0)** IDLE<br>**(1)** EXEC. INIT<br>**(2)** TIME OUT<br>**(3)** CONFIG ERROR<br>**(4)** OFF-LINE<br>**(5)** ON-LINE<br>**(6)** RESET | – | Displays the status of the adapter module.<br>IDLE = Adapter not configured.<br>EXEC. INIT = Adapter initialising.<br>TIME OUT = A timeout has occurred in the communication between the adapter and the drive.<br>CONFIG ERROR = Adapter configuration error. The major or minor revision code of the CPI program revision in the drive is not the revision required by the module (refer to par. 51.32) or configuration file upload has failed more than five times.<br>OFF-LINE = Adapter is off-line.<br>ON-LINE = Adapter is on-line.<br>RESET = Adapter performing a hardware reset. |
| 51.32 FBA CPI FW REV* | – | – | Displays the CPI program revision of the module inserted in slot 1. **x** = major revision number; **y** = minor revision number; **z** = correction number. Example: **107** = revision 1.07. |
| 51.33 FBA APPL FW REV* | – | – | Displays the application program revision of the module inserted in slot 1. **x** = major revision number; **y** = minor revision number; **z** = correction number. Example: **107** = revision 1.07. |

*Parameters 51.27 to 51.33 are only visible when type Rxxx fieldbus adapter is installed.

After the module configuration parameters in group 51 have been set, the drive control parameters (section *Drive control parameters* on page *199*) must be checked and adjusted where necessary.

The new settings will take effect when the drive is next powered up, or when parameter 51.27 is activated.

## Setting up communication through the Standard Modbus Link

An RMBA-01 Modbus Adapter installed in slot 1 or 2 of the drive forms an interface called the Standard Modbus Link. The Standard Modbus Link can be used for external control of the drive by a Modbus controller (RTU protocol only).

Before configuring the drive for Modbus control, the adapter module must be mechanically and electrically installed according to the instructions given in the hardware manual of the drive, and the module manual.

The following table lists the parameters, which need to be defined when setting up communication through the standard Modbus link.

| Parameter | Alternative settings | Setting for control through Standard Modbus Link | Function/Information |
|---|---|---|---|
| COMMUNICATION INITIALISATION | | | |
| 98.02 | NO<br>FIELDBUS<br>ADVANT<br>STD MODBUS<br>CUSTOMISED | STD MODBUS | Initialises communication between drive (Standard Modbus Link) and Modbus-protocol controller. Activates communication parameters in group 52. |
| 98.07 | ABB DRIVES<br>GENERIC<br>CSA 2.8/3.0 | ABB DRIVES | Selects the communication profile used by the drive. See section *Communication profiles* on page *210*. |
| COMMUNICATION PARAMETERS | | | |
| 52.01 | 1 to 247 | – | Specifies the station number of the drive on the Standard Modbus Link. |
| 52.02 | 600<br>1200<br>2400<br>4800<br>9600<br>19200 | – | Defines the communication speed for the Standard Modbus Link. |
| 52.03 | ODD<br>EVEN<br>NONE1STOPBIT<br>NONE2STOPBIT | – | Selects the parity setting for the Standard Modbus Link. |

After the communication parameters in group 52 have been set, the drive control parameters (section *Drive control parameters* on page *199*) must be checked and adjusted where necessary.

*Modbus addressing*

In the Modbus controller memory, the Control Word, the Status Word, the references, and the actual values are mapped as follows:

| **Data from fieldbus controller to drive** | |
|---|---|
| **Address** | **Contents** |
| 40001 | Control Word |
| 40002 | Reference 1 |
| 40003 | Reference 2 |
| 40007 | Reference 3 |
| 40008 | Reference 4 |
| 40009 | Reference 5 |

| **Data from drive to fieldbus controller** | |
|---|---|
| **Address** | **Contents** |
| 40004 | Status Word |
| 40005 | Actual 1 |
| 40006 | Actual 2 |
| 40010 | Actual 3 |
| 40011 | Actual 4 |
| 40012 | Actual 5 |

More information on Modbus communication is available from the Modicon website http://www.modicon.com.

## Setting up communication through Advant controller

The Advant controller is connected via DDCS link to channel CH0 of the RDCO module.

- **AC 800M Advant Controller**

DriveBus connection: CI858 DriveBus Communication Interface required. See CI858 DriveBus Communication Interface User's Manual, [3AFE 68237432 (English)].

Optical ModuleBus connection: TB811 (5 MBd) or TB810 (10 MBd) Optical ModuleBus Port Interface required. See section *Optical ModuleBus connection* below.

For more information, see *AC 800M Controller Hardware Manual* [3BSE027941 (English)], *AC 800M/C Communication, Protocols and Design Manual* [3BSE028811 (English),] ABB Industrial Systems, Västerås, Sweden.

- **AC 80 Advant Controller**

Optical ModuleBus connection: TB811 (5 MBd) or TB810 (10 MBd) Optical ModuleBus Port Interface required. See section *Optical ModuleBus connection* below.

- **CI810A Fieldbus Communication Interface (FCI)**

Optical ModuleBus connection

TB811 (5 MBd) or TB810 (10 MBd) Optical ModuleBus Port Interface required.

The TB811 Optical ModuleBus Port Interface is equipped with 5 MBd optical components and the TB810 is equipped with 10 MBd components. All optical components on a fibre optic link must be of the same type since 5 MBd components do not match with 10 MBd components. The choice between TB810 and TB811 depends on the equipment it is connected to. With RDCO Communication Option Module, the Interface is selected as follows:

| Optional ModuleBus Port Interface | DDCS Communication Option Module | | |
|---|---|---|---|
| | RDCO-01 | RDCO-02 | RDCO-03 |
| TB811 | | × | × |
| TB810 | × | | |

If branching unit NDBU-85/95 is used with CI810A, TB810 Optical ModuleBus Port Interface must be used.

The following table lists the parameters which need to be defined when setting up communication between the drive and Advant controller.

| Parameter | Alternative settings | Setting for control through CH0 | Function/Information |
|---|---|---|---|
| COMMUNICATION INITIALISATION | | | |
| 98.02 | NO<br>FIELDBUS<br>ADVANT<br>STD MODBUS<br>CUSTOMISED | ADVANT | Initialises communication between drive (fibre optic channel CH0) and Advant controller. The transmission speed is 4 Mbit/s. |
| 98.07 | ABB DRIVES<br>GENERIC<br>CSA 2.8/3.0 | ABB DRIVES | Selects the communication profile used by the drive. See section *Communication profiles* on page *210*. |
| 70.01 | 0-254 | AC 800M ModuleBus ⏏ 1...125<br>AC 80 ModuleBus ⏏ 17-125<br>FCI (CI810A) ⏏ 17-125 | Defines the node address for DDCS channel CH0. |
| 70.04 | RING<br>STAR | | Selects the topology of the channel CH0 link. |

After the communication initialisation parameters have been set, the drive control parameters (section *Drive control parameters* on page *199*) must be checked and adjusted where necessary.

**In an Optical ModuleBus connection,** channel 0 address (parameter 70.01) is calculated from the value of the POSITION terminal in the appropriate database element (for the AC 80, DRISTD) as follows:

1. Multiply the hundreds of the value of POSITION by 16.

2. Add the tens and ones of the value of POSITION to the result.

For example, if the POSITION terminal of the DRISTD database element has the value of 110 (the tenth drive on the Optical ModuleBus ring), parameter 70.01 must be set to 16 × 1 + 10 = 26.

## Drive control parameters

After the fieldbus communication has been set up, the drive control parameters listed in the table below must be checked and adjusted where necessary.

The **Setting for fieldbus control** column gives the value to use when the fieldbus interface is the desired source or destination for that particular signal. The **Function/Information** column gives a description of the parameter.

The fieldbus signal routes and message composition are explained later in section *The fieldbus control interface* on page *202*.

| Parameter | Setting for fieldbus control | Function/Information |
|---|---|---|
| CONTROL COMMAND SOURCE SELECTION | | |
| 10.01 | COMM.CW | Enables the fieldbus Control Word (except 03.01 Main Control Word bit 11) when EXT1 is selected as the active control location. See also par. 10.07. |
| 10.02 | COMM.CW | Enables the fieldbus Control Word (except 03.01 Main Control Word bit 11) when EXT2 is selected as the active control location. |
| 10.03 | FORWARD<br>REVERSE or<br>REQUEST | Enables rotation direction control as defined by parameters 10.01 and 10.02. The direction control is explained in section *Reference handling* on page *204*. |
| 10.07 | 0 or 1 | Setting the value to 1 overrides the setting of par. 10.01 so that the fieldbus Control Word (except 03.01 Main Control Word bit 11) is enabled when EXT1 is selected as the active control location.<br>**Note 1:** Only visible with the Generic Drive communication profile selected (see par. 98.07).<br>**Note 2:** Setting not saved into permanent memory. |
| 10.08 | 0 or 1 | Setting the value to 1 overrides the setting of par. 11.03 so that Fieldbus reference REF1 is used when EXT1 is selected as the active control location.<br>**Note 1:** Only visible with the Generic Drive communication profile selected (see par. 98.07).<br>**Note 2:** Setting not saved into permanent memory. |
| 11.02 | COMM.CW | Enables EXT1/EXT2 selection by fieldbus Control Word bit 11 EXT CTRL LOC. |
| 11.03 | COMM.REF1<br>FAST COMM<br>COM.REF1+AI1<br>COM.REF1+AI5<br>COM.REF1*AI1 or<br>COM.REF1*AI5 | Fieldbus reference REF1 is used when EXT1 is selected as the active control location. See section *References* on page *203* for information on the alternative settings. |
| 11.06 | COMM.REF2<br>FAST COMM<br>COM.REF2+AI1<br>COM.REF2+AI5<br>COM.REF2*AI1 or<br>COM.REF2*AI5 | Fieldbus reference REF2 is used when EXT2 is selected as the active control location. See section *References* on page *203* for information on the alternative settings. |

| Parameter | Setting for fieldbus control | Function/Information |
|---|---|---|
| OUTPUT SIGNAL SOURCE SELECTION | | |
| 14.01 | COM.REF3 | Enables relay output RO1 control by fieldbus reference REF3 bit 13. |
| 14.02 | COM.REF3 | Enables relay output RO2 control by fieldbus reference REF3 bit 14. |
| 14.03 | COM.REF3 | Enables relay output RO3 control by fieldbus reference REF3 bit 15. |
| 15.01 | COMM.REF4 | Directs the contents of fieldbus reference REF4 to analogue output AO1. **Scaling**: 20000 = 20 mA |
| 15.06 | COMM.REF5 | Directs the contents of fieldbus reference REF5 to analogue output AO2. **Scaling:** 20000 = 20 mA. |
| SYSTEM CONTROL INPUTS | | |
| 16.01 | COMM.CW | Enables the control of the Run Enable signal through fieldbus 03.01 Main Control Word bit 3.<br>**Note:** Must be set to YES when the Generic Drive communication profile is selected (see par. 98.07). |
| 16.04 | COMM.CW | Enables fault reset through fieldbus 03.01 Main Control Word bit 7.<br>**Note:** Reset through fieldbus Control Word (03.01 bit 7) is enabled automatically and it is independent of parameter 16.04 setting if parameter 10.01 or 10.02 is set to COMM.CW. |
| 16.07 | DONE; SAVE | Saves parameter value changes (including those made through fieldbus control) to permanent memory. |
| COMMUNICATION FAULT FUNCTIONS | | |
| 30.18 | FAULT<br>NO CONST SP15<br>LAST SPEED | Determines drive action in case fieldbus communication is lost.<br>**Note:** The communication loss detection is based on monitoring of received Main and Auxiliary data sets (whose sources are selected with parameters 90.04 and 90.05 respectively). |
| 30.19 | 0.1 … 60.0 s | Defines the time between Main Reference data set loss detection and the action selected with parameter 30.18. |
| 30.20 | ZERO<br>LAST VALUE | Determines the state in which relay outputs RO1 to RO3 and analogue outputs AO1 and AO2 are left upon loss of the Auxiliary Reference data set. |
| 30.21 | 0.0 … 60.0 s | Defines the time between Auxiliary Reference data set loss detection and the action selected with parameter 30.18.<br>**Note:** This supervision function is disabled if this parameter, or parameters 90.01, 90.02 and 90.03 are set to 0. |
| FIELDBUS REFERENCE TARGET SELECTION | | |
| 90.01 | 0 … 8999 | Defines the drive parameter into which the value of fieldbus reference REF3 is written.<br>**Format: xxyy**, where **xx** = parameter group (10 to 89), **yy** = parameter Index. E.g. **3001** = parameter 30.01. |

| Parameter | Setting for fieldbus control | Function/Information |
|---|---|---|
| 90.02 | 0 … 8999 | Defines the drive parameter into which the value of fieldbus reference REF4 is written.<br>**Format:** see parameter 90.01. |
| 90.03 | 0 … 8999 | Defines the drive parameter into which the value of fieldbus reference REF5 is written.<br>**Format:** see parameter 90.01. |
| 90.04 | 1 (Fieldbus Control) or 81 (Standard Modbus Control) | If 98.02 is set to CUSTOMISED, this parameter selects the source from which the drive reads the Main Reference data set (comprising the fieldbus Control Word, fieldbus reference REF1, and fieldbus reference REF2). |
| 90.05 | 3 (Fieldbus Control) or 83 (Standard Modbus Control) | If 98.02 is set to CUSTOMISED, this parameter selects the source from which the drive reads the Auxiliary Reference data set (comprising fieldbus references REF3, REF4 and REF5). |
| ACTUAL SIGNAL SELECTION FOR FIELDBUS | | |
| 92.01 | 302 (Fixed) | The Status Word is transmitted to as the first word of the Main Actual Signal data set. |
| 92.02 | 0 … 9999 | Selects the Actual signal or parameter value to be transmitted as the second word (ACT1) of the Main Actual Signal data set.<br>**Format:** (**x**)**xyy,** where (**x**)**x** = actual signal group or parameter group, **yy** = actual signal or parameter index. E.g. **103** = actual signal 1.03 FREQUENCY; **2202** = parameter 22.02 ACCEL TIME 1.<br>**Note:** With the Generic Drive communication profile active (par. 98.07 = GENERIC), this parameter is fixed to **102** (actual signal 1.02 SPEED – in DTC motor control mode) or **103** (1.03 FREQUENCY – in Scalar mode). |
| 92.03 | 0 … 9999 | Selects the actual signal or parameter value to be transmitted as the third word (ACT2) of the Main Actual Signal data set.<br>**Format:** see parameter 92.02. |
| 92.04 | 0 … 9999 | Selects the actual signal or parameter value to be transmitted as the first word (ACT3) of the Auxiliary Actual Signal data set.<br>**Format:** see parameter 92.02. |
| 92.05 | 0 … 9999 | Selects the actual signal or parameter value to be transmitted as the second word (ACT4) of the Auxiliary Actual Signal data set.<br>**Format:** see parameter 92.02. |
| 92.06 | 0 … 9999 | Selects the actual signal or parameter value to be transmitted as the third word (ACT5) of the Auxiliary Actual Signal data set.<br>**Format:** see parameter 92.02. |
| 92.07 | -255.255.31…+255.255.31 / C.-32768 … C.32767 | Selects the address from which the 03.02 Main Status Word bit 10 is read from. |
| 92.08 | -255.255.31…+255.255.31 / C.-32768 … C.32767 | Selects the address from which the 03.02 Main Status Word bit 13 is read from. |
| 92.09 | -255.255.31…+255.255.31 / C.-32768 … C.32767 | Selects the address from which the 03.02 Main Status Word bit 14 is read from. |

## The fieldbus control interface

The communication between a fieldbus system and the drive employs *data sets.* One data set (abbreviated DS) consists of three 16-bit words called data words (DW). The Standard Control Program supports the use of four data sets, two in each direction.

The two data sets for controlling the drive are referred to as the Main Reference data set and the Auxiliary Reference data set. The sources from which the drive reads the Main and Auxiliary Reference data sets are defined by parameters 90.04 and 90.05 respectively. The contents of the Main Reference data set are fixed. The contents of the Auxiliary Reference data set can be selected using parameters 90.01, 90.02 and 90.03.

The two data sets containing actual information on the drive are referred to as the Main Actual Signal data set and the Auxiliary Actual Signal data set. The contents of both data sets are partly selectable with the parameters at group 92.

| **Data from fieldbus controller to drive** | | | |
|---|---|---|---|
| ***Index** | **Main Reference data set DS1** | | |
| 1 | 1st word | Control Word | (Fixed) |
| 2 | 2nd word | Reference 1 | (Fixed) |
| 3 | 3rd word | Reference 2 | (Fixed) |
| ***Index** | **Auxiliary Reference data set DS3** | | |
| 7 | 1st word | Reference 3 | Par. 90.01 |
| 8 | 2nd word | Reference 4 | Par. 90.02 |
| 9 | 3rd word | Reference 5 | Par. 90.03 |

| **Data from drive to fieldbus controller** | | | |
|---|---|---|---|
| ***Index** | **Main Actual Signal data set DS2** | | |
| 4 | 1st word | Status Word | (Fixed) |
| 5 | 2nd word | Actual 1 | **Par. 92.02 |
| 6 | 3rd word | Actual 2 | Par. 92.03 |
| ***Index** | **Aux. Actual Signal data set DS4** | | |
| 10 | 1st word | Actual 3 | Par. 92.04 |
| 11 | 2nd word | Actual 4 | Par. 92.05 |
| 12 | 3rd word | Actual 5 | Par. 92.06 |

*The index number is required when data word allocation to process data is defined via the fieldbus parameters at group 51. This function is dependent on the type of the fieldbus adapter.

**With the Generic Drive communication profile active, Actual 1 is fixed to actual signal 01.02 SPEED (in DTC motor control mode) or 01.03 FREQUENCY (in Scalar mode).

The update time for the Main Reference and Main Actual Signal data sets is 6 milliseconds; for the Auxiliary Reference and Auxiliary Actual Signal data sets, it is 100 milliseconds.

### The Control Word and the Status Word

The Control Word (CW) is the principal means of controlling the drive from a fieldbus system. It is effective when the active control location (EXT1 or EXT2, see parameters 10.01 and 10.02) is set to COMM.CW, or if par. 10.07 is set to 1 (with Generic Drive communication profile only).

The Control Word is sent by the fieldbus controller to the drive. The drive switches between its states according to the bit-coded instructions of the Control Word.

The Status Word (SW) is a word containing status information, sent by the drive to the fieldbus controller.

See section *Communication profiles* on page *210* for information on the composition of the Control Word and the Status Word.

### References

References (REF) are 16-bit signed integers. A negative reference (indicating reversed direction of rotation) is formed by calculating the two's complement from the corresponding positive reference value.

*Fieldbus reference selection and correction*

Fieldbus reference (called COM.REF in signal selection contexts) is selected by setting a Reference selection parameter – 11.03 or 11.06 – to COMM.REFx, FAST COMM, COM.REFx+AI1, COM.REFx+AI5, COM.REFx*AI1 or COM.REFx*AI5. (With Generic Drive communication profile, fieldbus reference is also selected when par. 10.08 is set to 1.) The latter four selections enable correction of the fieldbus reference using analogue inputs as shown below. (An optional RAIO-01 Analogue I/O Extension Module is required for use of Analogue input AI5).

COMM.REF1 (in 11.03) or COMM.REF2 (in 11.06)
The fieldbus reference is forwarded as such without correction.

FAST COMM
The fieldbus reference is forwarded as such without correction. The reference is read every 2 milliseconds if either of the following conditions is met:

- Control location is **EXT1**, par. 99.04 MOTOR CTRL MODE is **DTC**, and par. 40.14 TRIM MODE is **OFF**
- Control location is **EXT2**, par. 99.04 MOTOR CTRL MODE is **DTC**, par. 40.14 TRIM MODE is **OFF**, and a **torque reference** is used.

In any other event, the fieldbus reference is read every 6 milliseconds.

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**Note:** The FAST COMM selection disables the critical speed function.

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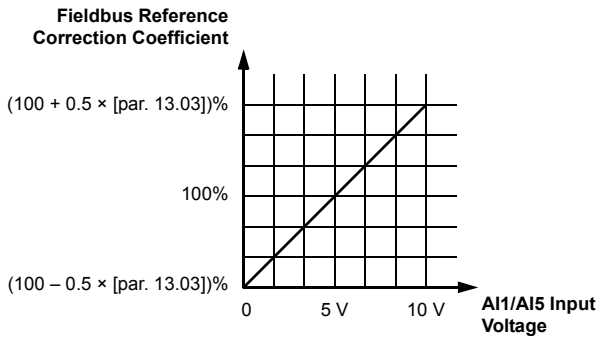
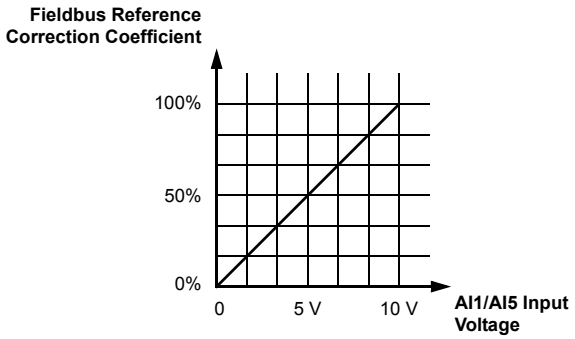
COM.REF1+AI1; COM.REF1+AI5; COM.REF1*AI1; COM.REF1*AI5 (in 11.03)
COM.REF2+AI1; COM.REF2+AI5; COM.REF2*AI1; COM.REF2*AI5 (in 11.06)
These selections enable the correction of the fieldbus reference as follows:

| Parameter Setting | Effect of AI1/AI5 Input Voltage on Fieldbus Reference |
|---|---|
| COM.REFx+AI1<br>COM.REFx+AI5 |  |
| COM.REFx*AI1<br>COM.REFx*AI5 |  |

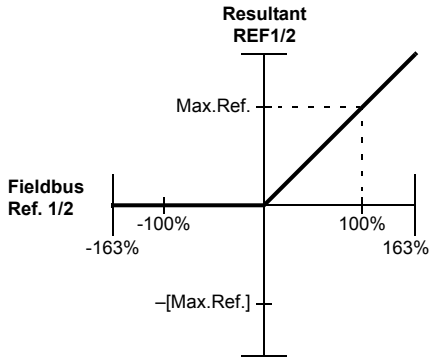
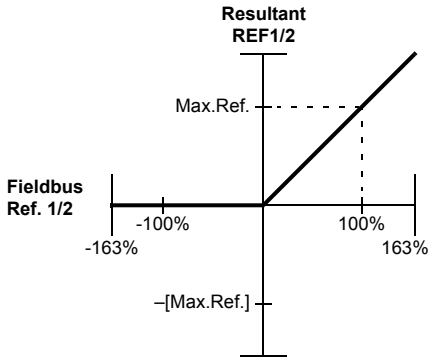
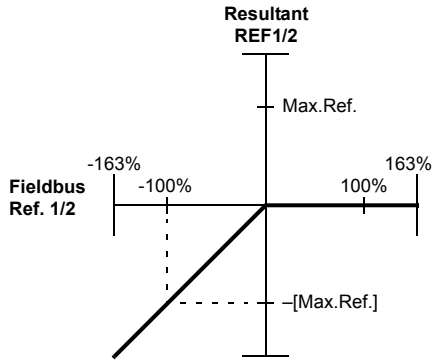
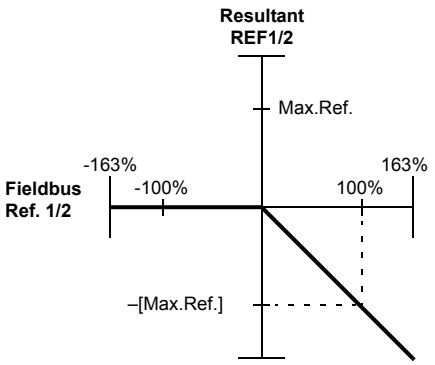
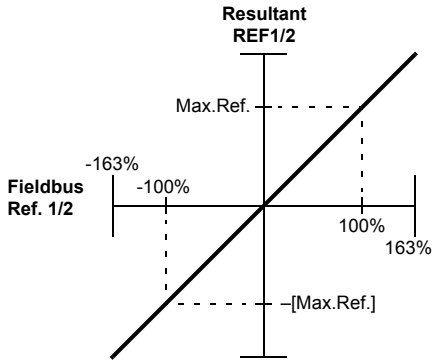
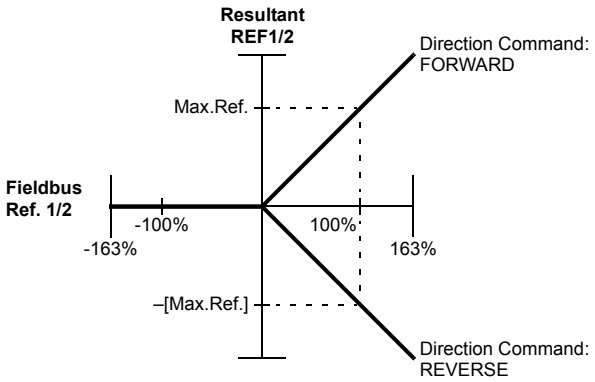
### Reference handling

The control of rotation direction is configured for each control location (EXT1 and EXT2) using the parameters in group 10. Fieldbus references are bipolar, i.e. they can be negative or positive. The following diagrams illustrate how group 10 parameters and the sign of the fieldbus reference interact to produce the reference REF1/REF2.

**Notes:**

- With the ABB Drives communication profile, 100% reference is defined by parameters 11.05 (REF1) and 11.08 (REF2).
- With the Generic Drive communication profile, 100% reference is defined by parameter 99.08 in DTC motor control mode (REF1), or 99.07 in scalar control mode (REF1), and by parameter 11.08 (REF2).
- External reference scaling parameters 11.04 and 11.07 are also in effect.

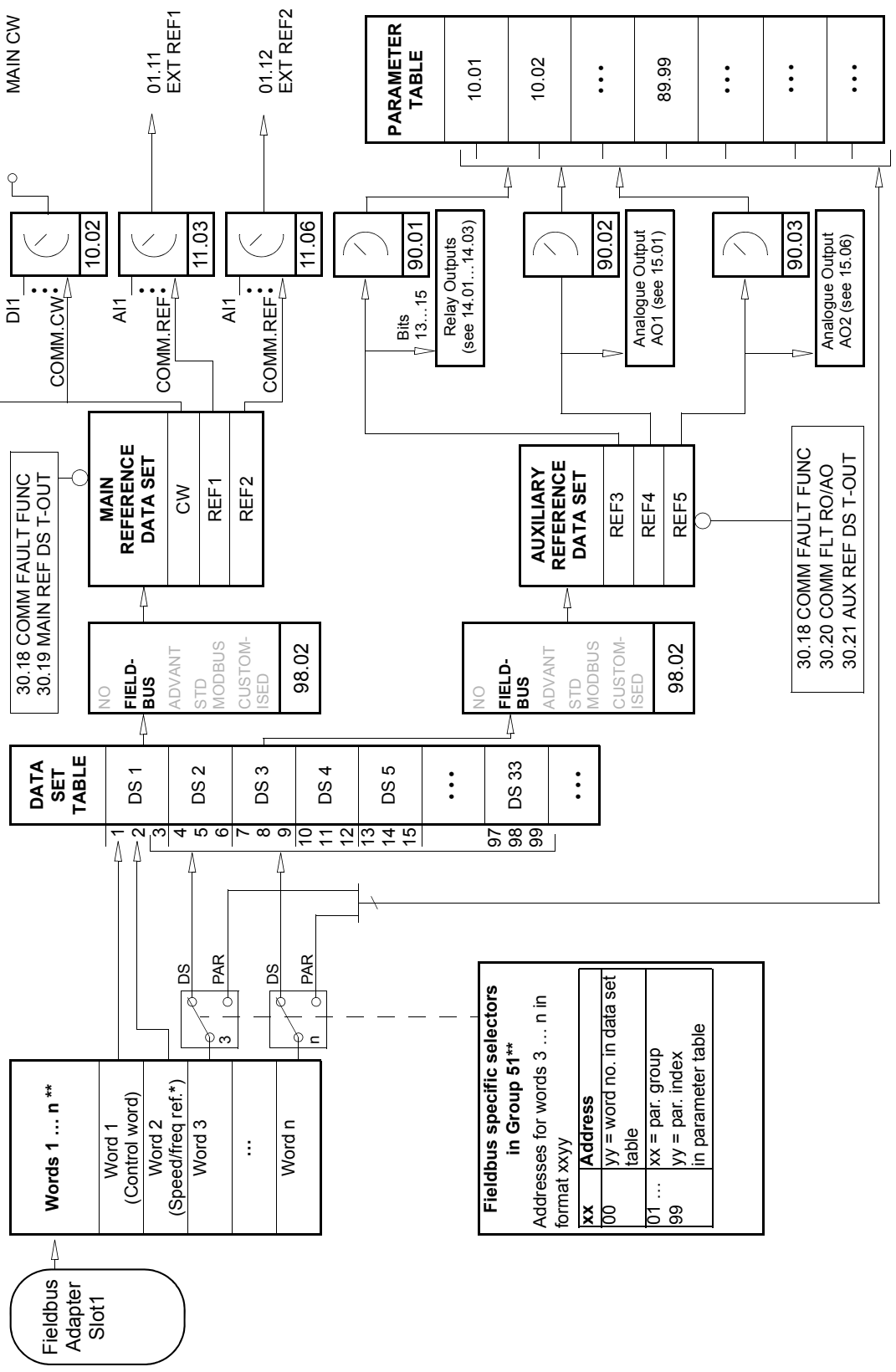
For information on the scaling of the fieldbus reference, see section *Fieldbus reference scaling* on page *214* (for ABB Drives profile) or *Fieldbus reference scaling* on page *217* (for Generic Drive profile).

| | *Direction determined by the sign of COM.REF | Direction determined by digital command, e.g. digital input, control panel |
|---|---|---|
| **par. 10.03 DIRECTION = FORWARD** |  |  |
| **par. 10.03 DIRECTION = REVERSE** |  |  |
| **par. 10.03 DIRECTION = REQUEST** |  |  |
| | *Direction is determined by the sign of COM.REF when<br>par. 10.01/10.02 EXTx STRT/STP/DIR is set to COMM.CW<br>OR<br>par. 11.03/11.06 EXT REFx SELECT is set to FAST COMM. | |

## Actual Values

Actual Values (ACT) are 16-bit words containing information on selected operations of the drive. The functions to be monitored are selected with the parameters in group 92. The scaling of the integers sent to the master as Actual Values depends on the selected function; please refer to chapter *Actual signals and parameters*.

