Nidec
All for dreams

Answer DRIVES 1000

Voltage Source Drive

PROGRAMMING MANUAL

IMAD10001EN
REV. 00 - 30 JULY 2015

All for dreams

Answer Drives 1000

PROGRAMMING MANUAL

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Contact us for information and comments at: nidec-industrial.com

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REV. 00 - 30 JULY 2015

Summary

CONTINUES SUMMARY

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Summary

PREVIOUS VIEW

1 SCOPE

Scope of this manual is to provide Drive programming instructions for AD1000.

This manual, together with the User and Maintenance Manual, is part of the equipment and has to be stored in a safe and easily retrievable place for the whole lifetime of AD1000.

Manuals are the same and apply to all models and types, electrical schematic diagrams and mechanical drawings are specific for each size.

Only actions described in these manuals shall be performed on equipment. Neither other action, measurement or change of any type shall be carried out.

This Programming Manual is alligned with the **software release: 1.15.4.0_0000-1G1504B1**.

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2 SAFETY

It is mandatory to fully understand and strictly apply all Safety and Cautionary Rules listed in the User and Maintenance Manual.

It is mandatory to fully understand and strictly apply all Safety Rules according to local laws and all safety site regulations.

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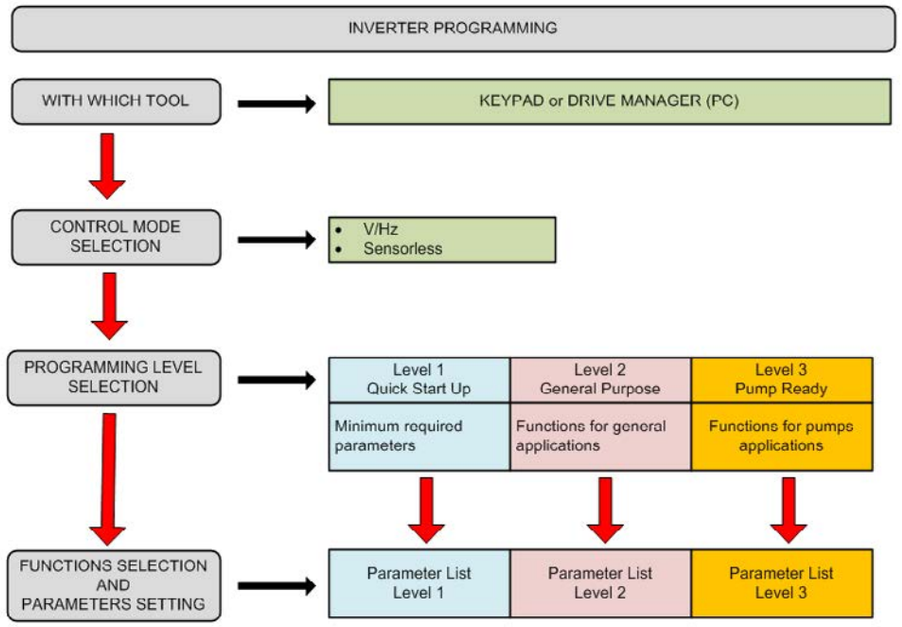
3 PROGRAMMING OVERVIEW

3.1 PROGRAMMING FLOW CHART

Figure 3.1 - Programming Flow



3.2 BACKUP SYSTEM AND SOFTWARE AND PARAMETERS DOWNLOAD

In order to make backup or download of parameters and to download a firmware, it is necessary to use Drive Manager interface program (DVM); refer to DVM user guide for this operation.

NOTE
In order to connect the Drive to a PC it is necessary to use the DB9-RJ45 adapter coded 1000007127. An RS232 port is required.

It is possible to backup and restore parameters also using the keypad. Refer to paragraph 4.2.11 for the procedure.

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4 PROGRAMMING TOOLS

4.1 INTRODUCTION

AD1000 can be programmed with:
- "Drive Manager" (DVM) interface program; refer to DVM user guide for this operation;
- Backlight graphic LCD type keypad.

NOTE
The keypad type to be used with AD1000 is SVGTAFK; code 8000001597

NOTE
In order to connect the Drive to a PC it is necessary to use the DB9-RJ45 adapter coded 1000007127. An RS232 port is required.

