ACS800

Firmware Manual

Standard Application Program

This manual includes information on:
- Drive start-up and control
- Control panel
- Program features
- Application macros (including the default I/O wiring diagrams)
- Actual signals and parameters
- Fault tracing
- Fieldbus control

Standard Application Program

Firmware Manual

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Chapter overview

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

Compatibility

The manual is compatible with ACS800 Standard Application Program 7.x.

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 subsection 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.
- *Fault tracing* lists the warning and fault messages with the possible causes and remedies.

- *Fieldbus control* describes the communication through the serial communication links.
- *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.

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: To run the Start-up Assistant, or to 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 the subsection *How to perform the guided start-up (covers all essential settings)*.
- **If you want to perform the limited start-up**, follow the instructions given in the subsection *How to perform the limited start-up (covers only the basic settings).*

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. 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. **De-couple the driven machine** if: - there is a risk of damage in case of incorrect direction of rotation, or - 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 mains power. The control panel first shows the panel identification data …	`CDP312 PANEL Vx.xx` `.......`

	… then the Identification Display of the drive …	ACS800 xx kW ID NUMBER 1
	… then the Actual Signal Display …	1 -> 0.0 rpm O FREQ 0.00 Hz CURRENT 0.00 A POWER 0.00 %
	…after which the display suggests starting the Language Assistant. (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 Assistant.) The drive is now ready for the start-up.	1 -> 0.0 rpm O *** INFORMATION *** Press FUNC to start Language Assistant
	SELECTING THE LANGUAGE	
☐	Press the FUNC key.	Language Assistant LANGUAGE ? [ENGLISH] ENTER:Ok
☐	Scroll to the desired language by the arrow keys (▲ or ▼) and press ENTER to accept. (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 *** INFORMATION *** Press FUNC to start guided Motor Setup
	STARTING THE GUIDED MOTOR SET-UP	
☐	Press FUNC to start the guided motor set-up. (The display shows which general command keys to use when stepping through the assistant.)	Motor Setup Assist. ENTER: Ok RESET: Back FUNC: More Info
☐	Press ENTER to step forward. Follow the instructions given on the display.	Motor Setup 2/10 MOTOR NAMEPLATE DATA AVAILABLE? ENTER:Yes FUNC:No

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.

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.
De-couple the driven machine if:
- there is a risk of damage in case of incorrect direction of rotation, or
- 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 mains power. The control panel first shows the panel identification data …

```
CDP312 PANEL Vx.xx
.......
```

… then the Identification Display of the drive …

```
ACS800      xx kW
ID NUMBER 1
```

… then the Actual Signal Display …

```
1  ->  0.0 rpm  O
FREQ     0.00 Hz
CURRENT  0.00 A
POWER     0.00 %
```

…after which the display suggests starting the Language Selection.
(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
*** INFORMATION ***
Press FUNC to start
Language Selection
```

Press RESET to remove the suggestion on starting the Language Selection.
The drive is now ready for the basic start-up.

```
1  ->  0.0 rpm  O
FREQ     0.00 Hz
CURRENT  0.00 A
POWER     0.00 %
```

MANUAL START-UP DATA ENTERING (parameter group 99)

☐ Select the language. The general parameter setting procedure is described below.

```
1   ->  0.0 rpm   O
99 START-UP DATA
01 LANGUAGE
ENGLISH
```

The general parameter setting procedure:
- Press ***PAR*** to select the Parameter Mode of the panel.
- Press the double-arrow keys (⏫ or ⏬) to scroll the parameter groups.
- Press the arrow keys (🔼 or 🔽) to scroll parameters within a group.
- Activate the setting of a new value by ***ENTER.***
- Change the value by the arrow keys (🔼 or 🔽), fast change by the double-arrow keys (⏫ or ⏬).
- Press ***ENTER*** to accept the new value (brackets disappear).

```
1   ->  0.0 rpm   O
99 START-UP DATA
01 LANGUAGE
[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
[ ]
```

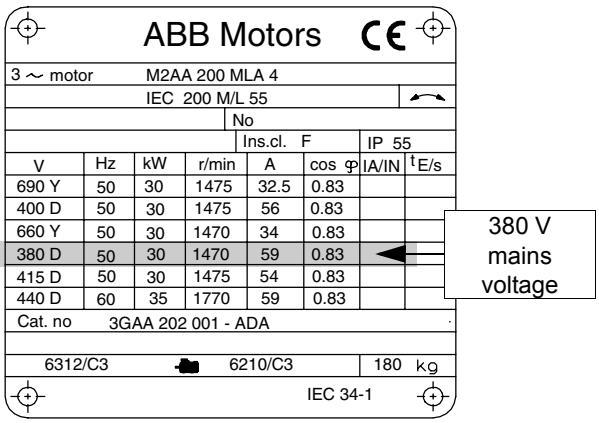
☐ Select the motor control mode. The general parameter setting procedure is given above.

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: 1/6 · I_{2hd} … 2 · I_{2hd} of ACS800

```
 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

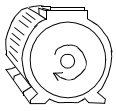
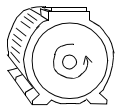
Range: 1 …18000 rpm

```
 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, a warning appears. It indicates that the motor parameters have been set, and the drive is ready to start the motor identification (ID Magnetisation or ID Run).	1 -> 0.0 rpm O ** WARNING ** ID MAGN REQ
☐	Select the motor identification method. The default value NO (ID Magnetisation) is suitable for most applications. It is applied in this basic start-up procedure. The ID Run (STANDARD or REDUCED) should be selected instead 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. For more information, see the subsection *How to perform the ID Run* below.	1 -> 0.0 rpm O 99 START-UP DATA 10 MOTOR ID RUN [NO]
	IDENTIFICATION MAGNETISATION (with Motor ID Run selection NO)	
☐	Press the ***LOC/REM*** key to change to local control (L shown on the first row). Press the ⏻ to start the Identification Magnetisation. The motor is magnetised at zero speed for 20 to 60 s. Two warnings are displayed: The upper warning is displayed while the magnetisation is on. The lower warning is displayed after the magnetisation is completed.	1 L-> 0.0 rpm I ** WARNING ** ID MAGN 1 L-> 0.0 rpm O ** WARNING ** ID DONE
	DIRECTION OF ROTATION OF THE MOTOR	
☐	Check the direction of rotation of the motor. - Press ***ACT*** to get the status row visible. - Increase the speed reference from zero to a small value by pressing ***REF*** and then the arrow keys (▲, ▼, ⏫ or ⏬). - Press ⏻ to start the motor. - Check that the motor is running in the desired direction. - Stop the motor by pressing ⏹. To change the direction of rotation of the motor: - Disconnect mains 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. - Exchange the position of two motor cable phase conductors at the motor terminals or at the motor connection box. - Verify your work by applying mains power and repeating the check as described above.	1 L->[xxx] rpm I FREQ xxx Hz CURRENT xx A POWER xx %  forward direction  reverse direction
	SPEED LIMITS AND ACCELERATION/DECELERATION TIMES	
☐	Set the minimum speed.	1 L-> 0.0 rpm O 20 LIMITS 01 MINIMUM SPEED [ ]

☐	Set the maximum speed.	1 L-> 0.0 rpm O 20 LIMITS 02 MAXIMUM SPEED [ ]
☐	Set the acceleration time 1. **Note:** Check also acceleration time 2, if two acceleration times will be used in the application.	1 L-> 0.0 rpm O 22 ACCEL/DECEL 02 ACCELER TIME 1 [ ]
☐	Set the deceleration time 1. **Note*:*** Set also deceleration time 2, if two deceleration times will be used in the application.	1 L-> 0.0 rpm O 22 ACCEL/DECEL 03 DECELER TIME 1 [ ]
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 the 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`
	`FREQ 0.00 Hz`
	`CURRENT 0.00 A`
	`POWER 0.00 %`

Regulate the speed by adjusting the voltage of analogue input AI1.	`1 -> 500.0 rpm I`
	`FREQ 16.66 Hz`
	`CURRENT 12.66 A`
	`POWER 8.33 %`

CHANGING THE DIRECTION OF ROTATION OF THE MOTOR	

Forward direction: Switch digital input DI2 off.	`1 -> 500.0 rpm I`
	`FREQ 16.66 Hz`
	`CURRENT 12.66 A`
	`POWER 8.33 %`

Reverse direction: Switch digital input DI2 on.	`1 <- 500.0 rpm I`
	`FREQ 16.66 Hz`
	`CURRENT 12.66 A`
	`POWER 8.33 %`

STOPPING THE MOTOR	

Switch off digital input DI1.	`1 -> 500.0 rpm O`
	`FREQ 0.00 Hz`
	`CURRENT 0.00 A`
	`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.

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.

```
1 L ->1242.0 rpm     O
99 START-UP DATA
10 MOTOR ID RUN
[STANDARD]
```

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