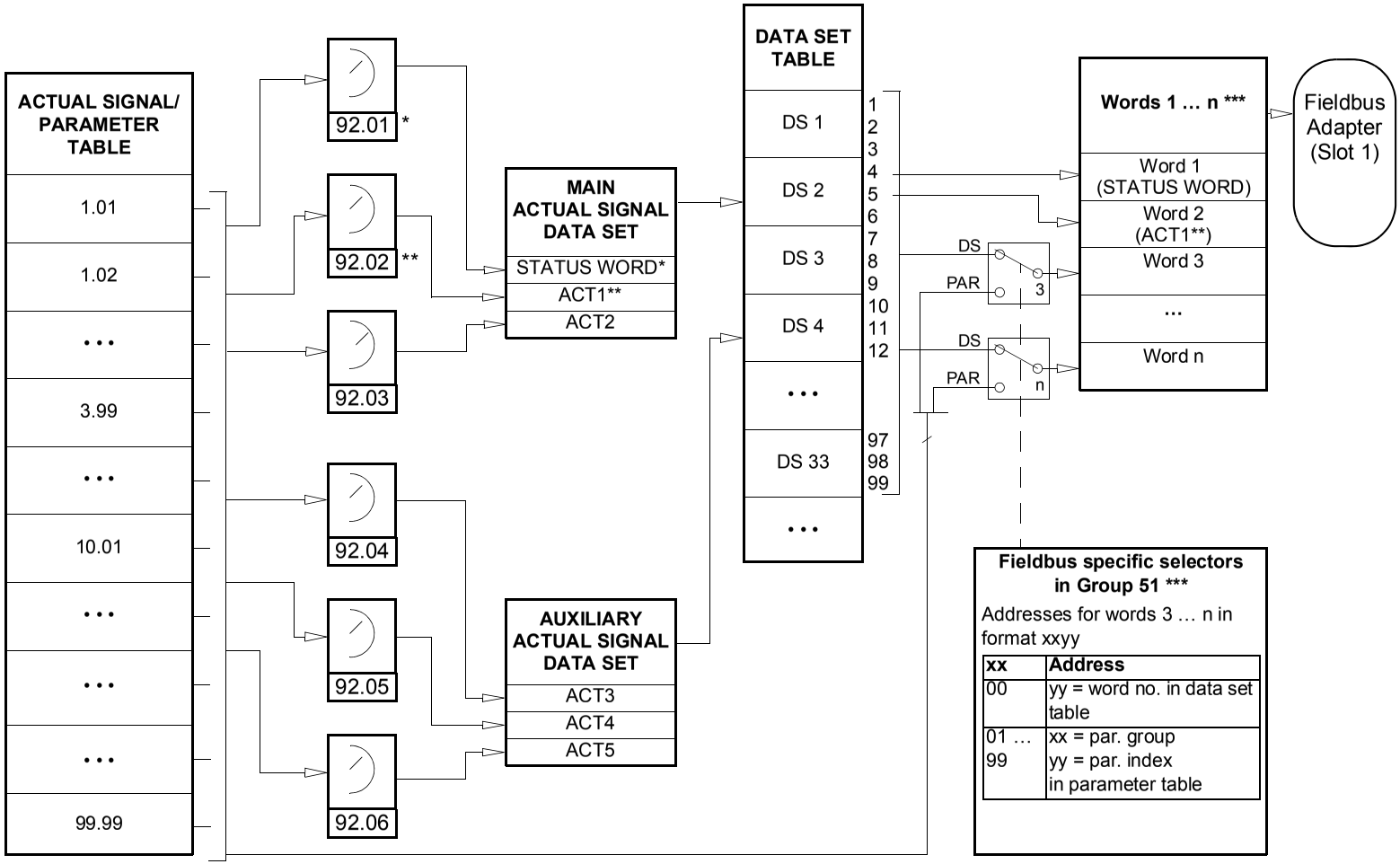
**Block diagram: Control data input from fieldbus when a type Rxxx fieldbus adapter is used**




* Depends on the selected motor control mode (parameter 99.04).

** See the fieldbus adapter user's manual for more information.

## Block diagram: Actual value selection for fieldbus when a type Rxxx fieldbus adapter is used

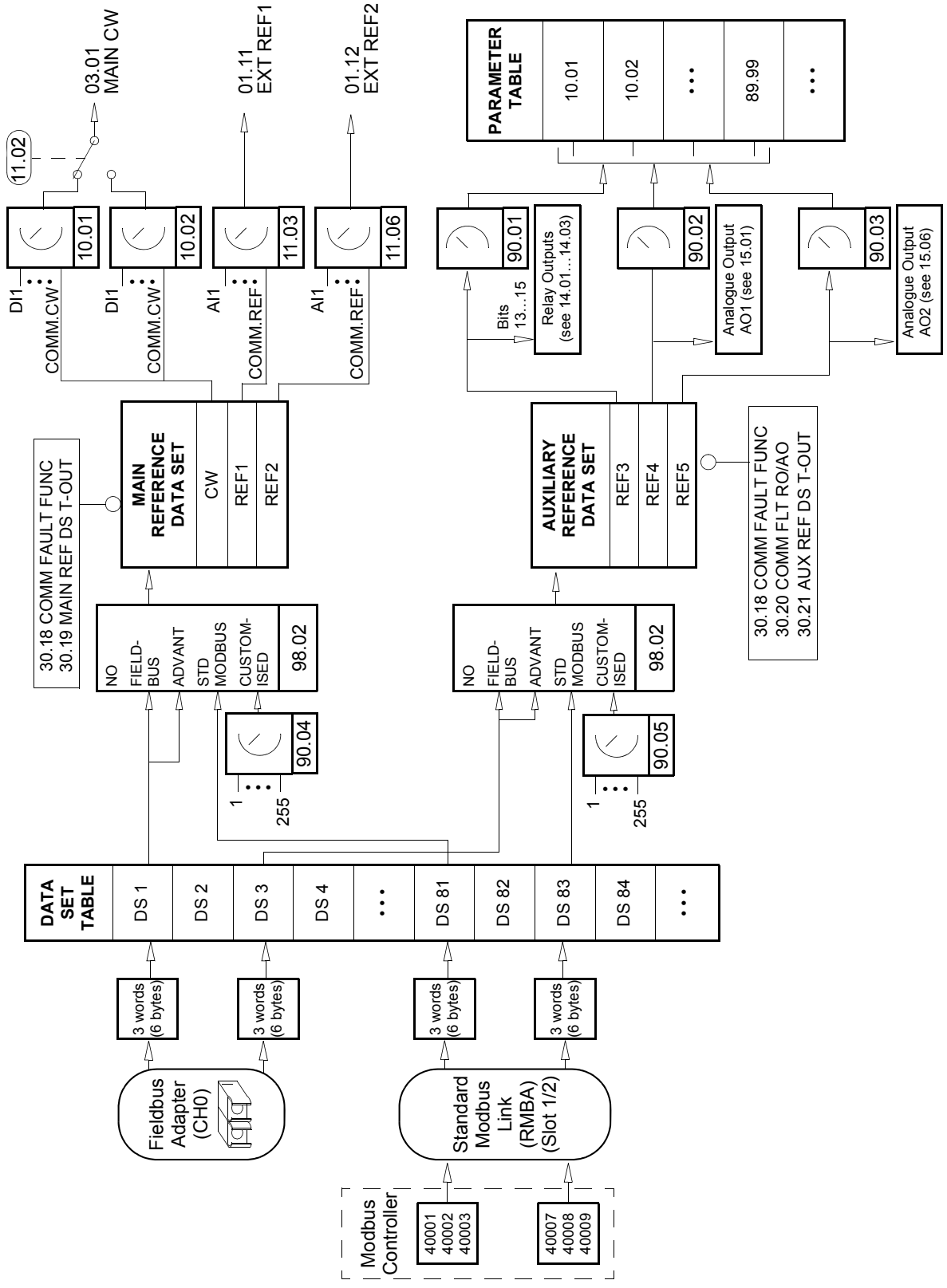



* Fixed to 03.02 MAIN STATUS WORD (bits 10, 13 and 14 are programmable).

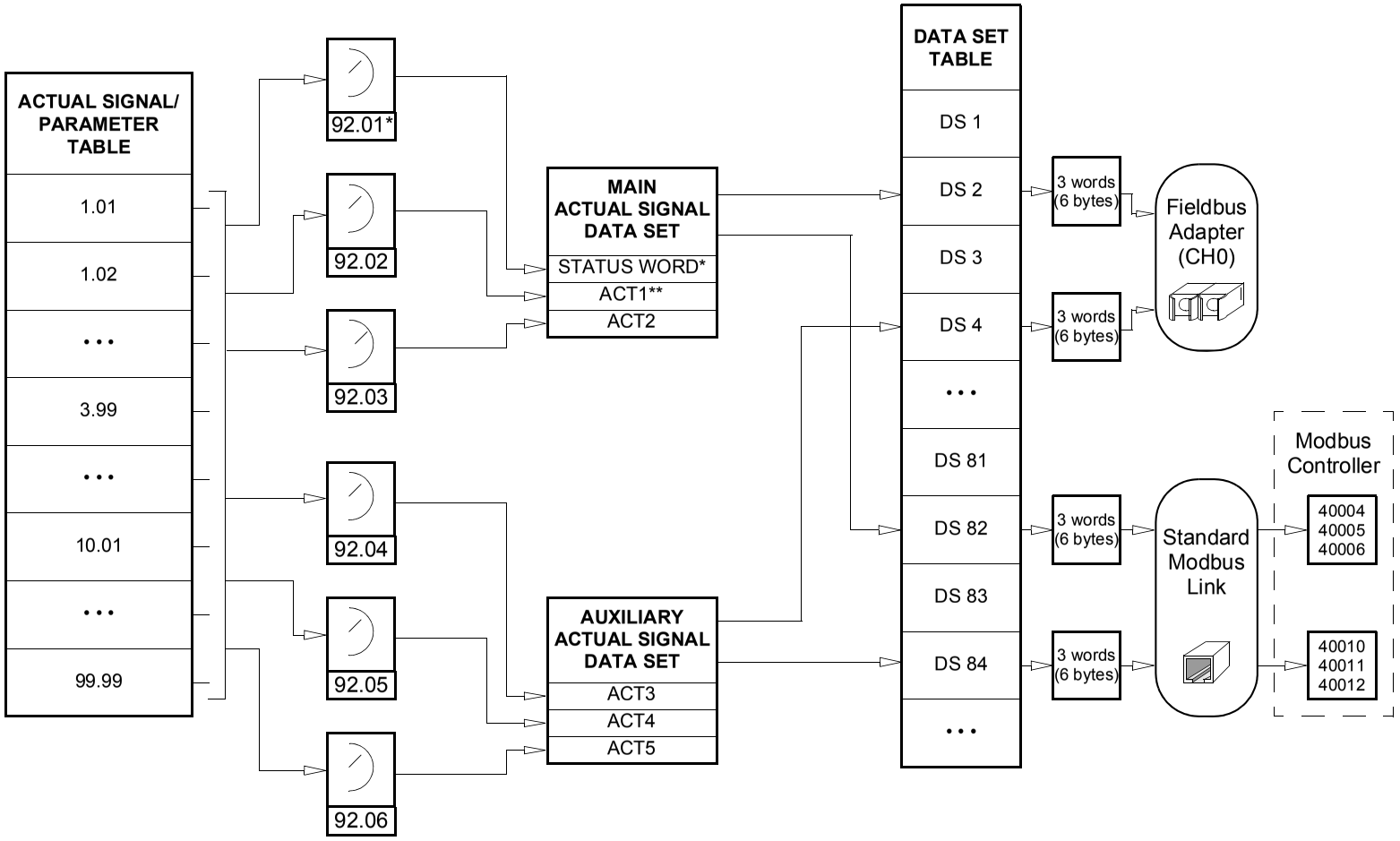
** Fixed to 01.02 SPEED (DTC control) or 01.03 FREQUENCY (Scalar control) when Generic communication profile is used.

*** See the fieldbus adapter user's manual for more information.

**Block diagram: Control data input from fieldbus when a type Nxxx fieldbus adapter is used**



## Block Diagram: Actual value selection for fieldbus when a type Nxxx fieldbus adapter is used




* Fixed to 03.02 MAIN STATUS WORD (bits 10, 13 and 14 are programmable).

** Fixed to 01.02 SPEED (DTC motor control) or 0103 FREQUENCY (Scalar control) when Generic communication profile is used.

## Communication profiles

The ACS800 supports three communication profiles:

- ABB Drives communication profile
- Generic Drive communication profile.
- CSA 2.8/3.0 communication profile.

The ABB Drives communication profile should be selected with type Nxxx fieldbus adapter modules, and when the manufacturer-specific mode is selected (via the PLC) with type Rxxx fieldbus adapter modules.

The Generic Drive profile is supported by type Rxxx fieldbus adapter modules only.

The CSA 2.8/3.0 communication profile can be selected for backward compatibility with Application Program versions 2.8 and 3.0. This eliminates the need for reprogramming the PLC when drives with the above-mentioned program versions are replaced.

### ABB Drives communication profile

The ABB Drives communication profile is active when parameter 98.07 is set to ABB DRIVES. The Control Word, Status Word, and reference scaling for the profile are described below.

The ABB Drives communication profile can be used through both EXT1 and EXT2. The Control Word commands are in effect when par. 10.01 or 10.02 (whichever control location is active) is set to COMM.CW.

### *03.01 MAIN CONTROL WORD*

The upper case boldface text refers to the states shown in Figure 1.

| Bit | Name | Value | Enter STATE/Description |
|---|---|---|---|
| 0 | OFF1 CONTROL | 1 | Enter **READY TO OPERATE.** |
| | | 0 | Stop along currently active deceleration ramp (22.03/22.05). Enter **OFF1 ACTIVE;** proceed to **READY TO SWITCH ON** unless other interlocks (OFF2, OFF3) are active. |
| 1 | OFF2 CONTROL | 1 | Continue operation (OFF2 inactive). |
| | | 0 | Emergency OFF, coast to stop.<br>Enter **OFF2 ACTIVE**; proceed to **SWITCH-ON INHIBITED.** |
| 2 | OFF3 CONTROL | 1 | Continue operation (OFF3 inactive). |
| | | 0 | Emergency stop, stop within time defined by par. 22.07. Enter **OFF3 ACTIVE**; proceed to **SWITCH-ON INHIBITED.**<br>**Warning:** Ensure motor and driven machine can be stopped using this stop mode. |
| 3 | INHIBIT_ OPERATION | 1 | Enter OPERATION ENABLED. (Note: The Run Enable signal must be active; see parameter 16.01. If par. 16.01 is set to COMM.CW, this bit also activates the Run Enable signal.) |
| | | 0 | Inhibit operation. Enter **OPERATION INHIBITED.** |
| 4 | RAMP_OUT_ ZERO | 1 | Normal operation.<br>Enter **RAMP FUNCTION GENERATOR: OUTPUT ENABLED.** |
| | | 0 | Force Ramp Function Generator output to zero.<br>Drive ramps to stop (current and DC voltage limits in force). |
| 5 | RAMP_HOLD | 1 | Enable ramp function.<br>Enter **RAMP FUNCTION GENERATOR: ACCELERATOR ENABLED.** |
| | | 0 | Halt ramping (Ramp Function Generator output held). |
| 6 | RAMP_IN_ ZERO | 1 | Normal operation. Enter **OPERATING.** |
| | | 0 | Force Ramp Function Generator input to zero. |
| 7 | RESET | 0 ⇒ 1 | Fault reset if an active fault exists. Enter **SWITCH-ON INHIBITED.** |
| | | 0 | Continue normal operation. |
| 8 | INCHING_1 | 1 | Not in use. |
| | | 1 ⇒ 0 | Not in use. |
| 9 | INCHING_2 | 1 | Not in use. |
| | | 1 ⇒ 0 | Not in use. |
| 10 | REMOTE_CMD | 1 | Fieldbus control enabled. |
| | | 0 | Control Word <> 0 or Reference <> 0: Retain last Control Word and Reference.<br>Control Word = 0 and Reference = 0: Fieldbus control enabled.<br>Reference and deceleration/acceleration ramp are locked. |
| 11 | EXT CTRL LOC | 1 | Select External Control Location EXT2. Effective if par. 11.02 is set to COMM.CW. |
| | | 0 | Select External Control Location EXT1. Effective if par. 11.02 is set to COMM.CW. |
| 12 … 15 | Reserved | | |

### 03.02 MAIN STATUS WORD

The upper case boldface text refers to the states shown in Figure 1.

| Bit | Name | Value | STATE/Description |
|---|---|---|---|
| 0 | RDY_ON | 1 | **READY TO SWITCH ON.** |
| | | 0 | **NOT READY TO SWITCH ON.** |
| 1 | RDY_RUN | 1 | **READY TO OPERATE.** |
| | | 0 | **OFF1 ACTIVE.** |
| 2 | RDY_REF | 1 | **OPERATION ENABLED.** |
| | | 0 | **OPERATION INHIBITED.** |
| 3 | TRIPPED | 1 | **FAULT.** |
| | | 0 | No fault. |
| 4 | OFF_2_STA | 1 | OFF2 inactive. |
| | | 0 | **OFF2 ACTIVE.** |
| 5 | OFF_3_STA | 1 | OFF3 inactive. |
| | | 0 | **OFF3 ACTIVE.** |
| 6 | SWC_ON_INHIB | 1 | **SWITCH-ON INHIBITED.** |
| | | 0 | |
| 7 | ALARM | 1 | Warning/Alarm. |
| | | 0 | No Warning/Alarm. |
| 8 | AT_SETPOINT | 1 | **OPERATING.** Actual value equals reference value (= is within tolerance limits i.e in speed control the speed error is less than or equal to 10% of the nominal motor speed). |
| | | 0 | Actual value differs from reference value (= is outside tolerance limits). |
| 9 | REMOTE | 1 | Drive control location: REMOTE (EXT1 or EXT2). |
| | | 0 | Drive control location: LOCAL. |
| 10 | ABOVE_LIMIT | 1 | Bit is read from the address defined by parameter 92.07 MSW B10 PTR.<br>The default value is signal 03.14 bit 9 ABOVE_LIMIT: Actual frequency or speed value equals or exceeds the supervision limit (par. 32.02). |
| | | 0 | Actual frequency or speed value is within supervision limit. |
| 11 | EXT CTRL LOC | 1 | External Control Location EXT2 selected. |
| | | 0 | External Control Location EXT1 selected. |
| 12 | EXT RUN ENABLE | 1 | External Run Enable signal received. |
| | | 0 | No External Run Enable received. |
| 13 | | | Bit is read from the address defined by parameter 92.08 MSW B13 PTR.<br>By default no address has been selected. |
| 14 | | | Bit is read from the address defined by parameter 92.09 MSW B14 PTR.<br>By default no address has been selected. |
| 15 | | 1 | Communication error detected by fieldbus adapter module (on fibre optic channel CH0). |
| | | 0 | Fieldbus adapter (CH0) communication OK. |

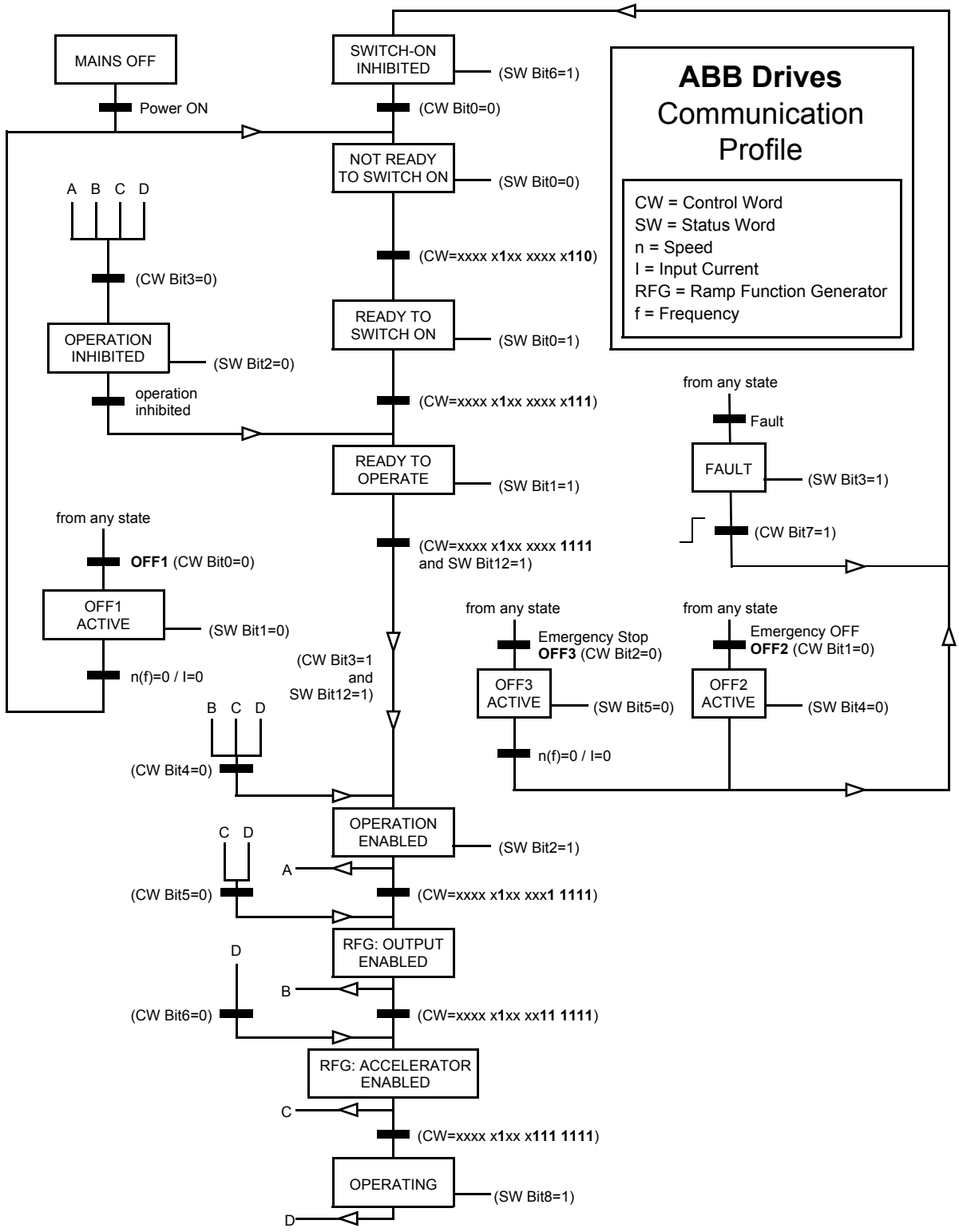



*Figure 1 State Machine for the ABB Drives communication profile.*

*Fieldbus reference scaling*

With the ABB Drives communication profile active, fieldbus references REF1 and REF2 are scaled as shown in the table below.

**Note:** Any correction of the reference is applied before scaling. See section *References* on page *203*.

| Ref. No. | Application Macro used (par. 99.02) | Range | Reference type | Scaling | Notes |
|---|---|---|---|---|---|
| REF1 | (any) | -32768 ... 32767 | Speed or Frequency (not with FAST COMM) | -20000 = **-[par. 11.05]**<br>-1 = **-[par. 11.04]**<br>0 = **[par. 11.04]**<br>20000 = **[par. 11.05]** | Final reference limited by 20.01/20.02 [speed] or 20.07/20.08 [frequency]. |
| | | | Speed or Frequency with FAST COMM | -20000 = **-[par. 11.05]**<br>0 = 0<br>20000 = **[par. 11.05]** | Final reference limited by 20.01/20.02 [speed] or 20.07/20.08 [frequency]. |
| REF2 | FACTORY, HAND/AUTO, or SEQ CTRL | -32768 ... 32767 | Speed or Freq. (not with FAST COMM) | -20000 = **-[par. 11.08]**<br>-1 = **-[par. 11.07]**<br>0 = **[par. 11.07]**<br>20000 = **[par. 11.08]** | Final reference limited by 20.01/20.02 [speed] or 20.07/20.08 [frequency]. |
| | | | Speed or Freq. with FAST COMM | -20000 = **-[par. 11.08]**<br>0 = 0<br>20000 = **[par. 11.08]** | Final reference limited by 20.01/20.02 [speed] or 20.07/20.08 [frequency]. |
| | T CTRL or M/F (optional) | -32768 ... 32767 | Torque (not with FAST COMM) | -10000 = **-[par. 11.08]**<br>-1 = **-[par. 11.07]**<br>0 = **[par. 11.07]**<br>10000 = **[par. 11.08]** | Final reference limited by par. 20.04. |
| | | | Torque with FAST COMM | -10000 = **-[par. 11.08]**<br>0 = 0<br>10000 = **[par. 11.08]** | Final reference limited by par. 20.04. |
| | PID CTRL | -32768 ... 32767 | PID Reference (not with FAST COMM) | -10000 = **-[par. 11.08]**<br>-1 = **-[par. 11.07]**<br>0 = **[par. 11.07]**<br>10000 = **[par. 11.08]** | |
| | | | PID Reference with FAST COMM | -10000 = **-[par. 11.08]**<br>0 = 0<br>10000 = **[par. 11.08]** | |

### Generic Drive communication profile

The Generic Drive communication profile is active when parameter 98.07 is set to GENERIC. The Generic Drive profile realises the device profile for drives – speed control only – as defined by specific fieldbus standards such as PROFIDRIVE for PROFIBUS, AC/DC Drive for DeviceNet™, Drives and Motion Control for CANopen®, etc. Each device profile specifies its Control and Status Words, Reference and Actual value scaling. The profiles also define Mandatory services which are transferred to the application interface of the drive in a standardised way.

The Generic Drive communication profile can be used through both EXT1 and EXT2*. The proper functioning of the Generic Drive profile requires that Control Word commands are enabled by setting parameter 10.01 or 10.02 (whichever control location is active) to COMM.CW (or par. 10.07 to 1) and by setting parameter 16.01 to YES.

*For vendor specific support of EXT2 reference, see appropriate fieldbus manual.