4.2 KEYPAD

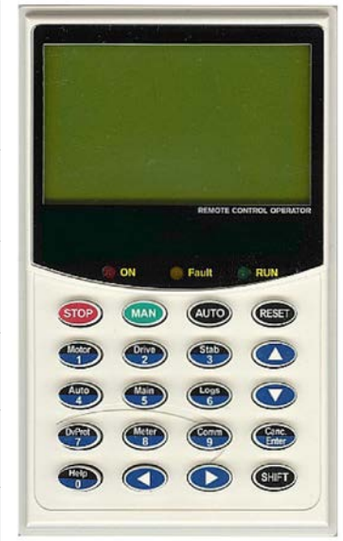
The SVGTAFK keypad is equipped with 4 arrow keys, 6 function keys and 10 numeric/shortcut keys and allows immediate access to menus and parameters.
The MAN, AUTO and STOP keys described below are used with HOA function disabled. See paragraph 9.1.

*MAN:	This key has got two functions: - in **Auto** mode it transfers control mode from **Auto** to **Man**. If so a confirmation request appears and the [Canc./Enter] key shall be pressed to confirm the action. - in Man mode, with Drive READY TO SWITCH ON (pre-charge performed), it makes the Drive run. Transfer from **Auto** to **Man** can be performed whatever the Drive status is; if it occurs with the Drive in RUN state, the Drive stops the motor in controlled deceleration. In **Man** mode, the speed reference is set with the up [⬆] and down [⬇] arrow keys.
**AUTO:	This key is active only in **Man** mode. It transfers the control mode from **Man** to **Auto**. If so a confirmation request appears and the [Canc./Enter] key shall be pressed to confirm the action. In Auto mode with drive pre-charged the AD1000 is started through the selected source (digital input or fieldbus). Transfer from **Man** to **Auto** can be performed whatever the Drive status is; if it occurs with the Drive in RUN state, the Drive stops the motor in controlled deceleration. See HOA function for more details.
***STOP":	Active only in **Man** mode. Stops the motor in controlled deceleration.

Table 4.1 - Key and LED description

ON	LED	- On: AD1000 ready (pre-charged completed) - Blinking: AD1000 ready (pre-charged completed) and in manual mode
FAULT	LED	- On: One or more fault occurred - Blinking: there are one or more alarms
RUN	LED	- On: AD1000 is working - Blinking: the braking chopper is working
STOP	KEY	Decelerates the motor in a controlled way until it stops ***
MAN	KEY	- Sets the AD1000 in manual mode - Starts it if it is in manual * mode
AUTO	KEY	- Sets the AD1000 in Auto mode: the run command and speed reference come from an external source **
RESET	KEY	- Clears faults - Acknowledges alarms - Fault test LED
ENTER	KEY	- Selects a submenu or parameter - Enters in edit mode for a selected parameter - Accepts a new value in edit mode
CANCEL	KEY	- Returns to the monitor page - Rejects any modification to parameter values in edit mode
SHIFT	KEY	- Accesses the second group of functions: shall be pressed before the desired function keys (example SHIFT + 9 accesses the communication menu)

Figure 4.1 - SVGTAFK keypad



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4.2.1 KEYPAD CONNECTION

To connect the keypad to the Drive regulation card (Basis card), a standard Ethernet network cable shall be used, the one normally used for network connections. The communication cable shall be connected on the regulation card to the connector (RJ45 type) called “COM”.

4.2.2 CONNECTION

When the keypad is connected for the first time to an Drive, it loads configuration information to create an internal image of the Drive menu system and it saves it. If the keypad is connected to an Drive providing for the same version, it will use the menu structure internal image and shall be immediately operating. If not, the keypad shall load configuration information from the Drive.
In order to force the upload of the configuration from the Drive, disconnect the keypad from the Drive and reconnect it keeping the RESET key pressed.

NOTE
a. When parameter values are edited, all four digits shall be used. Values with less than four digits shall be preceded by one or more zeroes. For instance, to change the value of a 4-digit parameter from 1234 to 975, the operator shall enter 0975.
b. In case of signed parameters, the first active digit is the sign. The sign is changed using the up [⬆] and down [⬇] arrow keys. Positive values are displayed with no “+” sign. Negative values have always the “-” sign.
c. For numbers with a decimal part, the decimal point is in a fixed position.