```
1 L ->1242.0 rpm     O
ACS800 55 kW
**WARNING**
ID RUN SEL
```

- To start the ID Run, press the ⏀ key. The Run Enable signal must be active (see parameter 16.01 RUN ENABLE).

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 ACS800 55 kW **WARNING** MOTOR STARTS	1 L -> 1242.0 rpm I ACS800 55 kW **WARNING** ID RUN	1 L -> 1242.0 rpm I ACS800 55 kW **WARNING** ID DONE

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

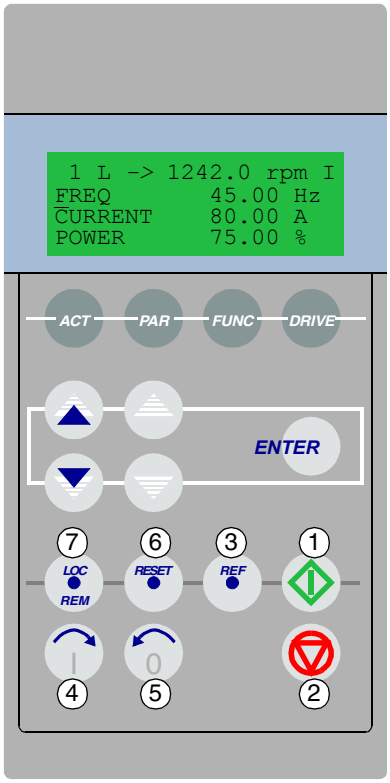
- The Motor ID Run can be stopped at any time by pressing the control panel stop key ( ).
- After the ID Run is started with the start key ( ), it is possible to monitor the actual values by first pressing the ***ACT*** key and then a double-arrow key ( ).

Control panel

Chapter overview

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

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)

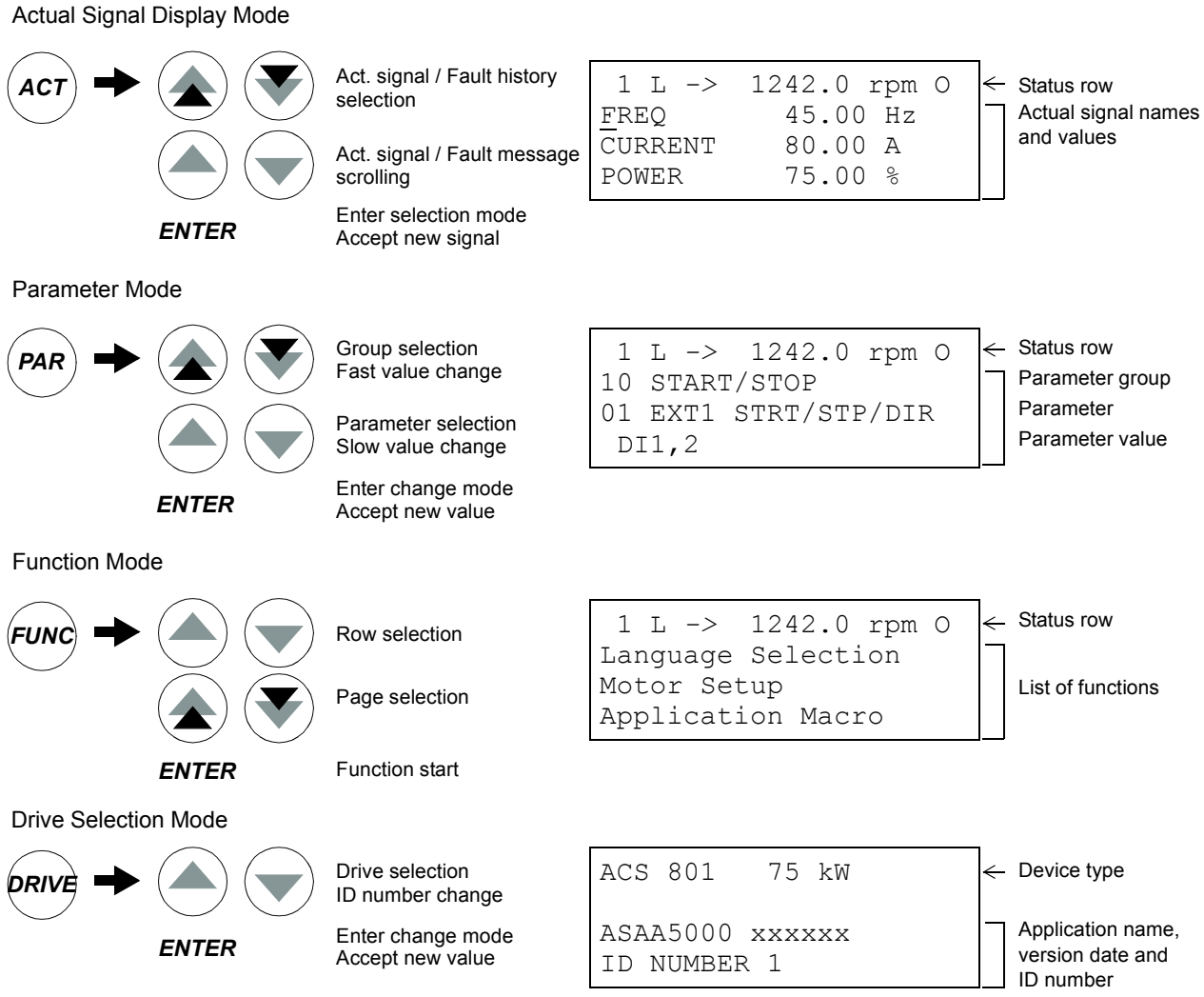
The use of single arrow keys, double arrow keys and ENTER depend on the operation mode of the panel.

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

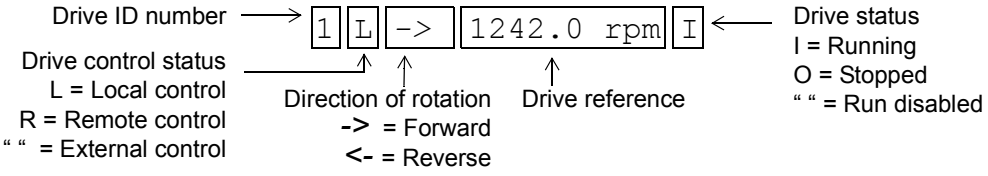
Panel operation mode keys and displays

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.



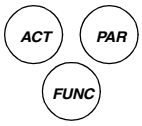
Drive control with the panel

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

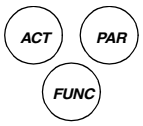
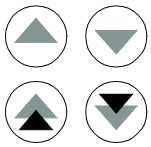
- start, stop, and change direction of the motor
- give the motor speed reference or torque reference
- give a process reference (when the process PID control is active)
- reset the fault and warning messages
- change between local and external drive control.

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.		1 ->1242.0 rpm I FREQ 45.00 Hz CURRENT 80.00 A POWER 75.00 %
2.	To switch to local control. (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 FREQ 45.00 Hz CURRENT 80.00 A POWER 75.00 %
3.	To stop		1 L ->1242.0 rpm O FREQ 45.00 Hz CURRENT 80.00 A POWER 75.00 %
4.	To start		1 L ->1242.0 rpm I FREQ 45.00 Hz CURRENT 80.00 A POWER 75.00 %
5.	To change the direction to reverse.		1 L <-1242.0 rpm I FREQ 45.00 Hz CURRENT 80.00 A POWER 75.00 %
6.	To change the direction to forward.		1 L ->1242.0 rpm I FREQ 45.00 Hz CURRENT 80.00 A POWER 75.00 %

How to set speed reference

Step	Action	Press Key	Display
1.	To show the status row.		1 ->1242.0 rpm I FREQ 45.00 Hz CURRENT 80.00 A POWER 75.00 %
2.	To switch to local control. (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 FREQ 45.00 Hz CURRENT 80.00 A POWER 75.00 %
3.	To enter the Reference Setting function.		1 L ->[1242.0 rpm]I FREQ 45.00 Hz CURRENT 80.00 A POWER 75.00 %
4.	To change the reference. (slow change) (fast change)		1 L ->[1325.0 rpm]I FREQ 45.00 Hz CURRENT 80.00 A POWER 75.00 %
5.	To save the reference. (The value is stored in the permanent memory; it is restored automatically after power switch-off.)	***ENTER***	1 L -> 1325.0 rpm I FREQ 45.00 Hz CURRENT 80.00 A POWER 75.00 %

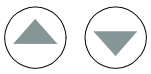
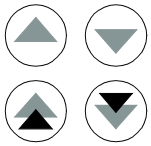
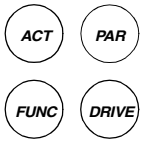
Actual signal display mode

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

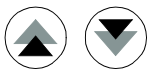
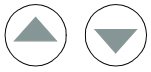
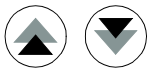
Step	Action	Press key	Display
1.	To enter the Actual Signal Display Mode.		1 L -> 1242.0 rpm I FREQ 45.00 Hz CURRENT 80.00 A POWER 75.00 %
2.	To select a row (a blinking cursor indicates the selected row).		1 L -> 1242.0 rpm I FREQ 45.00 Hz CURRENT 80.00 A POWER 75.00 %
3.	To enter the actual signal selection function.	***ENTER***	1 L -> 1242.0 rpm I 1 ACTUAL SIGNALS 04 CURRENT 80.00 A
4.	To select an actual signal. To change the actual signal group.		1 L -> 1242.0 rpm I 1 ACTUAL SIGNALS 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 FREQ 45.00 Hz TORQUE 70.00 % POWER 75.00 %
5.b	To cancel the selection and keep the original selection. The selected keypad mode is entered.		1 L -> 1242.0 rpm I FREQ 45.00 Hz CURRENT 80.00 A 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** 	1 L -> 1242.0 rpm I FREQUENCY CURRENT POWER
2.	To return to the Actual Signal Display Mode.	**Release** 	1 L -> 1242.0 rpm I FREQ 45.00 Hz CURRENT 80.00 A 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 FREQ 45.00 Hz CURRENT 80.00 A POWER 75.00 %
2.	To enter the Fault History Display.		1 L -> 1242.0 rpm I 1 LAST FAULT +OVERCURRENT 6451 H 21 MIN 23 S
3.	To select the previous (UP) or the next fault/warning (DOWN). To clear the Fault History.	 	1 L -> 1242.0 rpm I 2 LAST FAULT +OVERVOLTAGE 1121 H 1 MIN 23 S 1 L -> 1242.0 rpm I 2 LAST FAULT H MIN S
4.	To return to the Actual Signal Display Mode.		1 L -> 1242.0 rpm I FREQ 45.00 Hz CURRENT 80.00 A POWER 75.00 %

How to display and reset an active fault

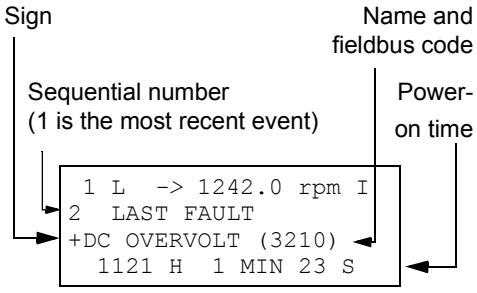
WARNING! If an external source for start command is selected and it is ON, the drive will start immediately after fault reset. If the cause of the fault has not been removed, the drive will trip again.

Step	Action	Press Key	Display
1.	To display an active fault.	ACT	1 L -> 1242.0 rpm ACS 801 75 kW ** FAULT ** ACS800 TEMP
2.	To reset the fault.	RESET	1 L -> 1242.0 rpm O FREQ 45.00 Hz CURRENT 80.00 A 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. Name of the fault and a “+” sign in front of the name. Total power-on time.
User resets the fault message.	Sequential number of the event and LAST FAULT text. -RESET FAULT text. Total power-on time.
Drive generates a warning message.	Sequential number of the event and LAST WARNING text. Name of the warning and a “+” sign in front of the name. Total power-on time.
Drive deactivates the warning message.	Sequential number of the event and LAST WARNING text. Name of the warning and a “-” sign in front of the name. Total power-on time.

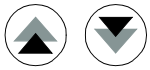
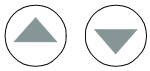
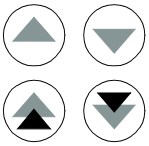
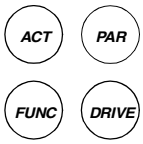
Parameter mode

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

Function mode

In the Function Mode, the user can:

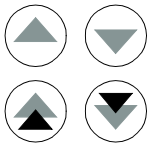
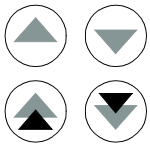
- start a guided procedure for adjusting the drive settings (assistants)
- upload the drive parameter values and motor data from the drive to the panel.
- download group 1 to 97 parameter values from the panel to the drive. [1)]
- adjust the contrast of the display.

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.

Step	Action	Press Key	Display
1.	To enter the Function Mode.		1 L -> 1242.0 rpm O Language Selection Motor Setup Application Macro
2.	To select a task or function from list (a flashing cursor indicates the selection). Double arrows: To change page to see more assistants/ functions.		1 L -> 1242.0 rpm O Language Selection Motor Setup Application Macro
3.	To enter the task.	***ENTER***	Motor Setup 1/10 ENTER: Ok/Continue RESET: Step back FUNC: More info
4.	To accept and continue.	***ENTER***	Motor Setup 2/10 MOTOR NAMEPLATE DATA AVAILABLE? ENTER:Yes FUNC:No
5.	To accept and continue.	***ENTER***	Motor Setup 3/10 MOTOR NOM VOLTAGE? [0 V] ENTER:Ok RESET:back
6.	a. To adjust the requested drive parameter. b. To ask for information on the requested value. (To scroll the information displays and return to the task).	 ***FUNC***  ***FUNC, ACT***	Motor Setup 3/10 MOTOR NOM VOLTAGE? [415 V] ENTER:Ok RESET:back INFO P99.05 Set as given on the motor nameplate.
7.	a. To accept a value and step forward. b. To cancel the setting and take one step back.	***ENTER*** ***RESET***	Motor Setup 4/10 MOTOR NOM CURRENT? [0.0 A] ENTER:Ok RESET:Back Motor Setup 3/10 MOTOR NOM VOLTAGE? [415 V] ENTER:Ok RESET:back
8.	To cancel and exit. **Note:** 1 x ACT returns to the first display of the task.	***2 x ACT***	1 L -> 0.0 rpm O FREQ 0.00 Hz CURRENT 0.00 A POWER 0.00 %

How to upload data from a drive to the panel

Note:

- Upload before downloading.
- Ensure the program versions of the destination drive are the same as the versions of the source drive, see parameters 33.01 and 33.02.
- 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.)

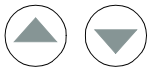
Before upload, do the following in the drive from which the copies are to be taken:

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

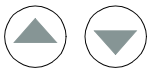
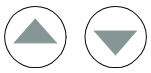
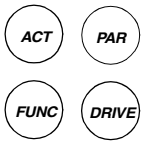
Step	Action	Press Key	Display
1.	Enter the Function Mode.	FUNC	1 L -> 1242.0 rpm O Language Selection Motor Setup Application Macro
2.	Enter the page that contains the upload, download and contrast functions.	▼	1 L -> 1242.0 rpm O UPLOAD <=<= DOWNLOAD =>=> CONTRAST 4
3.	Select the upload function (a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

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 FREQ 45.00 Hz CURRENT 80.00 A POWER 75.00 %
3.	Enter the Function Mode.		1 L -> 1242.0 rpm O Language Selection Motor Setup Application Macro
4.	Enter the page that contains the upload, download and contrast functions.		1 L -> 1242.0 rpm O UPLOAD <=<= DOWNLOAD =>=> CONTRAST 4
5.	Select the download function (a flashing cursor indicates the selected function).		1 L -> 1242.0 rpm O UPLOAD <=<= DOWNLOAD =>=> CONTRAST 4
6.	Start the download.	***ENTER***	1 L -> 1242.0 rpm O 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 Language Selection Motor Setup Application Macro
2.	Enter the page that contains the upload, download and contrast functions.		1 L -> 1242.0 rpm O UPLOAD <=<= DOWNLOAD =>=> CONTRAST 4
3.	Select a function (a flashing cursor indicates the selected function).		1 L -> 1242.0 rpm O UPLOAD <=<= DOWNLOAD =>=> CONTRAST 4
4.	Enter the contrast setting function.	***ENTER***	1 L -> 1242.0 rpm O CONTRAST [4]
5.	Adjust the contrast.		1 L -> 1242.0 rpm CONTRAST [6]
6.a	Accept the selected value.	***ENTER***	1 L -> 1242.0 rpm O UPLOAD <=<= DOWNLOAD =>=> CONTRAST 6
6.b	Cancel the new setting and retain the original value by pressing any of the mode selection keys. The selected mode is entered.		1 L -> 1242.0 rpm I FREQ 45.00 Hz CURRENT 80.00 A 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*, Code: 3AFY 58919748 [English]).

In the Drive Selection Mode, the user can:

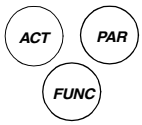
- Select the drive with which the panel communicates through the panel link.
- Change the identification number of a drive connected to the panel link.
- View the status of the drives connected on the panel link.

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.

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.

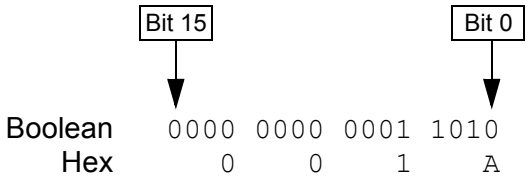
How to select a drive and change its panel link ID number

Step	Action	Press key	Display
1.	To enter the Drive Selection Mode.		ACS800 75 kW ASAAA5000 xxxxxx ID NUMBER 1
2.	To select the next drive/view. 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. 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 75 kW ASAAA5000 xxxxxx ID NUMBER 1 1 Status Display Symbols: = Drive stopped, direction forward = Drive running, direction reverse 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. The selected mode is entered.		1 L -> 1242.0 rpm I FREQ 45.00 Hz CURRENT 80.00 A 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 Assitant 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 the chapter *Control panel* on how to start the assistant, browse and exit.

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, Option Modules, Application, Option Speed Control 1, Speed Controller Tuning, Start/Stop Set-up, Protections, Output Signals
HAND/AUTO	Language Select, Motor Set-up, Application, Option Modules, Speed Control 1, Start/Stop Set-up, Speed Control 2, Speed Controller Tuning, Protections, Output Signals
T CTRL	Language Select, Motor Set-up, Application, Option Modules, Torque Control, Start/Stop Set-up, Speed Control 1, Protections, Output Signals
PID CTRL	Language Select, Motor Set-up, Application, Option Modules, PID Control, Start/Stop Set-up, Speed Control 1, Protections, Output Signals
USER 1 OR USER 2	Language Select, Motor Set-up, Application, Option Modules, Speed Control 1, Speed Controller Tuning, Start/Stop Set-up, 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	99.10
Application	Selecting the application macro	99.02
Option Modules	Activating the option modules	Group 98
Speed Control 1	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
	(If 99.02 = SEQ CTRL: Setting constant speed)	(12.01, 12.02)
Speed Control 2	Setting 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	11.08, 11.07
Speed Controller Tuning	Activating the speed controller Autotune Run	23.06
Torque Control	Selecting the source for the torque 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	11.08, 11.07
	Setting the torque ramp up and ramp down times	24.01, 24.02
PID Control	Selecting the source for the process reference	11.03
	(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	11.08, 11.07
	Setting the source and limits for the process actual value	40.07, 40.09, 40.10
Start/Stop Set-up	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	14.01, 14.02, 14.03
	Selecting the signals indicated through the analogue output AO1. Setting the minimum, maximum, scaling and inversion.	15.01, 15.02, 15.03, 15.04, 15.05

Contents of the assistant displays

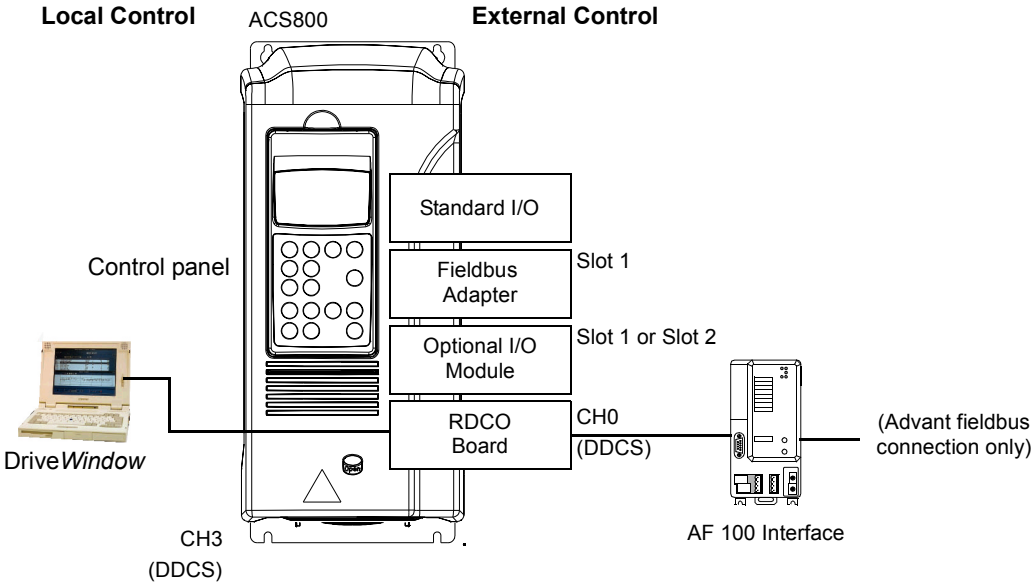
There are two types of displays in the Start-up Assistant: The main displays and the information displays. The main displays prompt the user to feed in information or answer a question. The assistant steps through the main displays. The information displays contain help texts for the main displays. The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

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

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 continue
4	Commands: accept value and step forward or cancel and step backwards	double arrow symbol (indicates that the text continues)

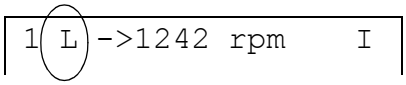
Local control vs. external control

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.

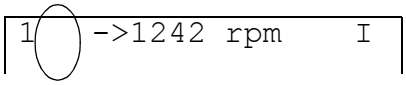


The control panel always overrides the external control signal sources when used in local mode.

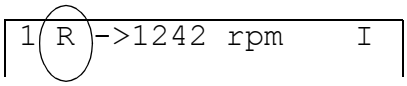
External control

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.

Settings

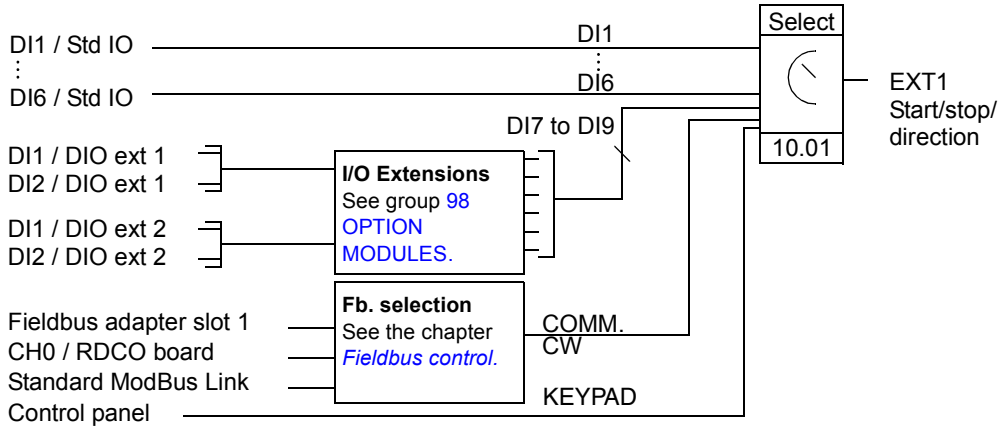
Panel key	Additional information
LOC/REM	Selection between local and external control
Parameter	
11.02	Selection between EXT1 and EXT2
10.01	Start, stop, direction source for EXT1
11.03	Reference source for EXT1
10.02	Start, stop, direction source for EXT2
11.06	Reference source for EXT2
Group 98 OPTION 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.

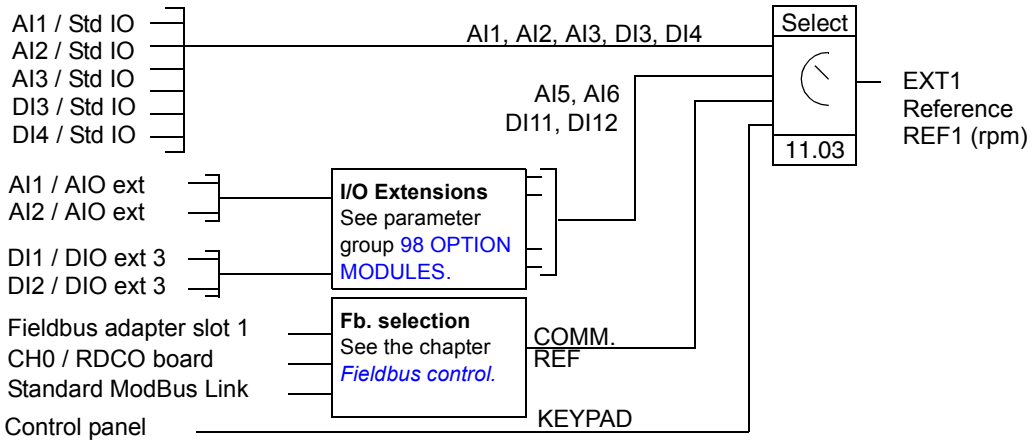


DI1 / Std IO = Digital input DI1 on the standard I/O terminal block

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 “joystick” 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

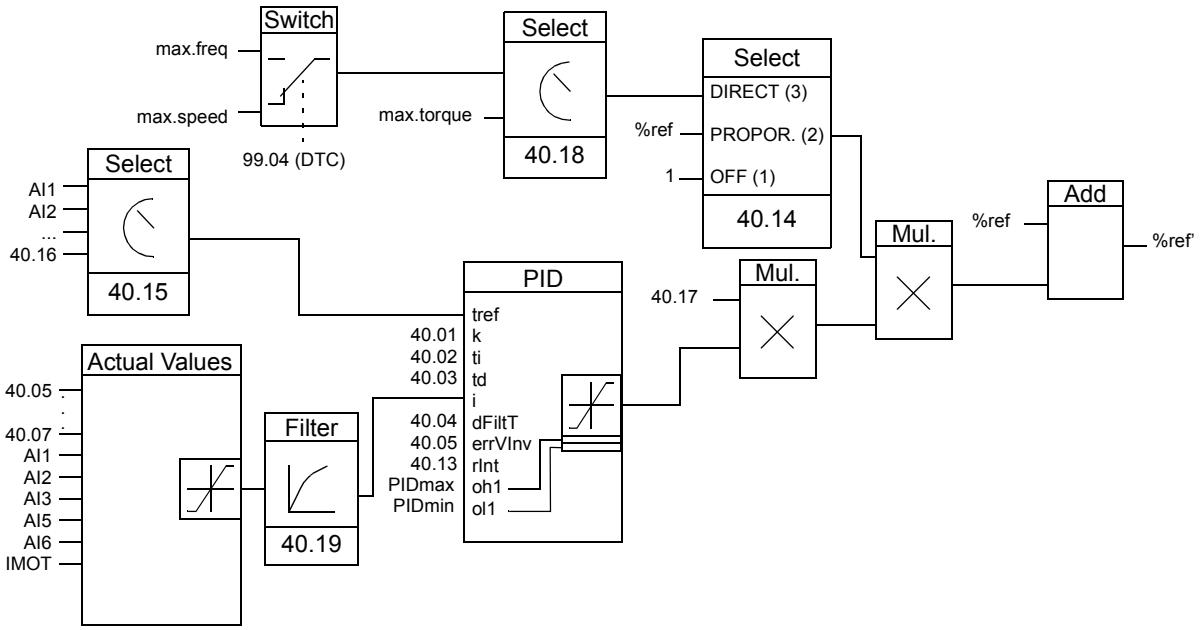
Parameter	Additional information
Group 11 REFERENCE SELECT	External reference source, type and scaling
Group 20 LIMITS	Operating limits
Group 22 ACCEL/DECEL	Speed reference acceleration and deceleration ramps
Group 24 TORQUE CTRL	Torque reference ramp times
Group 32 SUPERVISION	Reference supervision

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

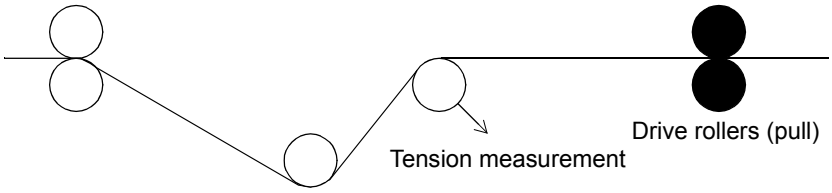
Example

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.

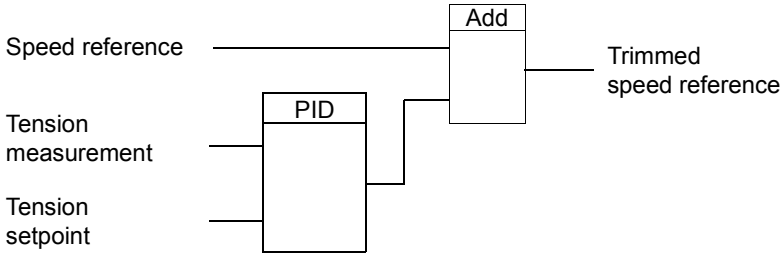
To accomplish the desired speed correction, the user:

- 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 Application 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 Application 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 CONF	Improper use of optional I/O
Fault	
IO CONF	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 Application Program

Input	Cycle
DI / standard	6 ms
DI / extension	6 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 SYSTEM CTRL INPUTS	DI as external Run Enable, fault reset or user macro change signal
21.01	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 CONF	Improper use of optional I/O
Fault	
IO CONF	Improper use of optional I/O
I/O COMM (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. With 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 Application 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
- Mains 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 dataset (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.

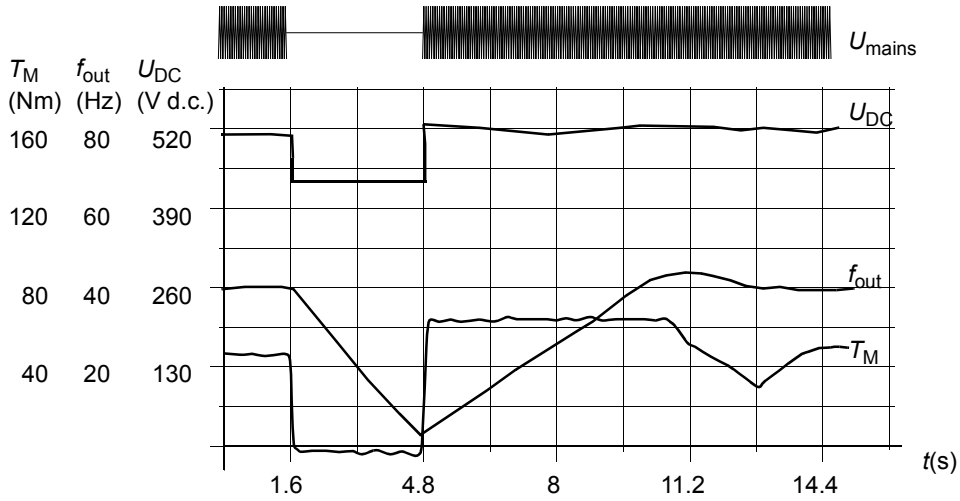
In demanding applications a separate Identification Run can be performed.

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 mains 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.

DC Magnetising

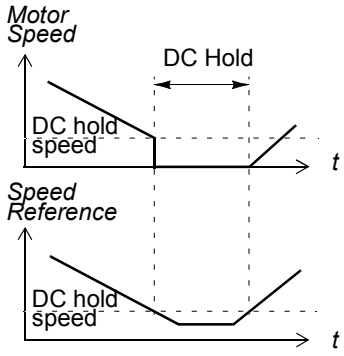
When DC Magnetising is activated, the drive automatically magnetises the motor before the start. This feature guarantees the highest possible breakaway torque, up to 200% of motor nominal torque. By adjusting the premagnetising time, it is possible to synchronise the motor start and e.g. a mechanical 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.

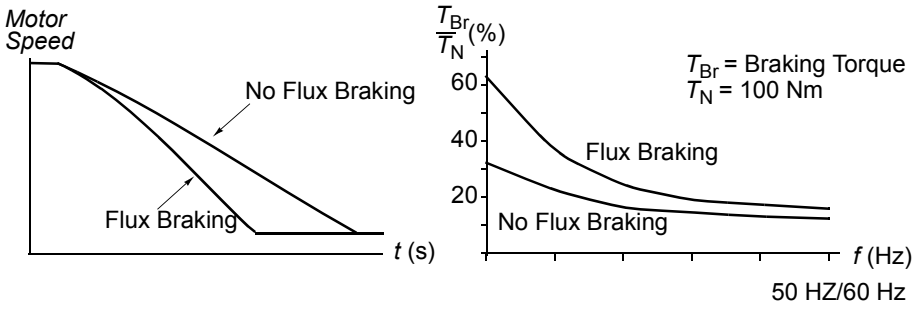


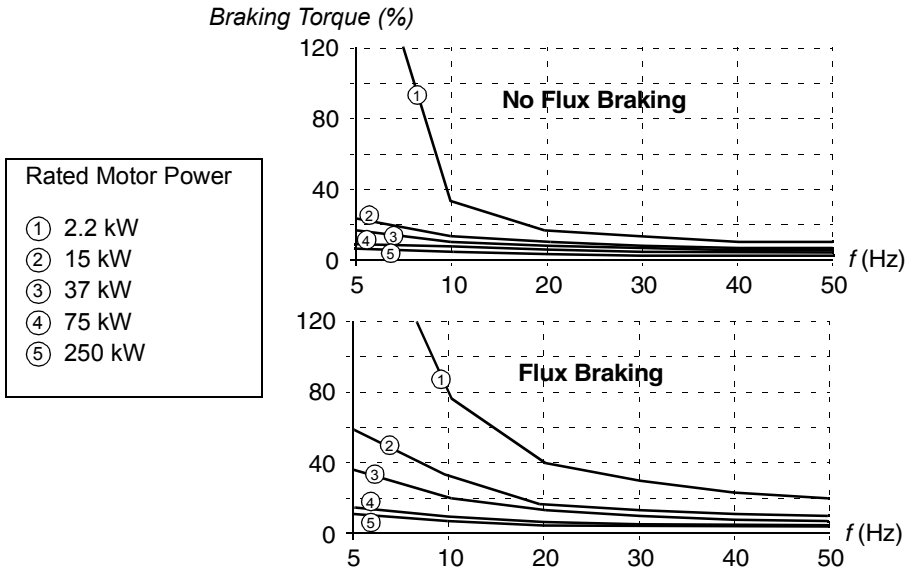
Settings

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.

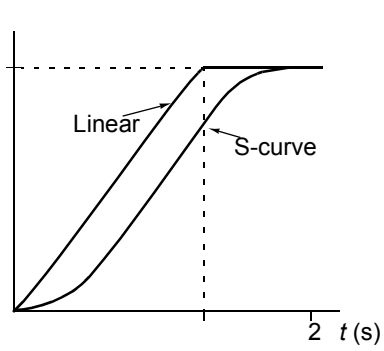
Settings

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 to e.g. mechanical resonance problems.

Settings

Parameter group 25 CRITICAL SPEEDS.

Constant speeds

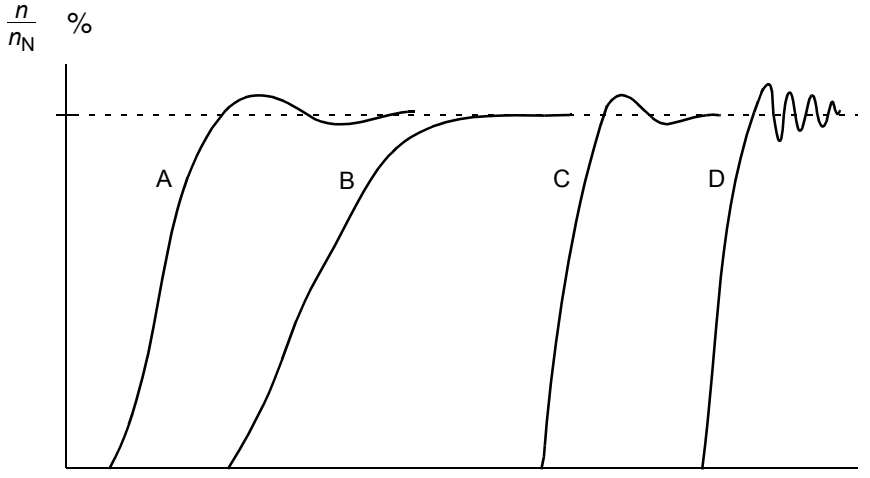
It is possible to predefine 15 constant speeds. Constant speeds are selected with digital inputs. Constant speed activation overrides the external speed reference.

Settings

Parameter group 12 CONSTANT SPEEDS.

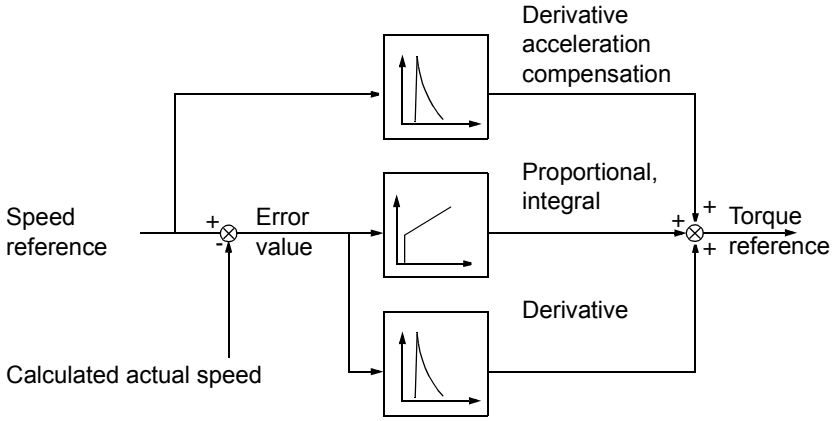
Speed controller tuning

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

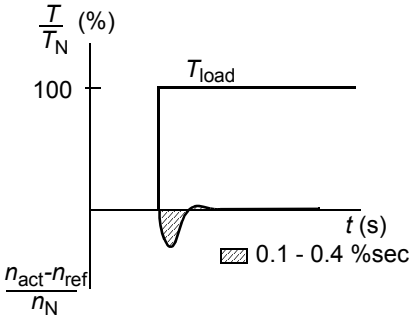
Actual signal 01.02.

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.



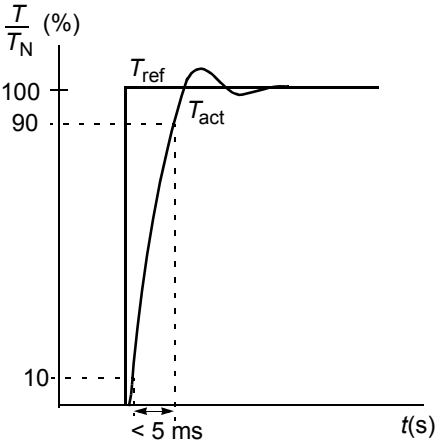
T_N = rated motor torque
n_N = rated motor speed
n_{act} = actual speed
n_{ref} = speed reference

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.

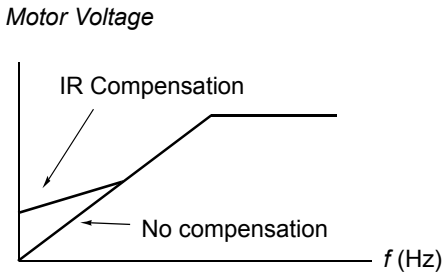
In the Scalar Control mode, some standard features are not available.

Settings

Parameter 99.04.

IR compensation for a scalar controlled drive

IR Compensation is active only when the motor control mode is Scalar (see the section *Scalar control* above). 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.

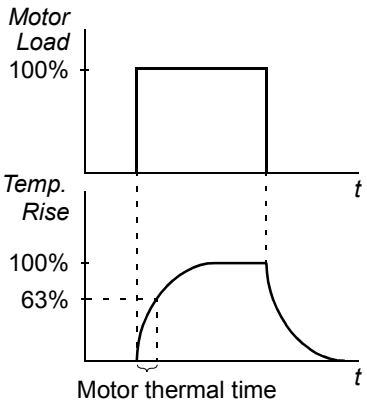
The Motor Thermal Protection modes are based either on a motor temperature thermal model or on an overtemperature indication from a motor thermistor.

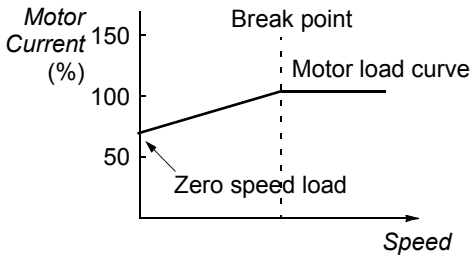
Motor temperature thermal model

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

1) The motor is in the ambient temperature of 30 °C when power is applied to the drive.

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.

Settings

Parameters 30.04 to 30.09.

Note: It is also possible to use the motor temperature measurement function. See the subsection *Motor temperature measurement through the standard I/O*.

Stall Protection

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

Settings

Parameters 30.10 to 30.12.

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, the motor cable or the inverter.

The Earth Fault protection is based on earth leakage current measurement with a summation current transformer at the input of the converter.

- An earth fault in the mains does not activate the protection.
- In an earthed (grounded) supply, the protection activates in 200 microseconds.
- In floating mains, the mains capacitance should be 1 microfarad or more.
- The capacitive currents due to screened copper motor cables up to 300 metres do not activate the protection.

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 same input (output) is used for two purposes simultaneously.

Settings

Parameter 30.22.

Preprogrammed Faults

Overcurrent

The overcurrent trip limit for the drive is 3.5 · I_{2hd} (rated output current, heavy-duty use rating).

DC overvoltage

The DC overvoltage trip limit is 1.3 ·U_{1max}, where U_{1max} is the maximum value of the mains 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 mains voltage trip level is 728 VDC for 400 V units, 877 VDC for 500 V units, and 1210 VDC for 690 V units.

DC undervoltage

The DC undervoltage trip limit is 0.65 · U_{1min}, where U_{1min} is the minimum value of the mains 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 mains voltage trip level is 334 VDC for 400 V and 500 V units, and 461 VDC for 690 V units.

Drive temperature

The drive supervises the inverter module temperature. If the inverter module temperature exceeds 115 °C, a warning is given. The temperature trip level is 125 °C.

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 mains 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%.

Ambient temperature

The drive will not start if the ambient temperature is below -5 to 0 °C or above 73 to 82 °C (the exact limits vary within the given ranges depending on drive type).

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

The maximum allowed motor power is 1.5 · P_{hd}. If the limit is exceeded, the motor torque is automatically restricted. The function protects the input bridge of the drive against overload.

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.

Settings

Parameter group 32 SUPERVISION.

Diagnostics

Actual Signals	Additional information
03.02	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

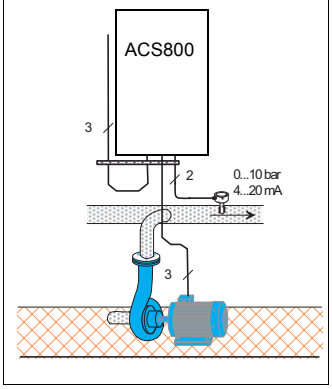
There is a built-in PID controller in the drive. The controller can be used to control process variables such as pressure, flow or fluid level.

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).

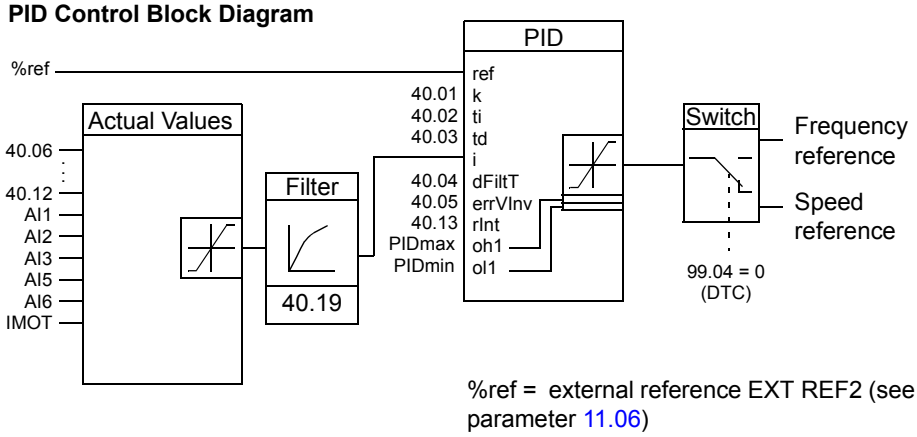