**Note:** The Generic Drive profile is only available with type Rxxx fieldbus adapter modules.

*Drive commands supported by the Generic Drive communication profile*

| Name | Description |
|---|---|
| STOP | The drive decelerates the motor to zero speed according to the active deceleration ramp (parameter 22.03 or 22.05). |
| START | The drive accelerates to the set reference value according to the active acceleration ramp (par. 22.02 or 22.04). The direction of rotation is determined by the sign of the reference value and the setting of par. 10.03. |
| COAST STOP | The drive coasts to stop, i.e. the drive stops modulating. However, this command can be overridden by the Brake Control function, which forces the drive to decelerate to zero speed by the active deceleration ramp. When the Brake Control function is active, Coast stop and Emergency coast stop (OFF2) commands given after the Emergency ramp stop (OFF3) coast the drive to a stop. |
| QUICK STOP | The drive decelerates the motor to zero speed within the emergency stop deceleration time defined by par. 22.07. |
| CURRENT LIMIT STOP (CLS) | The drive decelerates the motor to zero speed according to the set current limit (par. 20.03) or torque limit (20.04), whichever is first reached. The same procedure is valid in case of a Voltage Limit Stop (VLS). |
| INCHING1 | With this command active, the drive accelerates the motor to Constant Speed 12 (defined by par. 12.13). After the command is removed, the drive decelerates the motor to zero speed.<br>**Note:** The speed reference ramps are not effective. The speed change rate is only limited by the current (or torque) limit of the drive.<br>**Note:** Inching 1 takes priority over Inching 2.<br>**Note:** Not effective in Scalar control mode. |
| INCHING2 | With this command active, the drive accelerates the motor to Constant Speed 13 (defined by par. 12.14). After the command is removed, the drive decelerates the motor to zero speed.<br>**Note:** The speed reference ramps are not effective. The speed change rate is only limited by the current (or torque) limit of the drive.<br>**Note:** Inching 1 takes priority over Inching 2.<br>**Note:** Not effective in Scalar control mode. |
| RAMP OUT ZERO | When active, forces the output of the reference function generator to zero. |
| RAMP HOLD | When active, freezes the reference function generator output. |
| FORCED TRIP | Trips the drive. The drive will indicate fault FORCED TRIP. |
| RESET | Resets an active fault. |

*Fieldbus reference scaling*

With the Generic Drive communication profile active, the speed reference value received from the fieldbus and the actual speed value received from the drive are scaled as shown in the table below.

**Note:** Any correction of the reference (see section *References* on page *203*) is applied before scaling.

| Ref. No. | Application Macro used (par. 99.02) | Range | Reference type | Speed reference scaling | Actual speed scaling* | Notes |
|---|---|---|---|---|---|---|
| REF1 | (any) | -32768... 32767 | Speed or Frequency | 0 = 0<br>20000 = **[par. 99.08 (DTC) / 99.07 (scalar)]**** | 0 = 0<br>20000 = **[par. 99.08 (DTC) / 99.07 (scalar)]**** | |
| REF2 | FACTORY, HAND/AUT or SEQ CTRL | -32768... 32767 | Speed or Freq. (not with FAST COMM) | -20000 = **-[par. 11.08]**<br>-1 = **-[par. 11.07]**<br>0 = **[par. 11.07]**<br>20000 = **[par. 11.08]** | 0 = 0<br>20000 = **[par. 99.08 (DTC) / 99.07 (scalar)]**** | Final reference limited by 20.01/20.02 [speed] or 20.07/20.08 [frequency] |
| | | | Speed or Freq. with FAST COMM | -20000 = **-[par. 11.08]**<br>0 = 0<br>20000 = **[par. 11.08]** | 0 = 0<br>20000 = **[par. 99.08 (DTC) / 99.07 (scalar)]**** | Final reference limited by 20.01/20.02 [speed] or 20.07/20.08 [frequency] |
| | T CTRL or M/F (optional) | -32768... 32767 | Torque (not with FAST COMM) | -10000 = **-[par. 11.08]**<br>-1 = **-[par. 11.07]**<br>0 = **[par. 11.07]**<br>10000 = **[par. 11.08]** | 0 = 0<br>20000 = **[par. 99.08 (DTC) / 99.07 (scalar)]**** | Final reference limited by par. 20.04 |
| | | | Torque with FAST COMM | -10000 = **-[par. 11.08]**<br>0 = 0<br>10000 = **[par. 11.08]** | 0 = 0<br>20000 = **[par. 99.08 (DTC) / 99.07 (scalar)]**** | Final reference limited by par. 20.04 |
| | PID CTRL | -32768... 32767 | PID Reference (not with FAST COMM) | -10000 = **-[par. 11.08]**<br>-1 = **-[par. 11.07]**<br>0 = **[par. 11.07]**<br>10000 = **[par. 11.08]** | 0 = 0<br>20000 = **[par. 99.08 (DTC) / 99.07 (scalar)]**** | |
| | | | PID Reference with FAST COMM | -10000 = **-[par. 11.08]**<br>0 = 0<br>10000 = **[par. 11.08]** | 0 = 0<br>20000 = **[par. 99.08 (DTC) / 99.07 (scalar)]**** | |

* With DTC the filter time of the actual speed value can be adjusted using parameter 34.04.

** **Note:** The maximum reference value is 163% (i.e. 163% = 1.63 · value of parameter 99.08/99.07 value).

### CSA 2.8/3.0 communication profile

The CSA 2.8/3.0 communication profile is active when parameter 98.07 is set to CSA 2.8/3.0. The Control Word and Status Word for the profile are described below.

*CONTROL WORD for the CSA 2.8/3.0 communication profile*

| Bit | Name | Value | Description |
|---|---|---|---|
| 0 | Reserved | | |
| 1 | ENABLE | 1 | Enabled. |
| | | 0 | Coast to stop. |
| 2 | Reserved | | |
| 3 | START/STOP | 0 ⇒ 1 | Start. |
| | | 0 | Stop according to parameter 21.03 STOP FUNCTION. |
| 4 | Reserved | | |
| 5 | CNTRL_MODE | 1 | Select control mode 2. |
| | | 0 | Select control mode 1. |
| 6 | Reserved | | |
| 7 | Reserved | | |
| 8 | RESET_FAULT | 0 ⇒ 1 | Reset drive fault. |
| 9 … 15 | Reserved | | |

*STATUS WORD for the CSA 2.8/3.0 communication profile*

| Bit | Name | Value | Description |
|---|---|---|---|
| 0 | READY | 1 | Ready to start. |
| | | 0 | Initialising, or initialising error. |
| 1 | ENABLE | 1 | Enabled. |
| | | 0 | Coast to stop. |
| 2 | Reserved | | |
| 3 | RUNNING | 1 | Running with selected reference. |
| | | 0 | Stopped. |
| 4 | Reserved | | |
| 5 | REMOTE | 1 | Drive in Remote mode |
| | | 0 | Drive in Local mode |
| 6 | Reserved | | |
| 7 | AT_SETPOINT | 1 | Drive at reference |
| | | 0 | Drive not at reference |
| 8 | FAULTED | 1 | A fault is active. |
| | | 0 | No active faults |
| 9 | WARNING | 1 | A warning is active. |
| | | 0 | No active warnings |
| 10 | LIMIT | 1 | Drive at a limit |
| | | 0 | Drive at no limit |
| 11 … 15 | Reserved | | |

The reference and actual scaling is equal to that of the ABB Drives profile.

# Diverse status, fault, alarm and limit words

*03.03 AUXILIARY STATUS WORD*

| Bit | Name | Description |
|---|---|---|
| 0 | Reserved | |
| 1 | OUT OF WINDOW | Speed difference is out of the window (in speed control)*. |
| 2 | Reserved | |
| 3 | MAGNETIZED | Flux has been formed in the motor. |
| 4 | Reserved | |
| 5 | SYNC RDY | Position counter synchronised. |
| 6 | 1 START NOT DONE | Drive has not been started after changing the motor parameters in group 99. |
| 7 | IDENTIF RUN DONE | Motor ID Run successfully completed. |
| 8 | START INHIBITION | Safe torque off function or Prevention of unexpected start-up is active. |
| 9 | LIMITING | Control at a limit. See actual signal 3.04 LIMIT WORD 1 below. |
| 10 | TORQ CONTROL | Torque reference is followed*. |
| 11 | ZERO SPEED | Absolute value of motor actual speed is below zero speed limit (4% of synchronous speed). |
| 12 | INTERNAL SPEED FB | Internal speed feedback followed. |
| 13 | M/F COMM ERR | Master/Follower link (on CH2) communication error*. |
| 14 … 15 | Reserved | |

*See the *Master/Follower Application Guide* [3AFY58962180 (English)].

### 03.04 LIMIT WORD 1

| Bit | Name | Active Limit |
|---|---|---|
| 0 | TORQ MOTOR LIM | Pull-out limit |
| 1 | SPD_TOR_MIN_LIM | Speed control torque min. limit |
| 2 | SPD_TOR_MAX_LIM | Speed control torque max. limit |
| 3 | TORQ_USER_CUR_LIM | User-defined current limit |
| 4 | TORQ_INV_CUR_LIM | Internal current limit |
| 5 | TORQ_MIN_LIM | Any torque min. limit |
| 6 | TORQ_MAX_LIM | Any torque max. limit |
| 7 | TREF_TORQ_MIN_LIM | Torque reference min. limit |
| 8 | TREF_TORQ_MAX_LIM | Torque reference max. limit |
| 9 | FLUX_MIN_LIM | Flux reference min. limit |
| 10 | FREQ_MIN_LIMIT | Speed/Frequency min. limit |
| 11 | FREQ_MAX_LIMIT | Speed/Frequency max. limit |
| 12 | DC_UNDERVOLT | DC undervoltage limit |
| 13 | DC_OVERVOLT | DC overvoltage limit |
| 14 | TORQUE LIMIT | Any torque limit |
| 15 | FREQ_LIMIT | Any speed/frequency limit |

### 03.05 FAULT WORD 1

| Bit | Name | Description |
|---|---|---|
| 0 | SHORT CIRC | For the possible causes and remedies, see chapter *Fault tracing*. |
| 1 | OVERCURRENT | |
| 2 | DC OVERVOLT | |
| 3 | ACS800 TEMP | |
| 4 | EARTH FAULT | |
| 5 | THERMISTOR | |
| 6 | MOTOR TEMP | |
| 7 | SYSTEM_FAULT | A fault is indicated by the System Fault Word (Actual Signal 3.07). |
| 8 | UNDERLOAD | For the possible causes and remedies, see chapter *Fault tracing*. |
| 9 | OVERFREQ | |
| 10 … 15 | Reserved | |

### *03.06 FAULT WORD 2*

| Bit | Name | Description |
|---|---|---|
| 0 | SUPPLY PHASE | For the possible causes and remedies, see chapter *Fault tracing*. |
| 1 | NO MOT DATA | |
| 2 | DC UNDERVOLT | |
| 3 | Reserved | |
| 4 | RUN ENABLE | For the possible causes and remedies, see chapter *Fault tracing*. |
| 5 | ENCODER ERR | |
| 6 | I/O COMM | |
| 7 | CTRL B TEMP | |
| 8 | EXTERNAL FLT | |
| 9 | OVER SWFREQ | |
| 10 | AI < MIN FUNC | |
| 11 | PPCC LINK | |
| 12 | COMM MODULE | |
| 13 | PANEL LOSS | |
| 14 | MOTOR STALL | |
| 15 | MOTOR PHASE | |

### 03.07 SYSTEM FAULT WORD

| Bit | Name | Description |
|---|---|---|
| 0 | FLT (F1_7) | Factory default parameter file error |
| 1 | USER MACRO | User Macro file error |
| 2 | FLT (F1_4) | FPROM operating error |
| 3 | FLT (F1_5) | FPROM data error |
| 4 | FLT (F2_12) | Internal time level 2 overflow |
| 5 | FLT (F2_13) | Internal time level 3 overflow |
| 6 | FLT (F2_14) | Internal time level 4 overflow |
| 7 | FLT (F2_15) | Internal time level 5 overflow |
| 8 | FLT (F2_16) | State machine overflow |
| 9 | FLT (F2_17) | Application program execution error |
| 10 | FLT (F2_18) | Application program execution error |
| 11 | FLT (F2_19) | Illegal instruction |
| 12 | FLT (F2_3) | Register stack overflow |
| 13 | FLT (F2_1) | System stack overflow |
| 14 | FLT (F2_0) | System stack underflow |
| 15 | Reserved | |

### 03.08 ALARM WORD 1

| Bit | Name | Description |
|---|---|---|
| 0 | START INHIBIT | For the possible causes and remedies, see chapter *Fault tracing*. |
| 1 | Reserved | |
| 2 | THERMISTOR | For the possible causes and remedies, see chapter *Fault tracing*. |
| 3 | MOTOR TEMP | |
| 4 | ACS800 TEMP | |
| 5 | ENCODER ERR | |
| 6 | T MEAS ALM | |
| 7 … 11 | Reserved | |
| 12 | COMM MODULE | For the possible causes and remedies, see chapter *Fault tracing*. |
| 13 | Reserved | |
| 14 | EARTH FAULT | For the possible causes and remedies, see chapter *Fault tracing*. |
| 15 | Reserved | |

### 03.09 ALARM WORD 2

| Bit | Name | Description |
|---|---|---|
| 0 | Reserved | |
| 1 | UNDERLOAD | For the possible causes and remedies, see chapter *Fault tracing*. |
| 2, 3 | Reserved | |
| 4 | ENCODER | For the possible causes and remedies, see chapter *Fault tracing*. |
| 5, 6 | Reserved | |
| 7 | POWFAIL FILE (FFA0) | Error in restoring POWERFAIL.DDF |
| 8 | ALM (OS_17) | Error in restoring POWERDOWN.DDF |
| 9 | MOTOR STALL | For the possible causes and remedies, see chapter *Fault tracing*. |
| 10 | AI < MIN FUNC | |
| 11, 12 | Reserved | |
| 13 | PANEL LOSS | For the possible causes and remedies, see chapter *Fault tracing*. |
| 14, 15 | Reserved | |

### 03.13 AUXILIARY STATUS WORD 3

| Bit | Name | Description |
|---|---|---|
| 0 | REVERSED | Motor rotates in reverse direction. |
| 1 | EXT CTRL | External control is selected. |
| 2 | REF 2 SEL | Reference 2 is selected. |
| 3 | CONST SPEED | A Constant Speed (1…15) is selected. |
| 4 | STARTED | The drive has received a Start command. |
| 5 | USER 2 SEL | User Macro 2 has been loaded. |
| 6 | OPEN BRAKE | The Open Brake command is ON. See group 42 BRAKE CONTROL. |
| 7 | LOSS OF REF | The reference has been lost. |
| 8 | STOP DI STATUS | The state of the interlock input on the RMIO board. |
| 9 | READY | Ready to function: Run enable signal on, no fault |
| 10 | DATASET STATUS | Data set has not been updated. |
| 11 | MACRO CHG | Macro is changing or is being saved. |
| 12…15 | Reserved | |

### 03.14 AUXILIARY STATUS WORD 4

| Bit | Name | Description |
|---|---|---|
| 0 | SPEED 1 LIM | Output speed has exceeded or fallen below supervision limit 1. See group 32 SUPERVISION. |
| 1 | SPEED 2 LIM | Output speed has exceeded or fallen below supervision limit 2. See group 32 SUPERVISION. |
| 2 | CURRENT LIM | Motor current has exceeded or fallen below the set supervision limit. See group 32 SUPERVISION. |
| 3 | REF 1 LIM | Reference 1 has exceeded or fallen below the set supervision limit. See group 32 SUPERVISION. |
| 4 | REF 2 LIM | Reference 2 has exceeded or fallen below the set supervision limit. See group 32 SUPERVISION. |
| 5 | TORQUE 1 LIM | The motor torque has exceeded or fallen below the TORQUE1 supervision limit. See group 32 SUPERVISION. |
| 6 | TORQUE 2 LIM | The motor torque has exceeded or fallen below the TORQUE2 supervision limit. See group 32 SUPERVISION. |
| 7 | ACT 1 LIM | PID controller actual value 1 has exceeded or fallen below the set supervision limit. See group 32 SUPERVISION. |
| 8 | ACT 2 LIM | PID controller actual value 2 has exceeded or fallen below the set supervision limit. See group 32 SUPERVISION. |
| 9 | ABOVE_LIMIT | 1 = Actual frequency or speed value equals or exceeds the supervision limit (par. 32.02).<br>0 = Actual frequency or speed value is within supervision limit. |
| 10 … 15 | Reserved | |

### 03.15 FAULT WORD 4

| Bit | Name | Description |
|---|---|---|
| 0 | CHOKE OTEMP | Step-up module fault |
| 1 | MOTOR 1 TEMP | For the possible causes and remedies, see chapter *Fault tracing*. |
| 2 | MOTOR 2 TEMP | |
| 3 | BRAKE ACKN | |
| 4 … 15 | Reserved | |

### 03.16 ALARM WORD 4

| Bit | Name | Description |
|---|---|---|
| 0 | FAN OTEMP | Step-up module fan overtemperature alarm |
| 1 | MOTOR 1 TEMP | For the possible causes and remedies, see chapter *Fault tracing*. |
| 2 | MOTOR 2 TEMP | |
| 3 | BRAKE ACKN | |
| 4 | SLEEP MODE | |
| 5 | MACRO CHANGING | User or Application macro is being saved or loaded |
| 6 … 15 | Reserved | |

### 03.17 FAULT WORD 5

| Bit | Name | Description |
|---|---|---|
| 0 | BR BROKEN | For the possible causes and remedies, see chapter *Fault tracing*. |
| 1 | BR WIRING | |
| 2 | BC SHORT CIR | |
| 3 | BR OVERHEAT | |
| 4 | BC OVERHEAT | |
| 5 | IN CHOKE TEMP | |
| 6 | PP OVERLOAD | |
| 7 | INV DISABLED | |
| 8 | TEMP DIF | |
| 9 | POWERF INV xx/ POWERFAIL | |
| 10 | INT CONFIG | |
| 11 | USER L CURVE | |
| 12 | Reserved | |
| 13 | INV OVERTEMP | For the possible causes and remedies, see chapter *Fault tracing*. |
| 14...15 | Reserved | |

### 03.18 ALARM WORD 5

| Bit | Name | Description |
|---|---|---|
| 0 | REPLACE FAN | For the possible causes and remedies, see chapter *Fault tracing*. |
| 1 | SYNCRO SPEED | |
| 2 | BR OVERHEAT | |
| 3 | BC OVERHEAT | |
| 4 | IN CHOKE TEMP | |
| 5 | PP OVERLOAD | |
| 6 | INV DISABLED | |
| 7 | CUR UNBAL | |
| 8 | INV CUR LIM | |
| 9 | DC BUS LIM | |
| 10 | MOT CUR LIM | |
| 11 | MOT TORQ LIM | |
| 12 | MOT POW LIM | |
| 13 | USER L CURVE | |
| 14 | Reserved | |
| 15 | BATT FAILURE | For the possible causes and remedies, see chapter *Fault tracing*. |

### 03.19 INT INIT FAULT

| Bit | Name | Description |
|---|---|---|
| 0 | AINT FAULT | Wrong EPLD version |
| 1 | AINT FAULT | Wrong AINT board revision |
| 2 | AINT FAULT | Du/dt limitation hardware failure |
| 3 | AINT FAULT | Current measurement scaling error |
| 4 | AINT FAULT | Voltage measurement scaling error |
| 5 … 15 | Reserved | |
| This signal is active with AINT board. | | |

### *03.30 LIMIT WORD INV*

The LIMIT WORD INV Word includes faults and warnings, which occur when the output current limit of the drive is exceeded. The current limit protects the drive in various cases, e.g. integrator overload, high IGBT temperature etc.

| Bit | Name | Description |
|---|---|---|
| 0 | INTEGRAT 200 | Current limit at 200% integrator overload. Temperature model is not active.* |
| 1 | INTEGRAT 150 | Current limit at 150% integrator overload. Temperature model is not active.* |
| 2 | INT LOW FREQ | Current limit at high IGBT temperature with low output frequency (<10 Hz). Temperature model is not active.* |
| 3 | INTG PP TEMP | Current limit at high IGBT temperature. Temperature model is not active.* |
| 4 | PP OVER TEMP | Current limit at high IGBT temperature. Temperature model is active. |
| 5 | PP OVERLOAD | Current limit at high IGBT junction to case temperature. Temperature model is active.<br>If the IGBT junction to case temperature continues to rise in spite of the current limitation, PP OVERLOAD alarm or fault occurs. See chapter *Fault tracing* |
| 6 | INV POW LIM | Current limit at inverter output power limit |
| 7 | INV TRIP CUR | Current limit at inverter overcurrent trip limit |
| 8 | OVERLOAD CUR | Maximum inverter overload current limit. See par. 20.03. |
| 9 | CONT DC CUR | Continuous dc-current limit |
| 10 | CONT OUT CUR | Continuous output current limit ($I_{cont.max}$) |
| 11...15 | Reserved | |
| *Not active with ACS800 Factory macro default settings. | | |

### *03.31 ALARM WORD 6*

| Bit | Name | Description |
|---|---|---|
| 0 | INV OVERTEMP | For the possible causes and remedies, see chapter *Fault tracing*. |
| 1...2 | Reserved | |
| 3 | ENC CABLE | For the possible causes and remedies, see chapter *Fault tracing*. |
| 4…15 | Reserved | |

### 03.32 EXT IO STATUS

| Bit | Name | Description |
|---|---|---|
| 0 | EMSTOP MODULE ERROR | Emergency stop module is not communicating with the drive software. |
| 1 | EMSTOP OFF2 CMD | DI1 of emergency stop module. See 03.01 MAIN CONTROL WORD bit1 OFF2 CONTROL. |
| 2 | EMSTOP OFF3 CMD | DI2 of emergency stop module. See 03.01 MAIN CONTROL WORD bit2 OFF3 CONTROL. |
| 3 | FREE | DI3 of emergency stop module. |
| 4 | EMSTOP OFF3 STATUS | RO1 of emergency stop module. See 03.02 MAIN STATUS WORD bit5 OFF_3_STA. Bit inverted. |
| 5 | EMSTOP TRIP STATUS | RO2 of emergency stop module. See 03.02 MAIN STATUS WORD bit3 TRIPPED. |
| 6 | STEPUP MODULE ERROR | Step up module is not communicating with the drive software. |
| 7 | STEPUP CHOKE FLT CMD | DI1 of Step-Up module. For the possible causes and remedies, see chapter *Fault tracing*: *CHOKE OTEMP (FF82)*. |
| 8 | STEPUP FAN ALM CMD | DI2 of Step-Up module. For possible causes and remedies, see chapter *Fault tracing*: *FAN OTEMP (FF83)*. |
| 9 | FREE | DI3 of Step-Up module. |
| 10 | STEPUP MODULATING STATUS | RO1 of Step-Up module. Drive is modulating. |
| 11 | STEPUP TRIP STATUS | RO2 of Step-Up module. See 03.02 MAIN STATUS WORD bit3 TRIPPED. |
| 12-15 | Reserved | |

### 03.33 FAULT WORD 6

| Bit | Name | Description |
|---|---|---|
| 0…1 | Reserved | |
| 2 | ENC CABLE | For possible causes and remedies, see chapter *Fault tracing*. |
| 3…15 | Reserved | |

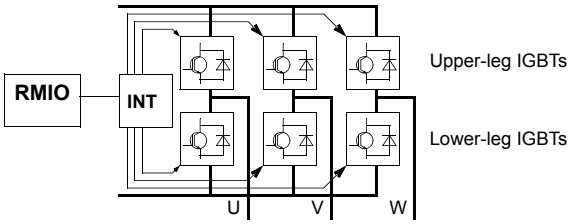
### *04.01 FAULTED INT INFO*

The FAULTED INT INFO Word includes information on the location of faults PPCC LINK, OVERCURRENT, EARTH FAULT, SHORT CIRCUIT, ACS800 TEMP, TEMP DIF and POWERF INV (see 03.05 FAULT WORD 1, 03.06 FAULT WORD 2, 03.17 FAULT WORD 5 and chapter *Fault tracing*).

| Bit | Name | Description |
|---|---|---|
| 0 | INT 1 FLT | INT 1 board fault |
| 1 | INT 2 FLT | INT 2 board fault |
| 2 | INT 3 FLT | INT 3 board fault |
| 3 | INT 4 FLT | INT 4 board fault |
| 4 | INT 5 FLT | INT 5 board fault |
| 5 | INT 6 FLT | INT 6 board fault |
| 6 | INT 7 FLT | INT 7 board fault |
| 7 | INT 8 FLT | INT 8 board fault |
| 8 | INT 9 FLT | INT 9 board fault |
| 9 | INT 10 FLT | INT 10 board fault |
| 10 | INT 11 FLT | INT 11 board fault |
| 11 | INT 12 FLT | INT 12 board fault |
| 12...14 | Reserved | |
| 15 | PBU FLT | PBU board fault |

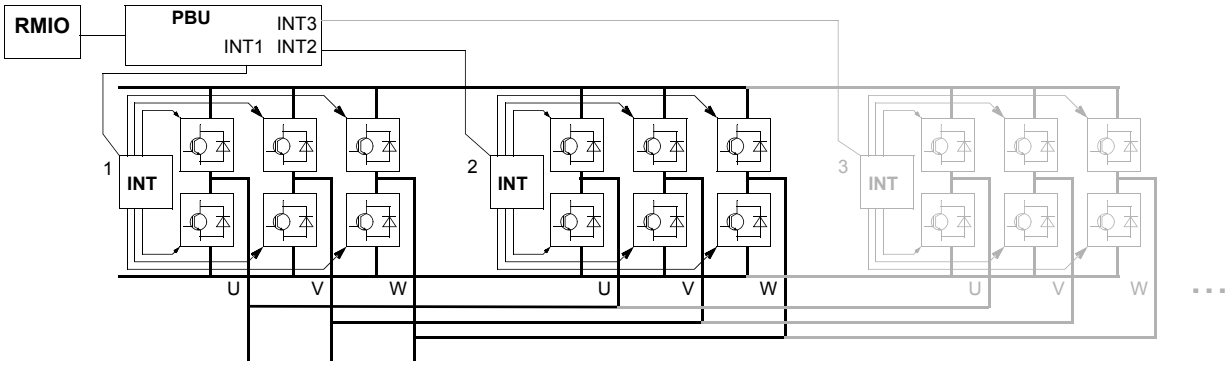
Used only with parallel connected inverters.

**Inverter Block Diagram**




| | |
|---|---|
| RMIO | Motor Control and I/O Board |
| INT | Main Circuit Interface Board |
| PBU | PPCS Link Branching Unit |

**Inverter Unit Block Diagram (2 to 12 parallel inverters)**




*04.02 INT SC INFO*

The INT SC INFO Word includes information on the location of the SHORT CIRCUIT fault (see 03.05 FAULT WORD 1 and chapter *Fault tracing*).

| Bit | Name | Description |
|---|---|---|
| 0 | U-PH SC U | Phase U upper-leg IGBT(s) short circuit |
| 1 | U-PH SC L | Phase U lower-leg IGBT(s) short circuit |
| 2 | V-PH SC U | Phase V upper-leg IGBT(s) short circuit |
| 3 | V-PH SC L | Phase V lower-leg IGBT(s) short circuit |
| 4 | W-PH SC U | Phase W upper-leg IGBT(s) short circuit |
| 5 | W-PH SC L | Phase W lower-leg IGBT(s) short circuit |
| 6...15 | Reserved | |

# Fault tracing

## Chapter overview

The chapter lists all warning and fault messages including the possible cause and corrective actions.

## Safety

**WARNING!** Only qualified electricians are allowed to maintain the drive. The *Safety Instructions* on the first pages of the appropriate hardware manual must be read before you start working with the drive.

## Warning and fault indications

A warning or fault message on the panel display indicates abnormal drive status. Most warning and fault causes can be identified and corrected using this information. If not, an ABB representative should be contacted.

If the drive is operated with the control panel detached, the red LED in the panel mounting platform indicates the fault condition. (Note: Some drive types are not fitted with the LEDs as standard).

The four digit code number in brackets after the message is for the fieldbus communication. (See chapter *Fieldbus control*.)

## How to reset

The drive can be reset either by pressing the keypad ***RESET*** key, by digital input or fieldbus, or switching the supply voltage off for a while. When the fault has been removed, the motor can be restarted.

## Fault history

When a fault is detected, it is stored in the Fault History. The latest faults and warnings are stored together with the time stamp at which the event was detected.

The fault logger collects 64 of the latest faults. When the drive power is switched off, 16 of the latest faults are stored.

See chapter *Control panel* for more information.