4.2.3 ARROW KEYS FUNCTIONS

Table 4.2 Arrow keys functions

Key combination	Description
◀	Navigate through the menu system. Change the active digit of a parameter value when in edit mode. Display the highlight bar when in monitor mode.
▶	Change the mode from monitor to menu list. Navigate through the menu system. Change the active digit of a parameter value when in edit mode.
▲ ▼	Scroll through the menu and parameter options lists. Change the speed reference (when in MAN mode and monitor mode). Increases/decreases parameter values (when in edit mode). Enter safety code (a combination of 4 digits, from 0 to 9). Enter the menu ID or ID parameter in numeric menu access mode. Highlight the monitor parameter when in monitor mode and the highlight bar is present.
SHIFT + Canc Enter	To cancel and quit parameter changes. To return to the previous menu.
SHIFT + ▶	To enter the numeric access men. The operator is then required to enter the ID number for the associated menu or parameter.
SHIFT + ▲	Skips to the top of the currently selected menu or submenu.
SHIFT + ▼	Skips to the bottom of the currently selected menu or submenu.
SHIFT + ◀	Enters the programming level mode. The operator is required to enter a programming level.
RESET + ▲ or ▼	Change display contrast.
SHIFT	To lock the keypad: press “shift” key for more than 3 seconds and only when the message “enter to lock the keypad” is displayed press “enter” key. To unlock the keypad: press a key and only when the message “enter to unlock the keypad” is displayed press “enter” key.

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4.2.4 MENU SYSTEM

Parameters inside the menu system are organized according to logical groups. To display or edit parameters, the operator shall select them using key sequences. Paragraphs 4.2.3 and 4.2.7 describe key sequences and the methods for navigating the menu system.

THE PRIMARY VISUALIZATION MODE IS MONITOR MODE.

Table 4.3 - Keys use in System Menu

To enter the menu system from the monitor mode press key:	→
To scroll the available parameters/submenus (as soon as the menu system has been entered) use keys:	↑ or ↓
To select a parameter/submenu press keys:	Canc Enter or →
To return to a previous menu press key:	←
After a parameter has been selected, **to modify it** (to highlight items within choice lists, or to change numeric values) use keys:	↑ or ↓
To modify the underlined active digit within the editing fields, use keys:	← or →
To change the value of a parameter within the editing fields:	Use numeric keys
To edit a parameter or **To confirm modification of a parameter** press key:	Canc Enter
To cancel and quit the modification of the selected parameter:	SHIFT and Canc Enter

Table 4.5 and Figure 4.5 describe the process to select and modify a parameter.
The menu system derives from the data obtained the first time the keypad is connected to the Drive (during the configuration phase).
As soon as the load of configuration is completed, the menu structure is stored in the keypad.

4.2.5 MONITOR MODE

The Monitor Mode allows the operator to observe Drive status and real time values of selectable variables (process data).
The top left corner shows drive status, while the top right corner shows the speed reference source.
The section below displays the actual values of five variables.

Table 4.4 - Keys use in Monitor Mode

To activate the highlight bar press key	←
To highlight the variable to be replaced use keys	↑ or ↓
To activate the list of variable type choice press key	Canc Enter
To highlight the variable type to be selected use keys	↑ or ↓
To activate the list of variable choice (as soon as the desired parameter type has been selected) press key:	Canc Enter
To highlight the variable to be displayed use keys:	↑ or ↓
To select the highlighted parameter press key:	Canc Enter

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Figure 4.2 describes this process.