The block diagram below on the right illustrates the process PID control. The minimum and maximum values of the controller output are the same as parameter 20.01 and 20.02 (or 20.07 and 20.08).

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

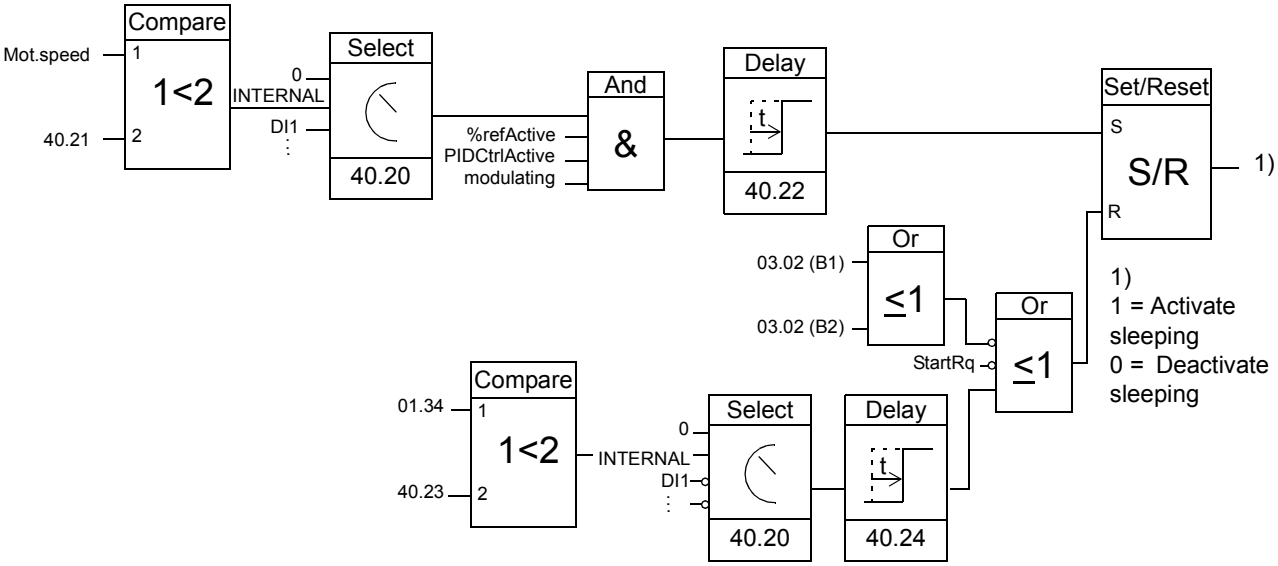
Parameter	Purpose
99.02	Process PID control activation
40.01 - 40.13, 40.19	The settings of the process PID controller
32.13 to 32.18	The supervision limits for the process reference REF2 and the variables ACT1 and ACT2

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 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

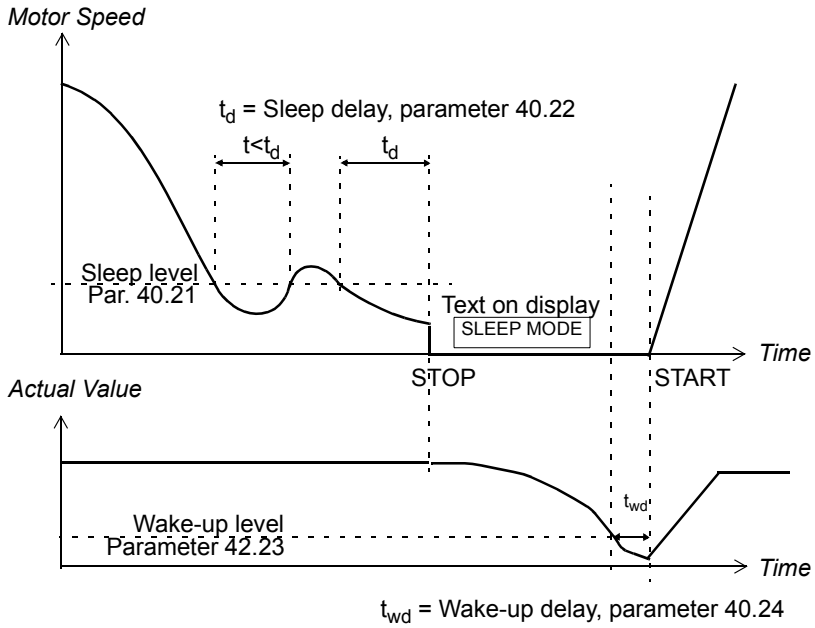
%refActive: The % reference (EXT REF2) is in use. See Parameter 11.02.

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

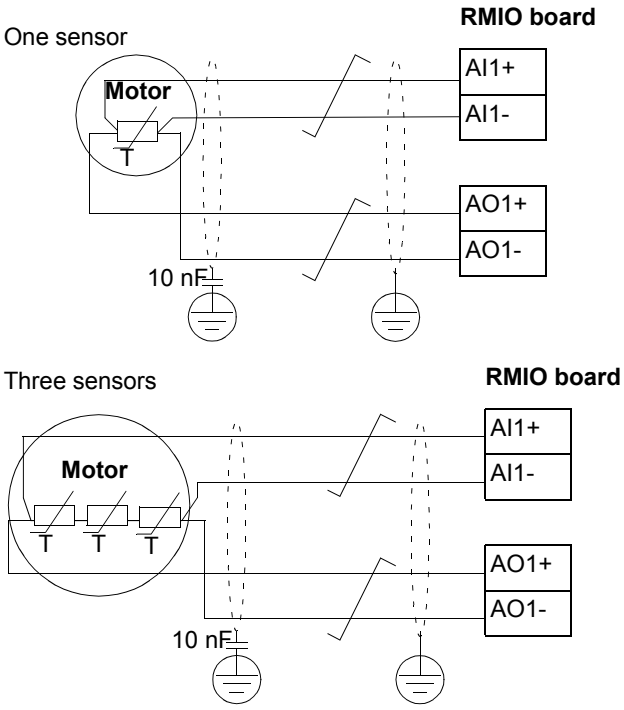
Parameter	Additional information
99.02	Process PID control activation
40.20 - 40.24	Sleep function settings

Diagnostics

Warning SLEEP MODE on the panel display.

Motor temperature measurement through the standard I/O

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



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.

Settings

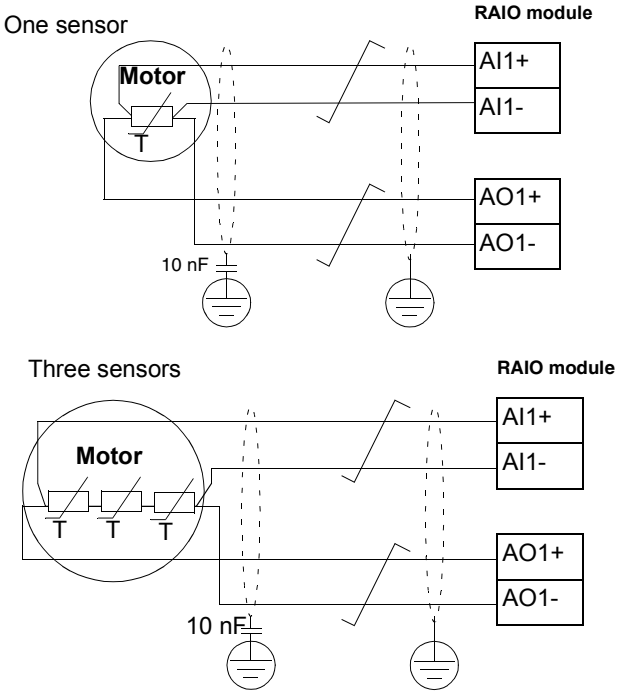
Parameter	Additional information
15.01	Analogue output in a motor 1 temperature measurement. Set to M1 TEMP MEAS.
35.01 … 35.03	Settings of motor 1 temperature measurement
Other	
Parameters 13.01 to 13.05 (AI1 processing) and 15.02 to 15.05 (AO1 processing) are not effective.	
At the motor end the cable 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
03.08	Warning bit state
03.15	Fault bit states
03.16	Warning bit states
Warnings	
MOTOR 1 TEMP (4312)	Chapter *Fault tracing* and parameter 03.16
T MEAS ALM	Chapter *Fault tracing* and parameter 03.08
Faults	
MOTOR 1 TEMP (4312)	Chapter *Fault tracing* and parameter 03.15

Motor temperature measurement through the analogue I/O extension

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



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. The module power supply must also have an isolation level of 2.5 kV. (Note that the drive RMIO board - if used as a power supply - does not fulfil this requirement.)

Or

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

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.	
The RAIO module must also be connected to a power supply. See the module manual.	

Diagnostics

Actual values	Additional information
01.35	Temperature value
03.08	Fault bit in a packed boolean word
03.15	Warning bit in a packed boolean word
03.16	Fault bit in a packed boolean word
Warnings	
MOTOR 1 TEMP (4312)	Chapter *Fault tracing* and parameter 03.16
T MEAS ALM	Chapter *Fault tracing* and parameter 03.08
Faults	
MOTOR 1 TEMP (4312)	Chapter *Fault tracing* and parameter 03.15

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 *Application Guide for Adaptive Program* (code: 3AFE 64527274 [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.

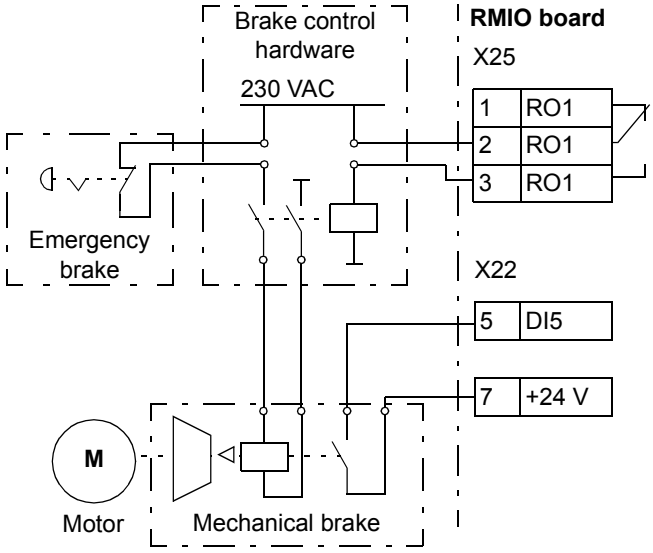
Example

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.

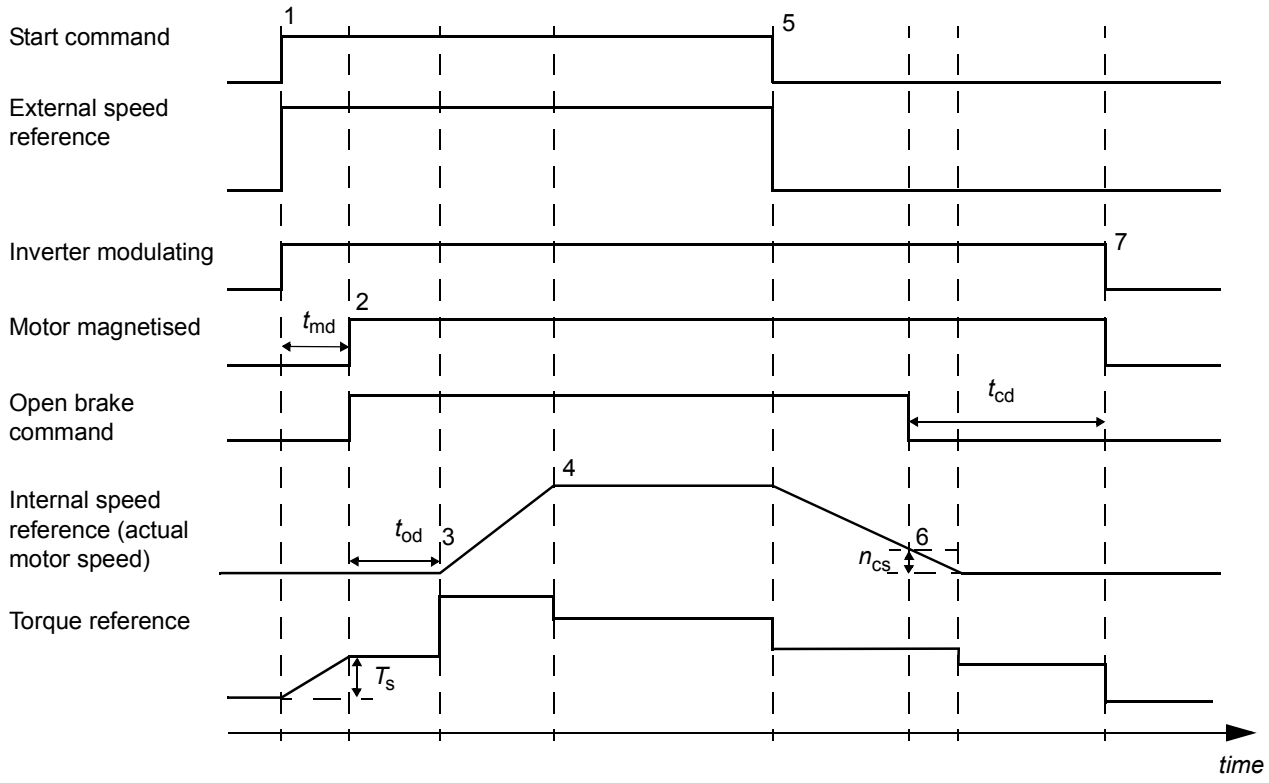
Brake control logic is integrated in the drive application program. The brake control hardware and wirings needs to be done by the user.

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



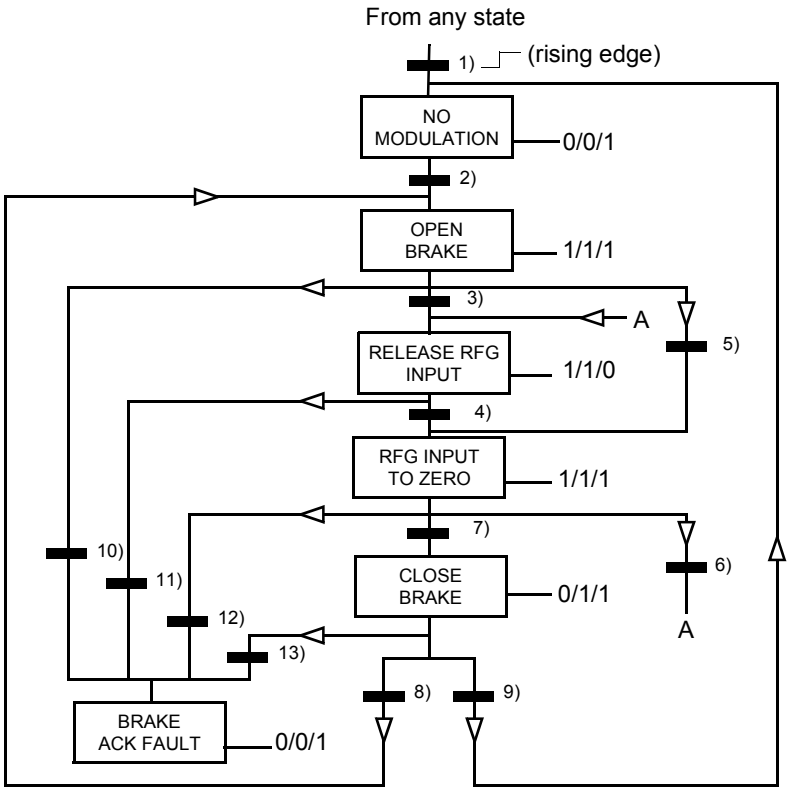
Operation time scheme

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”
03.15	Fault bit state
03.16	Warning bit state
Warnings	
BRAKE ACKN (ff74)	Chapter *Fault tracing*, and actual signal 03.16
Faults	
BRAKE ACKN (ff74)	Chapter *Fault tracing*, and actual signal 03.15

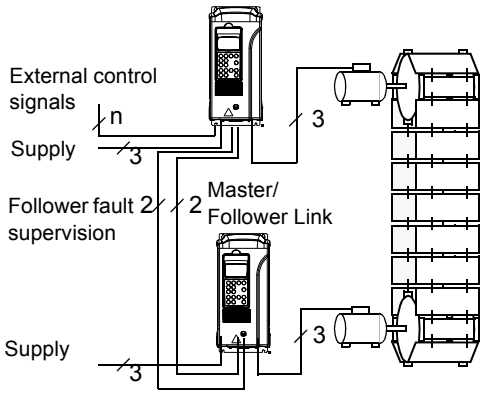
Master/Follower use of several drives

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

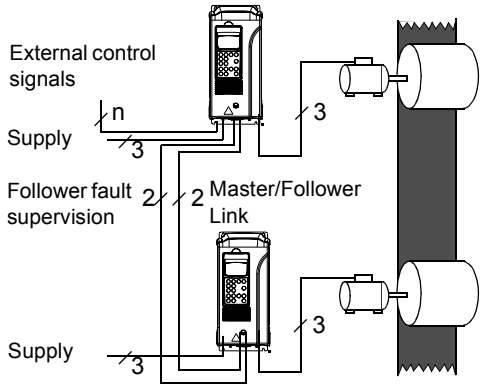
Solidly coupled motor shafts:

- 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 explains the functionality more in details	

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 can select one of the macros by parameter 99.02.

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: - Conveyors - Speed-controlled pumps and fans - 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: - pressure boost pumps of municipal water supply systems - level controlling pumps of water reservoirs - pressure boost pumps of district heating systems - material flow control on a conveyor line. 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

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 differs as follows (valid if the type code digit for the application program has value B):

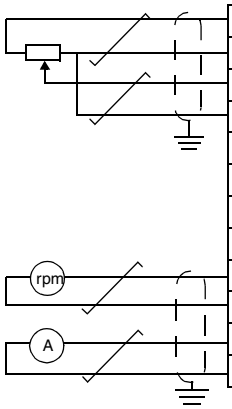
DI1	Start (Pulse: 0->1)
DI2	Stop (Pulse: 1->0)
DI3	Forward/Reverse

[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.



X20

1	VREF	Reference voltage -10 VDC
2	GND	

X21

1	VREF	Reference voltage 10 VDC 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, non-isolated, 24 VDC, 250 mA
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

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.

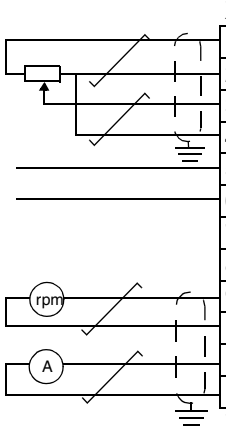
Two analogue and three relay output signals are available on terminal blocks. The default signals on the display of the control panel are FREQUENCY, CURRENT and CTRL LOC.

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.



X20		
1	VREF	Reference voltage -10 VDC
2	GND	
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, non-isolated, 24 VDC, 250 mA
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.

Default control connections

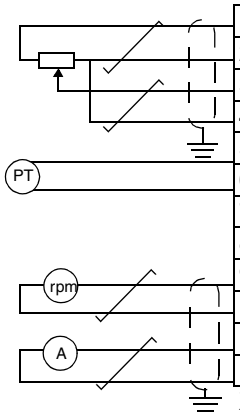
The figure below shows the external control connections for the PID Control macro. The markings of the standard I/O terminals on the RMIO board are shown.

[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.



X20		
1	VREF	Reference voltage -10 VDC
2	GND	
X21		
1	VREF	Reference voltage 10 VDC
2	GND	1 kohm ≤ R_L ≤ 10 kohm
3	AI1+	Speed ref. (speed cntrl) or process ref.
4	AI1-	(process cntrl). 0(2) … 10 V, R_{in} > 200 kohm
5	AI2+	Process actual value measurement. 0(4) …
6	AI2-	20 mA, R_{in} = 100 ohm
7	AI3+	By default, not in use. 0(4) … 20 mA, R_{in} =
8	AI3-	100 ohm.
9	AO1+	Motor speed 0(4) … 20 mA ≙
10	AO1-	0 … motor nom. speed, R_L ≤ 700 ohm
11	AO2+	Output current 0(4) … 20 mA ≙
12	AO2-	0 … motor nom. current, R_L ≤ 700 ohm
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, non-isolated,
2	GND	24 VDC, 250 mA
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	

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.

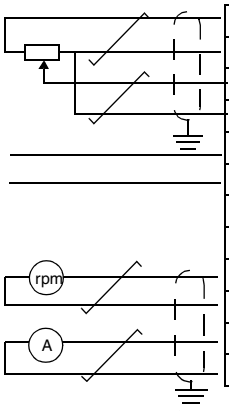
[1] Selection between external control locations EXT1 and EXT2

[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.



X20		
1	VREF	Reference voltage -10 VDC
2	GND	
X21		
1	VREF	Reference voltage 10 VDC
2	GND	1 kohm ≤ R_L ≤ 10 kohm
3	AI1+	Speed reference. 0(2) … 10 V, R_{in} >
4	AI1-	200 kohm
5	AI2+	Torque reference. 0(4) … 20 mA, R_{in} = 100
6	AI2-	ohm
7	AI3+	By default, not in use. 0(4) … 20 mA, R_{in} =
8	AI3-	100 ohm
9	AO1+	Motor speed 0(4) … 20 mA ≙ 0 … motor nom.
10	AO1-	speed, R_L ≤ 700 ohm
11	AO2+	Output current 0(4) … 20 mA ≙ 0 … motor
12	AO2-	nom. current, R_L ≤ 700 ohm
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, non-isolated,
2	GND	24 VDC, 250 mA
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	

Fault

Sequential Control macro

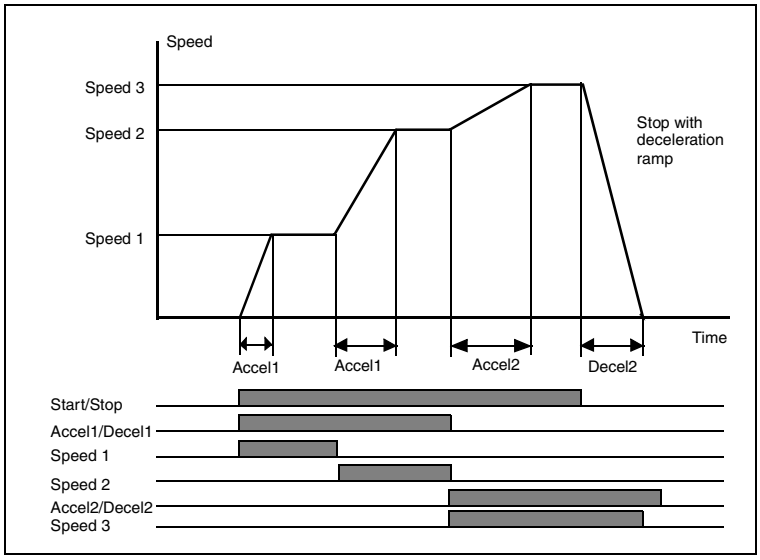
This macro offers seven preset constant speeds which can be activated by digital inputs DI4 to DI6. Two acceleration/deceleration ramps are preset. The acceleration and deceleration ramps are applied according to the state of digital input DI3. The Start/Stop and Direction commands are given through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

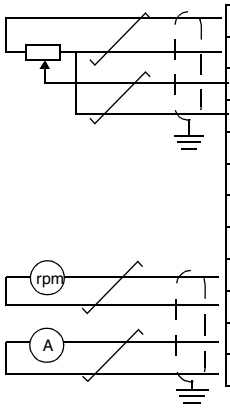
The figure below shows the external control connections for the Sequential Control macro. The markings of the standard I/O terminals on the RMIO board are shown.

[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.



X20

1	VREF	Reference voltage -10 VDC
2	GND	

X21

1	VREF	Reference voltage 10 VDC 1 kohm ≤ R_L ≤ 10 kohm
2	GND	
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, non-isolated, 24 VDC, 250 mA
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

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 and the control location setting (Local or Remote) are also saved.

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.

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).

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.	-2000 = -100% 2000 = 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.	0 = 0% 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	ACS 800 TEMP	Temperature of the heatsink.	1 = 1 °C
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 the chapter *Program features*.	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.	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	IGBT maximum temperature in inverter no. 1 (used only in high power units with parallel inverters).	1 = 1 °C
01.31	PP 2 TEMP	IGBT maximum temperature in inverter no. 2 (used only in high power units with parallel inverters).	1 = 1 °C
01.32	PP 3 TEMP	IGBT maximum temperature in inverter no. 3 (used only in high power units with parallel inverters).	1 = 1 °C
01.33	PP 4 TEMP	IGBT maximum 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
01.36	MOTOR 2 TEMP	Measured temperature of motor 2. See parameter 35.04.	1 = 1 °C
01.37	MOTOR TEMP EST	Estimated motor temperature.	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. **Note:** The counter can be reset by the DriveWindow PC tool. Resetting is recommended when the fan is replaced.	
01.45	CTRL BOARD TEMP	Control board temperature.	

No.	Name/Value	Description	FbEq
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	TORQ REF 2	Speed controller output. 100% corresponds to the motor nominal torque.	0 = 0% 10000 = 100% of motor nominal torque
02.10	TORQ 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%
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 the chapter *Fieldbus control*.	
03.02	MAIN STATUS WORD	A 16-bit data word. See the chapter *Fieldbus control*.	
03.03	AUX STATUS WORD	A 16-bit data word. See the chapter *Fieldbus control*.	
03.04	LIMIT WORD 1	A 16-bit data word. See the chapter *Fieldbus control*.	
03.05	FAULT WORD 1	A 16-bit data word. See the chapter *Fieldbus control*.	
03.06	FAULT WORD 2	A 16-bit data word. See the chapter *Fieldbus control*.	
03.07	SYSTEM FAULT	A 16-bit data word. See the chapter *Fieldbus control*.	
03.08	ALARM WORD 1	A 16-bit data word. See the chapter *Fieldbus control*.	
03.09	ALARM WORD 2	A 16-bit data word. See the chapter *Fieldbus control*.	
03.11	FOLLOWER MCW	A 16-bit data word. See the chapter *Fieldbus control*.	
03.12	INT FAULT INFO	A 16-bit data word. See the chapter *Fieldbus control*.	
03.13	AUX STATUS WORD 3	A 16-bit data word. See the chapter *Fieldbus control*.	
03.14	AUX STATUS WORD 4	A 16-bit data word. See the chapter *Fieldbus control*.	
03.15	FAULT WORD 4	A 16-bit data word. See the chapter *Fieldbus control*.	
03.16	ALARM WORD 4	A 16-bit data word. See the chapter *Fieldbus control*.	
03.17	FAULT WORD 5	A 16-bit data word. See the chapter *Fieldbus control*.	
03.18	ALARM WORD 5	A 16-bit data word. See the chapter *Fieldbus control*.	
3.20	LATEST FAULT	Fieldbus code of the latest fault. See chapter *Fault tracing* for the codes.	
3.21	2. LATEST FAULT	Fieldbus code of the 2nd latest fault.	
3.23	3. LATEST FAULT	Fieldbus code of the 3rd latest fault.	
3.24	4. LATEST FAULT	Fieldbus code of the 4th latest fault.	
3.25	5. LATEST FAULT	Fieldbus code of the 5th latest fault.	

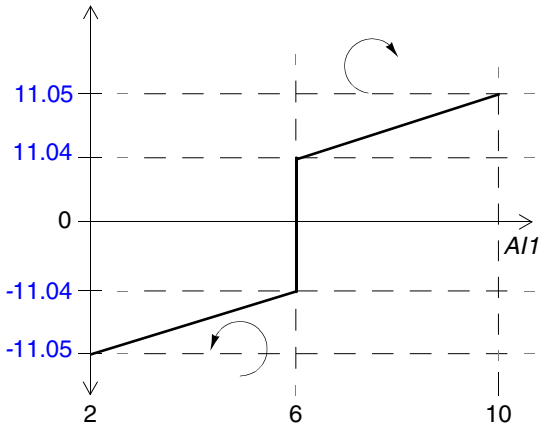
No.	Name/Value	Description	FbEq
3.26	LATEST WARNING	Fieldbus code of the latest warning.	
3.27	2. LATEST WARNING	Fieldbus code of the 2nd latest warning.	
3.28	3. LATEST WARNING	Fieldbus code of the 3rd latest warning.	
3.29	4. LATEST WARNING	Fieldbus code of the 4th latest warning.	
3.30	5. LATEST WARNING	Fieldbus code of the 5th latest warning.	
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
09.06	DS MCW	Control Word (CW) of the Main Reference Dataset received from the master station through the fieldbus interface	0 ... 65535 (Decimal)
09.07	MASTER REF1	Reference 1 (REF1) of the Main Reference Dataset received from the master station through the fieldbus interface	-32768 … 32767
09.08	MASTER REF2	Reference 2 (REF2) of the Main Reference Dataset received from the master station through the fieldbus interface	-32768 … 32767
09.09	AUX DS VAL1	Reference 3 (REF3) of the Auxiliary Reference Dataset received from the master station through the fieldbus interface	-32768 … 32767
09.10	AUX DS VAL2	Reference 4 (REF4) of the Auxiliary Reference Dataset received from the master station through the fieldbus interface	-32768 … 32767
09.11	AUX DS VAL3	Reference 5 (REF5) of the Auxiliary Reference Dataset received from the master station through the fieldbus interface	-32768 … 32767

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

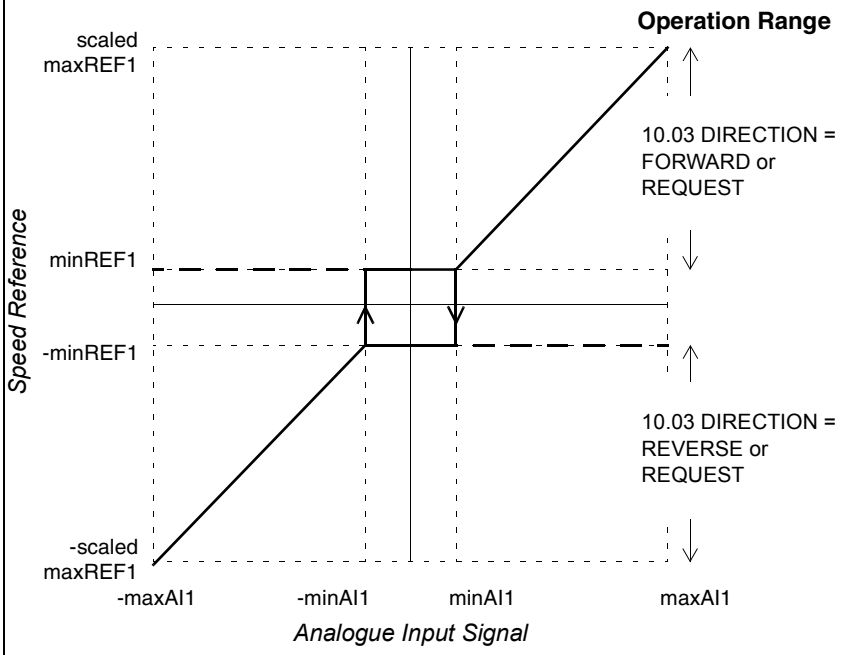
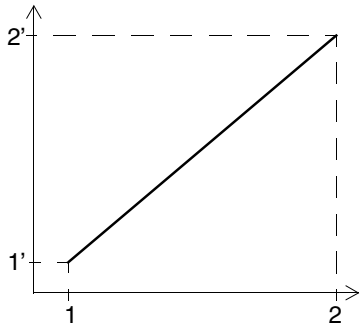
2) The contents of these data words are detailed in the chapter *Fieldbus control*. For the contents of Actual Signal 3.11, see the Master/Follower Application Guide [English].

Index	Name/Selection	Description	FbEq
10 START/STOP/DIR		The sources for external start, stop and direction control	
10.01	EXT1 STRT/STP/DIR	Defines the connections and the source of the start, stop and direction commands for external control location 1 (EXT1).	
	NOT SEL	No start, stop and direction command source.	1
	DI1	Start and stop through digital input DI1. 0 = stop; 1 = start. Direction is fixed according to parameter 10.3 DIRECTION. **WARNING!** After a fault reset, the drive will start if the start signal is on.	2
	DI1,2	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. **WARNING!** After a fault reset, the drive will start if the start signal is on.	3
	DI1P,2P	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.	4
	DI1P,2P,3	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.	5
	DI1P,2P,3P	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.	6
	DI6	See selection DI1.	7
	DI6,5	See selection DI1,2.	8
	KEYPAD	Control panel. To control the direction, parameter 10.03 DIRECTION must be REQUEST.	9
	COMM.CW	Fieldbus Control Word.	10
	DI7	See selection DI1.	11
	DI7,8	See selection DI1,2.	12
	DI7P,8P	See selection DI1P,2P.	13
	DI7P,8P,9	See selection DI1P,2P,3.	14
	DI7P,8P,9P	See selection DI1P,2P,3P.	15
	PARAM 10.04	Source selected by 10.04	16
10.02	EXT2 STRT/STP/DIR	Defines the connections and the source of the start, stop and direction commands for external control location 2 (EXT2).	
	NOT SEL	See parameter 10.01.	1
	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

Index	Name/Selection	Description	FbEq
	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
10.03	DIRECTION	Enables the control of direction of rotation 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: - Parameter pointer: Inversion, group, index and bit fields. The bit number is effective only for blocks handling boolean inputs. - 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.	-
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
	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(11)	Fieldbus Control Word, bit 11.	9
	DI7	See selection DI1.	10

Index	Name/Selection	Description	FbEq
	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. **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
	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. **Note:** Parameter 10.03 must have the value REQUEST. **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. *Speed Reference (REF1)*  Par. 13.01 = 2 V, Par 13.02 = 10 V **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 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

Index	Name/Selection	Description	FbEq
	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 DI3U,4D(R).	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
	FAST COMM	As with the selection COMM. REF, except the following differences: - shorter communication cycle time when transferring the reference to the core motor control program (6 ms -> 2 ms) - the direction cannot be controlled through interfaces defined by parameters 10.01 or 10.02, nor with the control panel. - parameter group 25 CRITICAL SPEEDS is not effective **Note:** If any of the following selections is true, the selection is not effective. Instead, the operation is according to COMM. REF. - parameter 99.02 is PID - parameter 99.04 is SCALAR - 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 AI1/JOYST.	28
	AI6/JOYST	See 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(AI5,6)	Lower of analogue input AI5 and AI6	33
	MAX(AI5,6)	Higher of analogue input AI5 and AI6	34
	DI11U,12D(R)	See DI3U,4D(R).	35
	DI11U,12D	See DI3U,4D.	36
	PARAM 11.10	Source selected by 11.10.	37

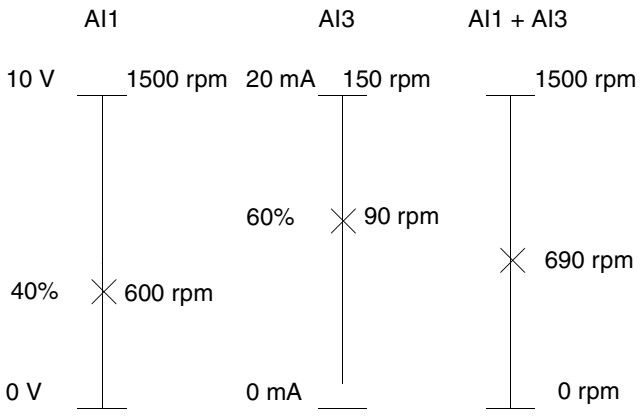
Index	Name/Selection	Description	FbEq
	AI1 BIPOLAR	Bipolar analogue input AI1 (-10 … 10 V). The figure below illustrates the use of the input as the speed reference.  minAI1 = 13.01 MINIMUM AI5 maxAI1 = 13.02 MAXIMUM AI5 scaled maxREF1 = 13.03 SCALE AI1 x 11.05 EXT REF1 MAXIMUM minREF1 = 11.04 EXT REF1 MINIMUM	38
11.04	EXT REF1 MINIMUM	Defines the minimum value for external reference REF1 (absolute value). Corresponds to the minimum setting of the source signal used.	
	0 … 18000 rpm	Setting range in rpm. (Hz if parameter 99.04 is SCALAR.) ***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: *EXT REF1 Range*  1 parameter 13.01 2 parameter 13.02 1' parameter 11.04 2' parameter 11.05 **Note:** If the reference is given through fieldbus, the scaling differs from that of an analogue signal. See the chapter *Fieldbus control* for more information.	1 … 18000
11.05	EXT REF1 MAXIMUM	Defines the maximum value for external reference REF1 (absolute value). Corresponds to the maximum setting of the used source signal.	

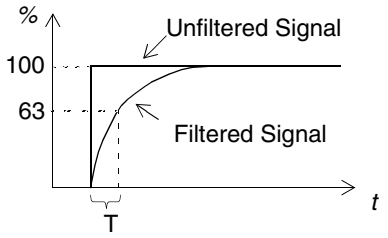
Index	Name/Selection	Description	FbEq
	0 … 18000 rpm	Setting range. (Hz if value of parameter 99.04 is SCALAR.) See parameter 11.04.	1 … 18000
11.06	EXT REF2 SELECT	Selects the signal source for external reference REF2. REF2 is a - speed reference in percent of the Absolute Maximum Speed if parameter 99.02 = FACTORY, HAND/AUTO or SEQ CTRL. - torque reference in percent of the motor nominal torque if parameter 99.02 = TORQUE. - process reference in percent of the maximum process quantity if parameter 99.02 = PID CTRL. - 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. **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
	AI5+AI6	See parameter 11.03.	30
	AI5-AI6	See parameter 11.03.	31

Index	Name/Selection	Description	FbEq
	AI5*AI6	See parameter 11.03.	32
	MIN(AI5,6)	See parameter 11.03.	33
	MAX(AI5,6)	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). Corresponds to the minimum setting of the source signal used.	
	0 … 100%	Setting range in percent. Correspondence to the source signal limits: - Source is an analogue input: See example for parameter 11.04. - Source is a serial link: See the 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 … 500%	Setting range. Correspondence to the source signal limits: - Source is an analogue input: See parameter 11.04. - Source is a serial link: See the chapter *Fieldbus control*.	0 … 5000
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. **Note:** If parameter 99.04 is SCALAR, the constant speeds are given in Hertz and 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. 1 = active, 0 = inactive.	2
	DI2(SPEED2)	Speed defined by parameter 12.03 is activated through digital input DI2. 1 = active, 0 = inactive.	3
	DI3(SPEED3)	Speed defined by parameter 12.04 is activated through digital input DI3. 1 = active, 0 = inactive.	4
	DI4(SPEED4)	Speed defined by parameter 12.05 is activated through digital input DI4. 1 = active, 0 = inactive.	5
	DI5(SPEED5)	Speed defined by parameter 12.06 is activated through digital input DI5. 1 = active, 0 = inactive.	6

<table>
<tr><th>Index</th><th>Name/Selection</th><th>Description</th><th>FbEq</th></tr>
<tr><td></td><td>DI6(SPEED6)</td><td>Speed defined by parameter 12.07 is activated through digital input DI6.
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.
<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.
<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
<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.
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.
1 = active, 0 = inactive.</td><td>16</td></tr>
<tr><td></td><td>DI9(SPEED3)</td><td>Speed defined by parameter 12.04 is activated through digital input DI9.
1 = active, 0 = inactive.</td><td>17</td></tr>
</table>

Index	Name/Selection	Description	FbEq
	DI10(SPEED4)	Speed defined by parameter 12.05 is activated through digital input DI10. 1 = active, 0 = inactive.	18
	DI11(SPEED5)	Speed defined by parameter 12.06 is activated through digital input DI11. 1 = active, 0 = inactive.	19
	DI12 (SPEED6)	Speed defined by parameter 12.07 is activated through digital input DI12. 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.	
	0 … 18000 rpm	Setting range	0 … 18000
12.14	CONST SPEED 13	Defines speed 13. An absolute value. Does not include the direction information.	
	0 … 18000 rpm	Setting range	0 … 18000
12.15	CONST SPEED 14	Defines speed 14. An absolute value. Does not include the direction information.	
	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.	

Index	Name/Selection	Description	FbEq
	-18000 … 18000 rpm	Setting range	-18000 … 18000
13 ANALOGUE INPUTS		The analogue input signal processing	
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. ***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: - Connect the minimum signal to input. - Set the parameter to TUNE. **Note:** The readable range in tuning is -10 … 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. ***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: - Connect the minimum signal to input. - Set the parameter to TUNE. **Note:** The readable range in tuning is 0 … 10 V.	3