## Warning messages generated by the drive

| WARNING | CAUSE | WHAT TO DO |
|---|---|---|
| ACS800 TEMP (4210)<br>3.08 AW 1 bit 4 | Drive IGBT temperature is excessive. Fault trip limit is 100%. | Check ambient conditions.<br>Check air flow and fan operation.<br>Check heatsink fins for dust pick-up.<br>Check motor power against unit power. |
| AI < MIN FUNC (8110)<br>3.09 AW 2 bit 10<br>(programmable Fault Function 30.01) | Analogue control signal is below minimum allowed value due to incorrect signal level or failure in control wiring. | Check for proper analogue control signal levels.<br>Check control wiring.<br>Check Fault Function parameters. |
| AD [message] | Message generated by an EVENT block in the Adaptive Program. | Consult the documentation or author of the Adaptive Program. |
| BACKUP USED (FFA3) | PC stored backup of drive parameters is downloaded into use. | Wait until download is completed. |
| BATT FAILURE (5581)<br>3.18 AW 5 bit 15 | APBU branching unit memory backup battery error caused by<br>- incorrect APBU switch S3 setting<br>- too low battery voltage. | With parallel connected inverters, enable backup battery by setting actuator 6 of switch S3 to ON.<br>Replace backup battery. |
| BC OVERHEAT (7114)<br>3.18 AW 5 bit 3 | Brake chopper overload | Stop drive. Let chopper cool down.<br>Check parameter settings of resistor overload protection function (see parameter group 27 BRAKE CHOPPER).<br>Check that braking cycle meets allowed limits.<br>Check that drive supply AC voltage is not excessive. |
| BRAKE ACKN (FF74)<br>3.16 AW 4 bit 3 | Unexpected state of brake acknowledge signal | See parameter group 42 BRAKE CONTROL.<br>Check connection of brake acknowledgement signal. |
| BR OVERHEAT (7112)<br>3.18 AW 5 bit 2 | Brake resistor overload | Stop drive. Let resistor cool down.<br>Check parameter settings of resistor overload protection function (see parameter group 27 BRAKE CHOPPER).<br>Check that braking cycle meets allowed limits. |
| CALIBRA DONE (FF37) | Calibration of output current transformers is completed. | Continue normal operation. |
| CALIBRA REQ (FF36) | Calibration of output current transformers is required. Displayed at start if drive is in scalar control (parameter 99.04) and scalar fly start feature is on (parameter 21.08). | Calibration starts automatically. Wait for a while. |

| WARNING | CAUSE | WHAT TO DO |
|---|---|---|
| COMM MODULE (7510)<br>3.08 AW 1 bit 12<br>(programmable Fault Function 30.18, 30.19) | Cyclical communication between drive and master is lost. | Check status of fieldbus communication. See chapter *Fieldbus control*, or appropriate fieldbus adapter manual.<br>Check parameter settings:<br>- group 51 COMM MODULE DATA (for fieldbus adapter)<br>- group 52 STANDARD MODBUS (for Standard Modbus Link).<br>Check Fault Function parameters.<br>Check cable connections.<br>Check if master can communicate. |
| DC BUS LIM<br>(3211)<br>3.18 AW5 bit 9<br>(programmable Fault Function 30.23) | Drive limits torque due to too high or too low intermediate circuit DC voltage. | Informative alarm<br>Check Fault Function parameters. |
| EARTH FAULT (2330)<br>3.08 AW 1 bit 14<br>(programmable Fault Function 30.17) | Drive has detected load unbalance typically due to earth fault in motor or motor cable. | Check there are no power factor correction capacitors or surge absorbers in motor cable.<br>Check that there is no earth fault in motor or motor cables:<br>- measure insulation resistances of motor and motor cable.<br>If no earth fault can be detected, contact your local ABB representative. |
| ENC CABLE<br>(7310)<br>3.31 AW 6 bit 3<br>(programmable Fault Function 50.07) | Pulse encoder phase signal is missing. | Check pulse encoder and its wiring.<br>Check pulse encoder interface module and its wiring. |
| ENCODER A<>B (7302)<br>3.09 AW 2 bit 4 | Pulse encoder phasing is wrong: Phase A is connected to terminal of phase B and vice versa. | Interchange connection of pulse encoder phases A and B. |
| ENCODER ERR (7301)<br>3.08 AW 1 bit 5 | Communication fault between pulse encoder and pulse encoder interface module and between module and drive | Check pulse encoder and its wiring, pulse encoder interface module and its wiring, parameter group 50 ENCODER MODULE settings. |
| FAN OTEMP (FF83)<br>3.16 AW 4 bit 0 | Excessive temperature of drive output filter fan. Supervision is in use in step-up drives. | Stop drive. Let it cool down.<br>Check ambient temperature.<br>Check fan rotates in correct direction and air flows freely. |
| HW RECONF RQ<br>(FF38) | Inverter type (e.g. sr0025_3) has been changed. Inverter type is usually changed at factory or during drive implementation. | Wait until alarm POWEROFF! activates and switch control board power off to validate inverter type change. |

| WARNING | CAUSE | WHAT TO DO |
|---|---|---|
| ID DONE<br>(FF32) | Drive has performed motor identification magnetisation and is ready for operation. This warning belongs to normal start-up procedure. | Continue drive operation. |
| ID MAGN<br>(FF31) | Motor identification magnetisation is on. This warning belongs to normal start-up procedure. | Wait until drive indicates that motor identification is completed. |
| ID MAGN REQ<br>(FF30) | Motor identification is required. This warning belongs to normal start-up procedure. Drive expects user to select how motor identification should be performed: By Identification Magnetisation or by ID Run. | Start Identification Magnetisation by pressing Start key, or select ID Run and start (see parameter 99.10). |
| ID N CHANGED<br>(FF68) | Drive ID number has been changed from 1. | Change ID number back to 1. See chapter *Control panel*. |
| ID RUN<br>(FF35) | Motor identification Run is on. | Wait until drive indicates that motor identification Run is completed. |
| ID RUN SEL<br>(FF33) | Motor Identification Run is selected, and drive is ready to start ID Run. This warning belongs to ID Run procedure. | Press Start key to start Identification Run. |
| IN CHOKE TEMP<br>(FF81)<br>3.18 AW 5 bit 4 | Excessive input choke temperature | Stop drive. Let it cool down.<br>Check ambient temperature.<br>Check that fan rotates in correct direction and air flows freely. |
| INV CUR LIM<br>(2212)<br>3.18 AW 5 bit 8<br>(programmable Fault Function 30.23) | Internal inverter current or power limit has been exceeded. | Reduce load or increase ramp time.<br>Limit inverter actual power or decrease line-side converter reactive power generation reference value (parameter 95.06 LCU Q PW REF).<br>Check Fault Function parameters. |
| INV DISABLED<br>(3200)<br>3.18 AW 5 bit 6 | Optional DC switch has opened while unit was stopped. | Close DC switch.<br>Check AFSC-0x Fuse Switch Controller unit. |

| WARNING | CAUSE | WHAT TO DO |
|---|---|---|
| INV OVERTEMP<br>(4290)<br>3.31 AW 6 bit 0 | Converter module temperature is excessive. | Check ambient temperature. If it exceeds 40°C, ensure that load current does not exceed derated load capacity of drive. See appropriate hardware manual.<br>Check that ambient temperature setting is correct (parameter 95.10).<br>Check converter module cooling air flow and fan operation.<br>Cabinet installation: Check cabinet air inlet filters. Change when necessary. See appropriate hardware manual.<br>Modules installed in cabinet by user: Check that cooling air circulation in cabinet has been prevented with air baffles. See module installation instructions.<br>Check inside of cabinet and heatsink of converter module for dust pick-up. Clean when necessary. |
| IO CONFIG<br>(FF8B)<br>(programmable Fault Function 30.22) | Input or output of optional I/O extension or fieldbus module has been selected as signal interface in application program but communication to appropriate I/O extension module has not been set accordingly. | Check Fault Function parameters.<br>Check parameter group 98 OPTION MODULES. |
| MACRO CHANGE<br>(FF69) | Macro is restoring or User macro is being saved. | Wait until drive has finished task. |
| MOD BOARD T<br>(FF88)<br>09.11 AW 3 bit 14 | Overtemperature in AINT board of inverter module. | Check inverter fan.<br>Check ambient temperature. |
| MOD CHOKE T<br>(FF89)<br>09.11 AW 3 bit 13 | Overtemperature in choke of liquid cooled R8i inverter module. | Check inverter fan.<br>Check ambient temperature.<br>Check liquid cooling system. |
| MOT CUR LIM<br>(2300)<br>3.18 AW 5 bit 10<br>(programmable Fault Function 30.23) | Drive limits motor current according to current limit defined by parameter 20.03 MAXIMUM CURRENT. | Reduce load or increase ramp time.<br>Increase parameter 20.03 MAXIMUM CURRENT value.<br>Check Fault Function parameters. |
| MOTOR STALL<br>(7121)<br>3.09 AW 2 bit 9<br>(programmable Fault Function 30.10) | Motor is operating in stall region due to e.g. excessive load or insufficient motor power. | Check motor load and drive ratings.<br>Check Fault Function parameters. |
| MOTOR STARTS<br>(FF34) | Motor Identification Run starts. This warning belongs to ID Run procedure. | Wait until drive indicates that motor identification is completed. |

| WARNING | CAUSE | WHAT TO DO |
|---|---|---|
| MOTOR TEMP (4310)<br>3.08 AW 1 bit 3<br>(programmable Fault Function 30.04…30.09) | Motor temperature is too high (or appears to be too high) due to excessive load, insufficient motor power, inadequate cooling or incorrect start-up data. | Check motor ratings, load and cooling.<br>Check start-up data.<br>Check Fault Function parameters. |
| MOTOR 1 TEMP (4312)<br>3.16 AW 4 bit 1 | Measured motor temperature has exceeded alarm limit set by parameter 35.02. | Check value of alarm limit.<br>Check that actual number of sensors corresponds to value set by parameter.<br>Let motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc. |
| MOTOR 2 TEMP (4313)<br>3.16 AW 4 bit 2 | Measured motor temperature has exceeded alarm limit set by parameter 35.05. | Check value of alarm limit.<br>Check that actual number of sensors corresponds to value set by parameter.<br>Let motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc. |
| MOT POW LIM<br>(FF86)<br>3.18 AW 5 bit 12<br>(programmable Fault Function 30.23) | Drive limits motor power according to limits defined by parameters 20.11 and 20.12. | Informative alarm<br>Check parameter 20.11 P MOTORING LIM and 20.12 P GENERATING LIM settings.<br>Check Fault Function parameters. |
| MOT TORQ LIM<br>(FF85)<br>3.18 AW 5 bit 11<br>(programmable Fault Function 30.23) | Drive limits motor torque according to calculated motor pull-out torque limit and minimum and maximum torque limits defined by parameters 20.13 and 20.14. | Informative alarm<br>Check parameter 20.13 MIN TORQ SEL and 20.14 MAX TORQ SEL settings.<br>Check Fault Function parameters.<br>If LIMIT WORD 1 bit 0 TORQ MOTOR LIM is 1,<br>- check motor parameter settings (parameter group 99 START-UP DATA)<br>- ensure that ID run has been completed successfully. |
| PANEL LOSS (5300)<br>3.09 AW 2 bit 13<br>(programmable Fault Function 30.02) | Control panel selected as active control location for drive has ceased communicating. | Check panel connection (see appropriate hardware manual).<br>Check control panel connector.<br>Replace control panel in mounting platform.<br>Check Fault Function parameters. |
| POINTER ERROR<br>(FFD0) | Source selection (pointer) parameter points to non existing parameter index. | Check source selection (pointer) parameter settings. |
| ->POWEROFF!<br>(FF39) | Inverter type (e.g. sr0025_3) has been changed. Inverter type is usually changed at factory or during drive implementation. | Switch control board power off to validate inverter type change. |

| WARNING | CAUSE | WHAT TO DO |
|---|---|---|
| PPCC LINK<br>(5210)<br>3.06 FW 2 bit 11 | Fibre optic link to INT board is faulty. | Check fibre optic cables or galvanic link. With frame sizes R2-R6 link is galvanic.<br>If RMIO is powered from external supply, ensure that supply is on. See parameter 16.09 CTRL BOARD SUPPLY.<br>Check signal 03.19. Contact ABB representative if any of faults in signal 3.19 are active. |
| PPCC LINK xx<br>(5210)<br>3.06 FW 2 bit 11 and 4.01 | INT board fibre optic connection fault in inverter unit of several parallel connected inverter modules. xx refers to inverter module number. | Check connection from inverter module Main Circuit Interface Board, INT to PPCC Branching Unit, PBU. (Inverter module 1 is connected to PBU INT1 etc.)<br>Check signal 03.19. Contact ABB representative if any of faults in signal 3.19 are active. |
| PP OVERLOAD<br>(5482)<br>3.18 AW 5 bit 5 | Excessive IGBT junction to case temperature. This can be caused by excessive load at low frequencies (e.g. fast direction change with excessive load and inertia). | Increase ramp time.<br>Reduce load. |
| REPLACE FAN<br>(4280)<br>3.18 AW 5 bit 0 | Running time of inverter cooling fan has exceeded its estimated life time. | Replace fan.<br>Reset fan run time counter 01.44. |
| RUN ENABLE<br>(FF8E)<br>3.06 FW 2 bit 4 | No Run enable signal received. | Check setting of parameter 16.01. Switch on signal or check wiring of selected source. |
| SLEEP MODE<br>(FF8C)<br>3.16 AW 4 bit 4 | Sleep function has entered sleeping mode. | See parameter group 40 PID CONTROL. |
| START INHIBI<br>(FF7A)<br>AW 1 bit 0 | Safe torque off function has been activated while drive was stopped.<br>Or: Optional start inhibit hardware logic is activated. | Close Safe torque off function switch. If switch is closed and warning is still active, check power supply at ASTO board input terminals. Replace ASTO board.<br>Or: Check start inhibit circuit (AGPS board). |
| START INTERL<br>(FF8D) | No Start Interlock signal received. | Check circuit connected to Start Interlock input on RMIO board. |
| SYNCRO SPEED<br>(FF87)<br>3.18 AW 5 bit 1 | Value of motor nominal speed set to parameter 99.08 is not correct: Value is too near synchronous speed of motor. Tolerance is 0.1%. This warning is active only in DTC mode. | Check nominal speed from motor rating plate and set parameter 99.08 exactly accordingly. |

| WARNING | CAUSE | WHAT TO DO |
|---|---|---|
| TEMP DIF xx y<br>(4380)<br>4.01 FAULTED INT INFO | Excessive temperature difference between several parallel connected inverter modules. xx (1...12) refers to inverter module number and y refers to phase (U, V, W).<br><br>Alarm is indicated when temperature difference is 15°C. Fault is indicated when temperature difference is 20°C.<br><br>Excessive temperature can be caused e.g. by unequal current sharing between parallel connected inverters. | Check cooling fan.<br>Replace fan.<br>Check air filters. |
| THERMISTOR<br>(4311)<br>3.08 AW 1 bit 2<br>(programmable Fault Function 30.04…30.05) | Motor temperature is excessive. Motor thermal protection mode selection is TEMP SENSOR. | Check motor ratings and load.<br>Check start-up data.<br>Check thermistor connections to digital input DI6. |
| T MEAS ALM<br>(FF91)<br>3.08 AW 1 bit 6 | Motor temperature measurement is out of acceptable range. | Check connections of motor temperature measurement circuit. See chapter *Program features* for circuit diagram. |
| UNDERLOAD<br>(FF6A)<br>3.09 AW 2 bit 1<br>(programmable Fault Function 30.13) | Motor load is too low due to e.g. release mechanism in driven equipment. | Check for problem in driven equipment.<br>Check Fault Function parameters. |
| USER L CURVE<br>(2312)<br>3.18 AW 5 bit 13 | Integrated motor current has exceeded load curve defined by parameters in group 72 USER LOAD CURVE. | Check parameter group 72 USER LOAD CURVE settings.<br>Reduce load. |

## Warning messages generated by the control panel

| WARNING | CAUSE | WHAT TO DO |
|---|---|---|
| DOWNLOADING FAILED | Download function of panel has failed. No data has been copied from panel to drive. | Make sure panel is in local mode.<br>Retry (there might be interference on link).<br>Contact ABB representative. |
| DRIVE IS RUNNING DOWNLOADING NOT POSSIBLE | Downloading is not possible while motor is running. | Stop motor. Perform downloading. |
| NO COMMUNICATION (X) | Cabling problem or hardware malfunction on Panel Link | Check Panel Link connections.<br>Press RESET key. Panel reset may take up to half a minute, please wait. |
| | (4) = Panel type not compatible with drive application program version | Check panel type and drive application program version. Panel type is printed on panel cover. Application program version is stored in parameter 33.02. |
| NO FREE ID NUMBERS ID NUMBER SETTING NOT POSSIBLE | Panel Link already includes 31 stations. | Disconnect another station from link to free ID number. |
| NOT UPLOADED DOWNLOADING NOT POSSIBLE | No upload function has been performed. | Perform upload function before downloading. See chapter *Control panel*. |
| UPLOADING FAILED | Upload function of panel has failed. No data has been copied from drive to panel. | Retry (there might be interference on link).<br>Contact ABB representative. |
| WRITE ACCESS DENIED PARAMETER SETTING NOT POSSIBLE | Certain parameters do not allow changes while motor is running. If tried, no change is accepted, and warning is displayed.<br>Parameter lock is on. | Stop motor, then change parameter value.<br>Open parameter lock (see parameter 16.02). |

## Fault messages generated by the drive

| FAULT | CAUSE | WHAT TO DO |
|---|---|---|
| ACS800 TEMP (4210)<br>3.05 FW 1 bit 3 | Drive IGBT temperature is excessive. Fault trip limit is 100%. | Check ambient conditions.<br>Check air flow and fan operation.<br>Check heatsink fins for dust pick-up.<br>Check motor power against unit power. |
| ACS TEMP xx y (4210)<br>3.05 FW 1 bit 3 and 4.01 | Excessive internal temperature in inverter unit of several parallel connected inverter modules. xx (1...12) refers to inverter module number and y refers to phase (U, V, W). | Check ambient conditions.<br>Check air flow and fan operation.<br>Check heatsink fins for dust pick-up.<br>Check motor power against unit power. |
| AI < MIN FUNC (8110)<br>3.06 FW 2 bit 10<br>(programmable Fault Function 30.01) | Analogue control signal is below minimum allowed value due to incorrect signal level or failure in control wiring. | Check for proper analogue control signal levels.<br>Check control wiring.<br>Check Fault Function parameters. |
| AD [message] | Message generated by an EVENT block in the Adaptive Program. | Consult the documentation or author of the Adaptive Program. |
| BACKUP ERROR (FFA2) | Failure when restoring PC stored backup of drive parameters. | Retry.<br>Check connections.<br>Check that parameters are compatible with drive. |
| BC OVERHEAT (7114)<br>3.17 FW 5 bit 4 | Brake chopper overload | Let chopper cool down.<br>Check parameter settings of resistor overload protection function (see parameter group 27 BRAKE CHOPPER).<br>Check that braking cycle meets allowed limits.<br>Check that drive supply AC voltage is not excessive. |
| BC SHORT CIR (7113)<br>3.17 FW 5 bit 2 | Short circuit in brake chopper IGBT(s) | Replace brake chopper.<br>Ensure brake resistor is connected and not damaged. |
| BRAKE ACKN (FF74)<br>3.15 FW 4 bit 3 | Unexpected state of brake acknowledge signal | See parameter group 42 BRAKE CONTROL.<br>Check connection of brake acknowledgement signal. |
| BR BROKEN (7110)<br>3.17 FW 5 bit 0 | Brake resistor is not connected or it is damaged.<br>Resistance rating of brake resistor is too high. | Check resistor and resistor connection.<br>Check that resistance rating meets specifications. See appropriate drive hardware manual. |

| FAULT | CAUSE | WHAT TO DO |
|---|---|---|
| BR OVERHEAT (7112)<br>3.17 FW 5 bit 3 | Brake resistor overload | Let resistor cool down.<br>Check parameter settings of resistor overload protection function (see parameter group 27 BRAKE CHOPPER).<br>Check that braking cycle meets allowed limits.<br>Check that drive supply AC voltage is not excessive. |
| BR WIRING (7111)<br>3.17 FW 5 bit 1 | Wrong connection of brake resistor | Check resistor connection.<br>Ensure brake resistor is not damaged. |
| CHOKE OTEMP (FF82) | Excessive temperature of drive output filter. Supervision is in use in step-up drives. | Let drive cool down.<br>Check ambient temperature.<br>Check filter fan rotates in correct direction and air flows freely. |
| COMM MODULE (7510)<br>3.06 FW 2 bit 12<br>(programmable Fault Function 30.18, 30.19) | Cyclical communication between drive and master is lost. | Check status of fieldbus communication. See chapter *Fieldbus control*, or appropriate fieldbus adapter manual.<br>Check parameter settings:<br>- group 51 COMM MODULE DATA (for fieldbus adapter), or<br>- group 52 STANDARD MODBUS (for Standard Modbus Link).<br>Check Fault Function parameters.<br>Check cable connections.<br>Check if master can communicate. |
| CTRL B TEMP (4110)<br>3.06 FW 2 bit 7 | Control board temperature is above 88°C. | Check ambient conditions.<br>Check air flow.<br>Check main and additional cooling fans. |
| CURR MEAS (2211) | Current transformer failure in output current measurement circuit | Check current transformer connections to Main Circuit Interface Board, INT. |
| CUR UNBAL xx (2330)<br>3.05 FW 1 bit 4 and 4.01<br>(programmable Fault Function 30.17) | Drive has detected excessive output current unbalance in inverter unit of several parallel connected inverter modules. This can be caused by external fault (earth fault, motor, motor cabling, etc.) or internal fault (damaged inverter component). xx (1...12) refers to inverter module number. | Check there are no power factor correction capacitors or surge absorbers in motor cable.<br>Check that there is no earth fault in motor or motor cables:<br>- measure insulation resistances of motor and motor cable.<br>If no earth fault can be detected, contact your local ABB representative. |
| DC HIGH RUSH (FF80) | Drive supply voltage is excessive. When supply voltage is over 124% of unit voltage rating (415, 500 or 690 V), motor speed rushes to trip level (40% of nominal speed). | Check supply voltage level, drive rated voltage and allowed voltage range of drive. |

| FAULT | CAUSE | WHAT TO DO |
|---|---|---|
| DC OVERVOLT (3210)<br>3.05 FW 1 bit 2 | Excessive intermediate circuit DC voltage. DC overvoltage trip limit is 1.3 × 1.35 × $U_{1max}$, where $U_{1max}$ is maximum value of supply voltage range. For 400 V units, $U_{1max}$ is 415 V. For 500 V units, $U_{1max}$ is 500 V. For 690 V units, $U_{1max}$ is 690 V. Actual voltage in intermediate circuit corresponding to the supply voltage trip level is 728 V DC for 400 V units, 877 V DC for 500 V units, and 1210 V DC for 690 V units. | Check that overvoltage controller is on (parameter 20.05).<br>Check supply voltage for static or transient overvoltage.<br>Check brake chopper and resistor (if used).<br>Check deceleration time.<br>Use coast-to-stop function (if applicable).<br>Retrofit frequency converter with brake chopper and brake resistor. |
| DC UNDERVOLT (3220)<br>3.06 FW 2 bit 2 | Intermediate circuit DC voltage is not sufficient due to missing supply voltage phase, blown fuse or rectifier bridge internal fault.<br>DC undervoltage trip limit is 0.6 × 1.35 × $U_{1min}$, where $U_{1min}$ is minimum value of supply voltage range. For 400 V and 500 V units, $U_{1min}$ is 380 V. For 690 V units, $U_{1min}$ is 525 V. Actual voltage in intermediate circuit corresponding to supply voltage trip level is 307 V DC for 400 V and 500 V units, and 425 V DC for 690 V units. | Check main supply and fuses. |
| EARTH FAULT (2330)<br>3.05 FW 1 bit 4<br>(programmable Fault Function 30.17) | Drive has detected load unbalance typically due to earth fault in motor or motor cable. | Check there are no power factor correction capacitors or surge absorbers in motor cable.<br>Check that there is no earth fault in motor or motor cables:<br>- measure insulation resistances of motor and motor cable.<br>If no earth fault can be detected, contact your local ABB representative. |
| ENC CABLE<br>(7310)<br>3.33 FW 6 bit 2<br>(programmable Fault Function 50.07) | Pulse encoder phase signal is missing. | Check pulse encoder and its wiring.<br>Check pulse encoder interface module and its wiring. |
| ENCODER A<>B (7302) | Pulse encoder phasing is wrong: Phase A is connected to terminal of phase B and vice versa. | Interchange connection of pulse encoder phases A and B. |
| ENCODER ERR (7301)<br>3.06 FW 2 bit 5 | Communication fault between pulse encoder and pulse encoder interface module and between module and drive | Check pulse encoder and its wiring, pulse encoder interface module and its wiring and parameter group 50 ENCODER MODULE settings. |
| EXTERNAL FLT (9000)<br>3.06 FW 2 bit 8<br>(programmable Fault Function 30.03) | Fault in external device. (This information is configured through one of programmable digital inputs.) | Check external devices for faults.<br>Check parameter 30.03 EXTERNAL FAULT. |

| FAULT | CAUSE | WHAT TO DO |
|---|---|---|
| FORCED TRIP<br>(FF8F) | Generic Drive Communication Profile trip command | See appropriate communication module manual. |
| GD DISABLED<br>(FF53) | AGPS power supply of parallel connected R8i inverter module has been switched off during run. X (1…12) refers to inverter module number. | Check Prevention of Unexpected Start-up circuit.<br>Replace AGPS board of R8i inverter module. |
| ID RUN FAIL<br>(FF84) | Motor ID Run is not completed successfully. | Check maximum speed (parameter 20.02). It should be at least 80% of motor nominal speed (parameter 99.08). |
| IN CHOKE TEMP<br>(FF81)<br>3.17 FW 5 bit 5 | Excessive input choke temperature | Stop drive. Let it cool down.<br>Check ambient temperature.<br>Check that fan rotates in correct direction and air flows freely. |
| INT CONFIG<br>(5410)<br>03.17 FW 5 bit 10 | Number of inverter modules is not equal to original number of inverters. | Check status of inverters. See signal 04.01 FAULTED INT INFO.<br>Check fibre optic cables between APBU and inverter modules.<br>If Reduced Run function is used, remove faulted inverter module from main circuit and write number of remaining inverter modules into parameter 95.03 INT CONFIG USER. Reset drive. |
| INV DISABLED<br>03.17 FW 5 bit 7<br>(3200) | Optional DC switch has opened while unit was running or start command was given. | Close DC switch.<br>Check AFSC-0x Fuse Switch Controller unit. |
| INV OVERTEMP<br>(4290)<br>3.17 FW 5 bit 13 | Converter module temperature is excessive. | Check ambient temperature. If it exceeds 40°C, ensure that load current does not exceed derated load capacity of drive. See appropriate hardware manual.<br>Check that ambient temperature setting is correct (parameter 95.10).<br>Check converter module cooling air flow and fan operation.<br>Cabinet installation: Check cabinet air inlet filters. Change when necessary. See appropriate hardware manual.<br>Modules installed in cabinet by user: Check that cooling air circulation in cabinet has been prevented with air baffles. See module installation instructions.<br>Check inside of cabinet and heatsink of converter module for dust pick-up. Clean when necessary.<br>Reset and restart after problem is solved and let converter module cool down. |

| FAULT | CAUSE | WHAT TO DO |
|---|---|---|
| I/O COMM ERR (7000)<br>3.06 FW 2 bit 6 | Communication error on control board, channel CH1<br>Electromagnetic interference | Check connections of fibre optic cables on channel CH1.<br>Check all I/O modules (if present) connected to channel CH1.<br>Check for proper earthing of equipment. Check for highly emissive components nearby. |
| LINE CONV (FF51) | Fault on line side converter | Shift panel from motor side converter control board to line side converter control board.<br>See line side converter manual for fault description. |
| MOD BOARD T (FF88) | Overtemperature in AINT board of inverter module. | Check inverter fan.<br>Check ambient temperature. |
| MOD CHOKE T (FF89) | Overtemperature in choke of liquid cooled R8i inverter module. | Check inverter fan.<br>Check ambient temperature.<br>Check liquid cooling system. |
| MOTOR PHASE (FF56)<br>3.06 FW 2 bit 15<br>(programmable Fault Function 30.16) | One of motor phases is lost due to fault in motor, motor cable, thermal relay (if used) or internal fault. | Check motor and motor cable.<br>Check thermal relay (if used).<br>Check Fault Function parameters. Disable this protection. |
| MOTOR STALL (7121)<br>3.06 FW 2 bit 14<br>(programmable Fault Function 30.10…30.12) | Motor is operating in stall region due to e.g. excessive load or insufficient motor power. | Check motor load and drive ratings.<br>Check Fault Function parameters. |
| MOTOR TEMP (4310)<br>3.05 FW 1 bit 6<br>(programmable Fault Function 30.04…30.09) | Motor temperature is too high (or appears to be too high) due to excessive load, insufficient motor power, inadequate cooling or incorrect start-up data. | Check motor ratings and load.<br>Check start-up data.<br>Check Fault Function parameters. |
| MOTOR 1 TEMP (4312)<br>3.15 FW 4 bit 1 | Measured motor temperature has exceeded fault limit set by parameter 35.03. | Check value of fault limit.<br>Let motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc. |
| MOTOR 2 TEMP (4313)<br>3.15 FW 4 bit 2 | Measured motor temperature has exceeded fault limit set by parameter 35.06. | Check value of fault limit.<br>Let motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc. |
| NO MOT DATA (FF52)<br>3.06 FW 2 bit 1 | Motor data is not given or motor data does not match with inverter data. | Check motor data parameters 99.04…99.09. |