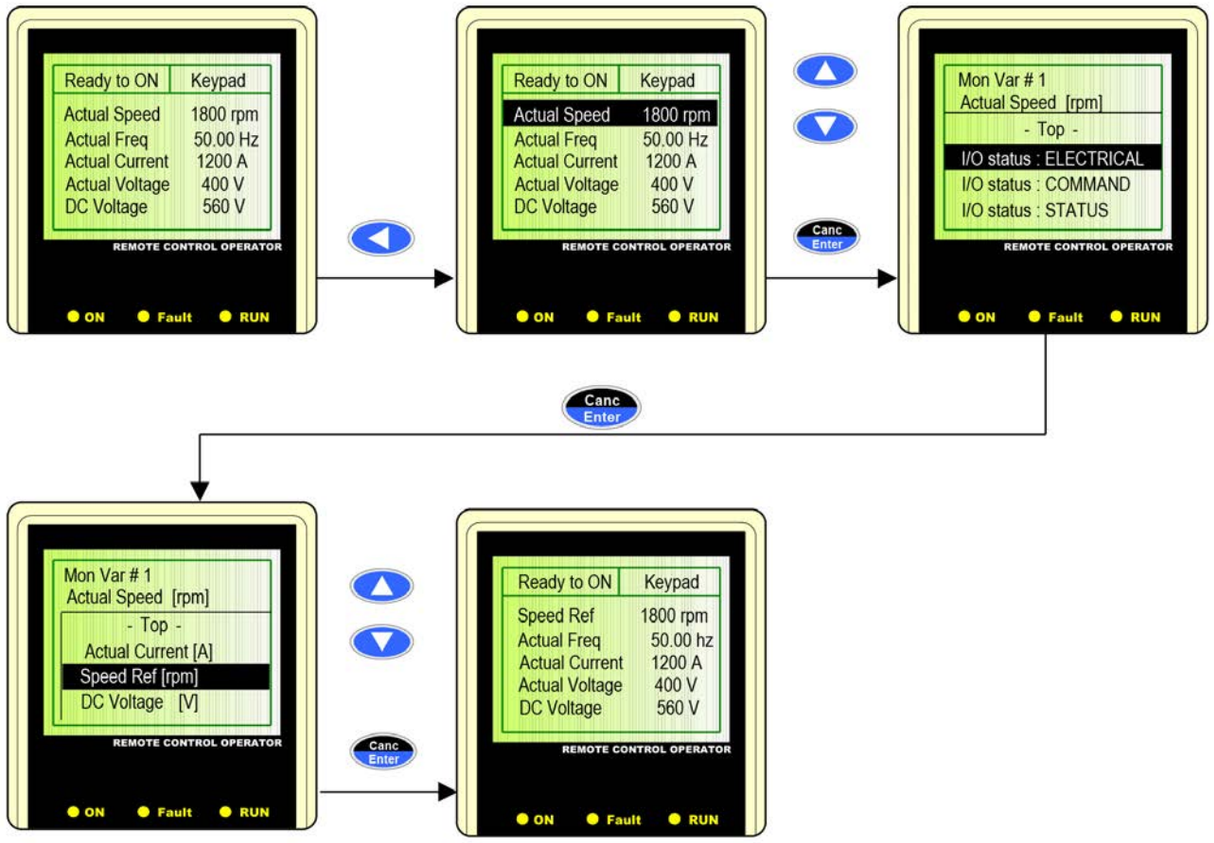
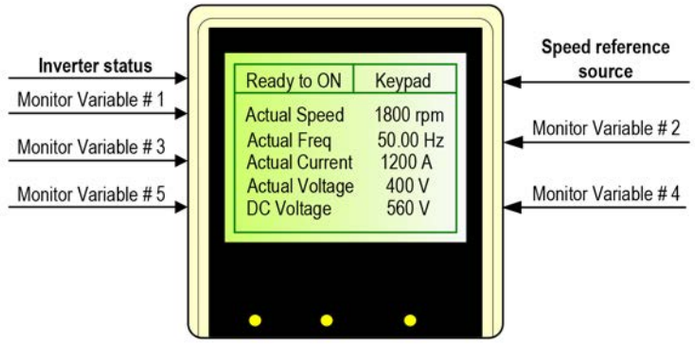