13.03	SCALE AI1	Scales analogue input AI1. ***Example:*** The effect on speed reference REF1 when: - REF1 source selection (Parameter 11.03) = AI1+AI3 - REF1 maximum value setting (Parameter 11.05) = 1500 rpm - Actual AI1 value = 4 V (40% of the full scale value) - Actual AI3 value = 12 mA (60% of the full scale value) - AI1 scaling = 100%, AI3 scaling = 10%  	
	0 … 100%	Scaling range	0 … 10000

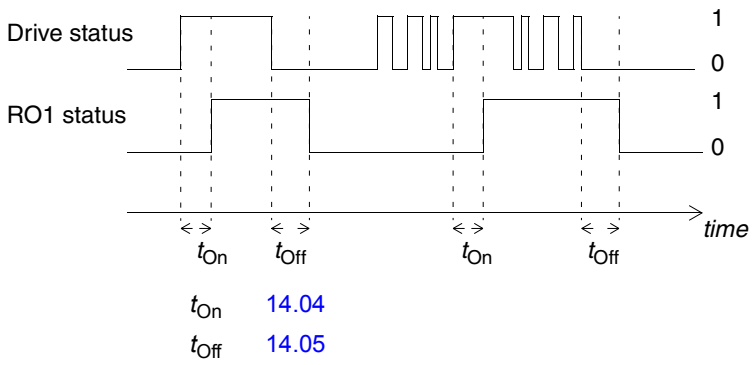
Index	Name/Selection	Description	FbEq
13.04	FILTER AI1	Defines the filter time constant for analogue input AI1.  $O = I \cdot (1 - e^{-t/T})$ I = filter input (step) O = filter output t = time T = filter time constant **Note:** The signal is also filtered due to the signal interface hardware (10 ms time 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
13.08	SCALE AI2	See parameter 13.03.	
	0 … 100%	See parameter 13.03.	0 … 10000
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 … 100%	See parameter 13.03.	0 … 10000

Index	Name/Selection	Description	FbEq
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.	
	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.	
	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 … 100%	See parameter 13.03.	0 … 10000
13.19	FILTER AI5	See parameter 13.04.	
	0.00 … 10.00 s	See parameter 13.04.	0 … 1000
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.	
	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.	
	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 … 100%	See parameter 13.03.	0 … 10000
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

Index	Name/Selection	Description	FbEq
14 RELAY OUTPUTS		Status information indicated through the relay outputs, and the relay operating delays	
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: 115 °C (239 °F).	11
	ACS TEMP FLT	Fault trip by the drive temperature supervision function: 125 °C (257 °F).	12
	FAULT/WARN	Fault or warning active	13
	WARNING	Warning active	14
	REVERSED	Motor rotates in reverse direction.	15
	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

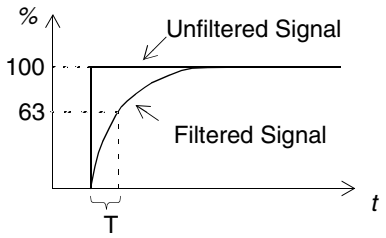
Index	Name/Selection	Description	FbEq
	COMM.REF3(13)	The relay is controlled by fieldbus reference REF3. See the chapter *Fieldbus control*.	33
	PARAM 14.16	Source selected by parameter 14.16.	34
	BRAKE CTRL	On/Off control of a mechanical brake. See parameter group 42 BRAKE CONTROL.	35
14.02	RELAY RO2 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
	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

Index	Name/Selection	Description	FbEq
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
	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
14.04	RO1 TON DELAY	Defines the operation delay for the relay RO1.	

Index	Name/Selection	Description	FbEq
	0.0 … 3600.0 s	Setting range. The figure below illustrates the operation (on) and release (off) delays for relay output RO1.  t_{On} 14.04 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
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

Index	Name/Selection	Description	FbEq
	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
	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.	

Index	Name/Selection	Description	FbEq
	-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.	-
15 ANALOGUE OUTPUTS		Selection of the actual signals to be indicated through the analogue outputs. Input signal processing.	
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. 20 mA = motor nominal speed. The updating interval is 24 ms.	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

Index	Name/Selection	Description	FbEq
	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 *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. **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
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  $O = I \cdot (1 - e^{-t/T})$ I = filter input (step) O = filter output t = time T = filter time constant **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.	

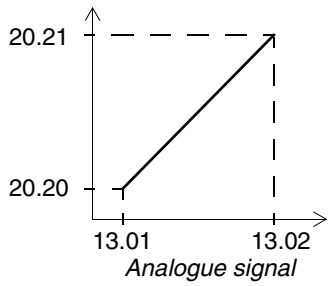
Index	Name/Selection	Description	FbEq
	10 … 1000%	Scaling factor. If the value is 100%, the reference value of the drive signal corresponds to 20 mA. ***Example:*** The nominal motor current is 7.5 A and the measured maximum current at maximum load 5 A. The motor current 0 to 5 A needs to be read as 0 to 20 mA analogue signal through AO1. The required settings are: 1. AO1 is set to CURRENT by parameter 15.01. 2. AO1 minimum is set to 0 mA by parameter 15.03. 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: $k \cdot 5\ A = 7.5\ A \Rightarrow k = 1.5 = 150\%$	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
	ACTUAL 2	See parameter 15.01.	14
	COMM.REF5	The value is read from fieldbus reference REF5. See *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.	1000=1 mA

Index	Name/Selection	Description	FbEq
	-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.	-
15.12	AO2 PTR	Defines the source or constant for value PAR 15.12 of parameter 15.06.	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.	-
16 SYSTEM 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(3)	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
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: - If the drive is in external control mode: Reset by a rising edge of DI1. - 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

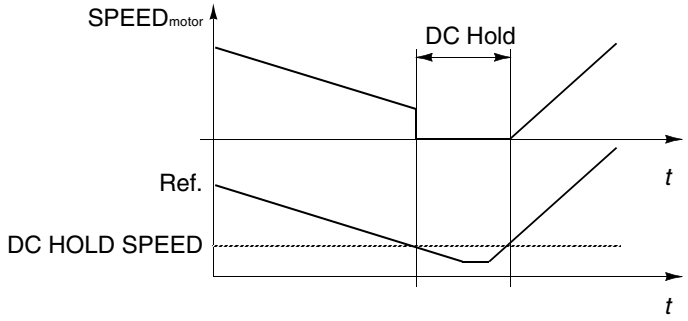
Index	Name/Selection	Description	FbEq
	DI6	See selection DI1.	7
	COMM.CW(7)	Reset through the fieldbus Control Word (bit 7), or by the RESET key of the control panel.	8
	ON STOP	Reset along with the stop signal received through a digital input, or by the RESET key of the control panel.	9
	DI7	See selection 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
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. **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. **Note:** The value of this parameter is not included in the User Macro. A setting once made remains despite the User Macro change. **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
	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). **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. **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 started.	0

Index	Name/Selection	Description	FbEq
	SAVE..	Saving is done.	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.	-
20 LIMITS		Drive operation limits.	
20.01	MINIMUM SPEED	Defines the allowed minimum speed. The limit cannot be set if parameter 99.04 = SCALAR. **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	1 = 1 rpm
20.02	MAXIMUM SPEED	Defines the allowed maximum speed. The value cannot be set if parameter 99.04 = SCALAR. **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 in percent of the rated heavy-duty use output current (I_{2hd}).	
	0.0 … 200.0% · Ihd	Current limit	0 … 20000
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. 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. **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. 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.	

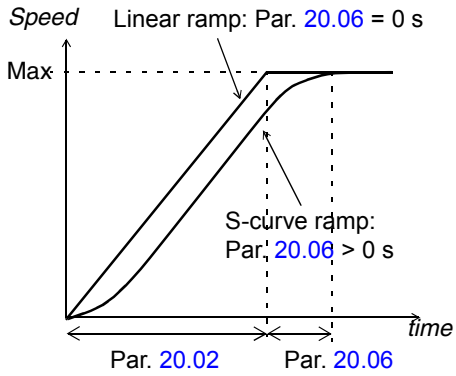
Index	Name/Selection	Description	FbEq
	-300.00 … 50 Hz	Minimum frequency limit. **Note:** If the value is positive, the motor cannot be run in the reverse direction.	-30000 … 5000
20.08	MAXIMUM FREQ	Defines the maximum limit for the drive output frequency. The limit can be set only if parameter 99.04 = SCALAR	
	-50 … 300.00 Hz	Maximum frequency limit	-5000 … 30000
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.	
	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.	
	MAX LIM1	Value of parameter 20.14.	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

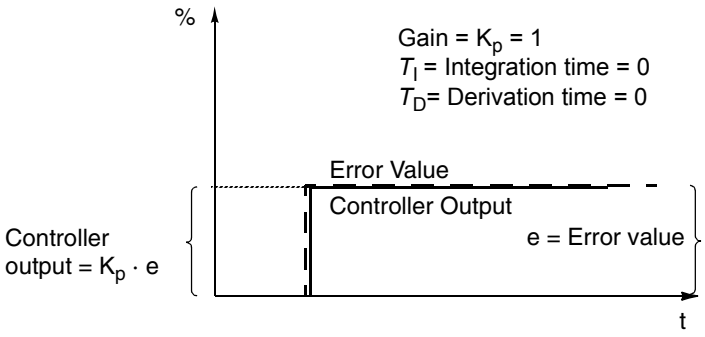
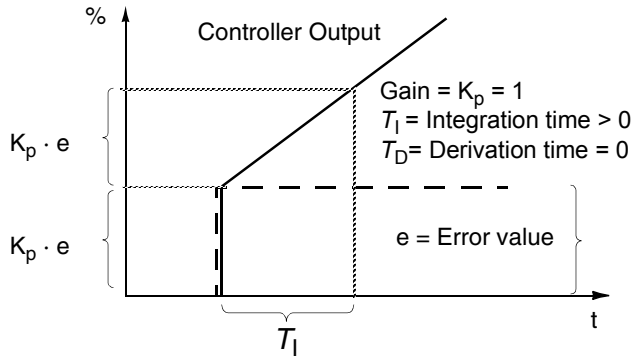
Index	Name/Selection	Description	FbEq
	DI9	See selection DI1.	10
	DI10	See selection DI1.	11
	DI11	See selection DI1.	12
	DI12	See selection DI1.	13
	AI1	Analogue input AI1. See parameter 20.20 on how the signal is converted to a torque limit.	14
	AI2	See selection AI1.	15
	AI3	See selection AI1.	16
	AI5	See selection AI1.	17
	AI6	See selection AI1.	18
	PARAM 20.19	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. *Torque limit*  *Analogue signal* 13.01 Minimum setting for AI1 13.02 Maximum setting for AI1 20.20 Minimum torque 20.21 Maximum torque	
	0.0 … 600.0%	%-value that correspond to the minimum setting of the analogue input	
20.21	MAX AI SCALE	See parameter 20.20.	
	0.0 … 600.0%	%-value that correspond to the maximum setting of the analogue input	
21 START/STOP		Start and stop modes of the motor.	
21.01	START FUNCTION	Selects the motor starting method.	

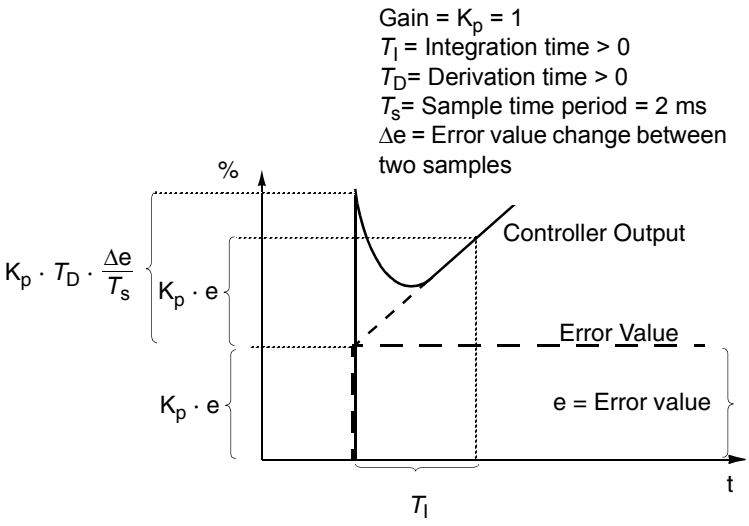
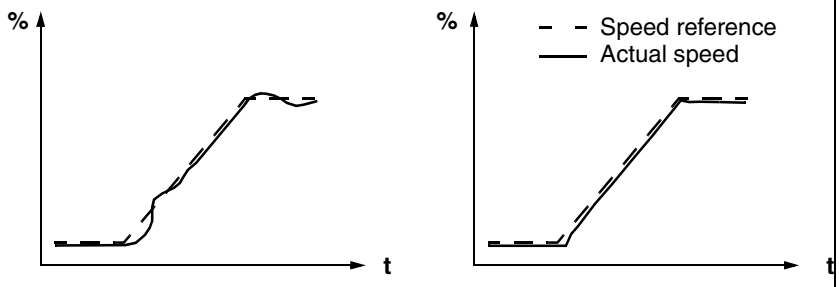
<table>
<tr><th>Index</th><th>Name/Selection</th><th>Description</th><th>FbEq</th></tr>
<tr><td></td><td>AUTO</td><td>Automatic start guarantees optimal motor start in most cases. It includes the flying start function (starting to a rotating machine) and the automatic restart function (stopped motor 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.
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.
Note: Starting to a rotating machine is not possible when DC magnetising is selected.
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.
Note: Starting to a rotating machine is not possible when DC magnetising is selected.
Note: DC magnetising cannot be selected if parameter 99.04 = SCALAR.
  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:
<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.
  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>

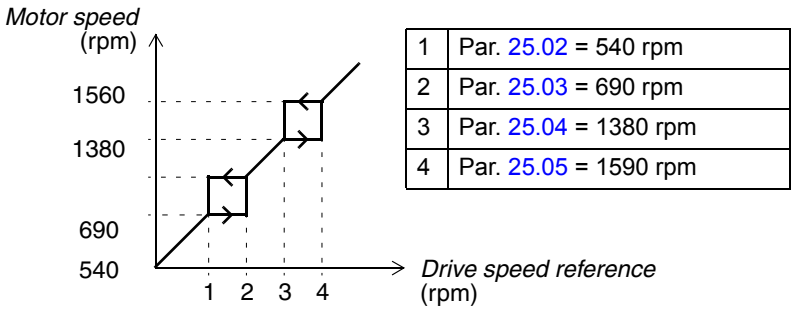
Index	Name/Selection	Description	FbEq
21.04	DC HOLD	Activates/deactivates the DC hold function. DC Hold is not possible if parameter 99.04 = SCALAR. When both the reference and the speed drop below the value of parameter 21.05, the drive will stop generating sinusoidal current and start to inject DC into the motor. The current is set by parameter 21.06. When the reference speed exceeds parameter 21.05, normal drive operation continues.  **Note:** DC Hold has no effect if the start signal is switched off. **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.	
	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. **Note:** The setting overrides the normal stop mode setting (parameter 21.03) when the Run Enable signal is switched off. **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. **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
	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

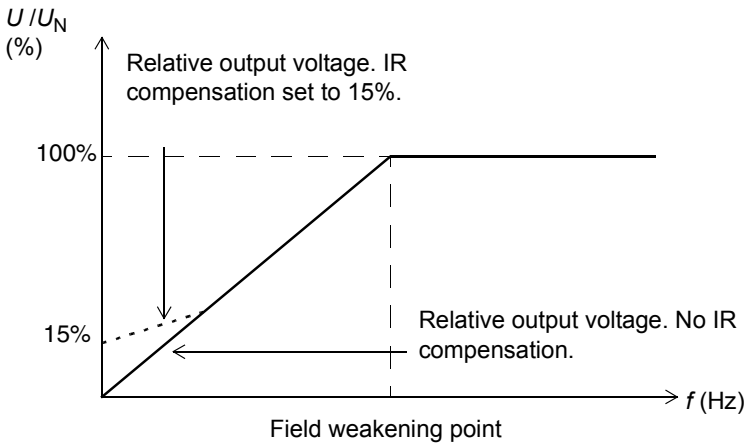
Index	Name/Selection	Description	FbEq
21.08	SCALAR FLY START	Activates the flying start feature in the scalar control mode. See parameters 21.01 and 99.04.	
	NO	Inactive.	0
	YES	Active.	1
21.09	START INTRL FUNC	Defines how the Start Interlock input on RMIO board affects the drive operation.	
	OFF2 STOP	Drive running: 1 = Normal operation. 0 = Stop by coasting. Drive stopped: 1 = Start allowed. 0 = No start allowed. 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. Drive stopped: 1 = Normal start. 0 = No start allowed. Restart after OFF3 STOP: Start Interlock input = 1 and the drive receives rising edge of the Start signal.	2
22 ACCEL/DECEL		Acceleration and deceleration times.	
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
	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. - If the speed reference increases faster than the set acceleration rate, the motor speed will follow the acceleration rate. - If the speed reference increases slower than the set acceleration rate, the motor speed will follow the reference signal. - 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

Index	Name/Selection	Description	FbEq
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. - If the speed reference decreases slower than the set deceleration rate, the motor speed will follow the reference signal. - If the reference changes faster than the set deceleration rate, the motor speed will follow the deceleration rate. - 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). **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
22.06	ACC/DEC RAMP SHPE	Selects the shape of the acceleration/deceleration ramp.	
	0.00 … 1000.00 s	0.00 s: Linear ramp. Suitable for steady acceleration or deceleration and for slow ramps. 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. A rule of thumb A suitable relation between the ramp shape time and the acceleration ramp time is 1/5. 	0 … 100000
22.07	EM STOP RAMP TIME	Defines the time inside which the drive is stopped if - the drive receives an emergency stop command or - the Run Enable signal is switched off and the Run Enable function has value OFF3 (see parameter 21.07). 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 Application 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.	

Index	Name/Selection	Description	FbEq
	-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
23 SPEED CTRL		Speed controller variables. The parameters are not visible if parameter 99.04 = SCALAR.	
23.01	GAIN	Defines a relative gain for the speed controller. Great gain may cause speed oscillation. The figure below shows the speed controller output after an error step when the error remains constant. 	
	0.0 … 200.0	Gain	0 … 20000
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. The figure below shows the speed controller output after an error step when the error remains constant. 	
	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. The derivation makes the control more responsive for disturbances. **Note:** Changing this parameter is recommended only if a pulse encoder is used. The figure below shows the speed controller output after an error step when the error remains constant. 	
	0.0 … 9999.8 ms	Derivation time value.	1 = 1 ms
23.04	ACC COMPENSATION	Defines the derivation time for acceleration 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. **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.) The figure below shows the speed responses when a high inertia load is accelerated along a ramp. **No Acceleration Compensation** **Acceleration Compensation** 	
	0.00 … 999.98 s	Derivation time	0 … 9999

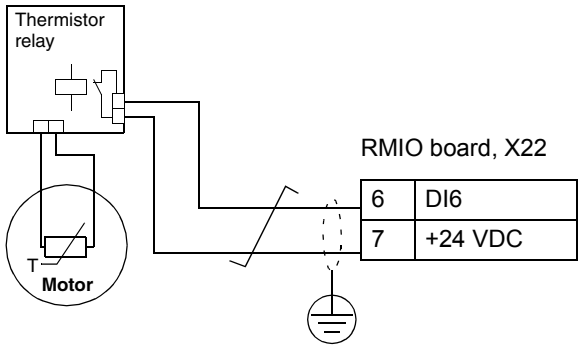
Index	Name/Selection	Description	FbEq
23.05	SLIP GAIN	Defines the slip gain for the motor slip compensation control. 100% means full slip compensation; 0% means no slip compensation. The default value is 100%. Other values can be used if a static speed error is detected despite of the full slip compensation. ***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: - Run the motor at a constant speed of 20 to 40% of the rated speed. - Change the autotuning parameter 23.06 to YES. **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
24 TORQUE CTRL		Torque control variables. 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.	
25.01	CRIT SPEED SELECT	Activates/deactivates the critical speeds function. ***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: - activate the critical speeds function, - set the critical speed ranges as in the figure below.  1 Par. 25.02 = 540 rpm 2 Par. 25.03 = 690 rpm 3 Par. 25.04 = 1380 rpm 4 Par. 25.05 = 1590 rpm **Note:** If parameter 99.02 = PID CTRL, the critical speeds are not in use.	
	OFF	Inactive	0
	ON	Active.	65535
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). **Note:** If parameter 99.04 = SCALAR, the unit is Hz.	0 … 18000

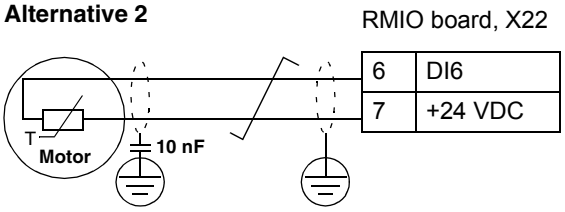
Index	Name/Selection	Description	FbEq
25.03	CRIT SPEED 1 HIGH	Defines the maximum limit for critical speed range 1.	
	0 … 18000 rpm	Maximum limit. The value cannot be below the minimum (parameter 25.02). **Note:** If parameter 99.04 = SCALAR, the unit is Hz.	0 … 18000
25.04	CRIT SPEED 2 LOW	See parameter 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. **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. **Note:** The function cannot be used if parameter 99.04 = SCALAR.	
	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. **Note:** The function can be used only if parameter 99.04 is SCALAR.  Field weakening point	
	0 … 30%	Voltage boost at zero speed in percent of the motor nominal voltage	0 … 3000
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).	
	NO	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

Index	Name/Selection	Description	FbEq
	YES	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.	1
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. FbEq for the flux value is 100 = 1%. The range of the flux is 25 … 140%.	100 = 1%
27 BRAKE CHOPPER		Control of the brake chopper. For more information, see the *Brake Chopper User's Manual* (code: 3AFE 64273507 [English])	
27.01	BRAKE CHOPPER CTL	Activates the brake chopper control.	
	OFF	Inactive	0
	ON	Active. **Note:** Ensure the brake chopper and resistor are installed and the overvoltage control is switched off (parameter 20.05).	6553
27.03	BR OVERLOAD FUNC	Activates the overload protection of the brake resistor. The user-adjustable variables are parameters 27.04, 27.05 and 27.06.	
	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
27.04	BR RESISTANCE	Defines the resistance value of the brake resistor. The value is used in the overload protection. See parameter 27.03.	
	0.01 … 100.00 ohm	Resistance value	0 … 100
27.05	BR THERM TCONST	Defines the thermal time constant of the brake resistor. The value is used in the overload protection. See parameter 27.03.	
	0.001 … 10000.000 s	Time constant.	
27.06	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 27.03.	
	0.01 …10000 kW	Power	
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. **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. **WARNING!** Make sure that it is safe to continue operation in case the analogue input signal is lost.	3

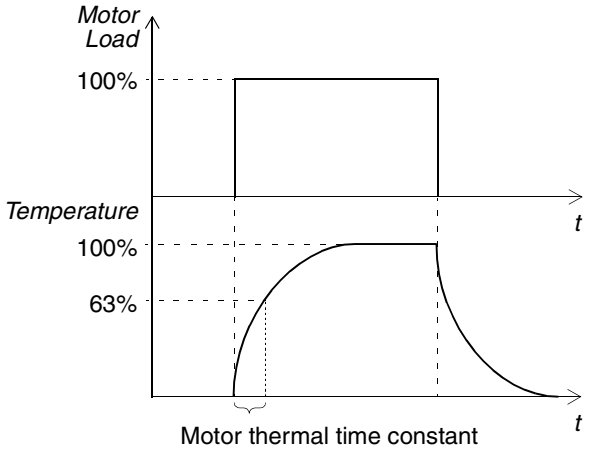
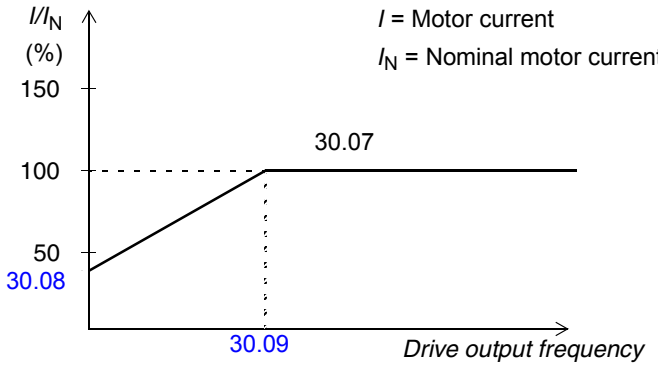
Index	Name/Selection	Description	FbEq
	LAST SPEED	The drive generates a warning AI < MIN FUNC (8110) and freezes the speed to the level the drive was operating at. The speed is determined by the average speed over the previous 10 seconds. **WARNING!** Make sure that it is safe to continue operation in 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 stops as defined by parameter 21.03.	1
	CONST SP 15	The drive generates a warning and sets the speed to the speed defined by parameter 12.16. **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. **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.	
	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
30.04	MOTOR THERM PROT	Selects how the drive reacts when the motor overtemperature is detected by the function defined by Parameter 30.05. **Note:** The parameter has no effect if the motor temperature measurement has been activated by parameter group 35 MOT TEMP MEAS.	
	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.	

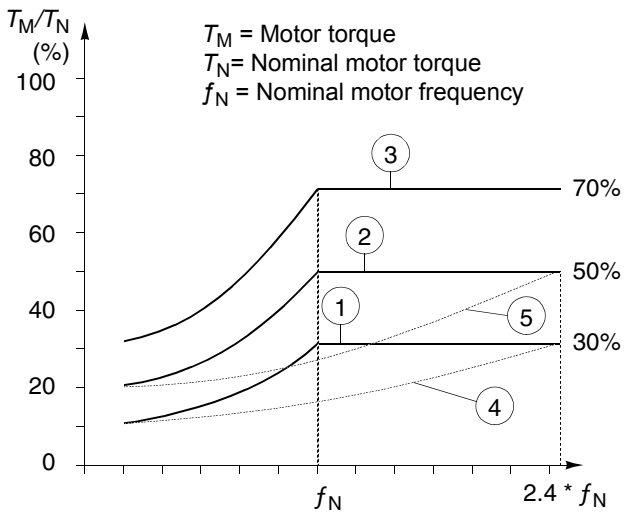
Index	Name/Selection	Description	FbEq
	DTC	The protection is based on the calculated motor thermal model. The following assumptions are used in the calculation: - The motor is at ambient temperature (30 °C) when the power is switched on. - The motor temperature increases if it operates in the region above the load curve and decreases if it operates below the curve. - The motor thermal time constant is an approximate value for a standard self-ventilated squirrel-cage motor. It is possible to finetune the model by parameter 30.07. **Note:** The model cannot be used with high power motors (parameter 99.06 is higher than 800 A). **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: - The motor is at ambient temperature (30 °C) when power is switched on. - The motor temperature increases if it operates in the region above the motor load curve and decreases if it operates below the curve. 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. **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>THERMISTOR</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:
<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>
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.
WARNING! Digital input DI6 may be selected for another use. Change these settings before selecting THERMISTOR. In other words, ensure that digital input DI6 is not selected by any other parameter.
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.
Alternative 1


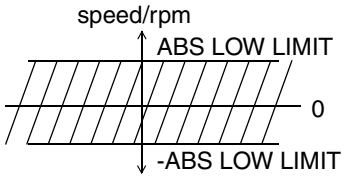
Alternative 2


</td><td>3</td></tr>
</table>

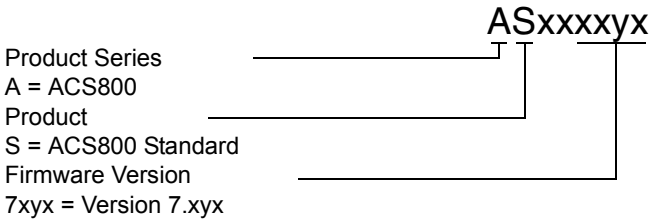
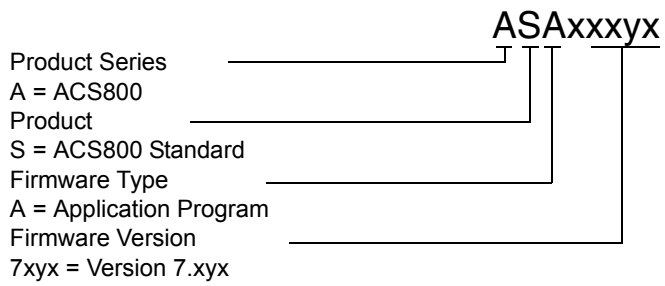
Index	Name/Selection	Description	FbEq
30.06	MOTOR THERM TIME	Defines the thermal time constant for the user-defined thermal model (see the selection USER MODE of parameter 30.05). 	
	256.0 … 9999.8 s	Time constant	256 … 9999
30.07	MOTOR LOAD CURVE	Defines the load curve together by parameters 30.08 and 30.09. The load curve is used in the user-defined thermal model (see the selection USER MODE of parameter 30.05). 	
	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
30.10	STALL FUNCTION	Selects how the drive reacts to a motor stall condition. The protection wakes up if: - the motor torque is at the internal stall torque limit (not user-adjustable) - the output frequency is below the level set by parameter 30.11 and - the conditions above have been valid longer than the time set by parameter 30.12.	
	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

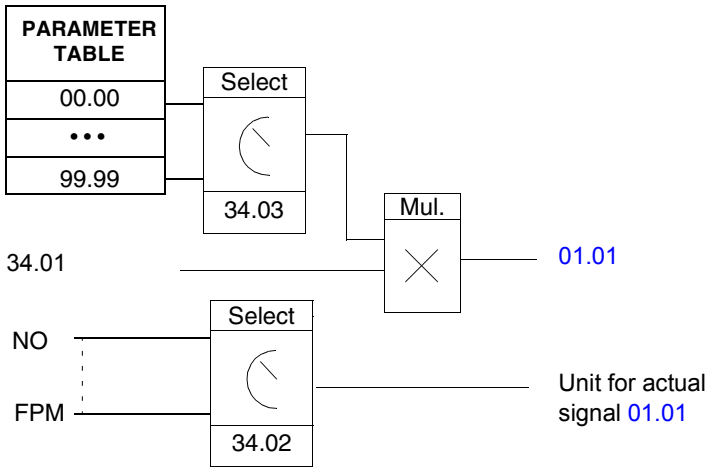
Index	Name/Selection	Description	FbEq
	NO	Protection is inactive.	3
30.11	STALL FREQ HI	Defines the frequency limit for the stall function. See parameter 30.10.	
	0.5 … 50.0 Hz	Stall frequency	50 … 5000
30.12	STALL TIME	Defines the time for the stall function. See parameter 30.10.	
	10.00 … 400.00 s	Stall time	10 … 400
30.13	UNDERLOAD FUNC	Selects how the drive reacts to underload. The protection wakes up if: - the motor torque falls below the curve selected by parameter 30.15, - output frequency is higher than 10% of the nominal motor frequency and - the above conditions have been valid longer than the time set by parameter 30.14.	