| FAULT | CAUSE | WHAT TO DO |
|---|---|---|
| OVERCURR xx (2310)<br>3.05 FW 1 bit 1 and 4.01 | Overcurrent fault in inverter unit of several parallel connected inverter modules. xx (1...12) refers to inverter module number. | Check motor load.<br>Check acceleration time.<br>Check motor and motor cable (including phasing).<br>Check encoder cable (including phasing).<br>Check motor nominal values from group 99 START-UP DATA to confirm that motor model is correct.<br>Check that there are no power factor correction or surge absorbers in motor cable. |
| OVERCURRENT (2310)<br>3.05 FW 1 bit 1 | Output current exceeds trip limit. | Check motor load.<br>Check acceleration time.<br>Check motor and motor cable (including phasing).<br>Check that there are no power factor correction capacitors or surge absorbers in motor cable.<br>Check encoder cable (including phasing). |
| OVERFREQ (7123)<br>3.05 FW 1 bit 9 | Motor is turning faster than highest allowed speed due to incorrectly set minimum/ maximum speed, insufficient braking torque or changes in load when using torque reference.<br><br>Trip level is 50 Hz over operating range absolute maximum speed limit (Direct Torque Control mode active) or frequency limit (Scalar Control active). Operating range limits are set by parameters 20.01 and 20.02 (DTC mode active) or 20.07 and 20.08 (Scalar Control active). | Check minimum/maximum speed settings.<br>Check adequacy of motor braking torque.<br>Check applicability of torque control.<br>Check need for brake chopper and resistor(s). |
| OVER SWFREQ (FF55)<br>3.06 FW 2 bit 9 | Switching frequency is too high. | Check motor parameter settings (parameter group 99 START-UP DATA)<br>Ensure that ID run has been completed successfully. |
| PANEL LOSS (5300)<br>3.06 FW 2 bit 13 (programmable Fault Function 30.02) | Control panel or DriveWindow selected as active control location for drive has ceased communicating. | Check panel connection (see appropriate hardware manual).<br>Check control panel connector.<br>Replace control panel in mounting platform.<br>Check Fault Function parameters.<br>Check DriveWindow connection. |
| PARAM CRC (6320) | CRC (Cyclic Redundancy Check) error | Switch control board power off and on again.<br>Reload firmware to control board.<br>Replace control board. |
| POWERFAIL (3381)<br>3.17 FW 5 bit 9 | INT board powerfail in several inverter units of parallel connected inverter modules. | Check that INT board power cable is connected.<br>Check that POW board is working correctly.<br>Replace INT board. |

| FAULT | CAUSE | WHAT TO DO |
|---|---|---|
| POWERF INV xx<br>(3381)<br>3.17 FW 5 bit 9 and 4.01 | INT board powerfail in inverter unit of several parallel connected inverter modules. xx (1...12) refers to inverter module number. | Check that INT board power cable is connected.<br>Check that POW board is working correctly.<br>Replace INT board. |
| PPCC LINK<br>(5210)<br>3.06 FW 2 bit 11 | Fibre optic link to INT board is faulty. | Check fibre optic cables or galvanic link. With frame sizes R2-R6 link is galvanic.<br>If RMIO is powered from external supply, ensure that supply is on. See parameter 16.09 CTRL BOARD SUPPLY.<br>Check signal 03.19. Contact ABB representative if any of faults in signal 3.19 are active. |
| PPCC LINK xx<br>(5210)<br>3.06 FW 2 bit 11 and 4.01 | INT board fibre optic connection fault in inverter unit of several parallel connected inverter modules. xx refers to inverter module number. | Check connection from inverter module Main Circuit Interface Board, INT to PPCC Branching Unit, PBU. (Inverter module 1 is connected to PBU INT1 etc.)<br>Check signal 03.19. Contact ABB representative if any of faults in signal 3.19 are active. |
| PP OVERLOAD<br>(5482)<br>3.17 FW 5 bit 6 | Excessive IGBT junction to case temperature. This fault protects IGBT(s) and it can be activated by short circuit at output of long motor cables. | Check motor cables. |
| SC INV xx y<br>(2340)<br>3.05 FW 1 bit 0, 4.01 and 4.02 | Short circuit in inverter unit of several parallel connected inverter modules. xx (1...12) refers to inverter module number and y refers to phase (U, V, W). | Check motor and motor cable.<br>Check power semiconductors (IGBTs) of inverter module. |
| SHORT CIRC<br>(2340)<br>3.05 FW 1 bit 0 and 4.02 | Short-circuit in motor cable(s) or motor<br><br>Output bridge of converter unit is faulty. | Check motor and motor cable.<br>Check there are no power factor correction capacitors or surge absorbers in motor cable.<br><br>Contact ABB representative. |
| SLOT OVERLAP<br>(FF8A) | Two option modules have same connection interface selection. | Check connection interface selections in group 98 OPTION MODULES. |
| START INHIBI<br>(FF7A)<br>3.03 bit 8 | Safe torque off has been activated during motor run or motor start command has been given when Safe torque off is active.<br>Or: Optional start inhibit hardware logic is activated. | Close Safe torque off switch. If switch is closed and fault is still active, check power supply at ASTO board input terminals. Replace ASTO board.<br>Or: Check start inhibit circuit (AGPS board). |
| SUPPLY PHASE<br>(3130)<br>3.06 FW 2 bit 0 | Intermediate circuit DC voltage is oscillating due to missing supply voltage phase, blown fuse or rectifier bridge internal fault.<br>Trip occurs when DC voltage ripple is 13% of DC voltage. | Check main supply fuses.<br>Check for main supply imbalance. |

| FAULT | CAUSE | WHAT TO DO |
|---|---|---|
| TEMP DIF xx y<br>(4380)<br>3.17 FW 5 bit 8 and 4.01 | Excessive temperature difference between several parallel connected inverter modules. xx (1...12) refers to inverter module number and y refers to phase (U, V, W).<br><br>Alarm is indicated when temperature difference is 15°C. Fault is indicated when temperature difference is 20°C<br><br>Excessive temperature can be caused e.g. by unequal current sharing between parallel connected inverters. | Check cooling fan.<br>Replace fan.<br>Check air filters. |
| THERMAL MODE<br>(FF50) | Motor thermal protection mode is set to DTC for high-power motor. | See parameter 30.05. |
| THERMISTOR<br>(4311)<br>3.05 FW 1 bit 5<br>(programmable Fault Function 30.04…30.05) | Motor temperature is excessive. Motor thermal protection mode selection is TEMP SENSOR. | Check motor ratings and load.<br>Check start-up data.<br>Check thermistor connections to digital input DI6. |
| UNDERLOAD<br>(FF6A)<br>3.05 FW 1 bit 8<br>(programmable Fault Function 30.13…30.15) | Motor load is too low due to e.g. release mechanism in driven equipment. | Check for problem in driven equipment.<br>Check Fault Function parameters. |
| USER L CURVE<br>(2312)<br>3.17 FW 5 bit 11 | Integrated motor current has exceeded load curve defined by parameter group 72 USER LOAD CURVE. | Check parameter group 72 USER LOAD CURVE settings.<br>After motor cooling time specified by parameter 72.20 LOAD COOLING TIME has elapsed, fault can be reset. |
| USER MACRO<br>(FFA1)<br>3.07 SFW bit 1 | No User Macro saved or file is defective. | Create User Macro. |

# Analogue Extension Module

## Chapter overview

The chapter describes the use of analogue extension module RAIO as an speed reference interface of ACS800 equipped with Standard Control Program.

## Speed control through the analogue extension module

Two variants are described:

- Bipolar Input in Basic Speed Control
- Bipolar Input in Joystick Mode

Only the use of a bipolar input (± signal range) is covered here. The use of unipolar input corresponds to that of a standard unipolar input when:

- the settings described below are done, and
- the communication between the module and the drive is activated by parameter 98.06.

### Basic checks

Ensure the drive is:

- installed and commissioned, and
- the external start and stop signals are connected.

Ensure the extension module:

- settings are adjusted. (See below.)
- is installed and reference signal is connected to AI1.
- is connected to the drive.

### Settings of the analogue extension module and the drive

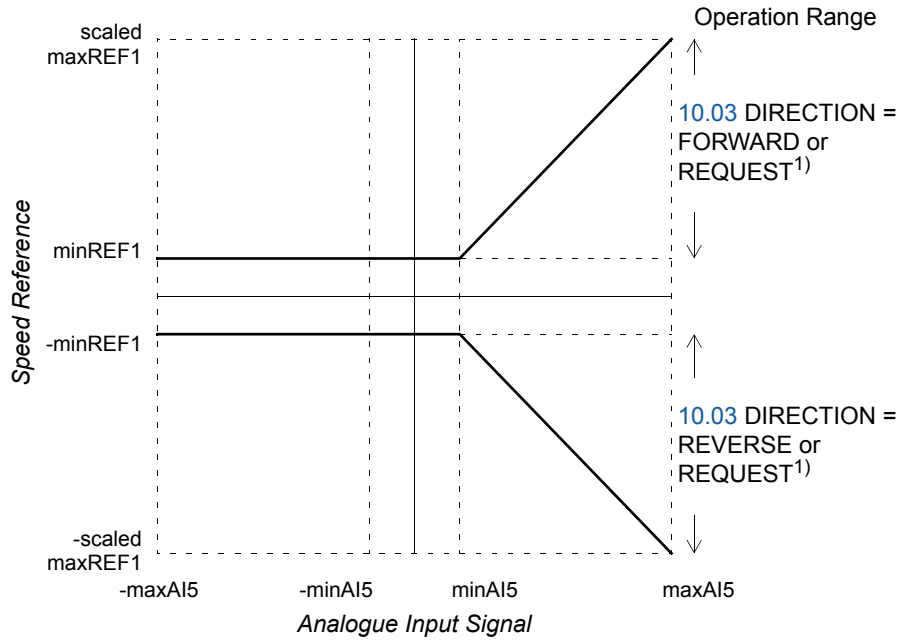
- Set the module node address to 5 (not required if installed to the option slot of the drive).
- Select the signal type for the module input AI1 (switch).
- Select the operation mode (unipolar/bipolar) of the module input (switch).
- Ensure the drive parameter settings correspond to the mode of the module inputs (parameter 98.13 and 98.14).
- Set the drive parameters (see the appropriate section on the following pages).

## Parameter settings: bipolar input in basic speed control

The table below lists the parameters that affect the handling of the speed reference received through the extension module bipolar input AI1 (AI5 of the drive).

| Parameter | Setting |
|---|---|
| 98.06 AI/O EXT MODULE | RAIO-SLOT1 |
| 98.13 AI/O EXT AI1 FUNC | BIPO AI5 |
| 10.03 DIRECTION | FORWARD; REVERSE; REQUEST(1 |
| 11.02 EXT1/EXT2 SELECT | EXT1 |
| 11.03 EXT REF1 SELECT | AI5 |
| 11.04 EXT REF1 MINIMUM | minREF1 |
| 11.05 EXT REF1 MAXIMUM | maxREF1 |
| 13.16 MINIMUM AI5 | minAI5 |
| 13.17 MAXIMUM AI5 | maxAI5 |
| 13.18 SCALE AI5 | 100% |
| 13.20 INVERT AI5 | NO |
| 30.01 AI<MIN FUNCTION | (2 |

The figure below presents the speed reference corresponding to bipolar input AI1 of the extension module.




minAI5 = 13.16 MINIMUM AI5
maxAI5 = 13.17 MAXIMUM AI5
scaled maxREF1 = 13.18 SCALE AI5 x 11.05 EXT REF1 MAXIMUM
minREF1 = 11.04 EXT REF1 MINIMUM

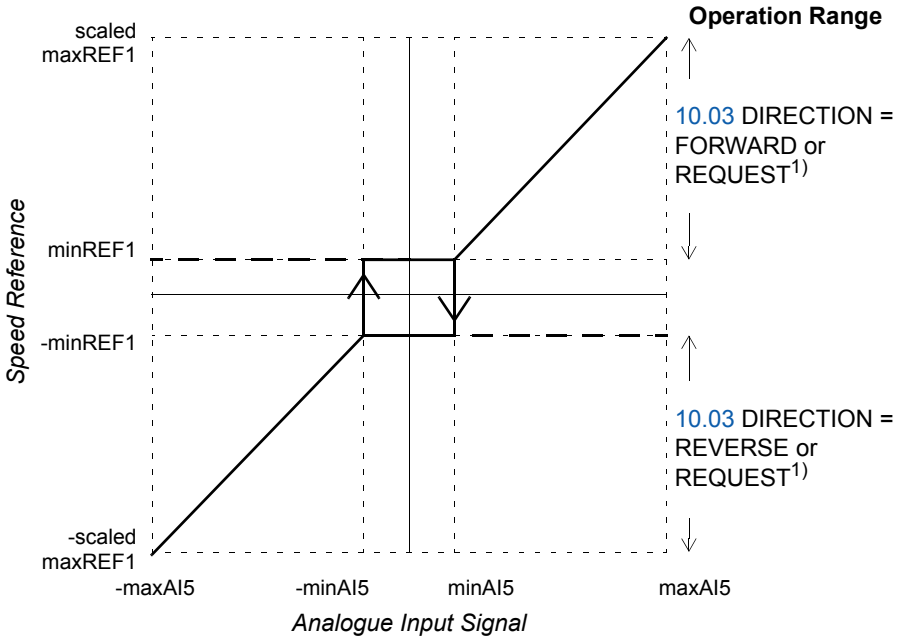
1) For the negative speed range, the drive must receive a separate reverse command.
2) Set if supervision of living zero is used.

## Parameter settings: bipolar input in joystick mode

The table below lists the parameters that affect the handling of the speed and direction reference received through the extension module bipolar input AI1 (AI5 of the drive).

| Parameter | Setting |
|---|---|
| 98.06 AI/O EXT MODULE | RAIO-SLOT1 |
| 98.13 AI/O EXT AI1 FUNC | BIPO AI5 |
| 10.03 DIRECTION | FORWARD; REVERSE; REQUEST(1 |
| 11.02 EXT1/EXT2 SELECT | EXT1 |
| 11.03 EXT REF1 SELECT | AI5/JOYST |
| 11.04 EXT REF1 MINIMUM | minREF1 |
| 11.05 EXT REF1 MAXIMUM | maxREF1 |
| 13.16 MINIMUM AI5 | minAI5 |
| 13.17 MAXIMUM AI5 | maxAI5 |
| 13.18 SCALE AI5 | 100% |
| 13.20 INVERT AI5 | NO |
| 30.01 AI<MIN FUNCTION | (2 |

The figure below presents the speed reference corresponding to bipolar input AI1 of the extension module in joystick mode.




| | | |
|---|---|---|
| minAI5 | = | 13.15 MINIMUM AI5 |
| maxAI5 | = | 13.17 MAXIMUM AI5 |
| scaled maxREF1 | = | 13.18 SCALE AI5 x 11.05 EXT REF1 MAXIMUM |
| minREF1 | = | 11.04 EXT REF1 MINIMUM |

1) Enables the use of both positive and negative speed range.
2) Set if supervision of living zero is used.

# Additional data: actual signals and parameters

## Chapter overview

This chapter lists the actual signal and parameter lists with some additional data. For the descriptions, see chapter *Actual signals and parameters*.

## Terms and abbreviations

| Term | Definition |
|---|---|
| PB | Profibus equivalent for drive parameters communicating through the **NPBA-12** Profibus Adapter. |
| FbEq | Fieldbus equivalent: The scaling between the value shown on the panel and the integer used in serial communication. |
| Absolute Maximum Frequency | Value of 20.08, or 20.07 if the absolute value of the minimum limit is greater than the maximum limit. |
| Absolute Maximum Speed | Value of parameter 20.02, or 20.01 if the absolute value of the minimum limit is higher than the maximum limit. |
| W | Write access is not allowed when the motor is running. |

## Fieldbus addresses

### Rxxx adapter modules (such as RPBA-01, RDNA-01, etc.)

See the appropriate fieldbus adapter module User's Manual.

### Nxxx adapter modules (such as NPBA-12, NDNA-02, etc.)

*NPBA-12 Profibus Adapter*

All versions

- see column PB in the tables below.

Version 1.5 or later

- see *NPBA-12 PROFIBUS Adapter Installation and Start-Up Guide* [3BFE64341588 (English)].

Reading or writing a drive parameter can be done also by converting the parameter group (PNU) and the parameter index (subindex) into hexadecimal.

Example: drive parameter 12.07:
12 = 0C(hex)
07 = 07(hex) => 0C07.

Request label for request parameter value is 6. Request label for change parameter value is 7. **Note:** Not every parameter has Profibus equivalent value (PB).

*NIBA-01 InterBus-S Adapter*

- xxyy · 100 + 12288 converted into hexadecimal, where xxyy = drive parameter number
  Example: The index number for drive parameter 13.09 is 1309 + 12288 = 13597 (dec) = 351D (hex)

*NMBP-01 ModbusPlus® Adapter and NMBA-01 Modbus Adapter*

- 4xxyy, where xxyy = drive parameter number

# Actual signals

| Index | Name | Short name | FbEq | Unit | Range | PB | |
|---|---|---|---|---|---|---|---|
| 01 | ACTUAL SIGNALS | | | | | | |
| 01.01 | PROCESS VARIABLE | PROC VAR | 1 = 1 | According to parameter 34.02 | | 1 | |
| 01.02 | SPEED | SPEED | -20000 = -100% 20000 = 100% of motor absolute max. speed | rpm | | 2 | |
| 01.03 | FREQUENCY | FREQ | -100 = -1 Hz 100 = 1 Hz | Hz | | 3 | |
| 01.04 | CURRENT | CURRENT | 10 = 1 A | A | | 4 | |
| 01.05 | TORQUE | TORQUE | -10000 = -100% 10000 = 100% of motor nominal torque | % | | 5 | |
| 01.06 | POWER | POWER | -1000 = -100% 1000 = 100% of motor nominal power | % | | 6 | |
| 01.07 | DC BUS VOLTAGE V | DC BUS V | 1 = 1 V | V | | 7 | |
| 01.08 | MAINS VOLTAGE | MAINS V | 1 = 1 V | V | | 8 | |
| 01.09 | OUTPUT VOLTAGE | OUT VOLT | 1 = 1 V | V | | 9 | |
| 01.10 | ACS800 TEMP | ACS TEMP | 10 = 1% | % | | 10 | |
| 01.11 | EXTERNAL REF 1 | EXT REF1 | 1 = 1 rpm | rpm | | 11 | |
| 01.12 | EXTERNAL REF 2 | EXT REF2 | 0 = 0% 10000 = 100% 1) | % | | 12 | |
| 01.13 | CTRL LOCATION | CTRL LOC | (1,2) LOCAL; (3) EXT1; (4) EXT2 | | LOCAL; EXT1; EXT2 | 13 | |
| 01.14 | OP HOUR COUNTER | OP HOURS | 1 = 1 h | h | | 14 | |
| 01.15 | KILOWATT HOURS | KW HOURS | 1 = 100 kWh | kWh | | 15 | |
| 01.16 | APPL BLOCK OUTPUT | APPL OUT | 0 = 0% 10000 = 100% | % | | 16 | |
| 01.17 | DI6-1 STATUS | DI6-1 | 1 = 1 | | | 17 | |
| 01.18 | AI1 [V] | AI1 [V] | 1 = 0.001 V | V | | 18 | |
| 01.19 | AI2 [mA] | AI2 [mA] | 1 = 0.001 mA | mA | | 19 | |
| 01.20 | AI3 [mA] | AI3 [mA] | 1 = 0.001 mA | mA | | 20 | |
| 01.21 | RO3-1 STATUS | RO3-1 | 1 = 1 | | | 21 | |
| 01.22 | AO1 [mA] | AO1 [mA] | 1 =0.001 mA | mA | | 22 | |
| 01.23 | AO2 [mA] | AO2 [mA] | 1 = 0.001 mA | mA | | 23 | |
| 01.24 | ACTUAL VALUE 1 | ACT VAL1 | 0 = 0% 10000 = 100% | % | | 24 | |
| 01.25 | ACTUAL VALUE 2 | ACT VAL2 | 0 = 0% 10000 = 100% | % | | 25 | |
| 01.26 | CONTROL DEVIATION | CONT DEV | -10000 = -100% 10000 = 100% | % | | 26 | |
| 01.27 | APPLICATION MACRO | MACRO | 1 … 7 | | According to parameter 99.02 | 27 | |
| 01.28 | EXT AO1 [mA] | EXT AO1 | 1 = 0.001 mA | mA | | 28 | |
| 01.29 | EXT AO2 [mA] | EXT AO2 | 1 = 0.001 mA | mA | | 29 | |
| 01.30 | PP 1 TEMP | PP 1 TEM | 1 = 1°C | °C | | 30 | |
| 01.31 | PP 2 TEMP | PP 2 TEM | 1 = 1°C | °C | | 31 | |
| 01.32 | PP 3 TEMP | PP 3 TEM | 1 = 1°C | °C | | 32 | |
| 01.33 | PP 4 TEMP | PP 4 TEM | 1 = 1°C | °C | | 33 | |
| 01.34 | ACTUAL VALUE | ACT V | 0 = 0% 10000 = 100% | % | | 34 | |
| 01.35 | MOTOR 1 TEMP | M 1 TEMP | 1 = 1°C/ohm | °C | | 35 | |
| 01.36 | MOTOR 2 TEMP | M 2 TEMP | 1 = 1°C/ohm | °C | | 36 | |
| 01.37 | MOTOR TEMP EST | MOTOR TE | 1 = 1°C | °C | | 37 | |
| 01.38 | AI5 [mA] | AI5 [mA] | 1 = 0.001 mA | mA | | 38 | |

| Index | Name | Short name | FbEq | Unit | Range | PB | |
|---|---|---|---|---|---|---|---|
| 01.39 | AI6 [mA] | AI6 [mA] | 1 = 0.001 mA | mA | | 39 | |
| 01.40 | DI7-12 STATUS | DI7...12 | 1 = 1 | | | 40 | |
| 01.41 | EXT RO STATUS | EXT RO | 1 = 1 | | | 41 | |
| 01.42 | PROCESS SPEED REL | P SPEED | 1 = 1 | % | | 42 | |
| 01.43 | MOTOR RUN TIME | MOTOR RUN TIME | 1 = 10 h | h | | 43 | |
| 01.44 | FAN ON-TIME | FAN TIME | 10 h = 1 | h | | 44 | |
| 01.45 | CTRL BOARD TEMP | CTRL B T | 1 = 1 | °C | | 45 | |
| 01.46 | SAVED KWH | SAV KWH | 1 = 100 kWh | kWh | 0…999 999 | 46 | |
| 01.47 | SAVED GWH | SAV GWH | 1 = 1 GWh | GWh | 1…8388607 | 47 | |
| 01.48 | SAVED AMOUNT | SAV AM | 1 = 100 cur | local; EUR; USD | 0…999 999 | 48 | |
| 01.49 | SAVED AMOUNT M | SAV AM M | 1 = 1 Mcur | local; EUR; USD | 1…8388607 | 49 | |
| 01.50 | SAVED CO2 | SAV CO2 | 1 = 100 kg | kg | 0…999 999 | 50 | |
| 01.51 | SAVED CO2 KTON | SAV CO2K | 1 = 1 kton | kton | 1…8388607 | - | |
| 02 | ACTUAL SIGNALS | | | | | | |
| 02.01 | SPEED REF 2 | S REF 2 | 0 = 0% 20000 = 100% of motor absolute max. speed | rpm | | 51 | |
| 02.02 | SPEED REF 3 | S REF 3 | | rpm | | 52 | |
| 02.09 | TORQUE REF 2 | T REF 2 | 0 = 0% 10000 = 100% of motor nominal torque | % | | 59 | |
| 02.10 | TORQUE REF 3 | T REF 3 | | % | | 60 | |
| 02.13 | TORQ USED REF | T USED R | | % | | 63 | |
| 02.14 | FLUX REF | FLUX REF | 0 = 0% 10000 = 100% | % | | 64 | |
| 02.17 | SPEED ESTIMATED | SPEED ES | 0 = 0% 20000 = 100% of motor absolute max. speed | rpm | | 67 | |
| 02.18 | SPEED MEASURED | SPEED ME | | rpm | | 68 | |
| 02.19 | MOTOR ACCELERATIO | MOTOR AC | 1 = 1 rpm/s. | rpm/s | | 69 | |
| 02.20 | USER CURRENT | USER CUR | 10 = 1% | % | | 70 | |
| 03 | ACTUAL SIGNALS | | 2) | | | | |
| 03.01 | MAIN CTRL WORD | MAIN CW | | | 0...65535 (Decimal) | 76 | |
| 03.02 | MAIN STATUS WORD | MAIN SW | | | 0...65535 (Decimal) | 77 | |
| 03.03 | AUX STATUS WORD | AUX SW | | | 0...65535 (Decimal) | 78 | |
| 03.04 | LIMIT WORD 1 | LIMIT W1 | | | 0...65535 (Decimal) | 79 | |
| 03.05 | FAULT WORD 1 | FAULT W1 | | | 0...65535 (Decimal) | 80 | |
| 03.06 | FAULT WORD 2 | FAULT W2 | | | 0...65535 (Decimal) | 81 | |
| 03.07 | SYSTEM FAULT | SYS FLT | | | 0...65535 (Decimal) | 82 | |
| 03.08 | ALARM WORD 1 | ALARM W1 | | | 0...65535 (Decimal) | 83 | |
| 03.09 | ALARM WORD 2 | ALARM W2 | | | 0...65535 (Decimal) | 84 | |
| 03.11 | FOLLOWER MCW | FOLL MCW | | | 0...65535 (Decimal) | 86 | |
| 03.13 | AUX STATUS WORD 3 | AUX SW 3 | | | 0...65535 (Decimal) | 88 | |
| 03.14 | AUX STATUS WORD 4 | AUX SW 4 | | | 0...65535 (Decimal) | 89 | |
| 03.15 | FAULT WORD 4 | FAULT W4 | | | 0...65535 (Decimal) | 90 | |
| 03.16 | ALARM WORD 4 | ALARM W4 | | | 0...65535 (Decimal) | 91 | |

| Index | Name | Short name | FbEq | Unit | Range | PB | |
|---|---|---|---|---|---|---|---|
| 03.17 | FAULT WORD 5 | FAULT W5 | | | 0...65535 (Decimal) | 92 | |
| 03.18 | ALARM WORD 5 | ALARM W5 | | | 0...65535 (Decimal) | 93 | |
| 03.19 | INT INIT FAULT | INT INIT | | | 0...65535 (Decimal) | 94 | |
| 03.20 | LATEST FAULT | LAST FLT | | | 0...65535 (Decimal) | 95 | |
| 03.21 | 2.LATEST FAULT | 2.FAULT | | | 0...65535 (Decimal) | 96 | |
| 03.22 | 3.LATEST FAULT | 3.FAULT | | | 0...65535 (Decimal) | 97 | |
| 03.23 | 4.LATEST FAULT | 4.FAULT | | | 0...65535 (Decimal) | 98 | |
| 03.24 | 5.LATEST FAULT | 5.FAULT | | | 0...65535 (Decimal) | 99 | |
| 03.25 | LATEST WARNING | LAST WRN | | | 0...65535 (Decimal) | 100 | |
| 03.26 | 2.LATEST WARNING | 2.WARN | | | 0...65535 (Decimal) | | |
| 03.27 | 3.LATEST WARNING | 3.WARN | | | 0...65535 (Decimal) | | |
| 03.28 | 4.LATEST WARNING | 4.WARN | | | 0...65535 (Decimal) | | |
| 03.29 | 5.LATEST WARNING | 5.WARN | | | 0...65535 (Decimal) | | |
| 03.30 | LIMIT WORD INV | LIMIT WO | | | 0...65535 (Decimal) | - | |
| 03.31 | ALARM WORD 6 | ALARM W6 | | | 0...65535 (Decimal) | - | |
| 03.32 | EXT IO STATUS | E IO ST | - | - | 0…65535 (Decimal) | - | |
| 03.33 | FAULT WORD 6 | FAULT W6 | | | 0…65535 (Decimal) | | |
| 04 | ACTUAL SIGNALS | | | | | | |
| 04.01 | FAULTED INT INFO | FLTD INT | | | 0...65535 (Decimal) | | |
| 04.02 | INT SC INFO | INT SC | | | 0...65535 (Decimal) | | |
| 09 | ACTUAL SIGNALS | | | | | | |
| 09.01 | AI1 SCALED | AI1 SCAL | 20000 = 10 V | | 0…20000 | - | |
| 09.02 | AI2 SCALED | AI2 SCAL | 20000 = 20 mA | | 0…20000 | - | |
| 09.03 | AI3 SCALED | AI3 SCAL | 20000 = 20 mA | | 0…20000 | - | |
| 09.04 | AI5 SCALED | AI5 SCAL | 20000 = 20 mA | | 0…20000 | - | |
| 09.05 | AI6 SCALED | AI6 SCAL | 20000 = 20 mA | | 0…20000 | - | |
| 09.06 | DS MCW | DS MCW | 0...65535 (Decimal) | | 0...65535 (Decimal) | - | |
| 09.07 | MASTER REF1 | M REF1 | -32768…32767 | | -32768…32767 | - | |
| 09.08 | MASTER REF2 | M REF2 | -32768…32767 | | -32768…32767 | - | |
| 09.09 | AUX DS VAL1 | AUX DSV1 | -32768…32767 | | -32768…32767 | - | |
| 09.10 | AUX DS VAL2 | AUX DSV2 | -32768…32767 | | -32768…32767 | - | |
| 09.11 | AUX DS VAL3 | AUX DSV3 | -32768…32767 | | -32768…32767 | - | |
| 09.12 | LCU ACT SIGNAL1 | LCU ACT1 | 1 = 1 | | - | - | |
| 09.13 | LCU ACT SIGNAL2 | LCU ACT2 | 1 = 1 | | - | - | |

1) Percent of motor max. speed / nominal torque / max. process reference (depending on the ACS800 macro selected).