Figure 4.2 - Parameter selection for display in Monitor Mode

Figure 4.3 - Monitor Mode screen



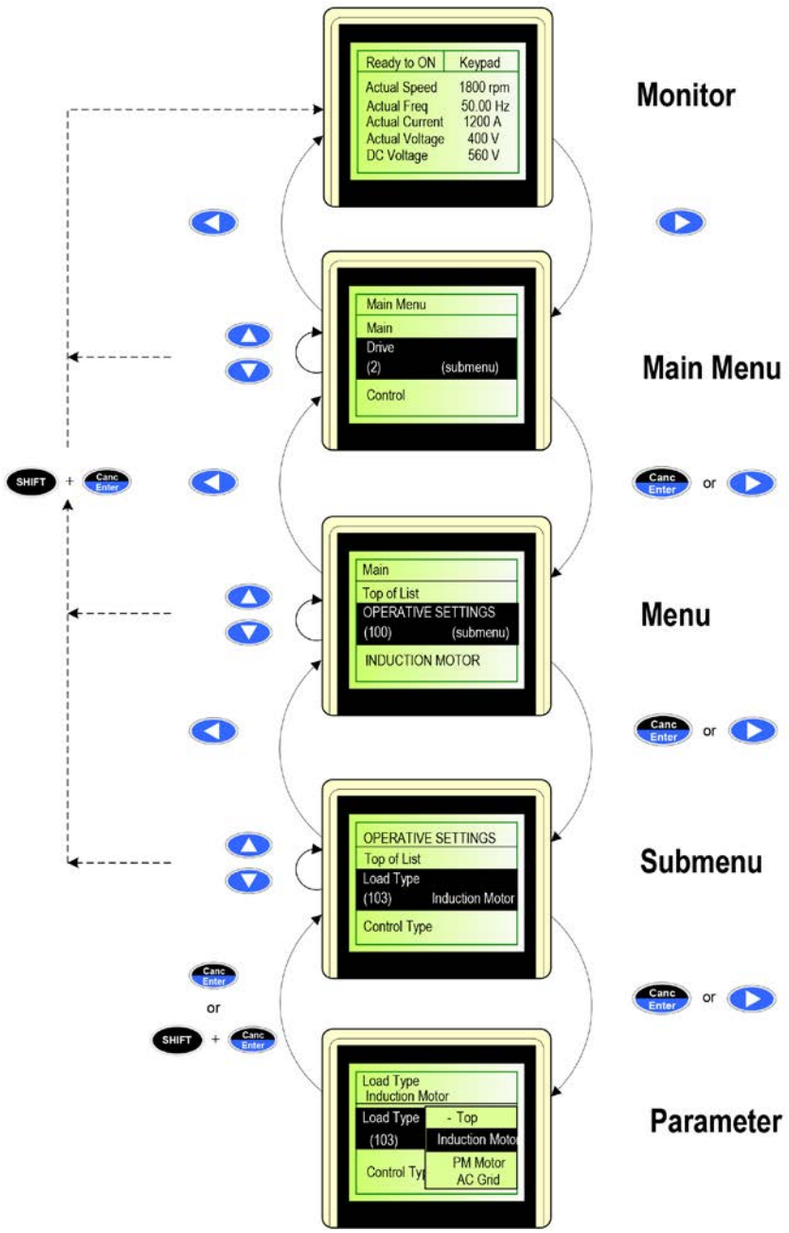
PREVIOUS VIEW

4.2.6 MENU NAVIGATION

The following sequence indicates the ways to navigate in menu and change a parameter.
A programming level code can be requested for certain menus and parameters.