	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. 	
	1 … 5	Number of the load curve	1 … 5
30.16	MOTOR PHASE LOSS	Activates the motor phase loss supervision function.	
	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.	
	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 stops the motor as defined by parameter 21.03.	1

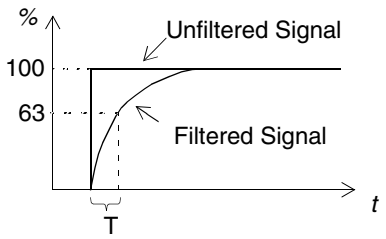
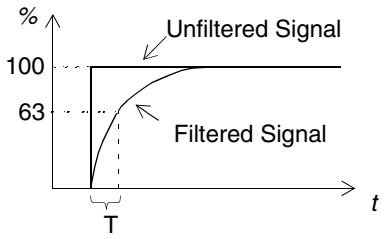
Index	Name/Selection	Description	FbEq
	NO	Protection is inactive.	2
	CONST SP 15	Protection is active. The drive generates a warning and sets the speed to the value defined by parameter 12.16. **WARNING**! Make sure that it is safe to continue operation in case of a communication break.	3
	LAST SPEED	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. **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 Dataset 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 the 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.	1
	LAST VALUE	The relay output keeps the last state before the communication loss. The analogue output gives the last value before the communication loss. **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 Dataset supervision. See parameter 30.18. The drive automatically activates the supervision 60 seconds after power switch-on if the value is other than zero. **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
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. ***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
31 AUTOMATIC RESET		Automatic fault reset. Automatic resets are possible only for certain fault types and when the automatic reset function is activated for that fault type. The automatic reset function is not operational if the drive is in local control (L visible on the first row of the panel display).	
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

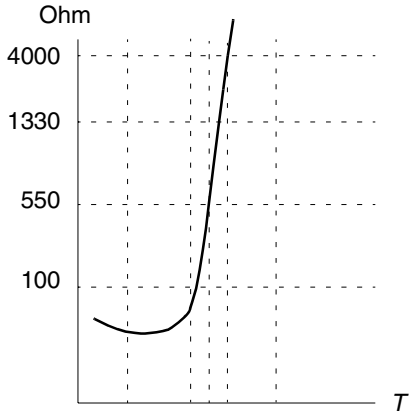
Index	Name/Selection	Description	FbEq
31.03	DELAY TIME	Defines the time that the drive will wait after a fault before attempting an automatic reset. See parameter 31.01.	
	0.0 … 3.0 s	Resetting delay	0 … 300
31.04	OVERCURRENT	Activates/deactivates the automatic reset for the overcurrent fault.	
	NO	Inactive	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).	
	NO	Inactive	0
	YES	Active. **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
32 SUPERVISION		Supervision limits. A relay output can be used to indicate when the value is above/below the limit.	
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.  	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.	

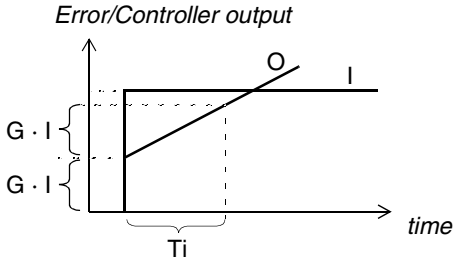
Index	Name/Selection	Description	FbEq
	- 18000 … 18000 rpm	See parameter 32.01.	- 18000 … 18000
32.05	CURRENT FUNCTION	Activates/deactivates the motor current supervision function and selects the type of the supervision limit.	
	NO	See parameter 32.01.	1
	LOW LIMIT	See parameter 32.01.	2
	HIGH LIMIT	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
	HIGH LIMIT	See parameter 32.01.	3
32.08	TORQUE 1 LIMIT	Defines the limit for the motor torque supervision (see parameter 32.07).	
	-400 … 400%	Value of the limit in percent of the motor nominal torque	-4000 … 4000
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).	
	-400 … 400%	Value of the limit in percent of motor nominal torque	-4000 … 4000
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 … 500%	Value of the limit	0 … 5000
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

Index	Name/Selection	Description	FbEq
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.	
		Decoding key:  	
33.02	APPL SW VERSION	Displays the type and the version of the application program.	
		Decoding key:  	
33.03	TEST DATE	Displays the test date.	
		Date value in format DDMMYY (day, month, year)	

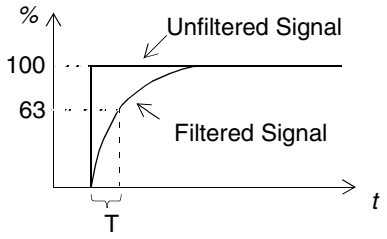
Index	Name/Selection	Description	FbEq
34 PROCESS VARIABLE		- user variable and unit - filtering for the actual signals speed and torque - reset of the run time counter	
34.01	SCALE	Scales the selected drive variable into a desired user-defined variable, which is stored as an actual signal 01.01. The block diagram below illustrates the use of the parameters that define actual signal 01.01.  	
	0.00 … 100000.00	Scaling factor	0 … 100000
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	labels 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

Index	Name/Selection	Description	FbEq
	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
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 the actual signal speed (01.02), the speed value used in the speed supervision (parameters 32.01 and 32.03) and the speed value read through an analogue output.	
	0 … 20000 ms	Filter time constant  $O = I \cdot (1 - e^{-t/T})$ I = filter input (step) O = filter output t = time 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  $O = I \cdot (1 - e^{-t/T})$ I = filter input (step) O = filter output t = time 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 the chapter *Program features*.	
35.01	MOT 1 TEMP AI1 SEL	Activates the motor 1 temperature measurement function and selects the sensor type.	
	NOT IN USE	The function is inactive.	1

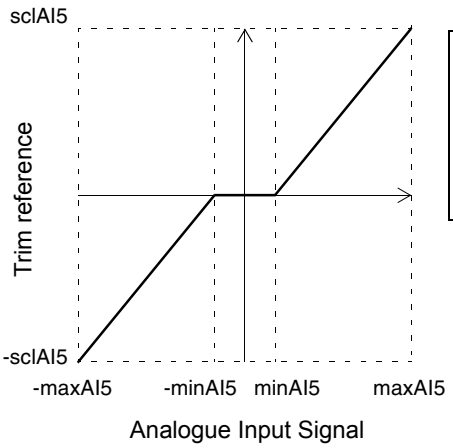
<table>
<tr><th>Index</th><th>Name/Selection</th><th>Description</th><th>FbEq</th></tr>
<tr><td></td><td>1xPT100</td><td>The function is active. The temperature is measured with one Pt 100 sensor. Analogue output AO1 feeds constant current through the sensor. The sensor resistance increases as the motor 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.</td><td>2</td></tr>
<tr><td></td><td>2XPT100</td><td>The function is active. Temperature is measured using two Pt 100 sensors. See selection 1xPT100.</td><td>3</td></tr>
<tr><td></td><td>3XPT100</td><td>The function is active. Temperature is measured using three Pt 100 sensors. See selection 1xPT100.</td><td>4</td></tr>
<tr><td></td><td>1..3 PTC</td><td>The function is active. The temperature is supervised using one to three PTC 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 PTC 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.
<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.
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).</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>
</table>

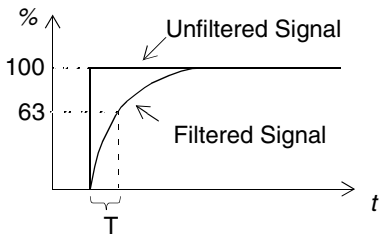
<table>
<tr><th>Index</th><th>Name/Selection</th><th>Description</th><th>FbEq</th></tr>
<tr><td>35.05</td><td>MOT 2 TEMP ALM L</td><td>Defines the alarm limit for the motor 2 temperature measurement function. The alarm indication is given when the limit is exceeded.</td><td></td></tr>
<tr><td></td><td>-10 … 5000 ohm/°C (PTC/Pt100)</td><td>See 35.02</td><td>-10 … 5000</td></tr>
<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.
Note: Selection is possible only when Pt 100 sensor(s) are used.</td><td>0</td></tr>
<tr><td colspan="2">40 PID CONTROL</td><td>- process PID control (99.02 = PID CTRL)
- speed or torque reference trimming (99.02 is not PID CTRL)
- sleep function for the process PID control (99.02 = PID CTRL)
For more information, see the chapter Program features.</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
- a 10% or 50% error value is connected to the controller (error = process reference - process actual value).
- motor maximum speed is 1500 rpm (Parameter 20.02)
<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.
 

I = controller input (error)
O = controller output
G = gain
t = time
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>
<tr><td>40.03</td><td>PID DERIV TIME</td><td>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:
PID DERIV TIME · (E_K - E_{K-1})/T_S, in which
T_S = 12 ms sample time.
E = Error = Process reference - process actual value</td><td></td></tr>
</table>

Index	Name/Selection	Description	FbEq
	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.  $O = I \cdot (1 - e^{-t/T})$ I = filter input (step) O = filter output t = time 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	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
	AI6	Analogue input AI6	5
	PARAM 40.25	Source selected by parameter 40.25.	6
40.08	ACTUAL2 INPUT SEL	Selects the source for the variable ACT2. See parameter 40.06.	
	AI1	Analogue input AI1	1
	AI2	Analogue input AI2	2
	AI3	Analogue input AI3	3
	AI5	Analogue input AI5	4
	AI6	Analogue input AI6	5

<table>
<tr><th>Index</th><th>Name/Selection</th><th>Description</th><th>FbEq</th></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.
$\text{ACT1 MINIMUM} = \frac{\text{AI1min - 13.01}}{\text{13.02 - 13.01}} \cdot 100\%$
<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.
$\text{ACT1 MAXIMUM} = \frac{\text{AI1max - 13.01}}{\text{13.02 - 13.01}} \cdot 100\%$
<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>
<tr><td>40.12</td><td>ACT2 MAXIMUM</td><td>See parameter 40.10.</td><td></td></tr>
<tr><td></td><td>-1000 … 1000%</td><td>See parameter 40.10.</td><td>-10000 … 10000</td></tr>
<tr><td>40.13</td><td>PID INTEGRATION</td><td>Activates the integration of the process PID controller.</td><td></td></tr>
<tr><td></td><td>OFF</td><td>Inactive</td><td>1</td></tr>
<tr><td></td><td>ON</td><td>Active</td><td>2</td></tr>
</table>

Index	Name/Selection	Description	FbEq
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. ***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. 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. ***Example:*** AI5 as a trim reference  minAI5 = parameter 13.16 maxAI5 = parameter 13.17 sclAI5 = parameter 13.18 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
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
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. Visible only when parameter 99.02 = T CTRL.	
	SPEED TRIM	Speed reference trimming	1

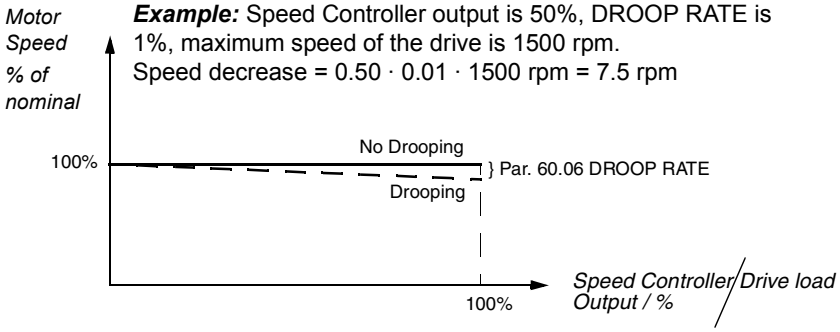
Index	Name/Selection	Description	FbEq
	TORQUE TRIM	Torque reference trimming	2
40.19	ACTUAL FILT TIME	Defines the time constant for the filter through which the actual signals are connected to the process PID controller.	
	0.04 … 10.00 s	Filter time constant.  $O = I \cdot (1 - e^{-t/T})$ I = filter input (step) O = filter output t = time T = filter time constant	4 … 1000
40.20	SLEEP SELECTION	Activates the sleep function and selects the source for the activation input. Visible only when parameter 99.02 = PID CTRL.	
	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. Activation: Digital input DI1 = 1. Deactivation: DI1 = 0. 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
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”. 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. Visible only when parameter 99.02 = PID CTRL.	
	0.0 … 3600.0 s	Sleep start delay	0 … 36000

Index	Name/Selection	Description	FbEq
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). Visible only when parameter 99.02 = PID CTRL.	
	0.0 … 100.0%	The wake-up level in percent of the used process reference 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. 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%
42 BRAKE CONTROL		Control of a mechanical brake. The function operates on a 100 ms time level. For the function description, see the chapter *Program features*.	
42.01	BRAKE CTRL	Activates the brake control function.	
	OFF	Inactive	1
	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 DI5.	3
	DI11	See DI5.	4
	DI12	See DI5.	5
42.03	BRAKE OPEN DELAY	Defines the brake open delay. 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

Index	Name/Selection	Description	FbEq
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
42.08	START TORQ REF	Defines the motor starting torque at brake release if parameter 42.07 has value PAR 40.28.	
	-300 … 300%	Torque value in percent of the motor nominal torque	-30000 … 30000
50 ENCODER MODULE		Encoder connection. Visible only when a pulse encoder module (optional) is installed and activated by parameter 98.01. 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.	1
	A ¯_¯	Channel A: positive and negative edges calculated for speed. Channel B: not used.	2
	A ¯_¯ B DIR	Channel A: positive and negative edges are calculated for speed. Channel B: direction.	3
	A ¯_¯ B ¯_¯	All edges of the signals are calculated.	4
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: -There is a 20% difference between the estimated speed and the measured speed received from the encoder. - No pulses are received from the encoder within the defined time (see parameter 50.04*)* and the motor torque is at the allowed maximum value.	
	WARNING	The drive generates a warning indication.	1
	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).	
	5 … 50000 ms	Time delay	5 … 50000

Index	Name/Selection	Description	FbEq
50.05	ENCODER DDCS CHANNEL	Defines the fibre optic channel of the control board from which the drive program reads the signals coming from the pulse encoder interface module. 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).	
	CHANNEL 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
	CHANNEL 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	0
	ENCODER	Actual speed measured with an encoder	65535
51 COMMUNICATION MODULE		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. These parameter settings will remain the same even though the macro is changed.	
52 STANDARD MODBUS		The settings for the Standard Modbus Link. See the 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	
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 stopbit	3
	EVEN	Even parity indication bit, one stopbit	4
60 MASTER/ FOLLOWER		Master/Follower application. For more information, see the chapter *Program features* and a separate Master/Follower Application Guide.	
60.01	MASTER LINK MODE	Defines the role of the drive on the Master/Follower link.	
	NOT IN USE	The Master/Follower link is not active.	1
	MASTER	Master drive	2
	FOLLOWER	Follower drive	3
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). The parameter is visible only when parameter 99.02 = T CTRL. External control location 2 (EXT2) must be active to enable torque selector.	

Index	Name/Selection	Description	FbEq
	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 - the motor shafts of the Master and Follower are connected flexibly. (A slight speed difference between the Master and the Follower is possible/allowed.) - drooping is used (see parameter 60.06).	1
	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. **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.	2
	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.	3
	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.	4
	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.	5
	ZERO	This selection forces the output of the torque selector to zero.	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: - the speed error exceeds the value of parameter 60.04 or - the absolute value of the negative speed error exceeds the value of parameter 60.05. 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. ***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: - External control location 1 (EXT1) is selected (see parameter 11.02 or - External control location 2 (EXT2) is selected (see parameter 11.02) and parameter 60.02 is set to SPEED. 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. 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. **Speed Decrease =** Speed Controller Output · Drooping · Max. Speed ***Example:*** Speed Controller output is 50%, DROOP RATE is 1%, maximum speed of the drive is 1500 rpm. Speed decrease = 0.50 · 0.01 · 1500 rpm = 7.5 rpm  	
	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

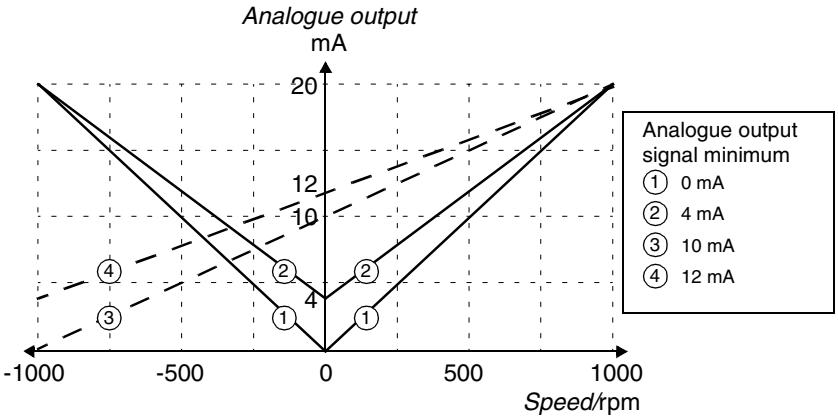
Index	Name/Selection	Description	FbEq
70.02	CHANNEL 3 ADDR	Node address for channel 3. No two nodes on-line may have the same address. Typically the setting needs to be changed when the drive is connected in a ring which consists of several drives and a PC with the Drive*Window*® program running.	
	1 … 254	Address.	1 … 254
70.03	CH1 BAUDRATE	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 Mbits. See also parameter 50.05.	
	8 Mbits	8 megabits per second	0
	4 Mbits	4 megabits per second	1
	2 Mbits	2 megabits per second	2
	1 Mbits	1 megabits per second	3
70.04	CH0 DDCS HW CONN	Selects the topology of the channel 0 link.	
	RING	Devices are connected in a ring.	0
	STAR	Devices are connected in a star.	1
83 ADAPT PROG CTRL		Control of the Adaptive Program execution. For more information, see the *Adaptive Program Application Guide* (code: 3AFE 64527274 [English]).	
83.01	ADAPT PROG CMD	Selects the operation mode for the Adaptive Program.	
	STOP	Stop. The program cannot be edited.	
	START	Run. The program cannot be edited.	
	EDIT	Stop to edit mode. Program can be edited.	
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.	
	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. ***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). In order to do this: - Shift the program to the editing mode by parameter 83.01. - Select location number five as the desired location for the new block by parameter 83.03. - Shift the block in location number 5 and the following blocks one location forward by parameter 83.02.(selection PUSH) - Program the emptied location number 5 by parameters 84.25 to 84.29 as usual.	
	DELETE	Deletes the block in location defined by parameter 83.03 and shifts the following blocks one step down.	
83.03	EDIT BLOCK	Defines the block location number for the command selected by parameter 83.02.	
	1 … 15	Block location number.	
83.04	TIMELEVEL SEL	Selects on the execution cycle time for the Adaptive Program. The setting is valid for all blocks.	

<table>
<tr><th>Index</th><th>Name/Selection</th><th>Description</th><th>FbEq</th></tr>
<tr><td></td><td>12 ms</td><td>12 milliseconds</td><td></td></tr>
<tr><td></td><td>100 ms</td><td>100 milliseconds</td><td></td></tr>
<tr><td></td><td>1000 ms</td><td>1000 milliseconds</td><td></td></tr>
<tr><td colspan="2">84 ADAPTIVE PROGRAM</td><td>- selections of the function blocks and their input connections.
- diagnostics
For more information, see the Adaptive Program Application Guide (code: 3AFE 64527274 [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 3</th><th>Bit 2</th><th>Bit 1</th><th>Bit 0</th><th>Display</th><th>Meaning</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>Stopped</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>Running</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>2</td><td>Editing</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>4</td><td>Checking</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>8</td><td>Faulted</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 (code: 3AFE 64527274 [English]).</td><td></td></tr>
<tr><td></td><td>ABS</td><td></td><td></td></tr>
<tr><td></td><td>ADD</td><td></td><td></td></tr>
<tr><td></td><td>AND</td><td></td><td></td></tr>
<tr><td></td><td>COMPARE</td><td></td><td></td></tr>
<tr><td></td><td>EVENT</td><td></td><td></td></tr>
<tr><td></td><td>FILTER</td><td></td><td></td></tr>
<tr><td></td><td>MAX</td><td></td><td></td></tr>
<tr><td></td><td>MIN</td><td></td><td></td></tr>
<tr><td></td><td>MULDIV</td><td></td><td></td></tr>
<tr><td></td><td>NO</td><td></td><td></td></tr>
<tr><td></td><td>OR</td><td></td><td></td></tr>
<tr><td></td><td>PI</td><td></td><td></td></tr>
<tr><td></td><td>PI-BAL</td><td></td><td></td></tr>
<tr><td></td><td>SR</td><td></td><td></td></tr>
<tr><td></td><td>SWITCH-B</td><td></td><td></td></tr>
<tr><td></td><td>SWITCH-I</td><td></td><td></td></tr>
<tr><td></td><td>TOFF</td><td></td><td></td></tr>
<tr><td></td><td>TON</td><td></td><td></td></tr>
<tr><td></td><td>TRIGG</td><td></td><td></td></tr>
<tr><td></td><td>XOR</td><td></td><td></td></tr>
<tr><td>84.06</td><td>INPUT1</td><td>Selects the source for input I1 of Block Parameter Set 1.</td><td></td></tr>
</table>

Index	Name/Selection	Description	FbEq
	-255.255.31 … +255.255.31 / C.-32768 … C.32767	Parameter index or a constant value: - Parameter pointer: Inversion, group, index and bit fields. The bit number is effective only for blocks handling boolean inputs. - Constant value: Inversion and constant fields. Inversion field must have value C to enable the constant setting. ***Example:*** The state of digital input DI2 is connected to Input 1 as follows: - 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.) - 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* (code: 3AFE 64527274 [English]).	
85.01	CONSTANT1	Sets a constant for the Adaptive Program.	
	-8388608 to 8388607	Integer value.	
85.02	CONSTANT2	Sets a constant for the Adaptive Program.	
	-8388608 to 8388607	Integer value.	
85.03	CONSTANT3	Sets a constant for the Adaptive Program.	
	-8388608 to 8388607	Integer value.	
85.04	CONSTANT4	Sets a constant for the Adaptive Program.	
	-8388608 to 8388607	Integer value.	
85.05	CONSTANT5	Sets a constant for the Adaptive Program.	
	-8388608 to 8388607	Integer value.	
85.06	CONSTANT6	Sets a constant for the Adaptive Program.	
	-8388608 to 8388607	Integer value.	
85.07	CONSTANT7	Sets a constant for the Adaptive Program.	
	-8388608 to 8388607	Integer value.	
85.08	CONSTANT8	Sets a constant for the Adaptive Program.	
	-8388608 to 8388607	Integer value.	
85.09	CONSTANT9	Sets a constant for the Adaptive Program.	
	-8388608 to 8388607	Integer value.	
85.10	CONSTANT10	Sets a constant for the Adaptive Program.	
	-8388608 to 8388607	Integer value.	
85.11	STRING1	Stores a message to be used in the Adaptive Program (EVENT block).	

Index	Name/Selection	Description	FbEq
	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. - Numbers of the main and auxiliary data sets. The parameters are visible only when a fieldbus communication is activated by parameter 98.02. For more information, see the 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.	
	1 … 255	Data set number	
92 D SET TR ADDR		Main and Auxiliary Data Sets which the drive sends to the fieldbus master station. The parameters are visible only when a fieldbus communication is activated by parameter 98.02. For more information, see the 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	