2) The contents of these data words are detailed in chapter *Fieldbus control*. For the contents of Actual Signal 3.11, see the Master/Follower Application Guide [3AFE64590430 (English)].

# Parameters

| Index | Name/Selection | FACTORY | HAND/AUTO | PID-CTRL | T-CTRL | SEQ CTRL | PB | W |
|---|---|---|---|---|---|---|---|---|
| 10 | START/STOP/DIR | | | | | | | |
| 10.01 | EXT1 STRT/STP/DIR | DI1,2 (US: DI1P,2P,3) | DI1,2 | DI1 | DI1,2 | DI1,2 | 101 | W |
| 10.02 | EXT2 STRT/STP/DIR | NOT SEL | DI6,5 | DI6 | DI1,2 | NOT SEL | 102 | W |
| 10.03 | REF DIRECTION | FORWARD | REQUEST | FORWARD | REQUEST | REQUEST | 103 | W |
| 10.04 | EXT 1 STRT PTR | 0 | 0 | 0 | 0 | | 104 | W |
| 10.05 | EXT 2 STRT PTR | 0 | 0 | 0 | 0 | 0 | 105 | W |
| 10.06 | JOG SPEED SELECT | NOT SEL | NOT SEL | NOT SEL | NOT SEL | NOT SEL | 106 | W |
| 10.07 | NET CONTROL | 0 | 0 | 0 | 0 | 0 | 107 | |
| 10.08 | NET REFERENCE | 0 | 0 | 0 | 0 | 0 | 108 | |
| 10.09 | SLS ACTIVE | NO | NO | NO | NO | NO | 109 | |
| 11 | REFERENCE SELECT | | | | | | | |
| 11.01 | KEYPAD REF SEL | REF1 (rpm) | REF1 (rpm) | REF1 (rpm) | REF1 (rpm) | REF1 (rpm) | 126 | |
| 11.02 | EXT1/EXT2 SELECT | EXT1 | DI3 | DI3 | DI3 | EXT1 | 127 | W |
| 11.03 | EXT REF1 SELECT | AI1 | AI1 | AI1 | AI1 | AI1 | 128 | W |
| 11.04 | EXT REF 1 MINIMUM | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 129 | |
| 11.05 | EXT REF 1 MAXIMUM | 1500 rpm | 1500 rpm | 1500 rpm | 1500 rpm | 1500 rpm | 130 | |
| 11.06 | EXT REF2 SELECT | KEYPAD | AI2 | AI1 | AI2 | AI1 | 131 | W |
| 11.07 | EXT REF 2 MINIMUM | 0% | 0% | 0% | 0% | 0% | 132 | |
| 11.08 | EXT REF 2 MAXIMUM | 100% | 100% | 100% | 100% | 100% | 133 | |
| 11.09 | EXT 1/2 SEL PTR | 0 | 0 | 0 | 0 | 0 | 134 | |
| 11.10 | EXT 1 REF PTR | 0 | 0 | 0 | 0 | 0 | 135 | |
| 11.11 | EXT 2 REF PTR | 0 | 0 | 0 | 0 | 0 | 136 | |
| 12 | CONSTANT SPEEDS | | | | | | | |
| 12.01 | CONST SPEED SEL | DI5,6 | DI4(SPEED4) | DI4(SPEED4) | DI4(SPEED4) | DI4,5,6 | 151 | W |
| 12.02 | CONST SPEED 1 | 300 rpm | 300 rpm | 300 rpm | 300 rpm | 300 rpm | 152 | |
| 12.03 | CONST SPEED 2 | 600 rpm | 600 rpm | 600 rpm | 600 rpm | 600 rpm | 153 | |
| 12.04 | CONST SPEED 3 | 900 rpm | 900 rpm | 900 rpm | 900 rpm | 900 rpm | 154 | |
| 12.05 | CONST SPEED 4 | 300 rpm | 300 rpm | 300 rpm | 300 rpm | 1200 rpm | 155 | |
| 12.06 | CONST SPEED 5 | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 1500 rpm | 156 | |
| 12.07 | CONST SPEED 6 | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 2400 rpm | 157 | |
| 12.08 | CONST SPEED 7 | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 3000 rpm | 158 | |
| 12.09 | CONST SPEED 8 | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 159 | |
| 12.10 | CONST SPEED 9 | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 160 | |
| 12.11 | CONST SPEED 10 | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 161 | |
| 12.12 | CONST SPEED 11 | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 162 | |
| 12.13 | CONST SPEED 12 | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 163 | |
| 12.14 | CONST SPEED 13 | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 164 | |
| 12.15 | CONST SPEED 14 | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 165 | |
| 12.16 | CONST SPEED 15 | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 166 | |
| 13 | ANALOGUE INPUTS | | | | | | | |
| 13.01 | MINIMUM AI1 | 0 V | 0 V | 0 V | 0 V | 0 V | 176 | |
| 13.02 | MAXIMUM AI1 | 10 V | 10 V | 10 V | 10 V | 10 V | 177 | |
| 13.03 | SCALE AI1 | 100% | 100% | 100% | 100% | 100% | 178 | |
| 13.04 | FILTER AI1 | 0.10 s | 0.10 s | 0.10 s | 0.10 s | 0.10 s | 179 | |
| 13.05 | INVERT AI1 | NO | NO | NO | NO | NO | 180 | |
| 13.06 | MINIMUM AI2 | 0 mA | 0 mA | 0 mA | 0 mA | 0 mA | 181 | |
| 13.07 | MAXIMUM AI2 | 20 mA | 20 mA | 20 mA | 20 mA | 20 mA | 182 | |
| 13.08 | SCALE AI2 | 100% | 100% | 100% | 100% | 100% | 183 | |
| 13.09 | FILTER AI2 | 0.10 s | 0.10 s | 0.10 s | 0.10 s | 0.10 s | 184 | |
| 13.10 | INVERT AI2 | NO | NO | NO | NO | NO | 185 | |
| 13.11 | MINIMUM AI3 | 0 mA | 0 mA | 0 mA | 0 mA | 0 mA | 186 | |
| 13.12 | MAXIMUM AI3 | 20 mA | 20 mA | 20 mA | 20 mA | 20 mA | 187 | |
| 13.13 | SCALE AI3 | 100% | 100% | 100% | 100% | 100% | 188 | |
| 13.14 | FILTER AI3 | 0.10 s | 0.10 s | 0.10 s | 0.10 s | 0.10 s | 189 | |
| 13.15 | INVERT AI3 | NO | NO | NO | NO | NO | 190 | |

| Index | Name/Selection | FACTORY | HAND/AUTO | PID-CTRL | T-CTRL | SEQ CTRL | PB | W |
|---|---|---|---|---|---|---|---|---|
| 13.16 | MINIMUM AI5 | 0 mA | 0 mA | 0 mA | 0 mA | 0 mA | 191 | |
| 13.17 | MAXIMUM AI5 | 20 mA | 20 mA | 20 mA | 20 mA | 20 mA | 192 | |
| 13.18 | SCALE AI5 | 100% | 100% | 100% | 100% | 100% | 193 | |
| 13.19 | FILTER AI5 | 0.10 s | 0.10 s | 0.10 s | 0.10 s | 0.10 s | 194 | |
| 13.20 | INVERT AI5 | NO | NO | NO | NO | NO | 195 | |
| 13.21 | MINIMUM AI6 | 0 mA | 0 mA | 0 mA | 0 mA | 0 mA | 196 | |
| 13.22 | MAXIMUM AI6 | 20 mA | 20 mA | 20 mA | 20 mA | 20 mA | 197 | |
| 13.23 | SCALE AI6 | 100% | 100% | 100% | 100% | 100% | 198 | |
| 13.24 | FILTER AI6 | 0.10 s | 0.10 s | 0.10 s | 0.10 s | 0.10 s | 199 | |
| 13.25 | INVERT AI6 | NO | NO | NO | NO | NO | 200 | |
| 14 | RELAY OUTPUTS | | | | | | | |
| 14.01 | RELAY RO1 OUTPUT | READY | READY | READY | READY | READY | 201 | W |
| 14.02 | RELAY RO2 OUTPUT | RUNNING | RUNNING | RUNNING | RUNNING | RUNNING | 202 | W |
| 14.03 | RELAY RO3 OUTPUT | FAULT(-1) | FAULT(-1) | FAULT(-1) | FAULT(-1) | FAULT(-1) | 203 | W |
| 14.04 | RO1 TON DELAY | 0.0 s | 0.0 s | 0.0 s | 0.0 s | 0.0 s | 204 | W |
| 14.05 | RO1 TOFF DELAY | 0.0 s | 0.0 s | 0.0 s | 0.0 s | 0.0 s | 205 | W |
| 14.06 | RO2 TON DELAY | 0.0 s | 0.0 s | 0.0 s | 0.0 s | 0.0 s | 206 | W |
| 14.07 | RO2 TOFF DELAY | 0.0 s | 0.0 s | 0.0 s | 0.0 s | 0.0 s | 207 | W |
| 14.08 | RO3 TON DELAY | 0.0 s | 0.0 s | 0.0 s | 0.0 s | 0.0 s | 208 | W |
| 14.09 | RO3 TOFF DELAY | 0.0 s | 0.0 s | 0.0 s | 0.0 s | 0.0 s | 209 | W |
| 14.10 | DIO MOD1 RO1 | READY | READY | READY | READY | READY | 210 | W |
| 14.11 | DIO MOD1 RO2 | RUNNING | RUNNING | RUNNING | RUNNING | RUNNING | 211 | W |
| 14.12 | DIO MOD2 RO1 | FAULT | FAULT | FAULT | FAULT | FAULT | 212 | W |
| 14.13 | DIO MOD2 RO2 | WARNING | WARNING | WARNING | WARNING | WARNING | 213 | W |
| 14.14 | DIO MOD3 RO1 | REF 2 SEL | REF 2 SEL | REF 2 SEL | REF 2 SEL | REF 2 SEL | 214 | W |
| 14.15 | DIO MOD3 RO2 | AT SPEED | AT SPEED | AT SPEED | AT SPEED | AT SPEED | 215 | W |
| 14.16 | RO PTR1 | 0 | 0 | 0 | 0 | 0 | 216 | W |
| 14.17 | RO PTR2 | 0 | 0 | 0 | 0 | 0 | 217 | W |
| 14.18 | RO PTR3 | 0 | 0 | 0 | 0 | 0 | 218 | W |
| 14.19 | RO PTR4 | 0 | 0 | 0 | 0 | 0 | 219 | W |
| 14.20 | RO PTR5 | 0 | 0 | 0 | 0 | 0 | 220 | W |
| 14.21 | RO PTR6 | 0 | 0 | 0 | 0 | 0 | 221 | W |
| 14.22 | RO PTR7 | 0 | 0 | 0 | 0 | 0 | 222 | W |
| 14.23 | RO PTR8 | 0 | 0 | 0 | 0 | 0 | 223 | W |
| 14.24 | RO PTR9 | 0 | 0 | 0 | 0 | 0 | 224 | W |
| 15 | ANALOGUE OUTPUTS | | | | | | | |
| 15.01 | ANALOGUE OUTPUT1 | SPEED | SPEED | SPEED | SPEED | SPEED | 226 | W |
| 15.02 | INVERT AO1 | NO | NO | NO | NO | NO | 227 | |
| 15.03 | MINIMUM AO1 | 0 mA | 0 mA | 0 mA | 0 mA | 0 mA | 228 | |
| 15.04 | FILTER AO1 | 0.10 s | 0.10 s | 0.10 s | 0.10 s | 0.10 s | 229 | |
| 15.05 | SCALE AO1 | 100% | 100% | 100% | 100% | 100% | 230 | |
| 15.06 | ANALOGUE OUTPUT2 | CURRENT | CURRENT | CURRENT | CURRENT | CURRENT | 231 | W |
| 15.07 | INVERT AO2 | NO | NO | NO | NO | NO | 232 | |
| 15.08 | MINIMUM AO2 | 0 mA | 0 mA | 0 mA | 0 mA | 0 mA | 233 | |
| 15.09 | FILTER AO2 | 2.00 s | 2.00 s | 2.00 s | 2.00 s | 2.00 s | 234 | |
| 15.10 | SCALE AO2 | 100% | 100% | 100% | 100% | 100% | 235 | |
| 15.11 | AO1 PTR | 0 | 0 | 0 | 0 | 0 | 236 | |
| 15.12 | AO2 PTR | 0 | 0 | 0 | 0 | 0 | 237 | |
| 16 | SYS CTRL INPUTS | | | | | | | |
| 16.01 | RUN ENABLE | YES | YES | DI5 | DI6 | YES | 251 | W |
| 16.02 | PARAMETER LOCK | OPEN | OPEN | OPEN | OPEN | OPEN | 252 | |
| 16.03 | PASS CODE | 0 | 0 | 0 | 0 | 0 | 253 | |
| 16.04 | FAULT RESET SEL | NOT SEL | NOT SEL | NOT SEL | NOT SEL | NOT SEL | 254 | W |
| 16.05 | USER MACRO IO CHG | NOT SEL | NOT SEL | NOT SEL | NOT SEL | NOT SEL | 255 | W |
| 16.06 | LOCAL LOCK | OFF | OFF | OFF | OFF | OFF | 256 | |
| 16.07 | PARAMETER SAVE | DONE | DONE | DONE | DONE | DONE | 257 | |
| 16.08 | RUN ENA PTR | 0 | 0 | 0 | 0 | 0 | 258 | |

| Index | Name/Selection | FACTORY | HAND/AUTO | PID-CTRL | T-CTRL | SEQ CTRL | PB | W |
|---|---|---|---|---|---|---|---|---|
| 16.09 | CTRL BOARD SUPPLY | INTERNAL 24V | INTERNAL 24V | INTERNAL 24V | INTERNAL 24V | INTERNAL 24V | 259 | |
| 16.10 | ASSIST SEL | ON | ON | ON | ON | ON | 260 | |
| 16.11 | FAULT RESET PTR | 0 | 0 | 0 | 0 | 0 | 261 | |
| 16.12 | RESET COUNTER | NO | NO | NO | NO | NO | 262 | |
| 20 | LIMITS | | | | | | | |
| 20.01 | MINIMUM SPEED | (calculated) | (calculated) | (calculated) | (calculated) | (calculated) | 351 | |
| 20.02 | MAXIMUM SPEED | (calculated) | (calculated) | (calculated) | (calculated) | (calculated) | 352 | |
| 20.03 | MAXIMUM CURRENT | type specific | type specific | type specific | type specific | type specific | 353 | |
| 20.04 | TORQ MAX LIM1 | 300% | 300% | 300% | 300% | 300% | 354 | |
| 20.05 | OVERVOLTAGE CTRL | ON | ON | ON | ON | ON | 355 | |
| 20.06 | UNDERVOLTAGE CTRL | ON | ON | ON | ON | ON | 356 | |
| 20.07 | MINIMUM FREQ | - 50 Hz | - 50 Hz | - 50 Hz | - 50 Hz | - 50 Hz | 357 | |
| 20.08 | MAXIMUM FREQ | 50 Hz | 50 Hz | 50 Hz | 50 Hz | 50 Hz | 358 | |
| 20.11 | P MOTORING LIM | 300% | 300% | 300% | 300% | 300% | 361 | |
| 20.12 | P GENERATING LIM | -300% | -300% | -300% | -300% | -300% | 362 | |
| 20.13 | MIN TORQ SEL | NEG MAX TORQ | NEG MAX TORQ | NEG MAX TORQ | NEG MAX TORQ | NEG MAX TORQ | 363 | |
| 20.14 | MAX TORQ SEL | MAX LIM1 | MAX LIM1 | MAX LIM1 | MAX LIM1 | MAX LIM1 | 364 | |
| 20.15 | TORQ MIN LIM1 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 365 | |
| 20.16 | TORQ MIN LIM2 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 366 | |
| 20.17 | TORQ MAX LIM2 | 300.0% | 300.0% | 300.0% | 300.0% | 300.0% | 367 | |
| 20.18 | TORQ MIN PTR | 0 | 0 | 0 | 0 | 0 | 368 | |
| 20.19 | TORQ MAX PTR | 0 | 0 | 0 | 0 | 0 | 369 | |
| 20.20 | MIN AI SCALE | 0% | 0% | 0% | 0% | 0% | 370 | |
| 20.21 | MAX AI SCALE | 300% | 300% | 300% | 300% | 300% | 371 | |
| 20.22 | SLS SPEED LIMIT | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 372 | W |
| 21 | START/STOP | | | | | | | |
| 21.01 | START FUNCTION | AUTO | AUTO | AUTO | AUTO | AUTO | 376 | W |
| 21.02 | CONST MAGN TIME | 500.0 ms | 500.0 ms | 500.0 ms | 500.0 ms | 500.0 ms | 377 | W |
| 21.03 | STOP FUNCTION | COAST | COAST | COAST | COAST | RAMP | 378 | |
| 21.04 | DC HOLD | NO | NO | NO | NO | NO | 379 | |
| 21.05 | DC HOLD SPEED | 5 rpm | 5 rpm | 5 rpm | 5 rpm | 5 rpm | 380 | W |
| 21.06 | DC HOLD CURR | 30% | 30% | 30% | 30% | 30% | 381 | W |
| 21.07 | RUN ENABLE FUNC | COAST STOP | COAST STOP | COAST STOP | COAST STOP | COAST STOP | 382 | |
| 21.08 | SCALAR FLY START | NO | NO | NO | NO | NO | 383 | |
| 21.09 | START INTRL FUNC | OFF2 STOP | OFF2 STOP | OFF2 STOP | OFF2 STOP | OFF2 STOP | 384 | |
| 21.10 | ZERO SPEED DELAY | 0.5 s | 0.5 s | 0.5 s | 0.5 s | 0.5 s | 385 | |
| 22 | ACCEL/DECEL | | | | | | | |
| 22.01 | ACC/DEC SEL | DI4 | ACC/DEC 1 | ACC/DEC 1 | DI5 | DI3 | 401 | W |
| 22.02 | ACCEL TIME 1 | 20 s | 20 s | 20 s | 20 s | 20 s | 402 | |
| 22.03 | DECEL TIME 1 | 20 s | 20 s | 20 s | 20 s | 20 s | 403 | |
| 22.04 | ACCEL TIME 2 | 60.00 s | 60.00 s | 60.00 s | 60.00 s | 60.00 s | 404 | |
| 22.05 | DECEL TIME 2 | 60.00 s | 60.00 s | 60.00 s | 60.00 s | 60.00 s | 405 | |
| 22.06 | ACC/DEC RAMP SHPE | 0.00 s | 0.00 s | 0.00 s | 0.00 s | 0.00 s | 406 | |
| 22.07 | EM STOP RAMP TIME | 3.00 s | 3.00 s | 3.00 s | 3.00 s | 3.00 s | 407 | |
| 22.08 | ACC PTR | 0 | 0 | 0 | 0 | 0 | 408 | |
| 22.09 | DEC PTR | 0 | 0 | 0 | 0 | 0 | 409 | |
| 22.10 | SLS ACCELER TIME | 20 s | 20 s | 20 s | 20 s | 20 s | 410 | W |
| 22.11 | SLS DECELER TIME | 20 s | 20 s | 20 s | 20 s | 20 s | 411 | W |
| 23 | SPEED CTRL | | | | | | | |
| 23.01 | GAIN | 10 | 10 | 10 | 10 | 10 | 426 | |
| 23.02 | INTEGRATION TIME | 2.50 s | 2.50 s | 2.50 s | 2.50 s | 2.50 s | 427 | |
| 23.03 | DERIVATION TIME | 0.0 ms | 0.0 ms | 0.0 ms | 0.0 ms | 0.0 ms | 428 | |
| 23.04 | ACC COMPENSATION | 0.00 s | 0.00 s | 0.00 s | 0.00 s | 0.12 s | 429 | |
| 23.05 | SLIP GAIN | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 430 | |
| 23.06 | AUTOTUNE RUN | NO | NO | NO | NO | NO | 431 | |
| 23.07 | SP ACT FILT TIME | 8 ms | 8 ms | 8 ms | 8 ms | 8 ms | 432 | |

| Index | Name/Selection | FACTORY | HAND/AUTO | PID-CTRL | T-CTRL | SEQ CTRL | PB | W |
|---|---|---|---|---|---|---|---|---|
| 24 | TORQUE CTRL | | | | | | | |
| 24.01 | TORQ RAMP UP | | | | 0.00 s | | 451 | |
| 24.02 | TORQ RAMP DOWN | | | | 0.00 s | | 452 | |
| 25 | CRITICAL SPEEDS | | | | | | | |
| 25.01 | CRIT SPEED SELECT | OFF | OFF | OFF | OFF | OFF | 476 | |
| 25.02 | CRIT SPEED 1 LOW | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 477 | |
| 25.03 | CRIT SPEED 1 HIGH | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 478 | |
| 25.04 | CRIT SPEED 2 LOW | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 479 | |
| 25.05 | CRIT SPEED 2 HIGH | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 480 | |
| 25.06 | CRIT SPEED 3 LOW | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 481 | |
| 25.07 | CRIT SPEED 3 HIGH | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 482 | |
| 26 | MOTOR CONTROL | | | | | | | |
| 26.01 | FLUX OPTIMIZATION | NO | NO | NO | NO | NO | 501 | W |
| 26.02 | FLUX BRAKING | YES | YES | YES | YES | YES | 502 | W |
| 26.03 | IR-COMPENSATION | 0% | 0% | 0% | 0% | 0% | 503 | W |
| 26.04 | IR STEP-UP FREQ | 0 | 0 | 0 | 0 | 0 | 504 | W |
| 26.05 | HEX FIELD WEAKEN | NO | NO | NO | NO | NO | 505 | W |
| 26.06 | FLUX REF PTR | C.10000 | C.10000 | C.10000 | C.10000 | C.10000 | 506 | W |
| 26.07 | FLYSTART CUR REF [%] | 60% | 60% | 60% | 60% | 60% | 507 | W |
| 26.08 | FLYSTART INIT DLY | 25 | 25 | 25 | 25 | 25 | 508 | W |
| 26.09 | FS METHOD | OFF | OFF | OFF | OFF | OFF | 509 | W |
| 27 | BRAKE CHOPPER | | | | | | | |
| 27.01 | BRAKE CHOPPER CTL | OFF | OFF | OFF | OFF | OFF | 526 | W |
| 27.02 | BR OVERLOAD FUNC | NO | NO | NO | NO | NO | 527 | |
| 27.03 | BR RESISTANCE | | | | | | 528 | |
| 27.04 | BR THERM TCONST | 0 s | 0 s | 0 s | 0 s | 0 s | 529 | |
| 27.05 | MAX CONT BR POWER | 0 kW | 0 kW | 0 kW | 0 kW | 0 kW | 530 | |
| 27.06 | BC CTRL MODE | COMMON DC | COMMON DC | COMMON DC | COMMON DC | COMMON DC | 531 | |
| 30 | FAULT FUNCTIONS | | | | | | | |
| 30.01 | AI<MIN FUNCTION | FAULT | FAULT | FAULT | FAULT | FAULT | 601 | |
| 30.02 | PANEL LOSS | FAULT | FAULT | FAULT | FAULT | FAULT | 602 | |
| 30.03 | EXTERNAL FAULT | NOT SEL | NOT SEL | NOT SEL | NOT SEL | NOT SEL | 603 | |
| 30.04 | MOTOR THERM PROT | NO | NO | NO | NO | NO | 604 | |
| 30.05 | MOT THERM P MODE | DTC/USER MODE | DTC/USER MODE | DTC/USER MODE | DTC/USER MODE | DTC/USER MODE | 605 | |
| 30.06 | MOTOR THERM TIME | (calculated) | (calculated) | (calculated) | (calculated) | (calculated) | 606 | |
| 30.07 | MOTOR LOAD CURVE | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 607 | |
| 30.08 | ZERO SPEED LOAD | 74.0% | 74.0% | 74.0% | 74.0% | 74.0% | 608 | |
| 30.09 | BREAK POINT | 45.0 Hz | 45.0 Hz | 45.0 Hz | 45.0 Hz | 45.0 Hz | 609 | |
| 30.10 | STALL FUNCTION | FAULT | FAULT | FAULT | FAULT | FAULT | 610 | |
| 30.11 | STALL FREQ HI | 20.0 Hz | 20.0 Hz | 20.0 Hz | 20.0 Hz | 20.0 Hz | 611 | |
| 30.12 | STALL TIME | 20.00 s | 20.00 s | 20.00 s | 20.00 s | 20.00 s | 612 | |
| 30.13 | UNDERLOAD FUNC | NO | NO | NO | NO | NO | 613 | |
| 30.14 | UNDERLOAD TIME | 600.0 s | 600.0 s | 600.0 s | 600.0 s | 600.0 s | 614 | |
| 30.15 | UNDERLOAD CURVE | 1 | 1 | 1 | 1 | 1 | 615 | |
| 30.16 | MOTOR PHASE LOSS | NO | NO | NO | NO | NO | 616 | |
| 30.17 | EARTH FAULT | FAULT | FAULT | FAULT | FAULT | FAULT | 617 | |
| 30.18 | COMM FLT FUNC | FAULT | FAULT | FAULT | FAULT | FAULT | 618 | |
| 30.19 | MAIN REF DS T-OUT | 3.00 s | 3.00 s | 3.00 s | 3.00 s | 3.00 s | 619 | |
| 30.20 | COMM FLT RO/AO | ZERO | ZERO | ZERO | ZERO | ZERO | 620 | |
| 30.21 | AUX DS T-OUT | 3.0 s | 3.0 s | 3.0 s | 3.0 s | 3.0 s | 621 | |
| 30.22 | IO CONFIG FUNC | WARNING | WARNING | WARNING | WARNING | WARNING | 622 | |
| 30.23 | LIMIT WARNING | 0 | 0 | 0 | 0 | 0 | 623 | |
| 31 | AUTOMATIC RESET | | | | | | | |
| 31.01 | NUMBER OF TRIALS | 0 | 0 | 0 | 0 | 0 | 626 | |
| 31.02 | TRIAL TIME | 30.0 s | 30.0 s | 30.0 s | 30.0 s | 30.0 s | 627 | |
| 31.03 | DELAY TIME | 0.0 s | 0.0 s | 0.0 s | 0.0 s | 0.0 s | 628 | |
| 31.04 | OVERCURRENT | NO | NO | NO | NO | NO | 629 | |