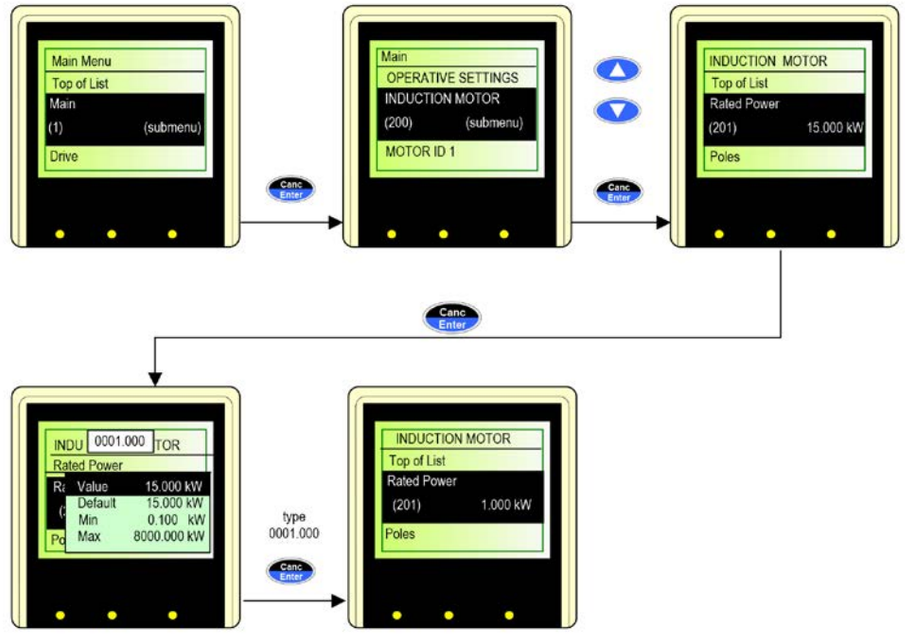
4.2.6.1 Navigation in menu and changing a parameter by the selection list

Figure 4.4 - Navigation modes



4.2.6.2 Navigation in menu and changing a numeric parameter

Figure 4.5 - Selection and modification of a parameter



PREVIOUS VIEW

4.2.7 QUICK ACCESS MENU AND FAMILIES OF AVAILABLE PARAMETERS

The [Shift] key allows accessing the second function of numeric keys. The [Shift] key shall be pressed before the desired function key. After pressing the [Shift] key, on top of the display, the [Shift] enabled indication appears. The following table describes the combination of keys.

The following table describes the available families in the submenus and the combination of keys associated with them.

Table 4.5 - Quick access menu

Combination of keys for quick access	Description	Available families
SHIFT + Help 0	Context sensitive guide	
SHIFT + Motor 1	Main	**INDUCTION MOTOR [02.00]** **MOTOR ID 1 [07.00]** **INERTIA ID [10.00]**
SHIFT + Drive 2	Drive	**Drive [06.00]** **DC - BUS [12.00]** **PER – UNIT BASE DATA [13.00]** **DIGITAL INPUTS [15.00]** **DIGITAL OUTPUTS [16.00]** **ANALOG INPUTS [17.00]** **ANALOG OUTPUTS [18.00]**
SHIFT + Stab 3	Control	**SPEED CONTROL [21.00]** **TORQUE CONTROL [22.00]** **V/f CONTROL [24.00]**
SHIFT + Auto 4	Auto	**SYSTEM CTRL INPUTS [31.00]** **SPEED REFERENCE [32.00]** **START/STOP MODE [33.00]** **AUTORESET [34.00]**
SHIFT + Main 5	Main	
SHIFT + Logs 6	Logs	**ALARM BUFFER [50.00]** **FAULT HISTORY [59.00]** **TIME - RTC TIME [65.00]** **TRACE SETTINGS [66.00]**
SHIFT + DvProt 7	Alarms	**MOTOR UNDER/OVERLOAD [35.00]** **ALARM SETTINGS [36.00]**
SHIFT + Meter 8	Meter menu	**ELECTRICAL [75.00]** **HYDRAULIC [76.00]** **COMMAND WORDS [51.00]** **STATUS WORDS [52.00]** **CURRENT REF[53.00]** **CURRENT FDB [54.00]** **DCBUS FDB [56.00]** **DIGITAL [57.00]** **ANALOG [58.00]** **SPEED REF [60.00]** **SPEED FDB [61.00]** **AUX [63.00]** **DIAGNOSTICS [64.00]** **COMMUNICATIONS [67.00]** **ELECTRICAL [75.00]** **HYDRAULIC [76.00]**
SHIFT + Comm 9	Communications	**PROFIBUS [81.00]** **MODBUS [82.00]** **EXCH AREA 1/2 CONFIG [87.00]** **ETHERNET – TCP/IP [88.00]**
No combination of keys, from the monitor mode press the right key [➡] then scroll with the down [⬇] key	Macro	**JOG/FLUSHING [41.00]** **DIGIT. POTENTIOMETER [42.00]** **PROCESS PID [45.00]**
No combination of keys, from the monitor mode press the right key [➡] then scroll with the down [⬇] key	Utility	**INFO [99.00]**