Index	Name/Selection	Description	FbEq
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	
96 EXTERNAL AO		Output signal selection and processing for the analogue extension module (optional). 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
	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

Index	Name/Selection	Description	FbEq
96.03	MINIMUM EXT AO1	Defines the minimum value for the analogue output AO1 of the analogue I/O extension module. **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. ***Example:*** Motor speed is read through the analogue output. - The motor nominal speed is 1000 rpm (parameter 99.08). - 96.02 is NO. - 96.05 is 100%. The analogue output value as a function of the speed is shown below. 	
	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.	
	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

Index	Name/Selection	Description	FbEq
	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 15.01.	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.	-
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. 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. **Note:** Module node number must be set to 16. For directions, see *Installation and Start-up Guide for NTAC-0x/NDIO-0x/NAIO-0x Modules* (Code: 3AFY 58919730 [English]).	1
	NO	Inactive	2
	RTAC-SLOT1	Communication active. Module type: RTAC. Connection interface: Option slot 1 of the drive.	3

Index	Name/Selection	Description	FbEq
	RTAC-SLOT2	Communication active. Module type: RTAC. Connection interface: Option slot 2 of the drive.	4
	RTAC-DDCS	Communication active. Module type: RTAC. Connection interface: Option module rack of the drive (communicates with the drive through a fibre optic DDCS link). **Note:** Module node number must be set to 16. For directions, see *User's Manual for RDIO Module* (Code: 3AFE 64485733 [English]).	5
98.02	COMM. MODULE LINK	Activates the external serial communication and selects the interface. See the chapter *Fieldbus control.*	
	NO	No communication	1
	FIELDBUS	The drive communicates via a fieldbus adapter module in option slot 1 of the drive, or via CH0 on the RDCO board. See also parameter group 51 COMMUNICATION MODULE.	2
	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. Module inputs: See parameter 98.09 for the use of the inputs in the drive application program. 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. **Note:** Module node number must be set to 2. For directions, see *Installation and Start-up Guide for NTAC-0x/NDIO-0x/NAIO-0x Modules* (Code: 3AFY 58919730 [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: Option module rack of the drive (communicates with the drive through a fibre optic DDCS link). **Note:** Module node number must be set to 2. For directions, see *User's Manual for RDIO Module* (Code: 3AFE 64485733 [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. Module inputs: See parameter 98.10 for the use of the inputs in the drive application program. Module outputs: See parameters 14.12 and 14.13 for selecting the drive states that are indicated through the relay outputs.	

Index	Name/Selection	Description	FbEq
	NDIO	Communication active. Module type: NDIO module. Connection interface: Fibre optic DDCS link. **Note:** Module node number must be set to 3. For directions, see *Installation and Start-up Guide for NTAC-0x/NDIO-0x/NAIO-0x Modules* (Code: 3AFY 58919730 [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: Option module rack of the drive (communicates with the drive through a fibre optic DDCS link). **Note:** Module node number must be set to 3. For directions, see *User's Manual for RDIO Module* (Code: 3AFE 64485733 [English]).	5
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. Module inputs: See parameter 98.11 for the use of the inputs in the drive application program. 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. **Note:** Module node number must be set to 4. For directions, see *Installation and Start-up Guide for NTAC-0x/NDIO-0x/NAIO-0x Modules* (Code: 3AFY 58919730 [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: Option module rack of the drive (communicates with the drive through a fibre optic DDCS link). **Note:** Module node number must be set to 4. For directions, see *User's Manual for RDIO Module* (Code: 3AFE 64485733 [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. Module inputs: - Values AI5 and AI6 in the drive application program are connected to module inputs 1 and 2. - See parameters 98.13 and 98.14 for the signal type definitions. Module outputs: - See parameters 96.01 and 96.06 for selecting the drive signals that are indicated through module outputs 1 and 2.	

Index	Name/Selection	Description	FbEq
	NAIO	Communication active. Module type: NAIO. Connection interface: Fibre optic DDCS link. **Note:** Module node number must be set to 5. For directions, see *Installation and Start-up Guide for NTAC-0x/NDIO-0x/NAIO-0x Modules* (Code: 3AFY 58919730 [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 module rack which communicates with the drive through a fibre optic DDCS link. **Note:** Module node number must be set to 5. For directions, see *User's Manual for RAIO Module* (Code: 3AFE 64484567 [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. Apply for the fieldbus modules that have type designation of form **N**xxx (communicate with the drive through the fibre optic link CH0).	
	ANYBUS	Anybus profile. Apply for the fieldbus modules that have the type designation of form **R**xxx (can be installed in the option slot of the drive).	
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.
For more information on the temperature measurement function, see parameter group 35 MOT TEMP MEAS.
The use of the analogue inputs (AI) and outputs (AO) of the module is shown in the table below.

<table><tr><th colspan="2">Motor 1 temperature measurement</th></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:
- AO1 is 9.1 mA with selection 1xPT100
- 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><th colspan="2">Motor 2 temperature measurement</th></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:
- AO2 is 9.1 mA with selection 1xPT100,
- 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>
Before setting the drive parameters, ensure the module hardware settings are appropriate for the motor temperature measurement:
1. The module node number is 9.
2. The input signal type selections are the following:
- for one Pt 100 sensor measurement, set the range to 0 … 2 V.
- for two to three Pt 100 sensors or one to three PTC sensors, set the range to 0 … 10 V.
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.
Note: Make the module hardware settings described above. For instructions, see Installation and Start-up Guide for NTAC-0x/NDIO-0x/NAIO-0x Modules (Code: 3AFY 58919730 [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.
Note: Make the module hardware settings described above. The node number is not required. For directions, see User’s Manual for RAIO Module (Code: 3AFE 64484567 [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.
Note: Make the module hardware settings described above. The node number is not required. For directions, see User’s Manual for RAIO Module (Code: 3AFE 64484567 [English]).</td><td>4</td></tr>
</table>

Index	Name/Selection	Description	FbEq
	RAIO-DDCS	Communication active. Module type: RAIO. Connection interface: Optional module rack which communicates with the drive through a fibre optic DDCS link. **Note:** Set the module node number to 9. For directions, see *User's Manual for RAIO Module* (Code: 3AFE 64484567 [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. **Note:** The communication must be activated by parameter 98.06.	
	UNIP AI5	Unipolar	1
	BIPO 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. **Note:** The communication must be activated by parameter 98.06.	
	UNIP AI6	Unipolar	1
	BIPO AI6	Bipolar	2
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
	CESKY	Czech	11
	POLSKI	Polish	12
	PO-RUSSKI	Russian	13
99.02	APPLICATION MACRO	Selects the application macro. See the chapter *Application macros* for more information. **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

Index	Name/Selection	Description	FbEq
	HAND/AUTO	Two control devices are connected to the drive: - device 1 device communicates through the interface defined by external control location EXT1. - device 2 communicates through the interface defined by external control location EXT2. - 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.	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. **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. **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). - 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. - 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. **Note:** The parameter settings and the motor model are restored according to the same principles when a macro is changed to another.	
	NO	No restoring	0
	YES	Restoring	1
99.04	MOTOR CTRL MODE	Selects the motor control mode.	
	DTC	Direct Torque Control mode is suitable for most applications.	0

Index	Name/Selection	Description	FbEq
	SCALAR	Scalar control is suitable in special cases where the DTC cannot be applied. The scalar control mode is recommended: - for multimotor drives with variable number of motors - when the nominal current of the motor is less than 1/6 of the nominal output current of the drive (inverter) - the drive is used for test purposes with no motor connected. **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).	1
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.	1 = 1 V
99.06	MOTOR NOM CURRENT	Defines the nominal motor current. Must be equal to the value on the motor rating plate. **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: 1/6 … 2 · I_{2hd} of ACS800 (parameter 99.04 = DTC). Allowed range: 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! **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.	
	0 … 9000 kW	Nominal motor power	0 … 90000
99.10	MOTOR ID RUN	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 the chapter *Start-up; and control through the I/O*. **Note:** 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. **Note:** The ID Run (STANDARD or REDUCED) cannot be performed if parameter 99.04 = SCALAR.	

Index	Name/Selection	Description	FbEq
	NO	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. **Note:** The motor must be de-coupled from the driven equipment. **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.  **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: - if mechanical losses are higher than 20% (i.e. the motor cannot be de-coupled from the driven equipment) - 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 teminals). **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.  **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

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.

The four digit code number in brackets after the message is for the fieldbus communication (see the 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. See the chapter *Control panel* for more information.

Warning messages generated by the drive

WARNING	CAUSE	WHAT TO DO
ACS 800 TEMP (4210)	The drive temperature is excessive. A warning is given if the inverter module temperature exceeds 115 °C.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against unit power.
AI < MIN FUNC (8110) (programmable Fault Function 30.01)	An analogue control signal is below minimum allowed value. This can be caused by incorrect signal level or a failure in the control wiring.	Check for proper analogue control signal levels. Check the control wiring. Check Fault Function parameters.
BRAKE ACKN (ff74)	Unexpected state of the brake acknowledge signal.	See parameter group 42 BRAKE CONTROL. Check connection of the brake acknowledgement signal.
BR OVERHEAT	Overload of the brake resistor.	Stop drive. Let resistor cool down. Check parameter settings of the resistor overload protection function (see parameter group 27 BRAKE CHOPPER). Check that braking cycle meets the allowed limits. See *Brake Chopper User's Manual* (code: 3AFE 64273507 [English]).
COMM MODULE (7510) (programmable Fault Function)	Cyclical communication between the drive and the master is lost.	Check the status of fieldbus communication. See the chapter *Fieldbus control*, or appropriate fieldbus adapter manual. Check parameter settings: - group 51 (for fieldbus adapter) - group 52 (for Standard Modbus Link) Check cable connections. Check if the bus master is not configured, or does not send/receive messages.
DC OVERVOLT (3210)	Excessive intermediate circuit DC voltage. DC overvoltage trip limit is $1.3 \cdot U_{1max,}$ where U_{1max} is the maximum value of the mains voltage range. For 400 V units, U_{1max} is 415 V. For 500 V units, U_{1max} is 500 V. Actual voltage in the intermediate circuit corresponding to the mains voltage trip level is 728 VDC for 400 V units and 877 VDC for 500 V units.	Check that the overvoltage controller is on (Parameter 20.05). Check mains for static or transient overvoltage. Check brake chopper and resistor (if used). Check deceleration time. Use coast-to-stop function (if applicable). Retrofit the frequency converter with a brake chopper and a brake resistor.
EARTH FAULT (2330) (programmable Fault Function 30.17)	The load on the incoming mains system is out of balance. This can be caused by a fault in the motor, motor cable, or an internal malfunction.	Check motor. Check motor cable. Check there are no power factor correction capacitors or surge absorbers in the motor cable.
ENCODER A<>B (7302)	Pulse encoder phasing is wrong: Phase A is connected to terminal of phase B and vice versa.	Interchange the connection of pulse encoder phases A and B.

WARNING	CAUSE	WHAT TO DO
ENCODER ERR (7301)	Communication fault between the pulse encoder and the pulse encoder interface module and between the module and the drive.	Check the pulse encoder and its wiring, the pulse encoder interface module and its wiring, parameter group 50 settings.
ID DONE	The drive has performed the motor identification magnetisation and is ready for operation. This warning belongs to the normal start-up procedure.	Continue drive operation.
ID MAGN	Motor identification magnetisation is on. This warning belongs to the normal start-up procedure.	Wait until the drive indicates that motor identification is completed.
ID MAGN REQ	Motor identification is required. This warning belongs to the normal start-up procedure. The drive expects the user to select how the motor identification should be performed: By Identification Magnetisation or by ID Run.	Start the Identification Magnetisation by pressing the Start key, or select the ID Run and start (see parameter 99.10).
ID N CHANGED	The ID number of the drive has been changed from 1.	Change the ID number back to 1. See the chapter *Control panel*.
ID RUN SEL	Motor Identification Run is selected, and the drive is ready to start the ID Run. This warning belongs to the ID Run procedure.	Press Start key to start the Identification Run.
IN CHOKE TEMP (ff81)	Excessive input choke temperature.	Stop drive. Let it cool down. Check that the cooling fan rotates. Check ambient temperature: Must be inside the allowed range.
IO CONF	An input or output of an optional I/O extension module has been selected as a signal interface in the application program but the communication to the appropriate I/O extension module has not been set accordingly.	Check fault function description (parameter 30.22) and parameter group 98 OPTION MODULES. Correct settings where necessary.
MACRO CHANGE	Macro is restoring or User macro is being saved.	Wait until the drive has finished the task.
MOTOR STALL (7121) (programmable Fault Function 30.10)	The motor is operating in the stall region. This can be caused by excessive load or insufficient motor power.	Check motor load and the ratings of the drive. Check Fault Function parameters.
MOTOR STARTS	Motor Identification Run starts. This warning belongs to the ID Run procedure.	Wait until the drive indicates that motor identification is completed.
MOTOR TEMP (4310) (programmable Fault Function 30.04 … 30.09)	The motor temperature is excessive. This can be caused by excessive load, insufficient motor power, inadequate cooling or incorrect start-up data.	Check motor ratings, load and cooling. Check start-up data. Check Fault Function parameters.

WARNING	CAUSE	WHAT TO DO
MOTOR 1 TEMP (4312)	Measured motor temperature has exceeded the alarm limit set by parameter 35.02.	Check the value of the alarm limit. Check that the actual number of the sensors corresponds to the parameter set value. Let the motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc.
MOTOR 2 TEMP (4313)	Measured motor temperature has exceeded the alarm limit set by parameter 35.05.	Check the value of the alarm limit. Check that the actual number of the sensors corresponds to the parameter set value. Let the motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc.
PANEL LOSS (5300) (programmable Fault Function 30.02)	A control panel selected as the active control location for the drive has ceased communicating.	Check the panel connection (see the hardware manual). Check control panel connector. Replace control panel in the mounting platform. Check Fault Function parameters.
REPLACE FAN	Running time of the inverter cooling fan has exceeded its estimated life time.	Change the fan. Reset fan run time counter 01.44.
SHORT CIRC (2340) *)	Short-circuit in the motor cable(s) or motor. Output bridge of the converter unit is faulty.	Check motor and motor cable. Check there are no power factor correction capacitors or surge absorbers in the motor cable. Consult ABB representative.
SLEEP MODE	The sleep function has entered the sleeping mode.	See parameter group 40 PID CONTROL.
SYNCRO SPEED	The value of the motor nominal speed set to parameter 99.08 is not correct: The value is too near the synchronous speed of the motor. Tolerance is 0.1%.	Check nominal speed from motor rating plate and set parameter 99.08 exactly accordingly.
THERMISTOR (4311) (programmable Fault Function 30.04 … 30.05)	The motor temperature is excessive. Motor thermal protection mode selection is THERMISTOR.	Check motor ratings and load. Check start-up data. Check thermistor connections to digital input DI6.
UNDERLOAD (ff6a) (programmable Fault Function 30.13)	Motor load is too low. This can be caused by a release mechanism in the driven equipment.	Check for a problem in the driven equipment. Check Fault Function parameters.
T MEAS ALM	Motor temperature measurement is out of the acceptable range.	Check connections of the motor temperature measurement circuit. See parameter group 35 MOT TEMP MEAS for circuit diagram.

Warning messages generated by the control panel

WARNING	CAUSE	WHAT TO DO
DOWNLOAD FAILED	Download function of the panel has failed. No data has been copied from panel to drive.	Make sure the panel is in local mode. Retry (there might be interference on the link). Contact ABB representative.
DRIVE INCOMPATIBLE DOWNLOADING NOT POSSIBLE	Program versions in the panel and drive do not match. It is not possible to copy data from panel to the drive.	Check program versions (see parameter group 33 INFORMATION).
DRIVE IS RUNNING DOWNLOADING NOT POSSIBLE	Downloading is not possible while the motor is running.	Stop motor. Perform downloading.
NO COMMUNICATION (X)	Cabling problem or a hardware malfunction on the Panel Link.	Check Panel Link connections. Press RESET key. The panel reset may take up to half a minute, please wait.
	(4) = Panel type not compatible with version of the drive application program.	Check panel type and version of the drive application program. The panel type is printed on the cover of the panel. The application program version is stored in parameter 33.02.
NO FREE ID NUMBERS ID NUMBER SETTING NOT POSSIBLE	The Panel Link already includes 31 stations.	Disconnect another station from the link to free an ID number.
NOT UPLOADED DOWNLOADING NOT POSSIBLE	No upload function has been performed.	Perform the upload function before downloading. See the chapter *Control panel*.
UPLOAD FAILED	Upload function of the panel has failed. No data has been copied from the drive to the panel.	Retry (there might be interference on the link). 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 a warning is displayed. Parameter lock is on.	Stop motor, then change parameter value. Open the parameter lock (see parameter 16.02).

Fault messages generated by the drive

FAULT	CAUSE	WHAT TO DO
AI < MIN FUNC (8110) (programmable Fault Function 30.01)	Analogue control signal is below minimum allowed value due to incorrect signal level or failure in the control wiring.	Check for proper analogue control signal levels. Check control wiring. Check Fault Function parameters.
CTRL B TEMP	Control board temperature is lower than -5 … 0 °C or exceeds +73 … 82 °C.	Check air flow and fan operation.
BRAKE ACKN (ff74)	Unexpected state of the brake acknowledge signal.	See parameter group 42 BRAKE CONTROL. Check connection of the brake acknowledgement signal.
BR BROKEN (7111)	Brake resistor is not connected or it is damaged. The resistance rating of the brake resistor is too high.	Check the resistor and the resistor connection. Check that the resistance rating meets the specification. See the *Brake Chopper User's Manual* (code: 3AFE 64273507 [English]).
BR OVERHEAT (7112)	Overload of the brake resistor.	Stop drive. Let the resistor cool down. Check parameter settings of the resistor overload protection function (see parameter group 27 BRAKE CHOPPER). Check that braking cycle meets the allowed limits. See *Brake Chopper User's Manual* (code: 3AFE 64273507 [English]). Check that the supply AC voltage of the drive is not excessive.
BC SHORT CIR (7112)	Short circuit in the IGBT(s) of the brake chopper.	Replace the brake chopper.