| Index | Name/Selection | FACTORY | HAND/AUTO | PID-CTRL | T-CTRL | SEQ CTRL | PB | W |
|---|---|---|---|---|---|---|---|---|
| 31.05 | OVERVOLTAGE | NO | NO | NO | NO | NO | 630 | |
| 31.06 | UNDERVOLTAGE | | NO | NO | NO | NO | 631 | |
| 31.07 | AI SIGNAL<MIN | NO | NO | NO | NO | NO | 632 | |
| 31.08 | LINE CONV | NO | NO | NO | NO | NO | 633 | |
| 32 | SUPERVISION | | | | | | | |
| 32.01 | SPEED1 FUNCTION | NO | NO | NO | NO | NO | 651 | |
| 32.02 | SPEED1 LIMIT | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 652 | |
| 32.03 | SPEED2 FUNCTION | NO | NO | NO | NO | NO | 653 | |
| 32.04 | SPEED2 LIMIT | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 654 | |
| 32.05 | CURRENT FUNCTION | NO | NO | NO | NO | NO | 655 | |
| 32.06 | CURRENT LIMIT | 0 | 0 | 0 | 0 | 0 | 656 | |
| 32.07 | TORQUE 1 FUNCTION | NO | NO | NO | NO | NO | 657 | |
| 32.08 | TORQUE 1 LIMIT | 0% | 0% | 0% | 0% | 0% | 658 | |
| 32.09 | TORQUE 2 FUNCTION | NO | NO | NO | NO | NO | 659 | |
| 32.10 | TORQUE 2 LIMIT | 0% | 0% | 0% | 0% | 0% | 660 | |
| 32.11 | REF1 FUNCTION | NO | NO | NO | NO | NO | 661 | |
| 32.12 | REF1 LIMIT | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 0 rpm | 662 | |
| 32.13 | REF2 FUNCTION | NO | NO | NO | NO | NO | 663 | |
| 32.14 | REF2 LIMIT | 0% | 0% | 0% | 0% | 0% | 664 | |
| 32.15 | ACT1 FUNCTION | NO | NO | NO | NO | NO | 665 | |
| 32.16 | ACT1 LIMIT | 0% | 0% | 0% | 0% | 0% | 666 | |
| 32.17 | ACT2 FUNCTION | NO | NO | NO | NO | NO | 667 | |
| 32.18 | ACT2 LIMIT | 0% | 0% | 0% | 0% | 0% | 668 | |
| 33 | INFORMATION | | | | | | | |
| 33.01 | SOFTWARE VERSION | (Version) | (Version) | (Version) | (Version) | (Version) | 676 | |
| 33.02 | APPL SW VERSION | (Version) | (Version) | (Version) | (Version) | (Version) | 677 | |
| 33.03 | TEST DATE | (Date) | (Date) | (Date) | (Date) | (Date) | 678 | |
| 33.04 | BOARD TYPE | (Control board type) | (Control board type) | (Control board type) | (Control board type) | (Control board type) | 679 | |
| 34 | PROCESS VARIABLE | | | | | | | |
| 34.01 | SCALE | 100 | 100 | 100 | 100 | 100 | 701 | |
| 34.02 | P VAR UNIT | % | % | % | % | % | 702 | |
| 34.03 | SELECT P VAR | 142 | 142 | 142 | 142 | 142 | 703 | |
| 34.04 | MOTOR SP FILT TIM | 500 ms | 500 ms | 500 ms | 500 ms | 500 ms | 704 | |
| 34.05 | TORQ ACT FILT TIM | 100 ms | 100 ms | 100 ms | 100 ms | 100 ms | 705 | |
| 34.06 | RESET RUN TIME | NO | NO | NO | NO | NO | 706 | |
| 35 | MOT TEMP MEAS | | | | | | | |
| 35.01 | MOT 1 TEMP AI1 SEL | NOT IN USE | NOT IN USE | NOT IN USE | NOT IN USE | NOT IN USE | 726 | |
| 35.02 | MOT 1 TEMP ALM L | 110 | 110 | 110 | 110 | 110 | 727 | |
| 35.03 | MOT 1 TEMP FLT L | 130 | 130 | 130 | 130 | 130 | 728 | |
| 35.04 | MOT 2 TEMP AI2 SEL | NOT IN USE | NOT IN USE | NOT IN USE | NOT IN USE | NOT IN USE | 729 | |
| 35.05 | MOT 2 TEMP ALM L | 110 | 110 | 110 | 110 | 110 | 730 | |
| 35.06 | MOT 2 TEMP FLT L | 130 | 130 | 130 | 130 | 130 | 731 | |
| 35.07 | MOT MOD COMPENSAT | YES | YES | YES | YES | YES | 732 | |
| 35.08 | MOT MOD COMP PTR | 0 | 0 | 0 | 0 | 0 | 733 | |
| 40 | PID CONTROL | | | | | | | |
| 40.01 | PID GAIN | 1 | 1 | 1 | 1 | 1 | 851 | |
| 40.02 | PID INTEG TIME | 60.00 s | 60.00 s | 60.00 s | 60.00 s | 60.00 s | 852 | |
| 40.03 | PID DERIV TIME | 0.00 s | 0.00 s | 0.00 s | 0.00 s | 0.00 s | 853 | |
| 40.04 | PID DERIV FILTER | 1.00 s | 1.00 s | 1.00 s | 1.00 s | 1.00 s | 854 | |
| 40.05 | ERROR VALUE INV | NO | NO | NO | NO | NO | 855 | |
| 40.06 | ACTUAL VALUE SEL | ACT1 | ACT1 | ACT1 | ACT1 | ACT1 | 856 | |
| 40.07 | ACTUAL1 INPUT SEL | AI2 | AI2 | AI2 | AI2 | AI2 | 857 | |
| 40.08 | ACTUAL2 INPUT SEL | AI2 | AI2 | AI2 | AI2 | AI2 | 858 | |
| 40.09 | ACT1 MINIMUM | 0 | 0 | 0 | 0 | 0 | 859 | |
| 40.10 | ACT1 MAXIMUM | 100% | 100% | 100% | 100% | 100% | 860 | |
| 40.11 | ACT2 MINIMUM | 0% | 0% | 0% | 0% | 0% | 861 | |
| 40.12 | ACT2 MAXIMUM | 100% | 100% | 100% | 100% | 100% | 862 | |

| Index | Name/Selection | FACTORY | HAND/AUTO | PID-CTRL | T-CTRL | SEQ CTRL | PB | W |
|---|---|---|---|---|---|---|---|---|
| 40.13 | PID INTEGRATION | ON | ON | ON | ON | ON | 863 | |
| 40.14 | TRIM MODE | OFF | OFF | | OFF | OFF | 864 | |
| 40.15 | TRIM REF SEL | AI1 | AI1 | | AI1 | AI1 | 865 | |
| 40.16 | TRIM REFERENCE | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 866 | |
| 40.17 | TRIM RANGE ADJUST | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 867 | |
| 40.18 | TRIM SELECTION | | | | SPEED TRIM | | 868 | |
| 40.19 | ACTUAL FILT TIME | 0.04 s | 0.04 s | 0.04 s | 0.04 s | 0.04 s | 869 | |
| 40.20 | SLEEP SELECTION | not visible | not visible | OFF | not visible | not visible | 870 | |
| 40.21 | SLEEP LEVEL | not visible | not visible | 0.0 rpm | not visible | not visible | 871 | |
| 40.22 | SLEEP DELAY | not visible | not visible | 0.0 s | not visible | not visible | 872 | |
| 40.23 | WAKE UP LEVEL | not visible | not visible | 0% | not visible | not visible | 873 | |
| 40.24 | WAKE UP DELAY | not visible | not visible | 0.0 s | not visible | not visible | 874 | |
| 40.25 | ACTUAL1 PTR | 0 | 0 | 0 | 0 | 0 | 875 | |
| 40.26 | PID MINIMUM | -100.0% | -100.0% | -100.0% | -100.0% | -100.0% | - | |
| 40.27 | PID MAXIMUM | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | - | |
| 40.28 | TRIM REF PTR | 0 | 0 | 0 | 0 | 0 | - | |
| 42 | BRAKE CONTROL | | | | | | | |
| 42.01 | BRAKE CTRL | OFF | OFF | OFF | OFF | OFF | - | |
| 42.02 | BRAKE ACKNOWLEDGE | OFF | OFF | OFF | OFF | OFF | - | |
| 42.03 | BRAKE OPEN DELAY | 0.0 s | 0.0 s | 0.0 s | 0.0 s | 0.0 s | - | |
| 42.04 | BRAKE CLOSE DELAY | 0.0 s | 0.0 s | 0.0 s | 0.0 s | 0.0 s | - | |
| 42.05 | ABS BRAKE CLS SPD | 10 rpm | 10 rpm | 10 rpm | 10 rpm | 10 rpm | - | |
| 42.06 | BRAKE FAULT FUNC | FAULT | FAULT | FAULT | FAULT | FAULT | - | |
| 42.07 | START TORQ REF SEL | NO | NO | NO | NO | NO | - | |
| 42.08 | START TORQ REF | 0% | 0% | 0% | 0% | 0% | - | |
| 42.09 | EXTEND RUN T | 0.0 s | 0.0 s | 0.0 s | 0.0 s | 0.0 s | - | |
| 42.10 | LOW REF BRK HOLD | 0.0 s | 0.0 s | 0.0 s | 0.0 s | 0.0 s | - | |
| 45 | ENERGY OPT | | | | | | | |
| 45.02 | ENERGY TARIFF1 | 0 c/E | 0 c/E | 0 c/E | 0 c/E | 0 c/E | - | |
| 45.06 | E TARIFF UNIT | EUR | EUR | EUR | EUR | EUR | - | |
| 45.08 | PUMP REF POWER | 100% | 100% | 100% | 100% | 100% | - | |
| 45.09 | ENERGY RESET | DONE | DONE | DONE | DONE | DONE | - | |
| 50 | ENCODER MODULE | | | | | | | |
| 50.01 | PULSE NR | 2048 | 2048 | 2048 | 2048 | 2048 | 1001 | |
| 50.02 | SPEED MEAS MODE | A --- B --- | A --- B --- | A --- B --- | A --- B --- | A --- B --- | 1002 | |
| 50.03 | ENCODER FAULT | WARNING | WARNING | WARNING | WARNING | WARNING | 1003 | |
| 50.04 | ENCODER DELAY | 1000 | 1000 | 1000 | 1000 | 1000 | 1004 | |
| 50.05 | ENCODER DDCS CH | CHANNEL 1 | CHANNEL 1 | CHANNEL 1 | CHANNEL 1 | CHANNEL 1 | 1005 | |
| 50.06 | SPEED FB SEL | INTERNAL | INTERNAL | INTERNAL | INTERNAL | INTERNAL | 1006 | |
| 50.07 | ENC CABLE CHECK | NO | NO | NO | NO | NO | 1007 | |
| 51 | COMM MOD DATA | | | | | | 1026 ... | |
| 52 | STANDARD MODBUS | | | | | | | |
| 52.01 | STATION NUMBER | 1 | 1 | 1 | 1 | 1 | 1051 | |
| 52.02 | BAUDRATE | 9600 | 9600 | 9600 | 9600 | 9600 | 1052 | |
| 52.03 | PARITY | ODD | ODD | ODD | ODD | ODD | 1053 | |
| 60 | MASTER/FOLLOWER | | | | | | | |
| 60.01 | MASTER LINK MODE | NOT IN USE | NOT IN USE | NOT IN USE | NOT IN USE | NOT IN USE | 1195 | |
| 60.02 | TORQUE SELECTOR | not visible | not visible | not visible | TORQUE | not visible | 1196 | |
| 60.03 | WINDOW SEL ON | not visible | not visible | not visible | NO | not visible | 1167 | |
| 60.04 | WINDOW WIDTH POS | not visible | not visible | not visible | 0 | not visible | 1198 | |
| 60.05 | WINDOW WIDTH NEG | not visible | not visible | not visible | 0 | not visible | 1199 | |
| 60.06 | DROOP RATE | 0 | 0 | 0 | 0 | 0 | 1200 | |
| 60.07 | MASTER SIGNAL 2 | 202 | 202 | 202 | 202 | 202 | 1201 | |
| 60.08 | MASTER SIGNAL 3 | 213 | 213 | 213 | 213 | 213 | 1202 | |
| 70 | DDCS CONTROL | | | | | | | |
| 70.01 | CHANNEL 0 ADDR | 1 | 1 | 1 | 1 | 1 | 1375 | |
| 70.02 | CHANNEL 3 ADDR | 1 | 1 | 1 | 1 | 1 | 1376 | |

| Index | Name/Selection | FACTORY | HAND/AUTO | PID-CTRL | T-CTRL | SEQ CTRL | PB | W |
|---|---|---|---|---|---|---|---|---|
| 70.03 | CH1 BAUDRATE | 4 Mbit/s | 4 Mbit/s | 4 Mbit/s | 4 Mbit/s | 4 Mbit/s | 1377 | |
| 70.04 | CH0 DDCS HW CONN | RING | RING | RING | RING | RING | 1378 | |
| 70.05 | CH2 HW CONNECTION | RING | RING | RING | RING | RING | | |
| 72 | USER LOAD CURVE | | | | | | | |
| 72.01 | OVERLOAD FUNC | NO | NO | NO | NO | NO | 1411 | |
| 72.02 | LOAD CURRENT 1 | 500 | 500 | 500 | 500 | 500 | 1412 | |
| 72.03 | LOAD CURRENT 2 | 500 | 500 | 500 | 500 | 500 | 1413 | |
| 72.04 | LOAD CURRENT 3 | 500 | 500 | 500 | 500 | 500 | 1414 | |
| 72.05 | LOAD CURRENT 4 | 500 | 500 | 500 | 500 | 500 | 1415 | |
| 72.06 | LOAD CURRENT 5 | 500 | 500 | 500 | 500 | 500 | 1416 | |
| 72.07 | LOAD CURRENT 6 | 500 | 500 | 500 | 500 | 500 | 1417 | |
| 72.08 | LOAD CURRENT 7 | 500 | 500 | 500 | 500 | 500 | 1418 | |
| 72.09 | LOAD CURRENT 8 | 500 | 500 | 500 | 500 | 500 | 1419 | |
| 72.10 | LOAD FREQ 1 | 0 | 0 | 0 | 0 | 0 | 1420 | |
| 72.11 | LOAD FREQ 2 | 0 | 0 | 0 | 0 | 0 | 1421 | |
| 72.12 | LOAD FREQ 3 | 0 | 0 | 0 | 0 | 0 | 1422 | |
| 72.13 | LOAD FREQ 4 | 0 | 0 | 0 | 0 | 0 | 1423 | |
| 72.14 | LOAD FREQ 5 | 0 | 0 | 0 | 0 | 0 | 1424 | |
| 72.15 | LOAD FREQ 6 | 0 | 0 | 0 | 0 | 0 | 1425 | |
| 72.16 | LOAD FREQ 7 | 0 | 0 | 0 | 0 | 0 | 1426 | |
| 72.17 | LOAD FREQ 8 | 0 | 0 | 0 | 0 | 0 | 1427 | |
| 72.18 | LOAD CURRENT LIMIT | 800 | 800 | 800 | 800 | 800 | 1428 | |
| 72.19 | LOAD THERMAL TIME | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| 72.20 | LOAD COOLING TIME | 0 | 0 | 0 | 0 | 0 | | |
| 83 | ADAPT PROG CTRL | | | | | | | |
| 83.01 | ADAPT PROG CMD | EDIT | EDIT | EDIT | EDIT | EDIT | 1609 | W |
| 83.02 | EDIT COMMAND | NO | NO | NO | NO | NO | 1610 | |
| 83.03 | EDIT BLOCK | 0 | 0 | 0 | 0 | 0 | 1611 | |
| 83.04 | TIMELEVEL SEL | 100ms | 100ms | 100ms | 100ms | 100ms | 1612 | |
| 83.05 | PASSCODE | 0 | 0 | 0 | 0 | 0 | 1613 | |
| 84 | ADAPTIVE PROGRAM | | | | | | | |
| 84.01 | STATUS | | | | | | 1628 | |
| 84.02 | FAULTED PAR | | | | | | 1629 | |
| 84.05 | BLOCK1 | NO | NO | NO | NO | NO | 1630 | |
| 84.06 | INPUT1 | 0 | 0 | 0 | 0 | 0 | 1631 | |
| 84.07 | INPUT2 | 0 | 0 | 0 | 0 | 0 | 1632 | |
| 84.08 | INPUT3 | 0 | 0 | 0 | 0 | 0 | 1633 | |
| 84.09 | OUTPUT | 0 | 0 | 0 | 0 | 0 | 1634 | |
| … | … | | | | | | … 1644 | |
| 84.79 | OUTPUT | 0 | 0 | 0 | 0 | 0 | - | |
| 85 | USER CONSTANTS | | | | | | | |
| 85.01 | CONSTANT1 | 0 | 0 | 0 | 0 | 0 | 1645 | |
| 85.02 | CONSTANT2 | 0 | 0 | 0 | 0 | 0 | 1646 | |
| 85.03 | CONSTANT3 | 0 | 0 | 0 | 0 | 0 | 1647 | |
| 85.04 | CONSTANT4 | 0 | 0 | 0 | 0 | 0 | 1648 | |
| 85.05 | CONSTANT5 | 0 | 0 | 0 | 0 | 0 | 1649 | |
| 85.06 | CONSTANT6 | 0 | 0 | 0 | 0 | 0 | 1650 | |
| 85.07 | CONSTANT7 | 0 | 0 | 0 | 0 | 0 | 1651 | |
| 85.08 | CONSTANT8 | 0 | 0 | 0 | 0 | 0 | 1652 | |
| 85.09 | CONSTANT9 | 0 | 0 | 0 | 0 | 0 | 1653 | |
| 85.10 | CONSTANT10 | 0 | 0 | 0 | 0 | 0 | 1654 | |
| 85.11 | STRING1 | MESSAGE1 | MESSAGE1 | MESSAGE1 | MESSAGE1 | MESSAGE1 | 1655 | |
| 85.12 | STRING2 | MESSAGE2 | MESSAGE2 | MESSAGE2 | MESSAGE2 | MESSAGE2 | 1656 | |
| 85.13 | STRING3 | MESSAGE3 | MESSAGE3 | MESSAGE3 | MESSAGE3 | MESSAGE3 | 1657 | |
| 85.14 | STRING4 | MESSAGE4 | MESSAGE4 | MESSAGE4 | MESSAGE4 | MESSAGE4 | 1658 | |
| 85.15 | STRING5 | MESSAGE5 | MESSAGE5 | MESSAGE5 | MESSAGE5 | MESSAGE5 | 1659 | |

| Index | Name/Selection | FACTORY | HAND/AUTO | PID-CTRL | T-CTRL | SEQ CTRL | PB | W |
|---|---|---|---|---|---|---|---|---|
| 90 | D SET REC ADDR | | | | | | | |
| 90.01 | AUX DS REF3 | 0 | 0 | 0 | 0 | 0 | 1735 | |
| 90.02 | AUX DS REF4 | 0 | 0 | 0 | 0 | 0 | 1736 | |
| 90.03 | AUX DS REF5 | 0 | 0 | 0 | 0 | 0 | 1737 | |
| 90.04 | MAIN DS SOURCE | 1 | 1 | 1 | 1 | 1 | 1738 | |
| 90.05 | AUX DS SOURCE | 3 | 3 | 3 | 3 | 3 | 1739 | |
| 92 | D SET TR ADDR | | | | | | | |
| 92.01 | MAIN DS STATUS WORD | 302 | 302 | 302 | 302 | 302 | 1771 | |
| 92.02 | MAIN DS ACT1 | 102 | 102 | 102 | 102 | 102 | 1772 | |
| 92.03 | MAIN DS ACT2 | 105 | 105 | 105 | 105 | 105 | 1773 | |
| 92.04 | AUX DS ACT3 | 305 | 305 | 305 | 305 | 305 | 1774 | |
| 92.05 | AUX DS ACT4 | 308 | 308 | 308 | 308 | 308 | 1775 | |
| 92.06 | AUX DS ACT5 | 306 | 306 | 306 | 306 | 306 | 1776 | |
| 92.07 | MSW B10 PTR | 3.014.09 | 3.014.09 | 3.014.09 | 3.014.09 | 3.014.09 | 1777 | |
| 92.08 | MSW B13 PTR | 0 | 0 | 0 | 0 | 0 | 1778 | |
| 92.09 | MSW B14 PTR | 0 | 0 | 0 | 0 | 0 | 1779 | |
| 95 | HARDWARE SPECIF | | | | | | | |
| 95.01 | FAN SPD CTRL MODE | CONTROLLED | | | | | 1825 | |
| 95.02 | FUSE SWITCH CTRL | Inverter type dependent | | | | | 1826 | |
| 95.03 | INT CONFIG USER | 0 | 0 | 0 | 0 | 0 | 1827 | |
| 95.04 | EX/SIN REQUEST | 1 | 1 | 1 | 1 | 1 | 1828 | |
| 95.05 | ENA INC SW FREQ | 0 | 0 | 0 | 0 | 0 | 1829 | |
| 95.06 | LCU Q PW REF | 0 | 0 | 0 | 0 | 0 | 1830 | |
| 95.07 | LCU DC REF | 0 | 0 | 0 | 0 | 0 | 1831 | |
| 95.08 | LCU PAR1 SEL | 106 | 106 | 106 | 106 | 106 | 1832 | |
| 95.09 | LCU PAR2 SEL | 110 | 110 | 110 | 110 | 110 | 1833 | |
| 95.10 | TEMP INV AMBIENT | 40°C | 40°C | 40°C | 40°C | 40°C | 1834 | |
| 95.11 | SUPPLY CTRL MODE | type specific | type specific | type specific | type specific | type specific | 1835 | |
| 95.12 | LCU RUN PTR | C.00000 | C.00000 | C.00000 | C.00000 | C.00000 | 1836 | |
| 96 | EXTERNAL AO | | | | | | | |
| 96.01 | EXT AO1 | SPEED | SPEED | SPEED | SPEED | SPEED | 1843 | |
| 96.02 | INVERT EXT AO1 | NO | NO | NO | NO | NO | 1844 | |
| 96.03 | MINIMUM EXT AO1 | 0 mA | 0 mA | 0 mA | 0 mA | 0 mA | 1845 | |
| 96.04 | FILTER EXT AO1 | 0.01 s | 0.01 s | 0.01 s | 0.01 s | 0.01 s | 1846 | |
| 96.05 | SCALE EXT AO1 | 100% | 100% | 100% | 100% | 100% | 1847 | |
| 96.06 | EXT AO2 | CURRENT | CURRENT | CURRENT | CURRENT | CURRENT | 1848 | |
| 96.07 | INVERT EXT AO2 | NO | NO | NO | NO | NO | 1849 | |
| 96.08 | MINIMUM EXT AO2 | 0 mA | 0 mA | 0 mA | 0 mA | 0 mA | 1850 | |
| 96.09 | FILTER EXT AO2 | 2.00 s | 2.00 s | 2.00 s | 2.00 s | 2.00 s | 1851 | |
| 96.10 | SCALE EXT AO2 | 100% | 100% | 100% | 100% | 100% | 1852 | |
| 96.11 | EXT AO1 PTR | 0 | 0 | 0 | 0 | 0 | 1853 | |
| 96.12 | EXT AO2 PTR | 0 | 0 | 0 | 0 | 0 | 1854 | |
| 98 | OPTION MODULES | | | | | | | |
| 98.01 | ENCODER MODULE | NO | NO | NO | NO | NO | 1901 | |
| 98.02 | COMM. MODULE LINK | NO | NO | NO | NO | NO | 1902 | |
| 98.03 | DI/O EXT MODULE 1 | NO | NO | NO | NO | NO | 1903 | |
| 98.04 | DI/O EXT MODULE 2 | NO | NO | NO | NO | NO | 1904 | |
| 98.05 | DI/O EXT MODULE 3 | NO | NO | NO | NO | NO | 1905 | |
| 98.06 | AI/O EXT MODULE | NO | NO | NO | NO | NO | 1906 | |
| 98.07 | COMM PROFILE | ABB DRIVES | ABB DRIVES | ABB DRIVES | ABB DRIVES | ABB DRIVES | 1907 | |
| 98.09 | DI/O EXT1 DI FUNC | DI7,8,9 | DI7,8,9 | DI7,8,9 | DI7,8,9 | DI7,8,9 | 1909 | |
| 98.10 | DI/O EXT2 DI FUNC | DI10,11,12 | DI10,11,12 | DI10,11,12 | DI10,11,12 | DI10,11,12 | 1910 | |
| 98.11 | DI/O EXT3 DI FUNC | DI11,12 | DI11,12 | DI11,12 | DI11,12 | DI11,12 | 1911 | |
| 98.12 | AI/O MOTOR TEMP | NO | NO | NO | NO | NO | 1912 | |
| 98.13 | AI/O EXT AI1 FUNC | UNIPOLAR AI5 | UNIPOLAR AI5 | UNIPOLAR AI5 | UNIPOLAR AI5 | UNIPOLAR AI5 | 1913 | |
| 98.14 | AI/O EXT AI2 FUNC | UNIPOLAR AI6 | UNIPOLAR AI6 | UNIPOLAR AI6 | UNIPOLAR AI6 | UNIPOLAR AI6 | 1914 | |

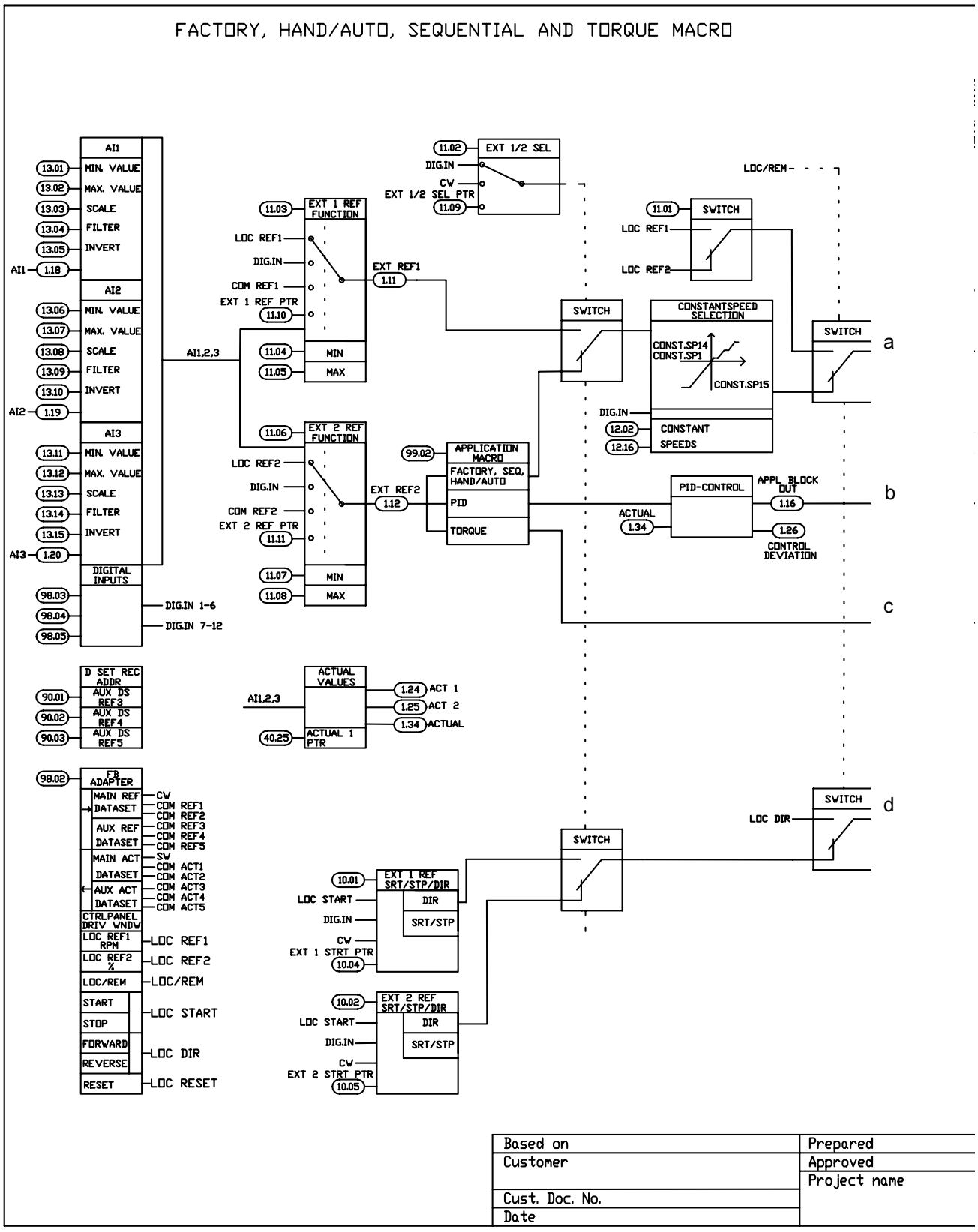
| Index | Name/Selection | FACTORY | HAND/AUTO | PID-CTRL | T-CTRL | SEQ CTRL | PB | W |
|---|---|---|---|---|---|---|---|---|
| 98.16 | SIN FILT SUPERV | NO | NO | NO | NO | NO | 1915 | |
| 99 | START-UP DATA | | | | | | | |
| 99.01 | LANGUAGE | ENGLISH | ENGLISH | ENGLISH | ENGLISH | ENGLISH | 1926 | |
| 99.02 | APPLICATION MACRO | FACTORY | HAND/AUTO | PID-CTRL | T CTRL | SEQ CTRL | 1927 | W |
| 99.03 | APPLIC RESTORE | NO | NO | NO | NO | NO | 1928 | W |
| 99.04 | MOTOR CTRL MODE | DTC | DTC | DTC | DTC | DTC | 1929 | |
| 99.05 | MOTOR NOM VOLTAGE | 0 V | 0 V | 0 V | 0 V | 0 V | 1930 | W |
| 99.06 | MOTOR NOM CURRENT | 0.0 A | 0.0 A | 0.0 A | 0.0 A | 0.0 A | 1931 | W |
| 99.07 | MOTOR NOM FREQ | 50.0 Hz | 50.0 Hz | 50.0 Hz | 50.0 Hz | 50.0 Hz | 1932 | W |
| 99.08 | MOTOR NOM SPEED | 2900 rpm | 2900 rpm | 2900 rpm | 2900 rpm | 2900 rpm | 1933 | W |
| 99.09 | MOTOR NOM POWER | 0.0 kW | 0.0 kW | 0.0 kW | 0.0 kW | 0.0 kW | 1934 | W |
| 99.10 | MOTOR ID RUN MODE | ID MAGN | ID MAGN | ID MAGN | ID MAGN | ID MAGN | 1935 | W |
| 99.11 | DEVICE NAME | | | | | | 1936 | |