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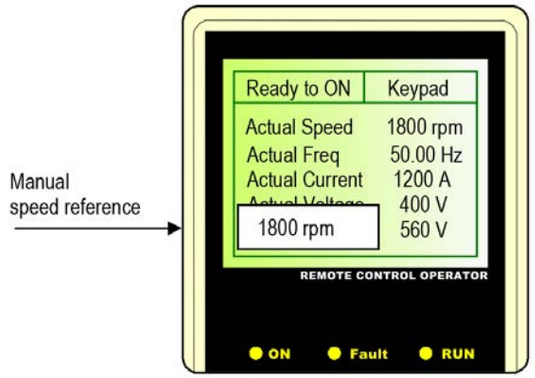
4.2.8 SPEED REFERENCE CHANGE

If the system is in manual mode and the keypad is active, the up [⬆] and down [⬇] arrow keys can be used to increase or decrease speed. When the up [⬆] and [⬇] keys are pressed a window appears on the bottom left of the display showing the reference value sent to the Drive, as shown in Figure 4.6. This window remains for 5 seconds after the up [⬆] and [⬇] keys have been released. To check the current value of the speed manual reference, momentarily press the up [⬆] and down [⬇] keys or the [Enter] key, a window with the current value shall appear.
To increase or decrease the speed reference hold the key up [⬆] or the key down [⬇] until reaching the desired value. The manual reference is a frequency (Hz) reference.

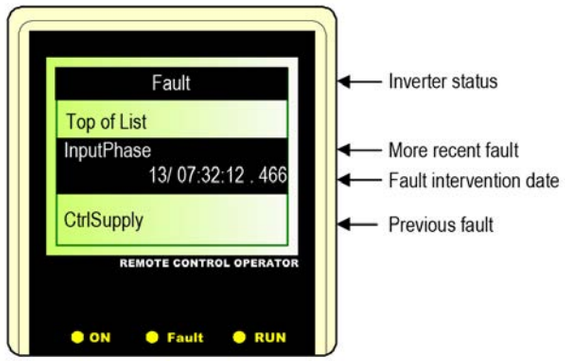
Figure 4.6 - Display with speed reference value



4.2.9 FAULT ANNOUNCEMENT

The **Fault** is displayed on the screen as soon as it occurs. If multiple faults occur, they are automatically queued, to scroll them use the up [⬆] and down [⬇] keys; after the last fault the writing "Bottom of list" appears.

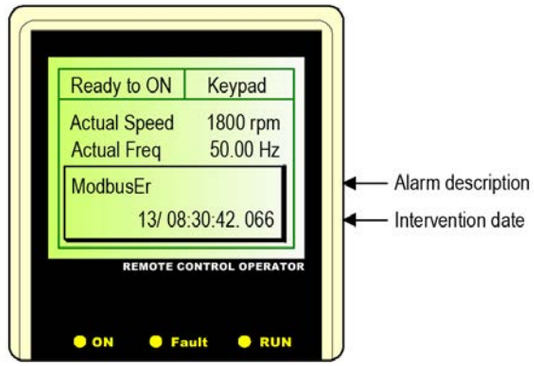
Figure 4.7 - Fault Display



4.2.10 ALARM ANNOUNCEMENT

As soon as an **Alarm** occurs, it is displayed only if the Monitor screen is active. With active alarm the Fault led blinks.
If multiple alarms occur they are automatically queued.

Figure 4.8 - Alarm Display



4.2.11 BACKUP AND DOWNLOAD PARAMETERS

It is possible to upload the values of parameters to the keypad in order to download it on another Drive. The two Drives must have the same firmware version.
To upload parameters to keypad press the right key [➡] and then scroll with down key [⬇] until "Store params in keypad" appears. Press [Enter] and then select "Overwrite existing data". The value of parameters will be saved in the keypad.
To download parameters to the Drive press the right key [➡] and then scroll with down key [⬇] until "Load params to Drive" appears. Press [Enter] and then select "Load". The value of parameters will be downloaded to the Drive.