BR WIRING (7111)	Wrong connection of the brake resistor.	Check the resistor connection.
COMM MODULE (7510) (programmable Fault Function)	Cyclical communication with drive and master station is lost.	Check status of fieldbus communication. See the chapter *Fieldbus control*, or appropriate fieldbus adapter manual. Check parameter settings: - group 51 (for fieldbus adapter), or - group 52 (for Standard Modbus Link) Check cable connections. Check if master can communicate.
CURR MEAS	Current transformer failure in output current measurement circuit.	Check current transformer connections to Main Circuit Interface Board, INT.

FAULT	CAUSE	WHAT TO DO
DC UNDERVOLT (3220)	Intermediate circuit DC voltage is not sufficient due to missing mains phase, a blown fuse or a rectifier bridge internal fault. DC undervoltage trip limit is 0.65 · $U_{1min,}$ where U_{1min} is the minimum value of the mains voltage range. For 400 V and 500 V units, U_{1min} is 380 V. Actual voltage in the intermediate circuit corresponding to the mains voltage trip level is 334 VDC	Check mains supply and fuses.
ENCODER A<>B (7302)	Pulse encoder phasing is wrong: Phase A is connected to terminal of phase B and vice versa.	Interchange the connection of pulse encoder phases A and B.
ENCODER ERR (7301)	Communication fault between pulse encoder and pulse encoder interface module or between module and drive.	Check pulse encoder and its wiring, module and its wiring and parameter group 50 settings.
EARTH FAULT (2330) (programmable Fault Function 30.17	Load on the incoming mains system is out of balance due to fault in the motor, motor cable or an internal malfunction.	Check motor. Check motor cable. Check there are no power factor correction capacitors or surge absorbers in the motor cable.
EXTERNAL FLT (9000) (programmable Fault Function 30.03)	Fault in one of the external devices. (This information is configured through one of the programmable digital inputs.)	Check external devices for faults. Check parameter 30.03 EXTERNAL FAULT.
ID RUN FAIL	Motor ID Run is not completed successfully.	Check maximum speed (Parameter 20.02). It should be at least 80% of the nominal speed of the motor (Parameter 99.08).
I/O COMM (7000)	Communication error on the control board, channel CH1. Electromagnetic interference.	Check connections of fibre optic cables on channel CH1. Check all I/O modules (if present) connected to channel CH1. Check for proper earthing of the equipment. Check for highly emissive components nearby.
IO CONF	Input or output of optional I/O extension module has been selected as a signal interface in the application program but the communication to the appropriate I/O extension module has not been set accordingly.	Check fault function description (Parameter 30.22) and parameter group 98 OPTION MODULES. Correct the settings where necessary.
LINE CONV	Fault on the line side converter.	Shift panel from motor-side converter control board to line-side converter control board. See line side converter manual for fault description.

FAULT	CAUSE	WHAT TO DO
MOTOR PHASE (ff56) (programmable Fault Function 30.16)	One of the motor phases is lost due to fault in the motor, motor cable, thermal relay (if used) or internal fault.	Check motor and motor cable. Check thermal relay (if used). Check Fault Function parameters. Disable this protection.
MOTOR TEMP (4310) (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. Check start-up data. Check Fault Function parameters.
MOTOR 1 TEMP (4312)	Measured motor temperature has exceeded the fault limit set by parameter 35.03.	Check value of fault limit. Let the motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc.
MOTOR 2 TEMP (4313)	Measured motor temperature has exceeded fault limit set by parameter 35.06.	Check value of fault limit. Let the motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc.
MOTOR STALL (7121) (programmable Fault Function 30.10 … 30.12)	Motor is operating in the stall region due to e.g. excessive load or insufficient motor power.	Check motor load and the drive ratings. Check Fault Function parameters.
NO MOT DATA (ff50)	Motor data is not given or motor data does not match with inverter data.	Check motor data given by parameters 99.04 … 99.09.
OVERCURRENT (2310) *)	Output current is excessive. Overcurrent trip limit is $3.5 \cdot I_{2hd}$.	Check motor load. Check acceleration time. Check motor and motor cable (including phasing). Check there are no power factor correction capacitors or surge absorbers in the motor cable. Check encoder cable (including phasing).
OVERFREQ (7123)	Motor is turning faster than the highest allowed speed due to incorrectly set minimum/ maximum speed, insufficient braking torque or changes in the load when using torque reference. Trip level is 40 Hz over the operating range absolute maximum speed limit (Direct Torque Control mode active) or frequency limit (Scalar Control active). The 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. Check adequacy of motor braking torque. Check applicability of torque control. Check need for a brake chopper and resistor(s).

FAULT	CAUSE	WHAT TO DO
PANEL LOSS (5300) (programmable Fault Function 30.02)	A control panel or Drives Window selected as active control location for the drive has ceased communicating.	Check panel connection (see appropriate hardware manual). Check control panel connector. Replace control panel in the mounting platform. Check Fault Function parameters. Check DrivesWindow connection.
PPCS LINK (5210) *)	Fibre optic link to the INT board is faulty.	Check fibre optic cables connected to the power plates.
SC (INU 1) SC (INU 2) SC (INU 3) SC (INU 4) *)	Short circuit in inverter unit of several parallel inverter modules. The number refers to the faulty inverter module number. INT board fibre optic connection fault in inverter unit consisting of several parallel inverter modules. The number refers to the inverter module number.	Check motor and motor cable. Check power semiconductors (IGBT power plates) of inverter module. (INU 1 stands for inverter module 1 etc.). Check connection from inverter module Main Circuit Interface Board, INT to PPCC Branching Unit, PBU. (Inverter module 1 is connected to PBU CH1 etc.)
SUPPLY PHASE (3130)	Intermediate circuit DC voltage is oscillating due to missing mains phase, a blown fuse or a rectifier bridge internal fault. A trip occurs when the DC voltage ripple is 13 per cent of the DC voltage.	Check mains fuses. Check for mains supply imbalance.
START INHIBIT (ff7a)	Optional start inhibit hardware logic is activated.	Check start inhibit circuit (GPS board).
TEMP	Excessive internal temperature. Trip level of inverter module temperature is 125 °C.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against unit power.
THERMISTOR (4311) (programmable Fault Function 30.04 … 30.05)	Excessive motor temperature (detected by the motor thermal protection function, which has selection THERMISTOR active) .	Check motor ratings and load. Check start-up data. Check thermistor connections. Check thermistor cabling.
USER MACRO	No User Macro saved or the file is defective.	Create User Macro.
UNDERLOAD (ff6a) (programmable Fault Function 30.13 … 30.15)	Motor load is too low due to e.g. release mechanism in the driven equipment.	Check for a problem in the driven equipment. Check Fault Function parameters.
THERMAL MODE	Motor thermal protection mode is set to DTC for a high-power motor.	See parameter 35.05.

*) More detailed information on the high power units with parallel inverters is given in fault word 03.12.

Fieldbus control

Chapter overview

The chapter describes how the drive communicates with external devices through the serial communication interfaces.

System overview

The drive can be connected to an external control system – usually a fieldbus controller – via an adapter module mounted in expansion slot 1 of the drive. (For connection to an Advant Fieldbus 100 system, an external AF 100 interface is used.)

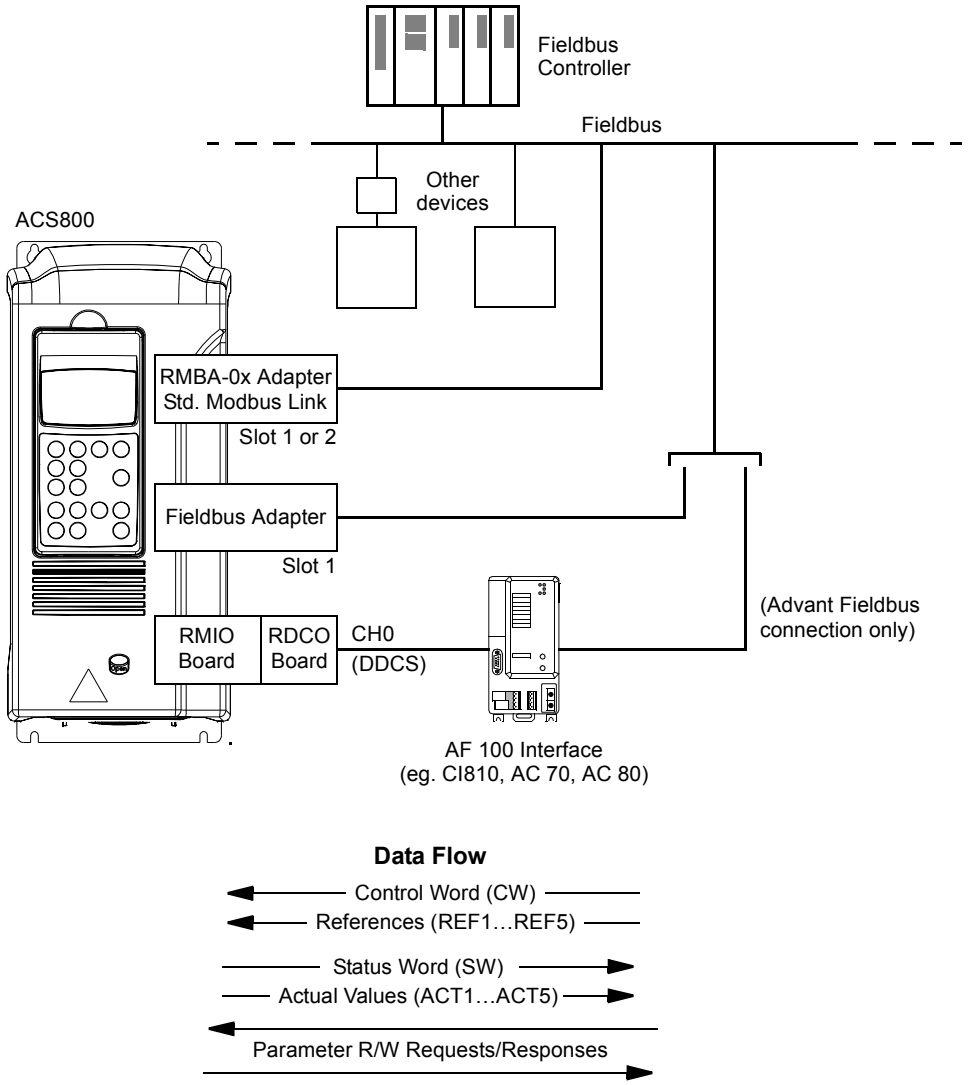


Figure 1 Fieldbus control.

The drive can be set to receive all of its control information through the fieldbus interface, or the control can be distributed between the fieldbus interface and other available sources, e.g. digital and analogue inputs.

Setting up communication through a fieldbus adapter module

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 communication between the drive and the fieldbus adapter module is then activated by setting parameter 98.02. After the communication is initialised, the configuration parameters of the module become available in the drive at parameter group 51. These parameters are specific to the module used; see its manual for information on the available settings.

Table 2 Communication set-up parameters for fieldbus adapter connection.

Parameter	Alternative settings	Setting for fieldbus control	Function/Information
COMMUNICATION INITIALISATION			
98.02	NO; FIELDBUS; ADVANT; STD MODBUS; CUSTOMISED	FIELDBUS	Initialises communication between drive and fieldbus adapter module. Activates module set-up parameters (Group 51).
98.07	ABB DRIVES; ANYBUS	ANYBUS	Selects the communication profile used by the drive. See section *Communication Profiles* below.
ADAPTER MODULE CONFIGURATION (Module-specific; see module manual.)			
51.01 (FIELDBUS PARAMETER 1)		–	
• • •	• • •	• • •	• • •
51.15 (FIELDBUS PARAMETER 15)		–	

After the parameters in group 51 have been set, the drive control parameters (shown in Table 5) must be checked and adjusted where necessary.

Control through the Standard Modbus Link

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

It is possible to switch the control between the Standard Modbus Link and another fieldbus adapter, in which case the RMBA-01 is installed in slot 2, the fieldbus adapter in slot 1.

Communication set-up

The communication through the Standard Modbus Link is initialised by setting parameter 98.02 to STD MODBUS. Then, the communication parameters in group 52 must be adjusted. See the table below.

Table 3 Communication set-up parameters for the Standard Modbus Link.

Parameter	Alternative Settings	Setting for Control through the Standard Modbus Link	Function/Information
COMMUNICATION INITIALISATION			
98.02	NO; FIELDBUS; ADVANT; STD MODBUS; CUSTOMISED	STD MODBUS	Initialises communication between drive (Standard Modbus Link) and Modbus-protocol controller. Activates communication parameters in group 52.
98.07	ABB DRIVES; ANYBUS	ABB DRIVES	Selects the communication profile used by the drive. See section *Communication Profiles* below.
COMMUNICATION PARAMETERS			
52.01	1 to 247	–	Specifies the station number of the drive on the Standard Modbus Link.
52.02	600; 1200; 2400; 4800; 9600; 19200	–	Communication speed for the Standard Modbus Link.
52.03	ODD; EVEN; NONE1STOPBIT; NONE2STOPBIT	–	Parity setting for the Standard Modbus Link.

After the parameters in group 52 have been set, the drive control parameters (shown in Table 5) should be checked and adjusted where necessary.

Setting up an Advant Fieldbus 100 (AF 100) connection

The connection of a drive to an AF (Advant Fieldbus) 100 bus is similar to other fieldbusses, with the exception that one of the AF 100 interfaces listed below is substituted for the fieldbus adapter. The AF 100 interface is connected to channel CH0 on the RDCO board inside the drive using fibre optic cables.

The following is a list of suitable AF 100 interfaces:

- **CI810A Fieldbus Communication Interface (FCI)**
  TB811 (5 MBd) or TB810 (10 MBd) Optical ModuleBus Port Interface required
- **Advant Controller 70 (AC 70)**
  TB811 (5 MBd) or TB810 (10 MBd) Optical ModuleBus Port Interface required
- **Advant Controller 80 (AC 80)**
  Optical ModuleBus connection: TB811 (5 MBd) or TB810 (10 MBd) Optical ModuleBus Port Interface required
  DriveBus connection: Connectible to RMIO-01/02 Board with RDCO-01 Communication Option.

One of the above interfaces may already be present on the AF 100 bus. If not, an Advant Fieldbus 100 Adapter kit (NAFA-01) is separately available, containing the CI810A Fieldbus Communication Interface, TB810 and TB811 Optical ModuleBus Port Interfaces, and a TC505 Trunk Tap. (More information on these components is available from the *S800 I/O User's Guide,* 3BSE 008 878 [ABB Industrial Systems, Västerås, Sweden]).

Optical component types

The TB811 Optical ModuleBus Port Interface is equipped with 5 MBd optical components, while the TB810 has 10 MBd components. All optical components on a fibre optic link must be of the same type since 5 MBd components do not communicate with 10 MBd components. The choice between TB810 and TB811 depends on the equipment it is connected to.

The TB811 (5 MBd) should be used when connecting to a drive with the following equipment:

- RMIO-01/02 Board with RDCO-02 Communication Option
- RMIO-01/02 Board with RDCO-03 Communication Option.

The TB810 (10 MBd) should be used when connecting to the following equipment:

- RMIO-01/02 Board with RDCO-01 Communication Option
- NDBU-85/95 DDCS Branching Units.

Communication Set-up

The communication between the drive and the AF 100 interface is activated by setting parameter 98.02 to ADVANT.

Table 4 Communication set-up parameters for AF 100 connection.

Parameter	Alternative Settings	Setting for Control through CH0	Function/Information
COMMUNICATION INITIALISATION			
98.02	NO; FIELDBUS; ADVANT; STD MODBUS, CUSTOMISED	ADVANT	Initialises communication between drive (fibre optic channel CH0) and AF 100 interface. The transmission speed is 4 Mbit/s.
98.07	ABB DRIVES; ANYBUS	ABB DRIVES	Selects the communication profile used by the drive. See section *Communication Profiles* below.

After the communication activation parameters have been set, the AF 100 interface must be programmed according to its documentation, and the drive control parameters (shown in Table 5) checked and adjusted where necessary.

In an Optical ModuleBus connection, the 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.

In an AC 80 DriveBus connection, the drives are addressed 1 to 12. The drive address (set with parameter 70.01) is related to the value of the DRNR terminal of ACSRX PC element.

Drive control parameters

After the fieldbus communication has been set up, the drive control parameters listed in Table 5 below should 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 under ***The fieldbus control interface***.

Table 5 Drive control parameters to be checked and adjusted for fieldbus control.

Parameter	Setting for fieldbus control	Function/Information
CONTROL COMMAND SOURCE SELECTION		
10.01	COMM.CW	Enables the fieldbus Control Word (except bit 11) when EXT1 is selected as the active control location.
10.02	COMM.CW	Enables the fieldbus Control Word (except bit 11) when EXT2 is selected as the active control location.
10.03	REQUEST	Enables rotation direction control as defined by parameters 10.01 and 10.02.
11.02	COMM.CW(11)	Enables EXT1/EXT2 selection by fieldbus Control Word bit 11 EXT CTRL LOC.
11.03	COMM.REF1, FAST COMM, COM.REF1+AI1, COM.REF1+AI5, COM.REF1*AI1 or COM.REF1*AI5	Fieldbus reference REF1 is used when EXT1 is selected as the active control location. See section *References* below for information on the alternative settings.
11.06	COMM.REF2, FAST COMM, COM.REF2+AI1, COM.REF2+AI5, COM.REF2*AI1 or COM.REF2*AI5	Fieldbus reference REF2 is used when EXT2 is selected as the active control location. See section *References* below for information on the alternative settings.
OUTPUT SIGNAL SOURCE SELECTION		
14.01	COM.REF3(13)	Enables Relay output RO1 control by fieldbus reference REF3 bit 13.
14.02	COM.REF3(14)	Enables Relay output RO2 control by fieldbus reference REF3 bit 14.
14.03	COM.REF3(15)	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

Parameter	Setting for fieldbus control	Function/Information
15.02 **po. 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(3)	Enables the control of the Run Enable signal through fieldbus Control Word bit 3.
16.04	COMM.CW(7)	Enables fault reset through fieldbus Control Word bit 7.
16.07		Saves parameter value changes (including those made through fieldbus control) to permanent memory.

COMMUNICATION FAULT FUNCTIONS		
30.18	–	Determines drive action in case fieldbus communication is lost. **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	–	Defines the time between Main Reference data set loss detection and the action selected with parameter 30.18.
30.20	–	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	–	Defines the time between Auxiliary Reference data set loss detection and the action selected with parameter 30.18. **Note:** This supervision function is disabled if parameters 90.01, 90.02 and 90.03 are set to 0.

FIELDBUS REFERENCE TARGET SELECTION (Not visible when 98.02 is set to NO.)		
90.01	–	Defines the drive parameter into which the value of fieldbus reference REF3 is written. **Format: xxyy**, where **xx** = parameter group (10 to 89), **yy** = parameter Index. E.g. **3001** = parameter 30.01.
90.02	–	Defines the drive parameter into which the value of fieldbus reference REF4 is written. **Format:** see parameter 90.01.
90.03	–	Defines the drive parameter into which the value of fieldbus reference REF5 is written. **Format:** see parameter 90.01.

Parameter	Setting for fieldbus control	Function/Information
90.04	1 or 81	If 98.02 is set to CUSTOMISED, this parameter selects the fieldbus channel 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 or 83	If 98.02 is set to CUSTOMISED, this parameter selects the fieldbus channel from which the drive reads the Auxiliary Reference data set (comprising fieldbus references REF3, REF4 and REF5).
ACTUAL SIGNAL SELECTION FOR FIELDBUS (Not visible when 98.02 is set to NO.)		
92.01	302 (Fixed)	The Status Word is transmitted to as the first word of the Main Actual Signal data set.
92.02	–	Selects the Actual signal or parameter value to be transmitted as the second word (ACT1) of the Main Actual Signal data set. **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.
92.03	–	Selects the Actual signal or parameter value to be transmitted as the third word (ACT2) of the Main Actual Signal data set. ***Format:*** see parameter 92.02.
92.04	–	Selects the Actual signal or parameter value to be transmitted as the first word (ACT3) of the Auxiliary Actual Signal data set. ***Format:*** see parameter 92.02.
92.05	–	Selects the Actual signal or parameter value to be transmitted as the second word (ACT4) of the Auxiliary Actual Signal data set. ***Format:*** see parameter 92.02.
92.06	–	Selects the Actual signal or parameter value to be transmitted as the third word (ACT5) of the Auxiliary Actual Signal data set. ***Format:*** see parameter 92.02.

The fieldbus control interface

The communication between a fieldbus system and the drive employs *data sets.* One data set consists of three 16-bit words. The ACS800 Standard Application Program supports the use of four data sets, two in each direction. The drive has a memory location for two control and two status data sets for both the fieldbus adapter in Slot 1 and fibre optic channel CH0 on the RDCO board, totalling 4 input and 4 output memory locations. Two out of the four input data sets are selected with parameters 98.02, 90.04 and 90.05. The selected data sets form the *Main Reference data set* and the *Auxiliary Reference data set* which are used to control the drive.

The status information transmitted by the drive is selected with parameters 92.01 to 92.03 (the *Main Actual Signal data set*), and the 92.04 to 92.06 (the *Auxiliary Actual Signal data set*).

The update time for the Main Reference and Main Actual Signal data sets is 12 milliseconds; for the Auxiliary Reference and Auxiliary Actual Signals, it is 100 milliseconds.

Figure 6 and Figure 7 demonstrate the routing of input and output signals in fieldbus control.

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 current control location (EXT1 or EXT2, see parameters 10.01 and 10.02) is set to COMM.CW.

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.

The composition of the Control Word and the Status Word is detailed under *Communication profiles* below.

References

References (REF) are 16-bit words comprising a sign bit and a 15-bit integer. A negative reference (indicating reversed direction of rotation) is formed by calculating the two's complement from the corresponding positive reference value if the value of parameter 10.01 or 10.02 is COMM. CW.

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. 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.

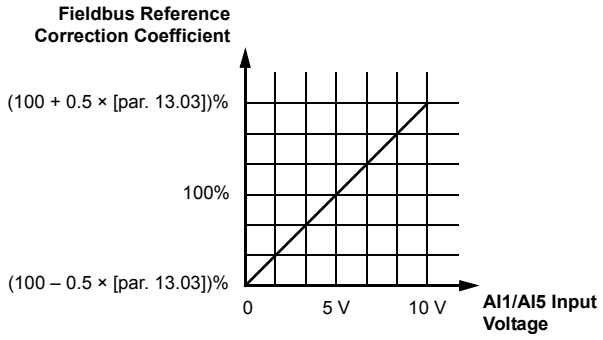
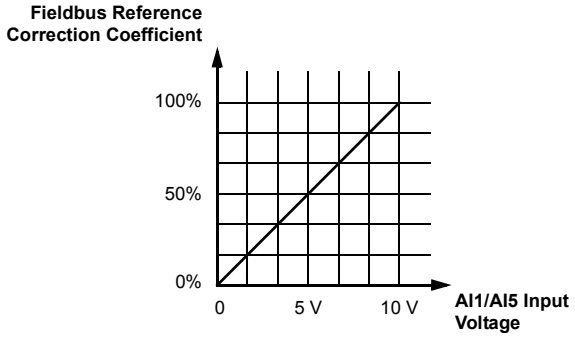
FAST COMM
The fieldbus reference is forwarded as such without correction. The reference is read every 2 milliseconds if either of the following conditions is met:

- 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.

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

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 COM.REFx+AI5	
COM.REFx*AI1 COM.REFx*AI5	

Fieldbus reference scaling

Corrected fieldbus references REF1 and REF2 (if correction is applied as described above) are scaled as shown in the table below.

Ref. No.	Application Macro Used (par. 99.02)	Reference Type	Range	Scaling	Notes
REF1	(any)	Speed or Frequency	-32765 ... 32765	-20000 = **-[par. 11.05]** 0 = 0 20000 = **[par. 11.05]**	Not limited by pars. 11.04/11.05. Final reference limited by 20.01/20.02 [speed] or 20.07/20.08 [frequency].
REF2	FACTORY, HAND/AUTO, or SEQ CTRL	Speed or Frequency	-32765 ... 32765	-20000 = **-[par. 11.08]** 0 = 0 20000 = **[par. 11.08]**	Not limited by pars. 11.07/11.08. Final reference limited by 20.01/20.02 [speed] or 20.07/20.08 [frequency].
	T CTRL or M/F (optional)	Torque	-32765 ... 32765	-10000 = **-[par. 11.08]** 0 = 0 10000 = **[par. 11.08]**	Not limited by pars. 11.07/11.08. Final reference limited by par. 20.04.
	PID CTRL	PID Reference	-32765 ... 32765	-10000 = **-[par. 11.08]** 0 = 0 10000 = **[par. 11.08]**	Not limited by pars. 11.07/11.08.