# Control block diagrams

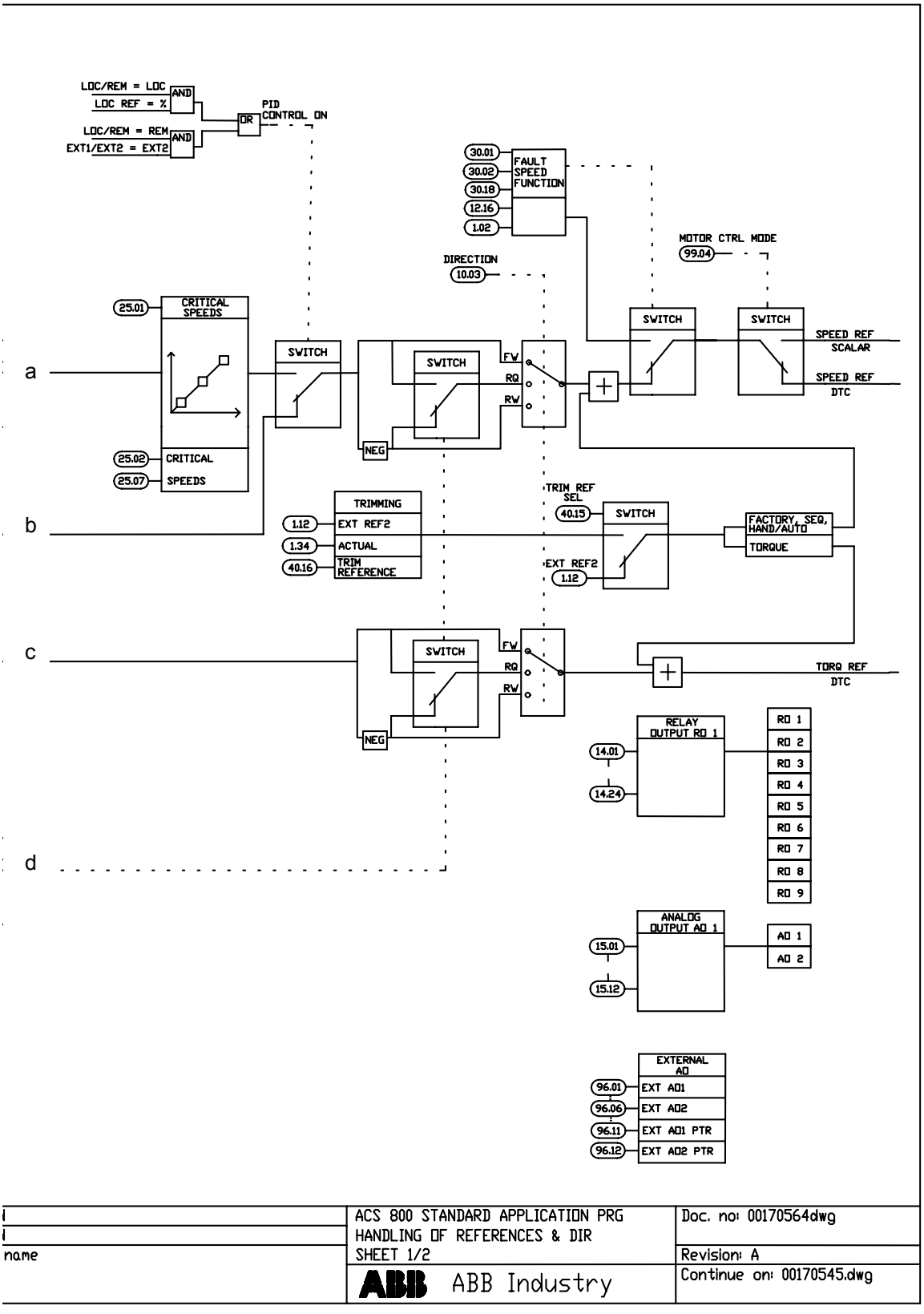
## Chapter overview

| Diagram | Related diagrams |
|---|---|
| *Reference control chain, sheet 1*<br>Valid when FACTORY, HAND/AUTO, SEQ CTRL or T CTRL macro is active (see parameter 99.02). | Continued on sheet 2 |
| *Reference control chain, sheet 1*<br>Valid when PID CTRL macro is active (see parameter 99.02). | Continued on sheet 2 |
| *Reference control chain, sheet 2*<br>Valid with all macros (see parameter 99.02). | Continued from sheet 1 |
| *Handling of Start, Stop, Run Enable Start Interlock*<br>Valid with all macros (see parameter 99.02). | - |
| *Handling of Reset and On/Off*<br>Valid with all macros (see parameter 99.02). | - |

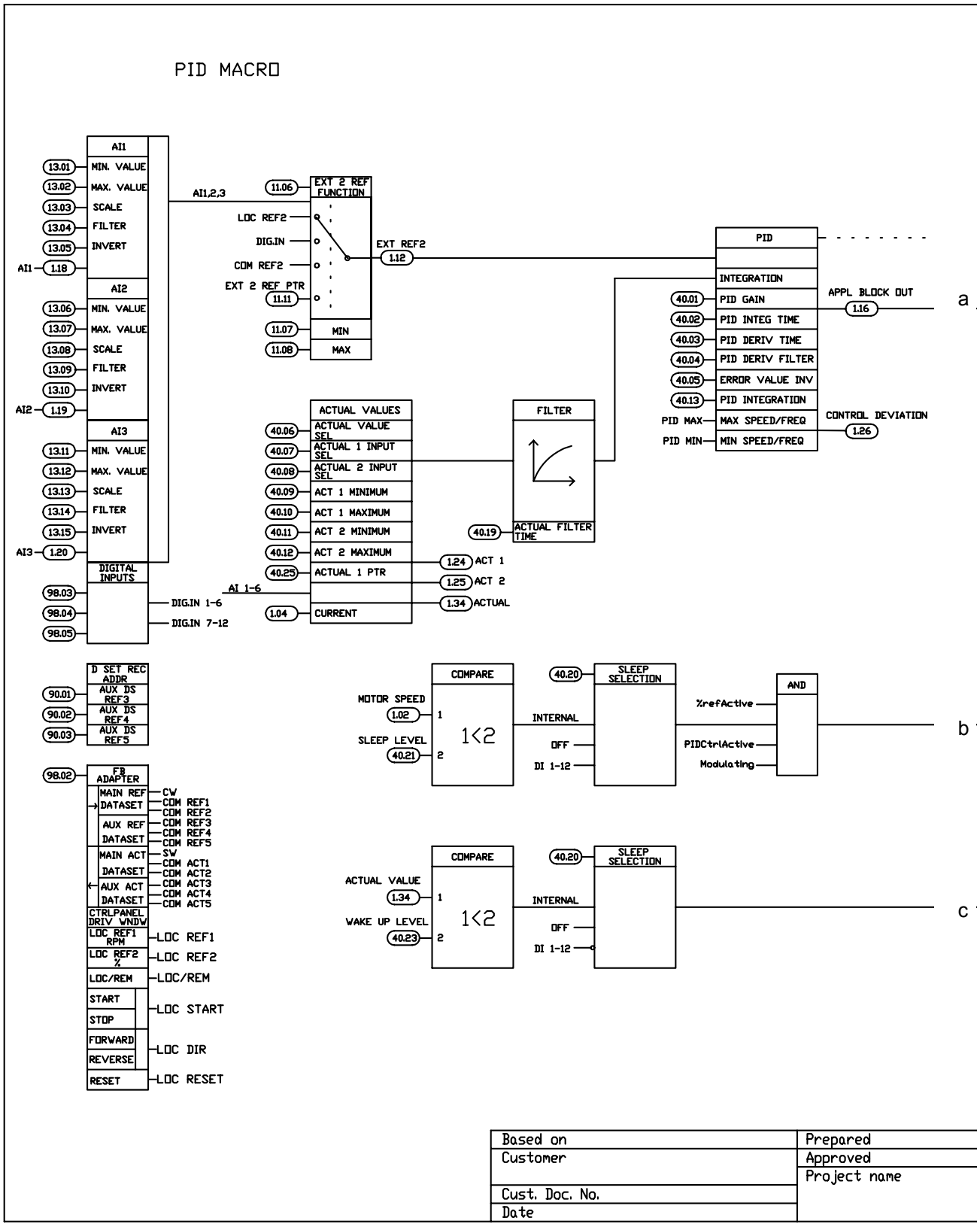
## **Reference control chain, sheet 1:** FACTORY, HAND/AUTO, SEQ CTRL and T CTRL macros (continued on the next page …)



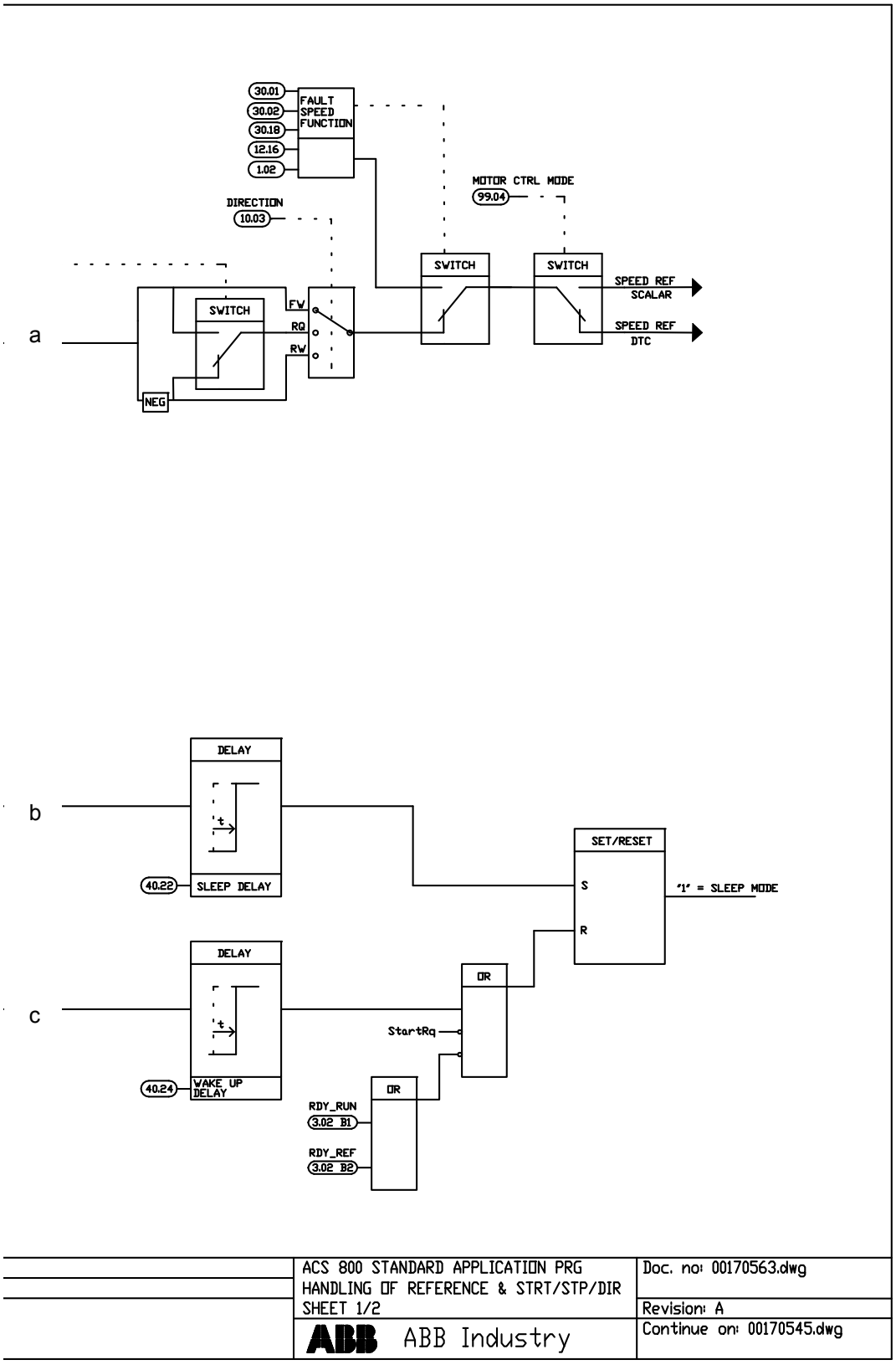
… continued from the previous page



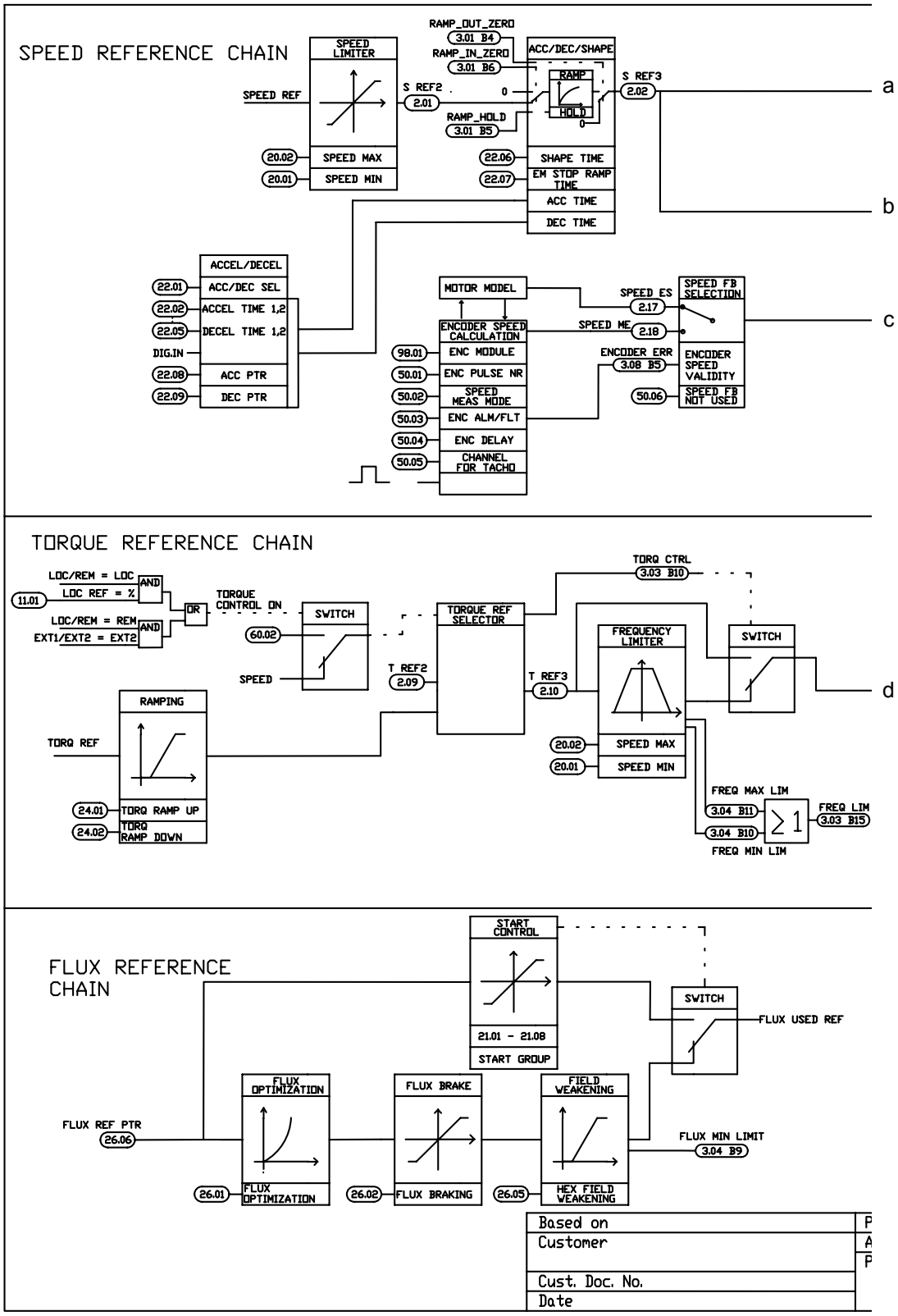
## **Reference control chain sheet 1:** PID CTRL macro (continued on the next page …)



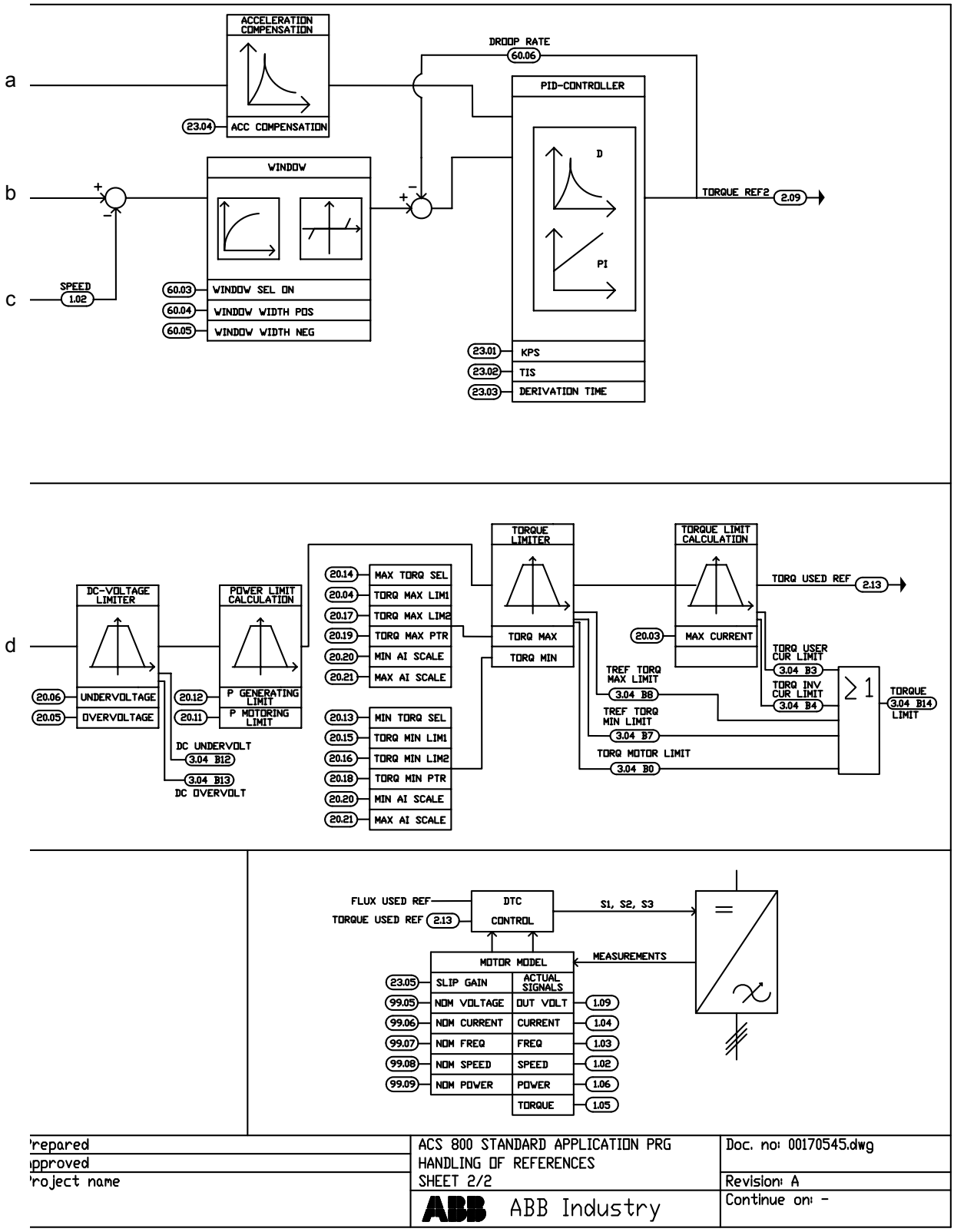
… continued from the previous page



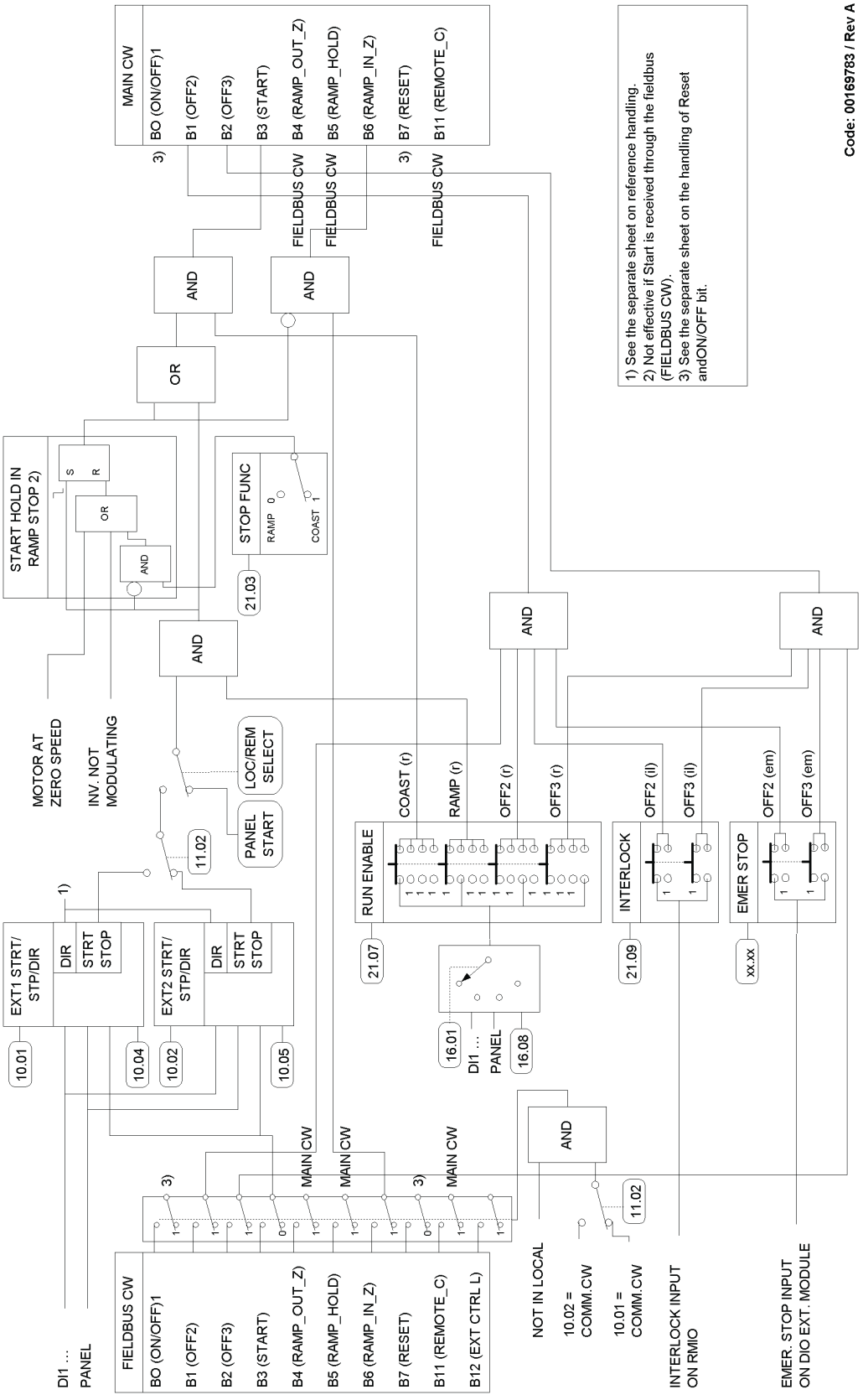
## **Reference control chain sheet 2:** All macros (continued on the next page …)



… continued from the previous page

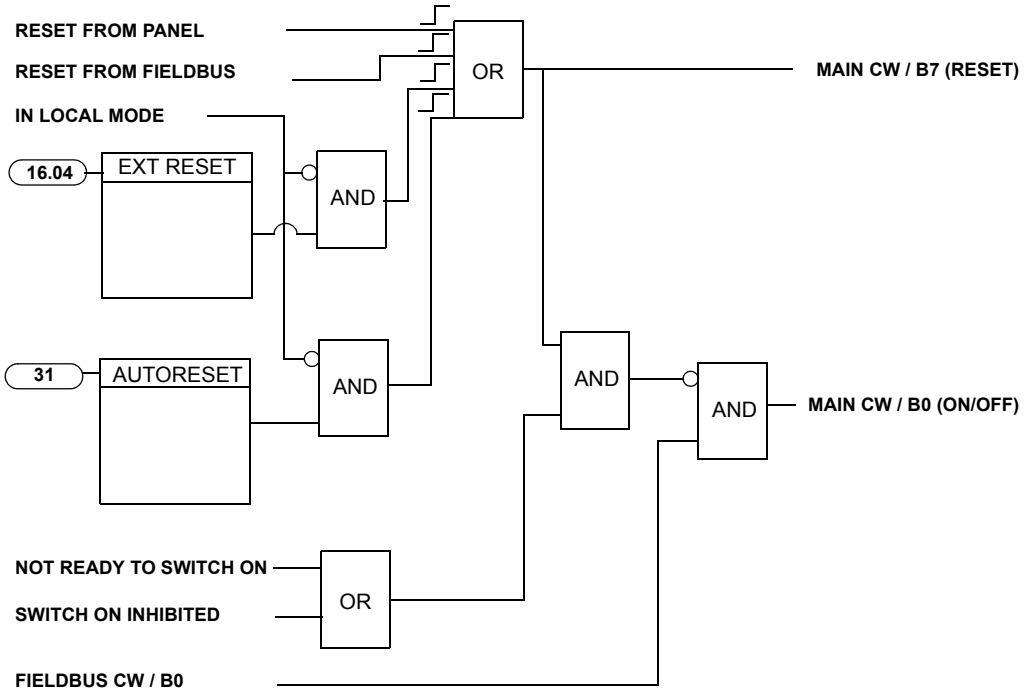


# Handling of Start, Stop, Run Enable and Start Interlock



### Handling of Reset and On/Off

The diagram below is a detail to the previous diagram (*Handling of Start, Stop, Run Enable and Start Interlock*).



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## E



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## H



## I

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## V

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