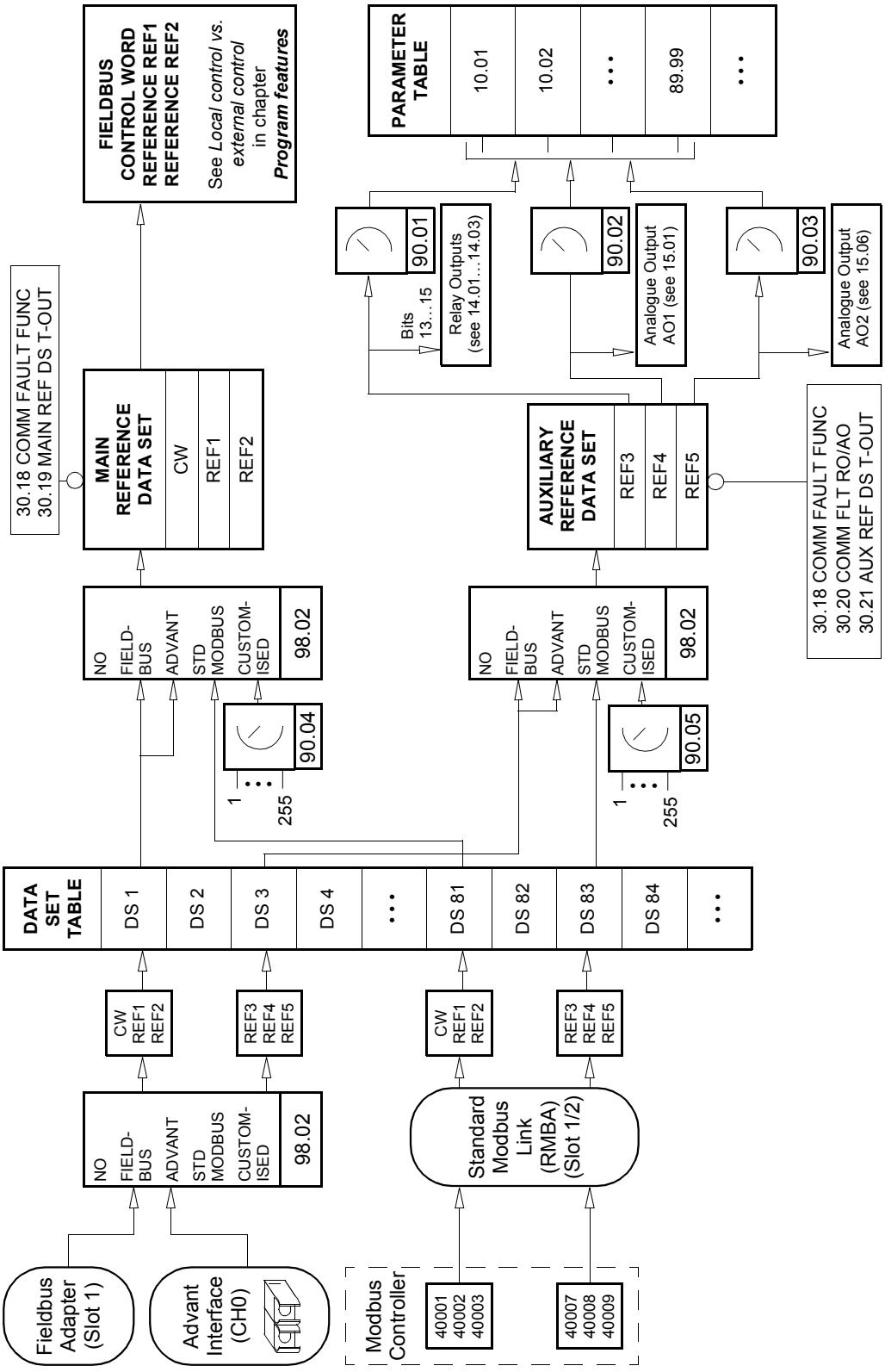


Figure 6 Control data input from fieldbus.

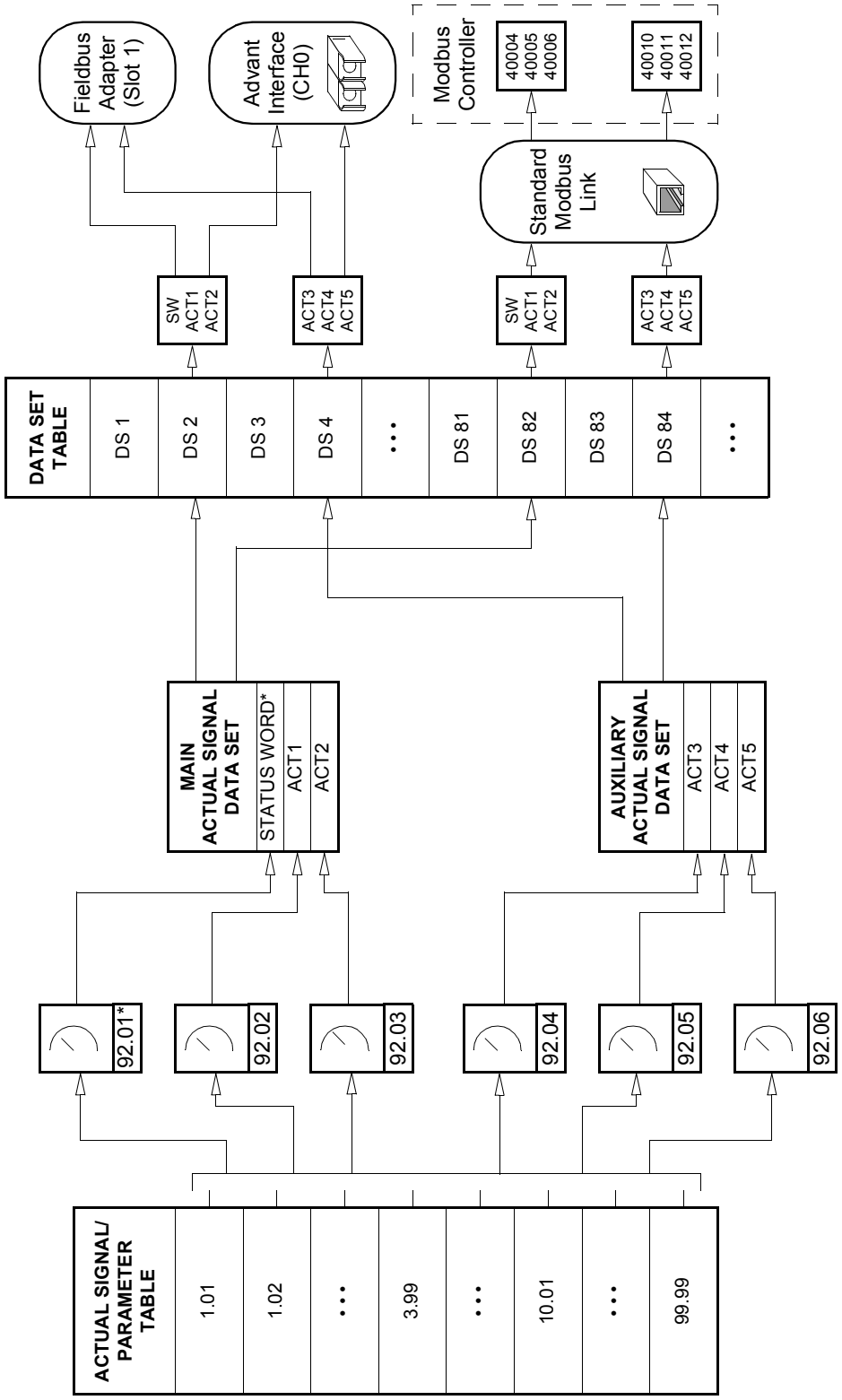


Figure 7 Actual value selection for fieldbus.

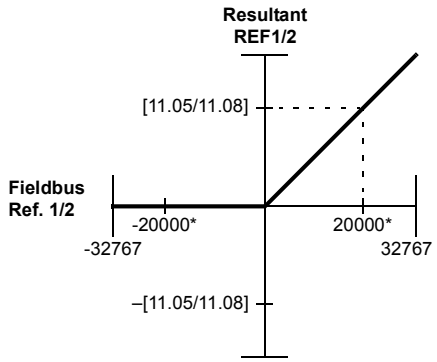
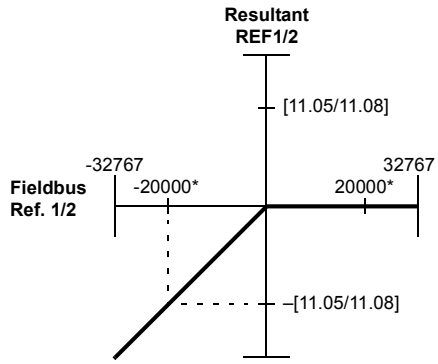
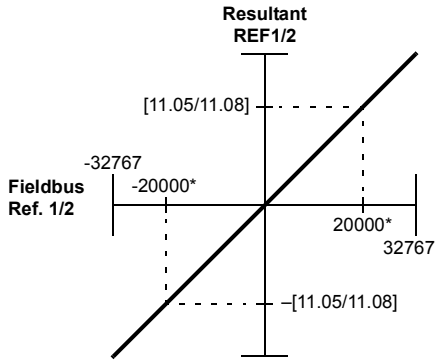
How direction of rotation is determined in fieldbus control

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.

The diagrams below show the relation between the fieldbus reference and the resultant REF1/REF2 when

– parameter 10.01/10.02 EXTx STRT/STP/DIR is set to COMM.CW,
OR
– parameter 11.03/11.06 EXT REFx SELECT is set to FAST COMM.

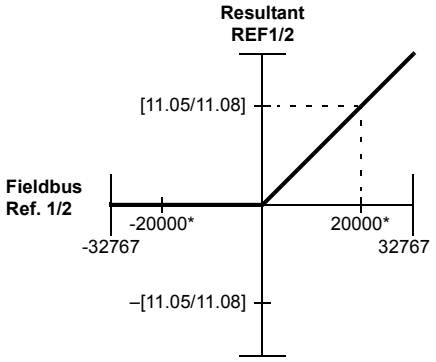
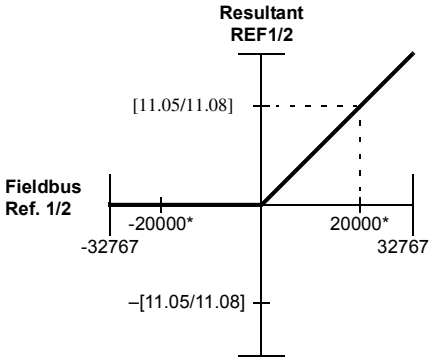
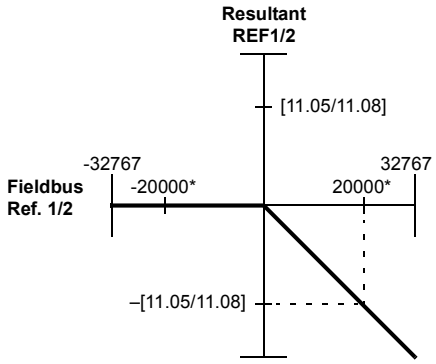
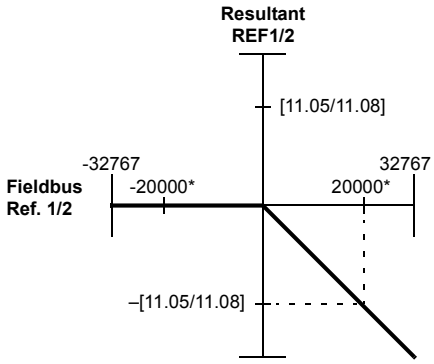
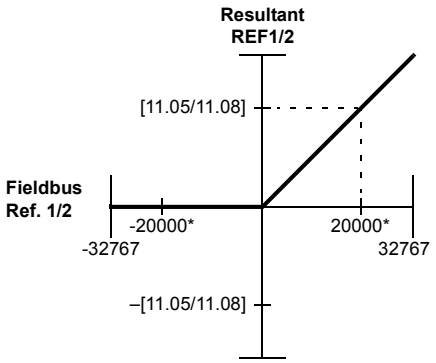
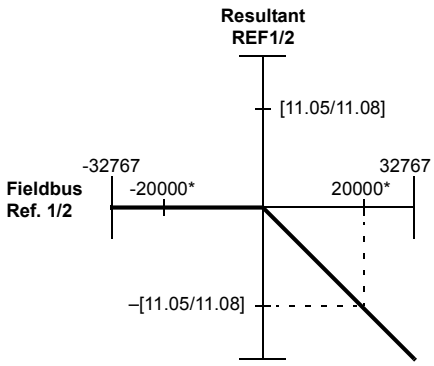
Note: External reference limiters 11.04, 11.05, 11.07 and 11.08 are also in effect.

par. 10.03 DIRECTION = FORWARD	
par. 10.03 DIRECTION = REVERSE	
par. 10.03 DIRECTION = REQUEST	
	*10000 if Reference Type is Torque or PID

The following diagrams show the relation between the fieldbus reference and the resultant REF1/REF2 when

– par. 10.01/10.02 EXTx STRT/STP/DIR is NOT set to COMM.CW
AND
– par. 11.03/11.06 EXT REFx SELECT is NOT set to FAST COMM.

Note: External reference limiters 11.04, 11.05, 11.07 and 11.08 are also in effect.

	Direction received (from source defined by par. 10.01/10.02 EXTx STRT/STP/DIR) = FORWARD	**Direction received (from source defined by par. 10.01/10.02 EXTx STRT/STP/DIR) = REVERSE**
par. 10.03 DIRECTION = FORWARD		
par. 10.03 DIRECTION = REVERSE		
par. 10.03 DIRECTION = REQUEST		
	*10000 if Reference Type is Torque or PID	

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 the chapter *Actual signals and parameters*.

The contents of group 3 actual signals are presented below from Table 14 onwards. (The Control and Status Words are also available as actual signals 3.01 and 3.02 respectively.)

Modbus addressing

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

Address	Contents	Address	Contents
40001	Control Word	40004	Status Word
40002	REF1	40005	ACT1
40003	REF2	40006	ACT2
40007	REF3	40010	ACT3
40008	REF4	40011	ACT4
40009	REF5	40012	ACT5

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

Communication profiles

ABB Drives communication profile

Table 8 The Control Word (Actual Signal 3.01) for the ABB Drives communication profile. The upper case boldface text refers to the states shown in Figure 10.

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. 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.** **Warning:** Ensure motor and driven machine can be stopped using this stop mode.
3	START	1	Enter OPERATION ENABLED. (Note: The Run Enable signal must be active; see parameter 16.01. If par. 16.01 is set to COMM. MODULE, this bit also activates the Run Enable signal.)
		0	Inhibit operation. Enter **OPERATION INHIBITED.**
4	RAMP_OUT_ ZERO	1	Normal operation. Enter **RAMP FUNCTION GENERATOR: OUTPUT ENABLED.**
		0	Force Ramp Function Generator output to zero. Drive ramps to stop (current and DC voltage limits in force).
5	RAMP_HOLD	1	Enable ramp function. 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. Control Word = 0 and Reference = 0: Fieldbus control enabled. 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(11).
		0	Select External Control Location EXT1. Effective if par. 11.02 is set to COMM.CW(11).
12 … 15	Reserved		

Table 9 The Status Word (Actual Signal 3.02) for the ABB Drives communication profile. The upper case boldface text refers to the states shown in Figure 10.

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).
		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	Actual frequency or speed value equals or is greater than supervision limit (par. 32.02). Valid in both rotation directions regardless of value of 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, 14	Reserved		
15		1	Communication error detected by fieldbus adapter module (on fibre optic channel CH0).
		0	Fieldbus adapter (CH0) communication OK.

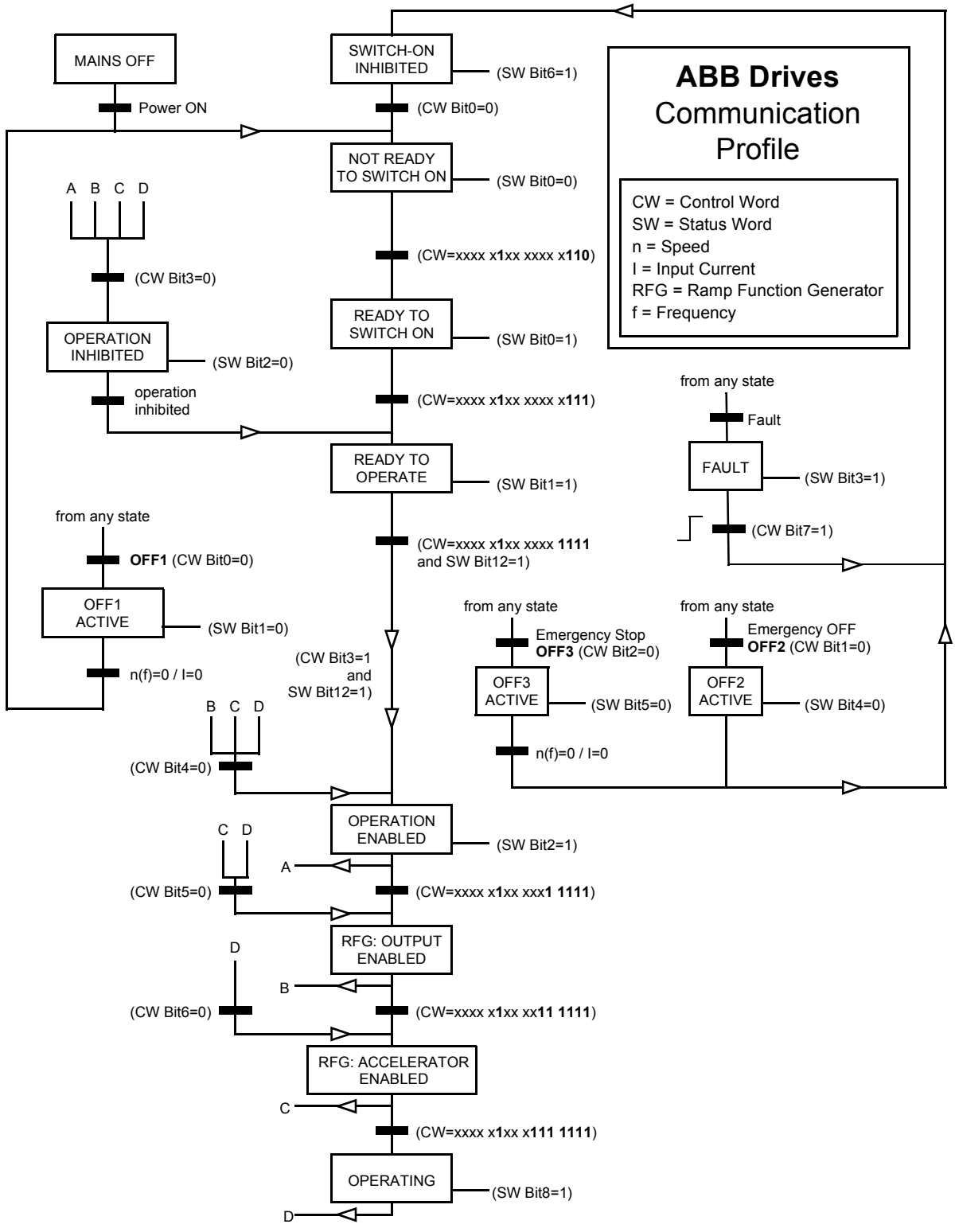


Figure 10 State Machine for the ABB Drives communication profile.

AnyBus communication profile

Table 11 The Control Word (Actual Signal 3.01) for the AnyBus communication profile. The upper case boldface text refers to the states shown in Figure 13.

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. 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.** **Warning:** Ensure motor and driven machine can be stopped using this stop mode.
3	START	1	Enter OPERATION ENABLED. (Note: The Run Enable signal must be active; see parameter 16.01. If par. 16.01 is set to COMM. MODULE, this bit also activates the Run Enable signal.)
		0	Inhibit operation. Enter **OPERATION INHIBITED.**
4	RAMP_OUT_ ZERO	1	Normal operation. Enter **RAMP FUNCTION GENERATOR: OUTPUT ENABLED.**
		0	Force Ramp Function Generator output to zero. Drive ramps to stop (current and DC voltage limits in force).
5	RAMP_HOLD	1	Enable ramp function. 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. Control Word = 0 and Reference = 0: Fieldbus control enabled. 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(11).
		0	Select External Control Location EXT1. Effective if par. 11.02 is set to COMM.CW(11).
12 … 15	Reserved		

Table 12 The Status Word (Actual Signal 3.02) for the AnyBus communication profile. The upper case boldface text refers to the states shown in Figure 13.

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).
		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	Actual frequency or speed value equals or is greater than supervision limit (par. 32.02). Valid in both rotation directions regardless of value of 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, 14	Reserved		
15		1	Communication error detected by fieldbus adapter module (on fibre optic channel CH0).
		0	Fieldbus adapter (CH0) communication OK.

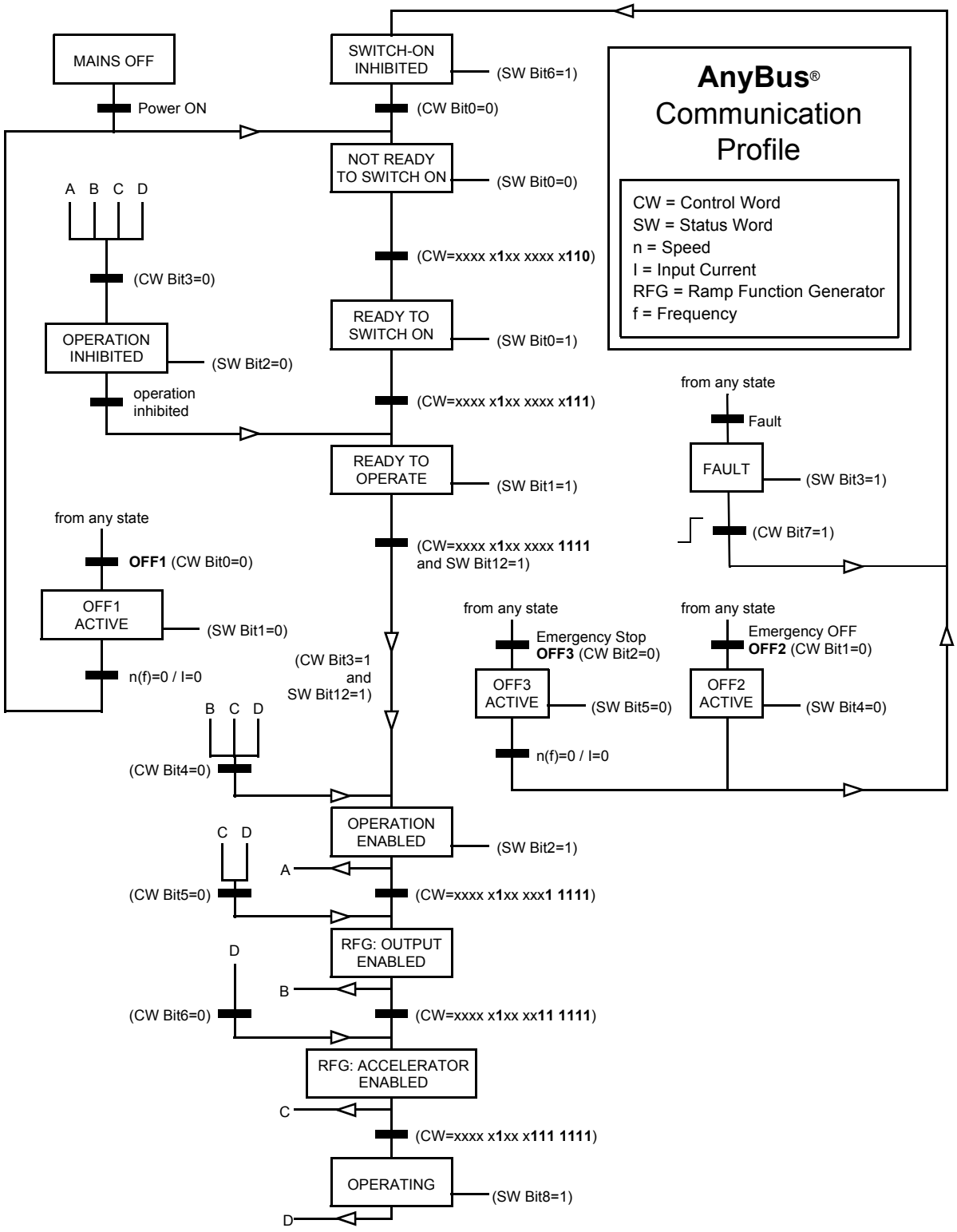


Figure 13 State Machine for the AnyBus communication profile.

Other status, fault, and limit words

Table 14 The Auxiliary Status Word (Actual Signal 3.03).

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	Prevention of unexpected start-up 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 *Master/Follower Application Guide* (3AFY 58962180 [English]).

Table 15 Limit Word 1 (Actual Signal 3.04).

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.

Table 16 Fault Word 1 (Actual Signal 3.05).

Bit	Name	Description
0	SHORT CIRC	For the possible causes and remedies, see the chapter *Fault tracing*.
1	OVERCURRENT	
2	DC OVERVOLT	
3	ACS 800 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 the chapter *Fault tracing*.
9	OVERFREQ	
10 … 15	Reserved	

Table 17 Fault Word 2 (Actual Signal 3.06).

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

Table 18 The System Fault Word (Actual Signal 3.07).

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	

Table 19 Alarm Word 1 (Actual Signal 3.08).

Bit	Name	Description
0	START INHIBIT	For the possible causes and remedies, see the chapter *Fault tracing*.
1	Reserved	
2	Reserved	
3	MOTOR TEMP	For the possible causes and remedies, see the chapter *Fault tracing*.
4	ACS 800 TEMP	
5	ENCODER ERR	
6	T MEAS ALM	
7 … 11	Reserved	
12	COMM MODULE	For the possible causes and remedies, see the chapter *Fault tracing*.
13	THERMISTOR	
14	EARTH FAULT	
15	Reserved	

Table 20 Alarm Word 2 (Actual Signal 3.09).

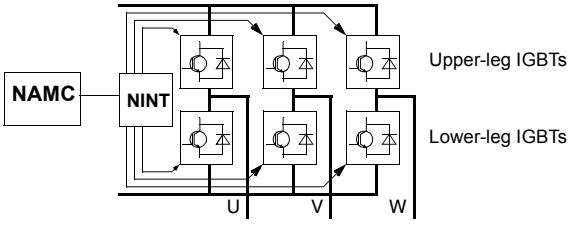
Bit	Name	Description
0	Reserved	
1	UNDERLOAD	For the possible causes and remedies, see the chapter *Fault tracing*.
2	Reserved	
3	DC UNDERVOLT	For the possible causes and remedies, see the chapter *Fault tracing*.
4	DC OVERVOLT	
5	OVERCURRENT	
6	OVERFREQ	
7	ALM (A_16)	Error in restoring POWERFAIL.DDF.
8	ALM (A_17)	Error in restoring POWERDOWN.DDF.
9	MOTOR STALL	For the possible causes and remedies, see the chapter *Fault tracing*.
10	AI < MIN FUNC	
11	Reserved	
12	Reserved	
13	PANEL LOSS	For the possible causes and remedies, see the chapter *Fault tracing*.
14, 15	Reserved	

Table 21 The NINT Fault Info Word (Actual Signal 3.12). The Word includes information on the location of faults PPCC LINK, OVERCURRENT, EARTH FAULT and SHORT CIRCUIT (see Table 16 Fault Word 1, Table 17 Fault Word 2, and the chapter Fault tracing.

Bit	Name	Description
0	NINT 1 FLT	NINT 1 board fault*
1	NINT 2 FLT	NINT 2 board fault *
2	NINT 3 FLT	NINT 3 board fault *
3	NINT 4 FLT	NINT 4 board fault *
4	NPBU FLT	NPBU board fault *
5	-	Not in use
6	U-PH SC U	Phase U upper-leg IGBT(s) short circuit
7	U-PH SC L	Phase U lower-leg IGBT(s) short circuit
8	V-PH SC U	Phase V upper-leg IGBT(s) short circuit
9	V-PH SC L	Phase V lower-leg IGBT(s) short circuit
10	W-PH SC U	Phase W upper-leg IGBT(s) short circuit
11	W-PH SC L	Phase W lower-leg IGBT(s) short circuit
12 ... 15		Not in use

* In use only with parallel inverters. NINT 0 is connected to NPBU CH1, NINT 1 to CH2 etc.

Inverter Block Diagram



NAMC	Application and Motor Control Board
NINT	Main Circuit Interface Board
NPBU	PPCS Link Branching Unit

Inverter Unit Block Diagram (two to four parallel Inverters)

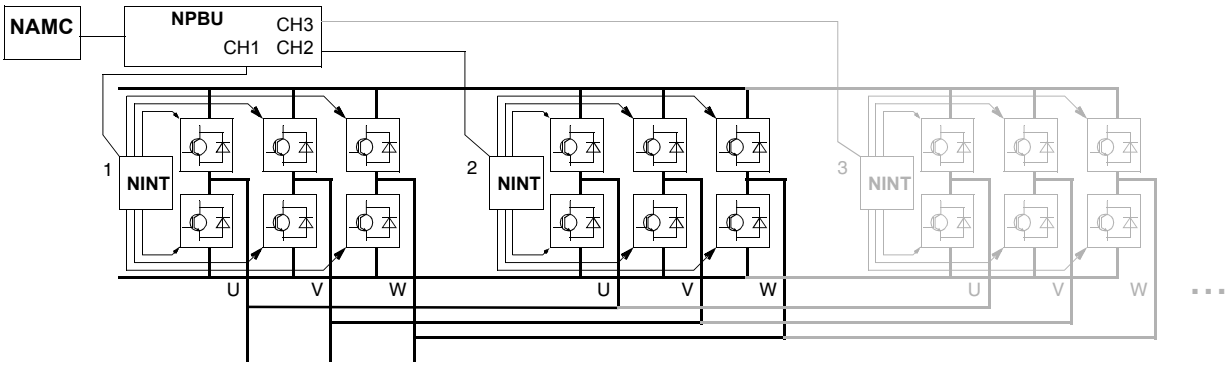


Table 22 Auxiliary Status Word 3 (Actual Signal 3.13)

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 … 15	Reserved	

Table 23 Auxiliary Status Word 4 (Actual Signal 3.14)

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 … 15	Reserved	

Table 24 Fault Word 4 (Actual Signal 3.15)

Bit	Name	Description
0	Reserved	
1	MOTOR 1 TEMP	For the possible causes and remedies, see the chapter *Fault tracing*.
2	MOTOR 2 TEMP	
3	BRAKE ACKN	
4 … 15	Reserved	

Table 25 Alarm Word 4 (Actual Signal 3.16)

Bit	Name	Description
0	Reserved	
1	MOTOR 1 TEMP	For the possible causes and remedies, see the chapter *Fault tracing*.
2	MOTOR 2 TEMP	
3	BRAKE ACKN	
4	SLEEP MODE	
5 … 15	Reserved	

Table 26 Fault Word 5 (Actual Signal 3.17)

Bit	Name	Description
0	BR BROKEN	For the possible causes and remedies, see the chapter *Fault tracing*.
1	BR WIRING	
2	BC SHORT CIR	
3	BR OVERHEAT	
4 … 15	Reserved	

Table 27 Alarm Word 5 (Actual Signal 3.18)

Bit	Name	Description
0	REPLACE FAN	For the possible causes and remedies, see the chapter *Fault tracing*.
1	SYNCRO SPEED	
2	BR OVERHEAT	
3	Reserved	
4	IN CHOKE TEMP	For the possible causes and remedies, see the chapter *Fault tracing*.
5 … 15	Reserved	

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 Application 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

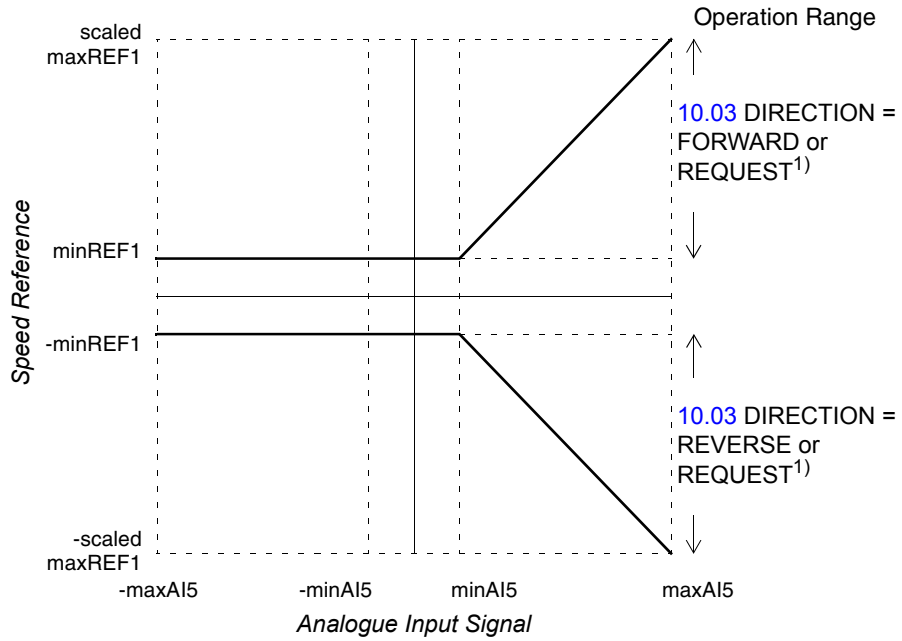
- Set the module node address to 5 (not required if installed to the option slot of the drive).
- Select the signal type for the module input AI1 (switch).
- Select the operation mode (unipolar/bipolar) of the module input (switch).
- Ensure the drive parameter settings correspond to the mode of the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

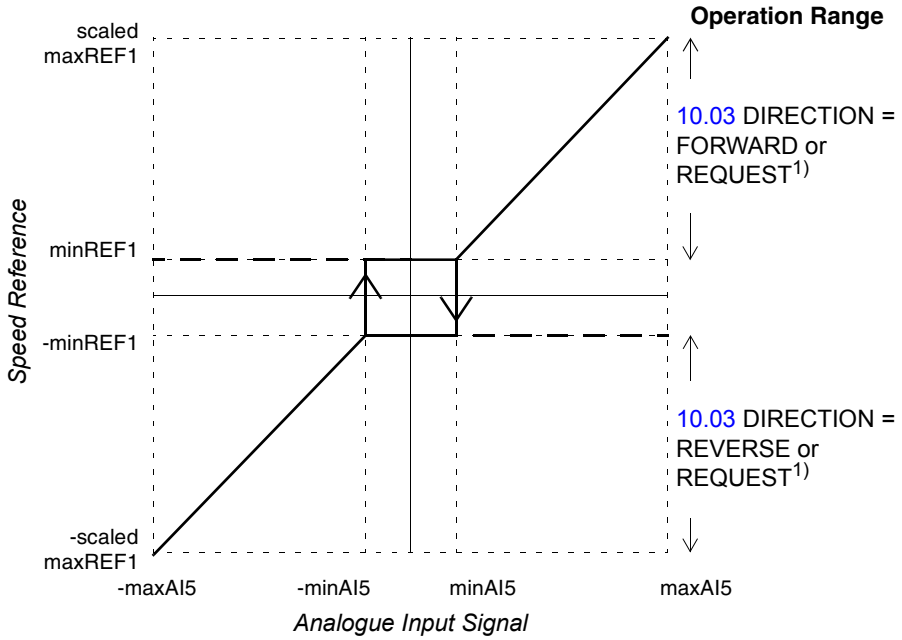
1) For the negative speed range, the drive must receive a separate reverse command.
2) Set if supervision of living zero is used.

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	Parameter address for the fieldbus communication through a Profibus link (Add 4000 in FMS Mode).
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.

Fieldbus addresses

Profibus

See the tables below.

Modbus and Modbus Plus address

4xxyy, where xxyy = drive parameter number

Interbus-S address

xxyy · 100 + 12288 converted into hexadecimal
xxyy = drive parameter number

Example: The index for drive parameter 13.09 is 1309 + 12288 = 13597 = 351D.

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	-2000 = -100% 2000 = 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	0 = 0% 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	ACS 800 TEMP	ACS TEMP	1 = 1 °C	C		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				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				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	°C		35
01.36	MOTOR 2 TEMP	M 2 TEMP	1 = 1 °C	°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
01.39	AI6 [mA]	AI6 [mA]	1 = 0.001 mA	mA		39

Index	Name	Short name	FbEq	Unit	Range	PB
01.40	DI7-12 STATUS	DI7..12				40
01.41	EXT RO STATUS	EXT RO				41
01.42	PROCESS SPEED REL	P SPEED	1 = 1	%		42
01.43	MOTOR RUN TIME	MOTOR RUN TIME	1 = 10 h	h		43
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	TORQ REF 2	T REF 2	0 = 0% 10000 = 100% of motor nominal torque	%		59
02.10	TORQ REF 3	T REF 3		%		60
02.13	TORQ USED REF	T USED R		%		63
02.14	FLUX REF	FLUX REF	25 … 140%	%		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
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
03.12	INT FAULT INFO	INT FAUL			0 ... 65535 (Decimal)	87
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
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	-

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 the chapter *Fieldbus control*. For the contents of Actual Signal 3.11, see the Master/Follower Application Guide [English].

Parameters

Index	Name/Selection	FACTORY	HAND/AUTO	PID-CTRL	T-CTRL	SEQ CTRL	PB
10	START/STOP/DIR						
10.01	EXT1 STRT/STP/DIR	DI1,2	DI1,2	DI1	DI1,2	DI1,2	101
10.02	EXT2 STRT/STP/DIR	NOT SEL	DI6,5	DI6	DI1,2	NOT SEL	102
10.03	DIRECTION	FORWARD	REQUEST	FORWARD	REQUEST	REQUEST	103
10.04	EXT 1 STRT PTR	0	0	0	0		104
10.05	EXT 2 STRT PTR	0	0	0	0	0	105
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
11.03	EXT REF1 SELECT	AI1	AI1	AI1	AI1	AI1	128
11.04	EXT REF1 MINIMUM	0 rpm	0 rpm	0 rpm	0 rpm	0 rpm	129
11.05	EXT REF1 MAXIMUM	1500 rpm	1500 rpm	1500 rpm	1500 rpm	1500 rpm	130
11.06	EXT REF2 SELECT	KEYPAD	AI2	AI1	AI2	AI1	131
11.07	EXT REF2 MINIMUM	0%	0%	0%	0%	0%	132
11.08	EXT REF2 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
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
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

Index	Name/Selection	FACTORY	HAND/AUTO	PID-CTRL	T-CTRL	SEQ CTRL	PB
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
14.02	RELAY RO2 OUTPUT	RUNNING	RUNNING	RUNNING	RUNNING	RUNNING	202
14.03	RELAY RO3 OUTPUT	FAULT(-1)	FAULT(-1)	FAULT(-1)	FAULT(-1)	FAULT(-1)	203
14.04	RO1 TON DELAY	0.0 s	0.0 s	0.0 s	0.0 s	0.0 s	204
14.05	RO1 TOFF DELAY	0.0 s	0.0 s	0.0 s	0.0 s	0.0 s	205
14.06	RO2 TON DELAY	0.0 s	0.0 s	0.0 s	0.0 s	0.0 s	206
14.07	RO2 TOFF DELAY	0.0 s	0.0 s	0.0 s	0.0 s	0.0 s	207
14.08	RO3 TON DELAY	0.0 s	0.0 s	0.0 s	0.0 s	0.0 s	208
14.09	RO3 TOFF DELAY	0.0 s	0.0 s	0.0 s	0.0 s	0.0 s	209
14.10	DIO MOD1 RO1	READY	READY	READY	READY	READY	210
14.11	DIO MOD1 RO2	RUNNING	RUNNING	RUNNING	RUNNING	RUNNING	211
14.12	DIO MOD2 RO1	FAULT	FAULT	FAULT	FAULT	FAULT	212
14.13	DIO MOD2 RO2	WARNING	WARNING	WARNING	WARNING	WARNING	213
14.14	DIO MOD3 RO1	REF 2 SEL	REF 2 SEL	REF 2 SEL	REF 2 SEL	REF 2 SEL	214
14.15	DIO MOD3 RO2	AT SPEED	AT SPEED	AT SPEED	AT SPEED	AT SPEED	215
14.16	RO PTR1	0	0	0	0	0	216
14.17	RO PTR2	0	0	0	0	0	217
14.18	RO PTR3	0	0	0	0	0	218
14.19	RO PTR4	0	0	0	0	0	219
14.20	RO PTR5	0	0	0	0	0	220
14.21	RO PTR6	0	0	0	0	0	221
14.22	RO PTR7	0	0	0	0	0	222
14.23	RO PTR8	0	0	0	0	0	223
14.24	RO PTR9	0	0	0	0	0	224
15	ANALOGUE OUTPUTS						
15.01	ANALOGUE OUTPUT1	SPEED	SPEED	SPEED	SPEED	SPEED	226
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
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	SYSTEM CTRL INPUTS						
16.01	RUN ENABLE	YES	YES	DI5	DI6	YES	251
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
16.05	USER MACRO IO CHG	NOT SEL	NOT SEL	NOT SEL	NOT SEL	NOT SEL	255
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						258
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	200.0% Ihd	200.0 % Ihd	200.0 % Ihd	200.0 % Ihd	200.0 % Ihd	353
20.04	TORQ MAX LIM1	300%	300%	300%	300%	300%	354
20.05	OVERVOLTAGE CTRL	ON	ON	ON	ON	ON	355

Index	Name/Selection	FACTORY	HAND/AUTO	PID-CTRL	T-CTRL	SEQ CTRL	PB
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
21	START/STOP						
21.01	START FUNCTION	AUTO	AUTO	AUTO	AUTO	AUTO	376
21.02	CONST MAGN TIME	500.0 ms	500.0 ms	500.0 ms	500.0 ms	500.0 ms	377
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
21.06	DC HOLD CURR	30%	30%	30%	30%	30%	381
21.07	RUN ENABLE FUNC	RAMP STOP	RAMP STOP	RAMP STOP	RAMP STOP	RAMP STOP	382
21.08	SCALAR FLY START	NO	NO	NO	NO	NO	383
21.09	START INTRL FUNC	OFF3 STOP	OFF3 STOP	OFF3 STOP	OFF3 STOP	OFF3 STOP	384
22	ACCEL/DECEL						
22.01	ACC/DEC SEL	DI4	ACC/DEC 1	ACC/DEC 1	DI5	DI3	401
22.02	ACCEL TIME 1	3.00 s	3.00 s	3.00 s	3.00 s	3.00 s	402
22.03	DECEL TIME 1	3.00 s	3.00 s	3.00 s	3.00 s	3.00 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
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
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	476
25.02	CRIT SPEED 1 LOW	0 rpm	0 rpm	-	0 rpm	0 rpm	477
25.03	CRIT SPEED 1 HIGH	0 rpm	0 rpm	-	0 rpm	0 rpm	478
25.04	CRIT SPEED 2 LOW	0 rpm	0 rpm	-	0 rpm	0 rpm	479
25.05	CRIT SPEED 2 HIGH	0 rpm	0 rpm	-	0 rpm	0 rpm	480
25.06	CRIT SPEED 3 LOW	0 rpm	0 rpm	-	0 rpm	0 rpm	481
25.07	CRIT SPEED 3 HIGH	0 rpm	0 rpm	-	0 rpm	0 rpm	482
26	MOTOR CONTROL						
26.01	FLUX OPTIMIZATION	NO	NO	NO	NO	NO	501
26.02	FLUX BRAKING	YES	YES	YES	YES	YES	502
26.03	IR COMPENSATION	0%	0%	0%	0%	0%	503
26.05	HEX FIELD WEAKEN	OFF	OFF	OFF	OFF	OFF	504

Index	Name/Selection	FACTORY	HAND/AUTO	PID-CTRL	T-CTRL	SEQ CTRL	PB
26.06	FLUX REF PTR	0	0	0	0	0	506
27	BRAKE CHOPPER						
27.01	BRAKE CHOPPER CTL	OFF	OFF	OFF	OFF	OFF	
27.03	BR OVERLOAD FUNC	NO	NO	NO	NO	NO	
27.04	BR RESISTANCE	1000 ohm	1000 ohm	1000 ohm	1000 ohm	1000 ohm	
27.05	BR THERM TCONST	0 s	0 s	0 s	0 s	0 s	
27.06	MAX CONT BR POWER	0 kW	0 kW	0 kW	0 kW	0 kW	
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	1.00 s	1.00 s	1.00 s	1.00 s	1.00 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
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
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
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

Index	Name/Selection	FACTORY	HAND/AUTO	PID-CTRL	T-CTRL	SEQ CTRL	PB
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
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
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
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			OFF			870
40.21	SLEEP LEVEL			0.0 rpm			871
40.22	SLEEP DELAY			0.0 s			872
40.23	WAKE UP LEVEL			0%			873
40.24	WAKE UP DELAY			0.0 s			874
40.25	ACTUAL1 PTR	0	0	0	0	0	875
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%	-
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

Index	Name/Selection	FACTORY	HAND/AUTO	PID-CTRL	T-CTRL	SEQ CTRL	PB
50.04	ENCODER DELAY	1000	1000	1000	1000	1000	1004
50.05	ENCODER DDCS CHANNEL	CHANNEL 2	CHANNEL 2	CHANNEL 2	CHANNEL 2	CHANNEL 2	1005
50.06	SPEED FB SEL	INTERNAL	INTERNAL	INTERNAL	INTERNAL	INTERNAL	1006
51	COMMUNICATION MODULE						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
70.03	CH1 BAUDRATE	2 Mbits	2 Mbits	2 Mbits	2 Mbits	2 Mbits	1377
70.04	CH0 DDCS HW CONN	RING	RING	RING	RING	RING	1378
83	ADAPT PROG CTRL						
83.01	ADAPT PROG CMD	EDIT	EDIT	EDIT	EDIT	EDIT	1609
83.02	EDIT COMMAND	NO	NO	NO	NO	NO	1610
83.03	EDIT BLOCK	1	1	1	1	1	1611
83.04	TIMELEVEL SEL	100ms	100ms	100ms	100ms	100ms	1612
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
90	D SET REC ADDR						
90.01	AUX DS REF3	0	0	0	0	0	1735

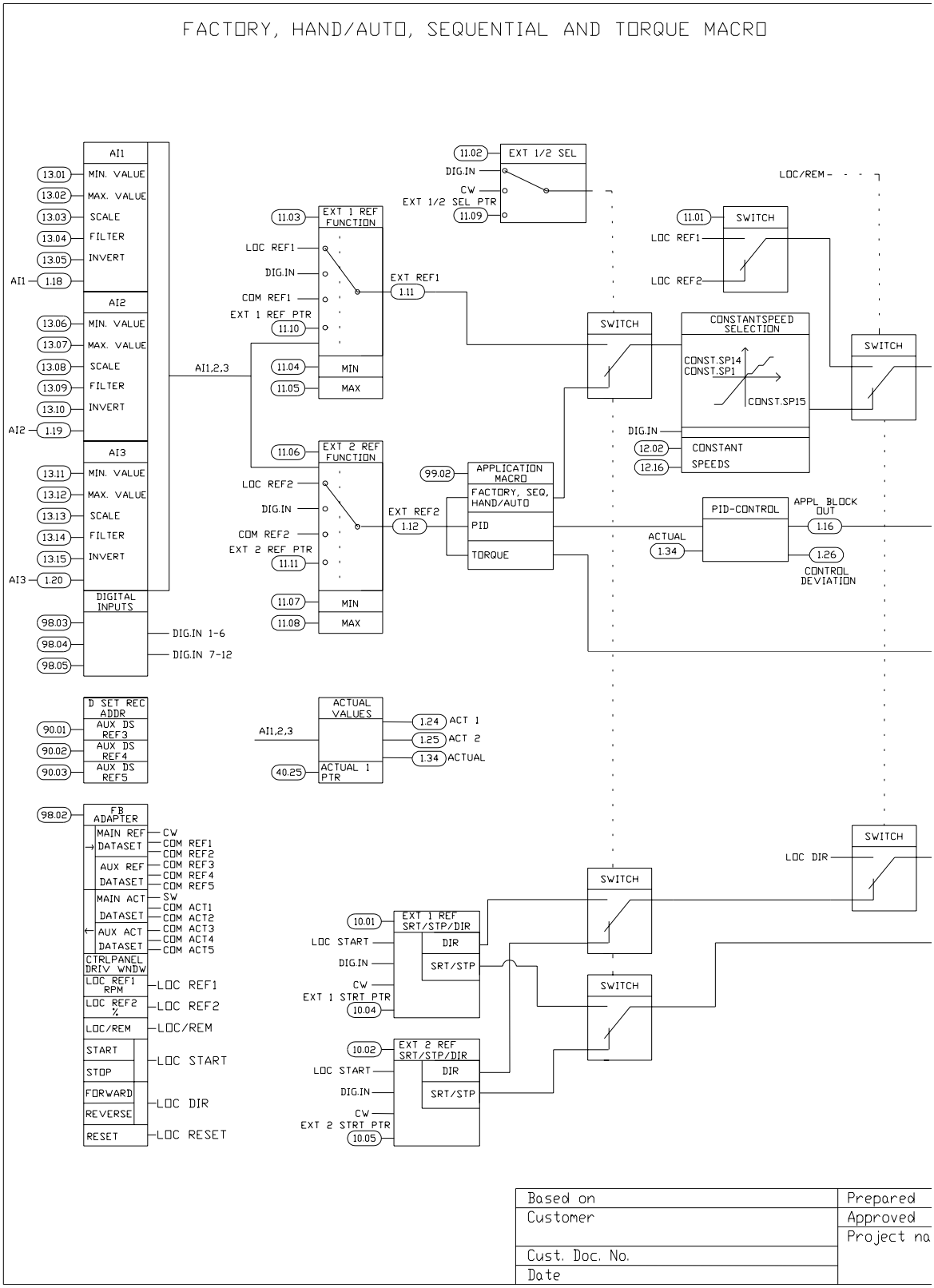
Index	Name/Selection	FACTORY	HAND/AUTO	PID-CTRL	T-CTRL	SEQ CTRL	PB
90.02	AUX DS REF4	0	0	0	0	0	1736
90.03	AUX DS REF5	0	0	0	0	0	1737
90.04	MAIN DS SOURCE	1	1	1	1	1	1738
90.05	AUX DS SOURCE	3	3	3	3	3	1739
92	D SET TR ADDR						
92.01	MAIN DS STATUS WORD	302	302	302	302	302	1771
92.02	MAIN DS ACT1	102	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
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	DI7,8	DI7,8	DI7,8	DI7,8	1909
98.10	DI/O EXT2 DI FUNC	DI9,10	DI9,10	DI9,10	DI9,10	DI9,10	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	UNIP AI5	UNIP AI5	UNIP AI5	UNIP AI5	UNIP AI5	1913
98.14	AI/O EXT AI2 FUNC	UNIP AI6	UNIP AI6	UNIP AI6	UNIP AI6	UNIP AI6	1914
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
99.03	APPLIC RESTORE	NO	NO	NO	NO	NO	1928
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
99.06	MOTOR NOM CURRENT	0.0 A	0.0 A	0.0 A	0.0 A	0.0 A	1931
99.07	MOTOR NOM FREQ	50.0 Hz	50.0 Hz	50.0 Hz	50.0 Hz	50.0 Hz	1932
99.08	MOTOR NOM SPEED	1 rpm	1 rpm	1 rpm	1 rpm	1 rpm	1933
99.09	MOTOR NOM POWER	0.0 kW	0.0 kW	0.0 kW	0.0 kW	0.0 kW	1934
99.10	MOTOR ID RUN	NO	NO	NO	NO	NO	1935

Control block diagrams

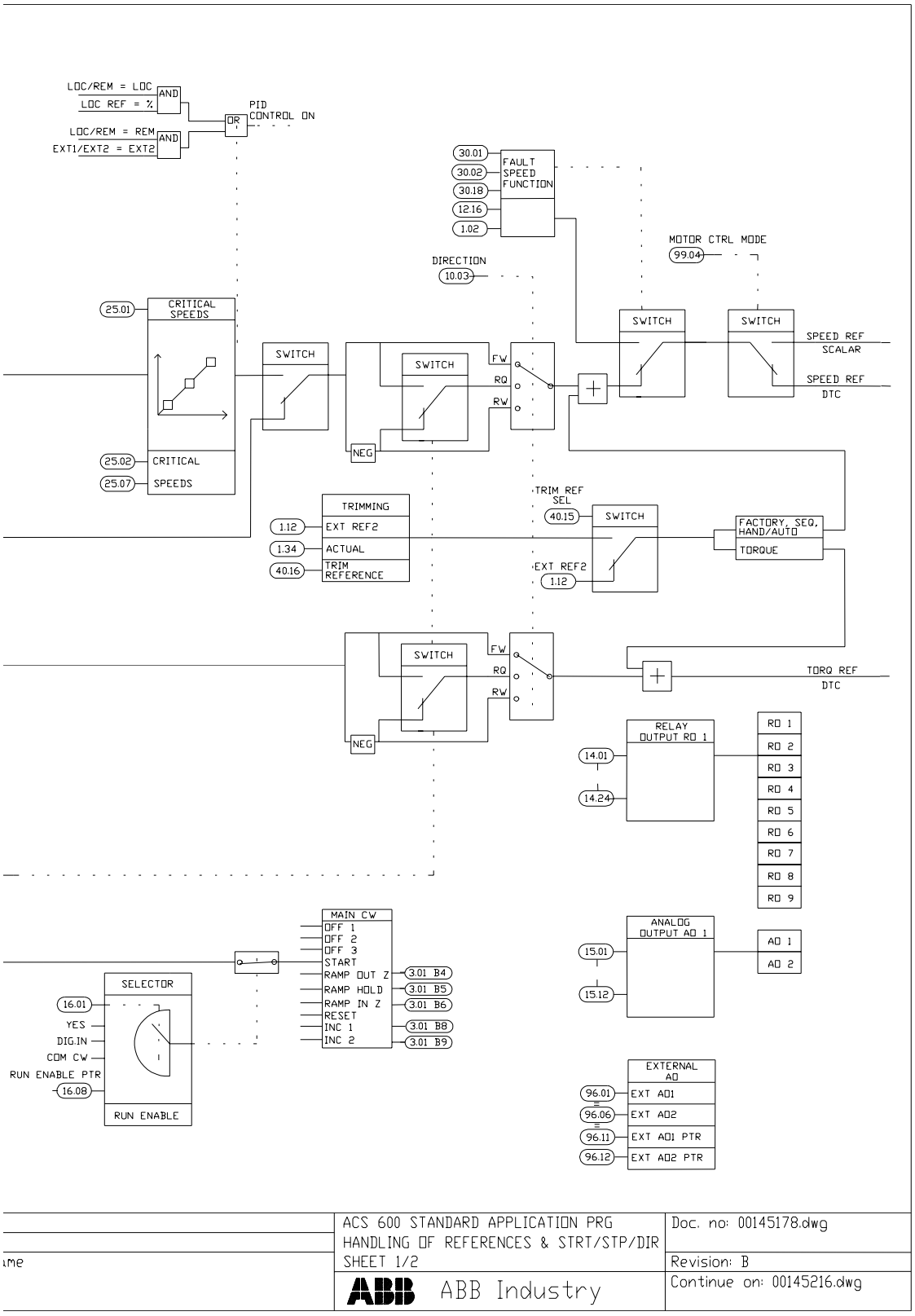
Chapter overview

Diagram	Page	Other
Reference control chain, sheet 1 Valid when FACTORY, HAND/AUTO, SEQ CTRL or T CTRL macro is active (see parameter 99.02).	2 - 3	Continued on sheet 2
Reference control chain, sheet 1 Valid when PID CTRL macro is active (see parameter 99.02).	4 - 5	Continued on sheet 2
Reference control chain, sheet 2 Valid with all macros (see parameter 99.02).	6 - 7	-
Handling of Start, Stop, Run Enable Start Interlock Valid with all macros (see parameter 99.02).	8 - 9	-

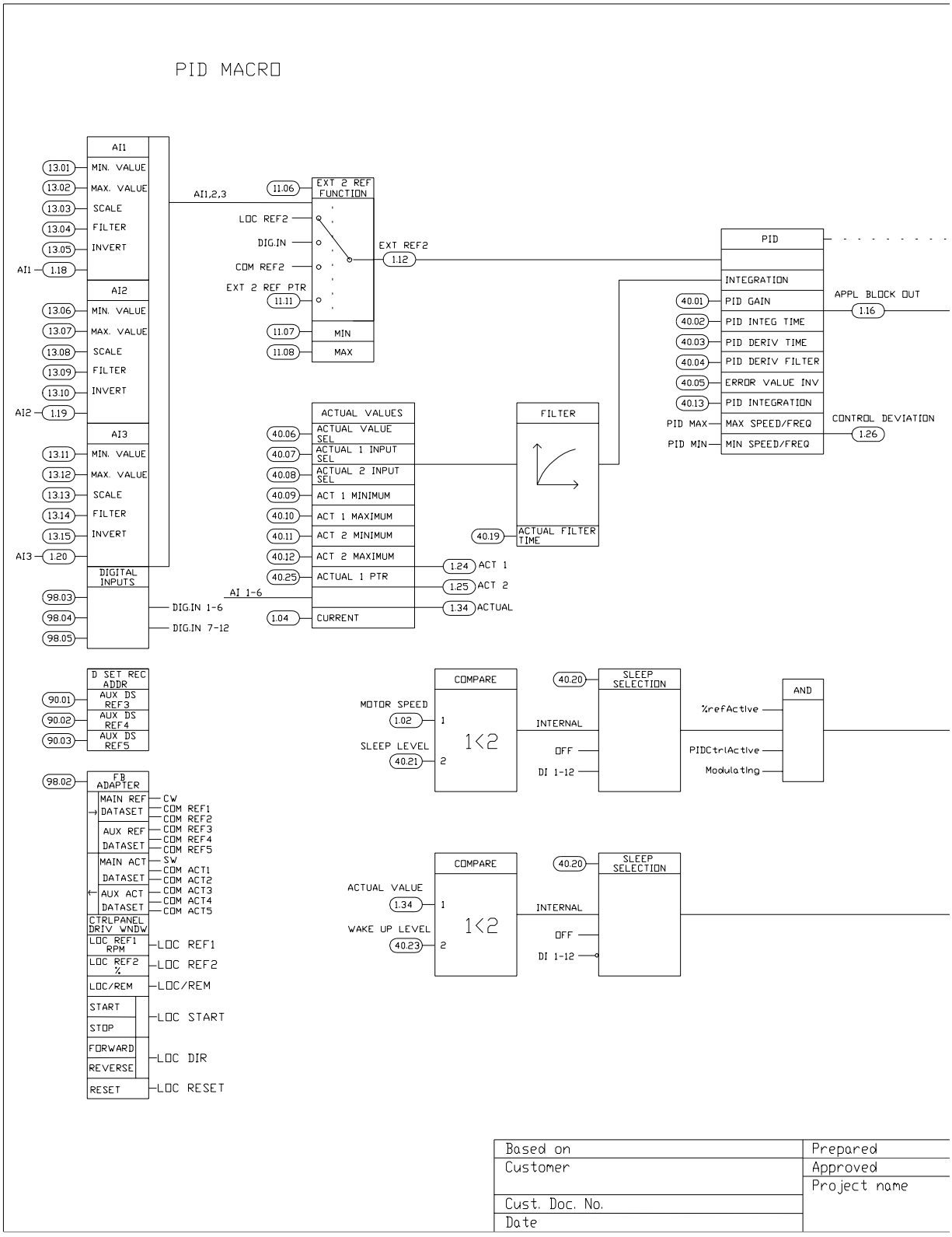
Reference control chain, sheet 1: FACTORY, HAND/AUTO, SEQ CTRL and T CTRL macros (continued on the next page …)



… continued from the previous page



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



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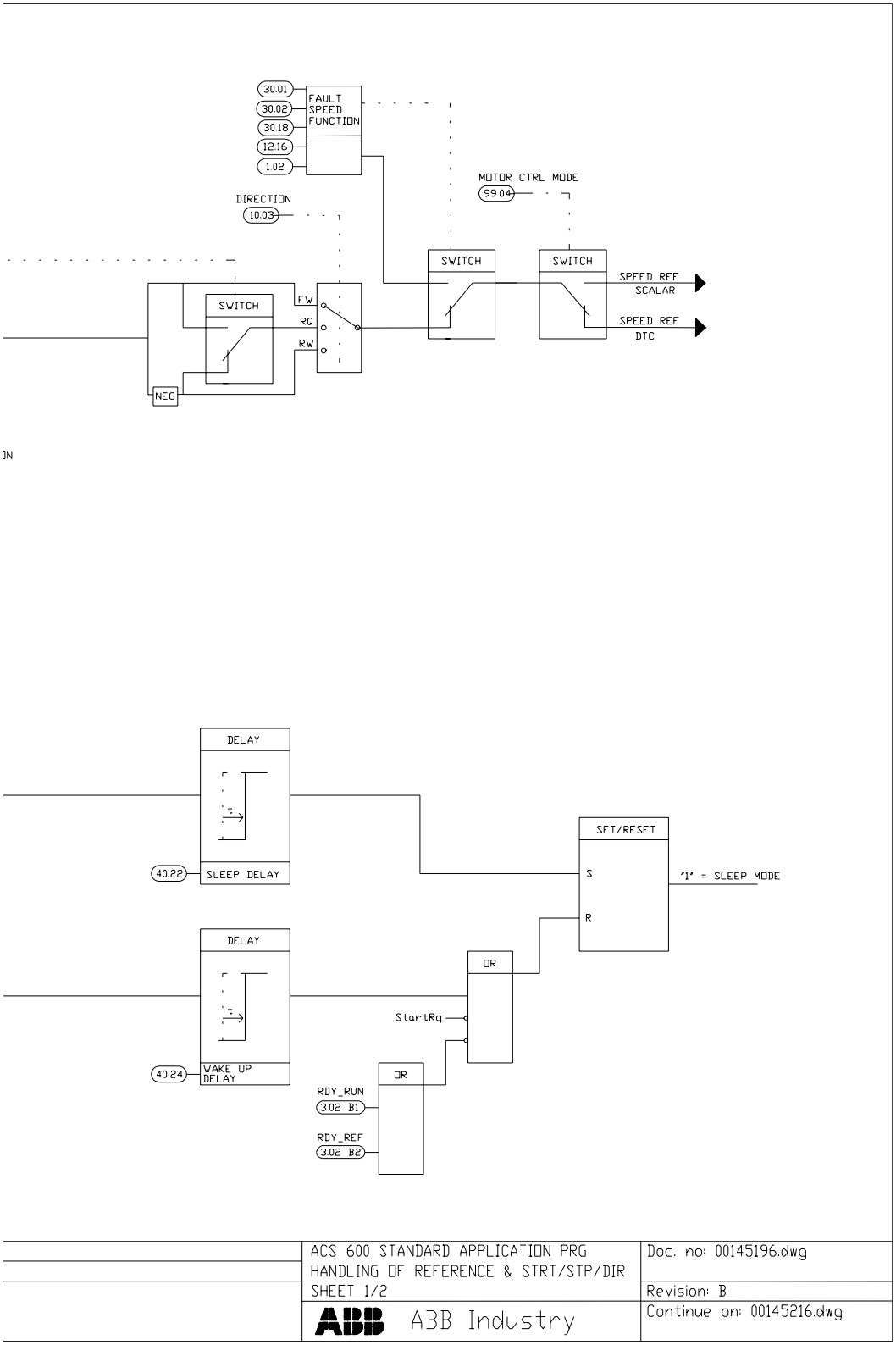
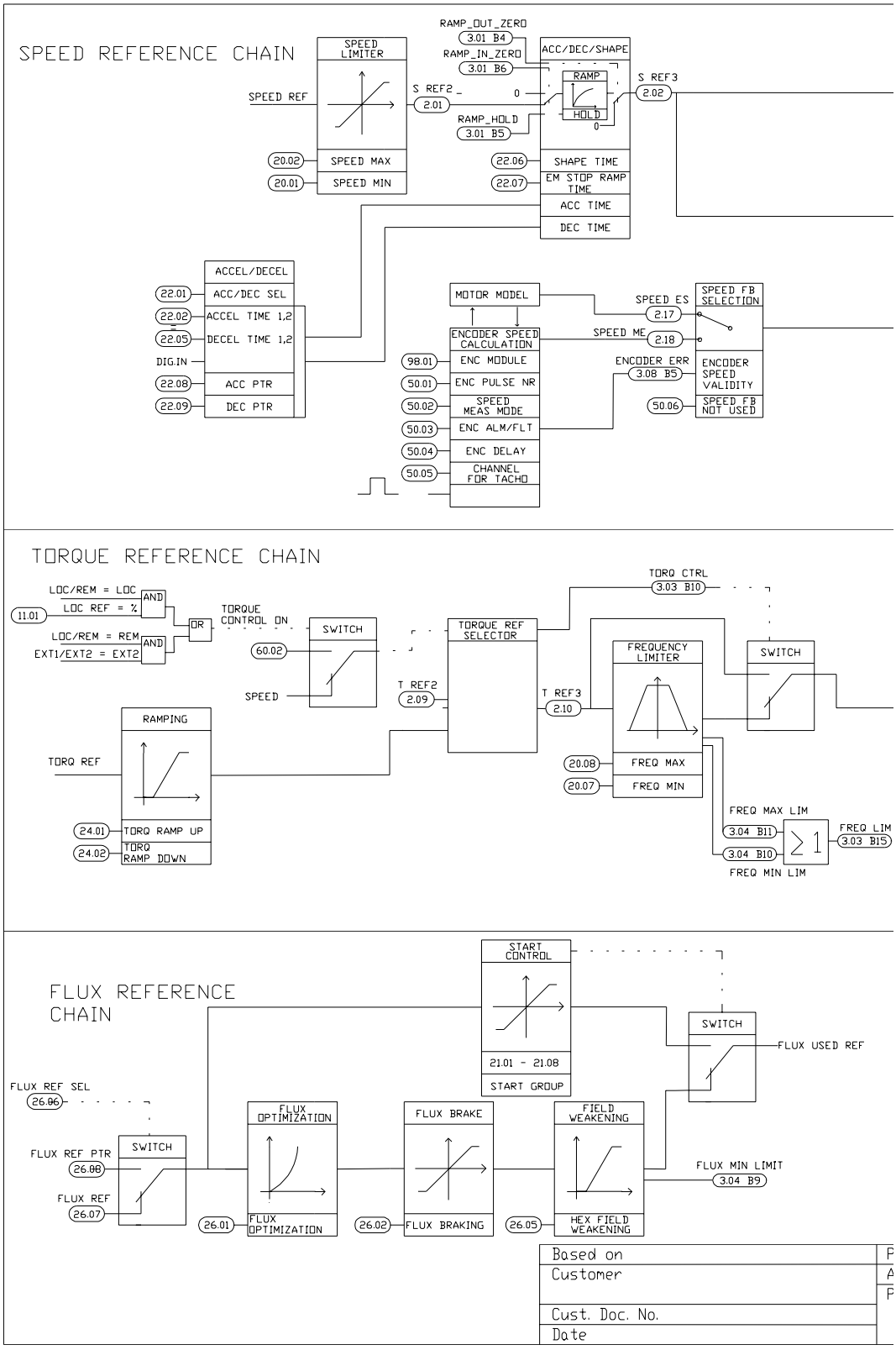


Reference control chain sheet 2: All macros (… continued on the next page)



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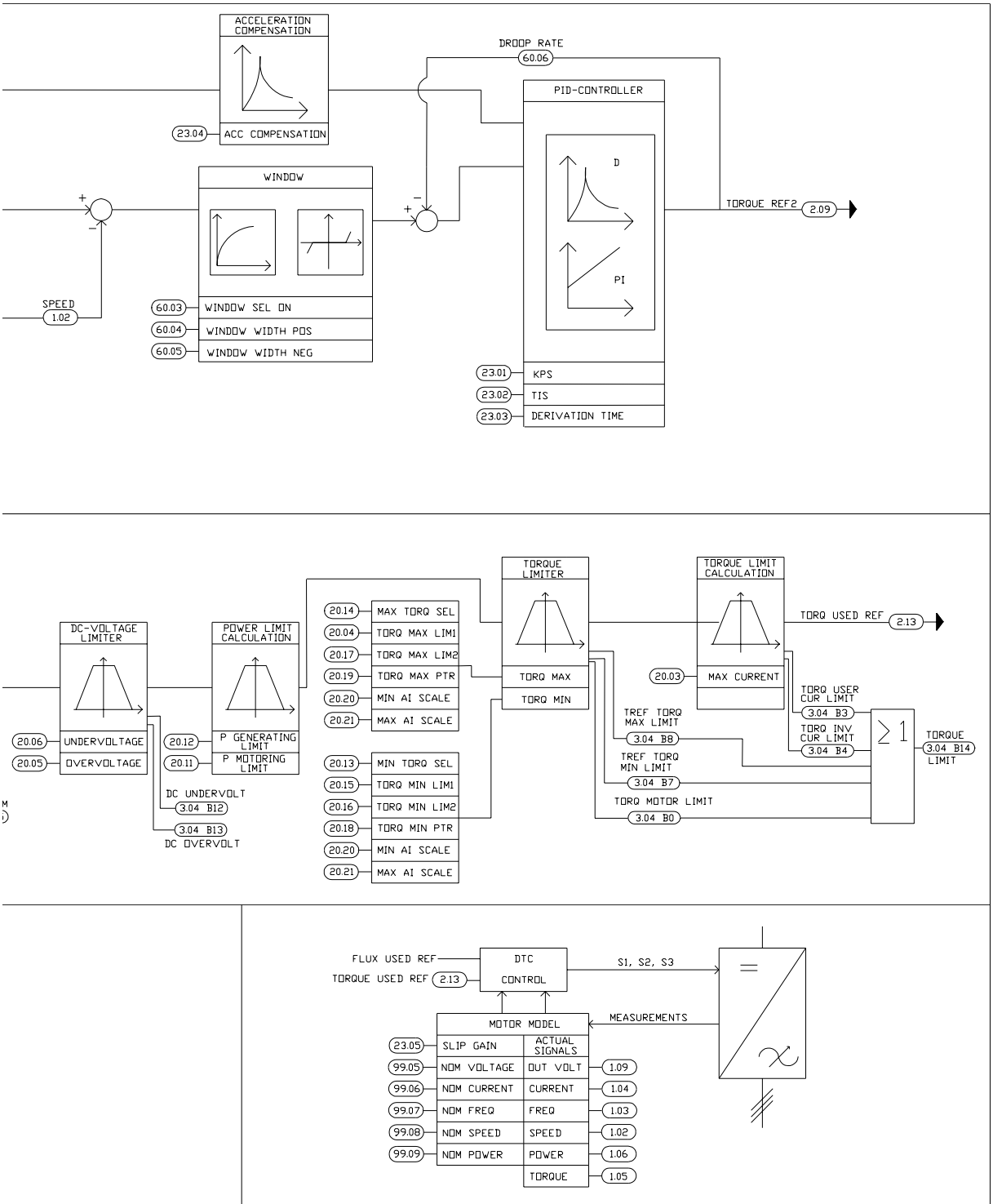

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Project name	SHEET 2/2	Revision: B
	ABB Industry	Continue on: -

Handling of Start, Stop, Run Enable Start Interlock (…continued on the next page)

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ABB Oy
AC Drives
P.O. Box 184
FIN-00381 HELSINKI
FINLAND
Telephone +358 10 22 2000
Telefax +358 10 22 22681
Internet http://www.abb.com

ABB Automation Inc.
Drives & Power Products
16250 West Glendale Drive
New Berlin, WI 53151
USA
Telephone 262 785-8378
800 243-4384
Telefax 262 780-5135