PREVIOUS VIEW

5 PROGRAMMING LEVELS AND CONTROL MODES

5.1 COMMISSIONING

Before proceeding with the commissioning check that all installation aspects have been completed, as indicated in the User and Maintenance Manual, including all input, output, control, motor and load connections.

NOTE
Programming levels, control modes, characteristics and control cards are illustrated in the manual. Refer to the following for description and definitions.

5.2 PROGRAMMING LEVELS

The AD1000 Software is organized according to three access levels. Each level allows the user to progressively access a wider list of functions, macrofunctions and parameters.

LEVEL 1:
- For quick motor start.
- Minimum number of parameters to be set.
- Parameters organized according to menus and logic families.
- Access code 0001.

LEVEL 2:
- Provides pre-defined macros for standard applications and allows establishing process parameters for application customization.
- Parameters organized according to menus and logic families.
- Allows configuration of the analog and digital inputs and outputs.
- Access code 0002.

LEVEL 3:
- Provides pre-defined macros for pump applications and allows establishing process parameters for application customization.
- Parameters organized according to menus and logic families.
- Access code 0003.

NOTE
For each programming level, the user can select the desired motor control mode.

5.3 CONTROL METHODS

Two motor control algorithms are available. Select the most indicated mode based on the application.
- V/f (also called Scalar V/f): default (parameter **Scalar V/f En [24.07]** to On).
- Sensorless (also called Vector V/f): set parameter **Scalar V/f En [24.07]** to Off to enable the sensorless control (Vector V/f)

5.4 FACTORY SETTINGS (DEFAULT VALUES)

The AD1000 is set at the factory at programming level 2, with V/f (Scalar V/f) control and induction motor.

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5.5 IEC/NEMA SELECTION

With the parameter **IEC/NEMA Selection [13.99]**, available in the family **PER-UNIT BASE DATA [13.00]**, it is possible to select the following units of measure for the parameters and process data reported in the table below:

- IEC units of measure;
- NEMA units of measure.

When IEC units are visible the NEMA ones are hidden and vice versa.

Example: if **IEC/NEMA Selection [13.99]** is set to **NEMA, Rated Power [02.91]** in [HP] replaces **Rated Power [02.01]** in [kW].

IEC/NEMA Selection [13.99]					
IEC			NEMA		
02.01	Rated Power	kW	02.91	Rated Power	HP
02.20	Rated Torque	Nm	02.92	Rated Torque	lb*ft
13.05	Per-Unit Power	kW	13.91	Per-Unit Power	HP
13.06	Per-Unit Torque	Nm	13.92	Per-Unit Torque	lb*ft
13.11	User Per-Unit Press. 1	bar	13.31	User Per-Unit Press. 1	PSI
13.12	User Per-Unit Flow 1	m^3/h	13.32	User Per-Unit Flow 1	GPM
13.13	User Per-Unit Level 1	m	13.33	User Per-Unit Level 1	ft
13.14	User Per-Unit Temp. 1	C	13.34	User Per-Unit Temp. 1	F
13.21	User Per-Unit Press. 2	bar	13.41	User Per-Unit Press. 2	PSI
13.22	User Per-Unit Flow 2	m^3/h	13.42	User Per-Unit Flow 2	GPM
13.23	User Per-Unit Level 2	m	13.43	User Per-Unit Level 2	ft
13.24	User Per-Unit Temp 2	C	13.44	User Per-Unit Temp. 2	F
75.13	Active Power [kW]	kW	75.91	Active Power [HP]	HP
76.01	Press. of Prs PID Ref 1	bar	76.41	Press. of Prs PID Ref 1	PSI
76.02	Press. of Prs PID Fdb 1	bar	76.42	Press. of Prs PID Fdb 1	PSI
76.03	Flow of Prs PID Ref 1	m^3/h	76.43	Flow of Prs PID Ref 1	GPM
76.04	Flow of Prs PID Fdb 1	m^3/h	76.44	Flow of Prs PID Fdb 1	GPM
76.05	Level of Prs PID Ref 1	m	76.45	Level of Prs PID Ref 1	ft
76.06	Level of Prs PID Fdb 1	m	76.46	Level of Prs PID Fdb 1	ft
76.07	Temp. of Prs PID Ref 1	C	76.47	Temp. of Prs PID Ref 1	F
76.08	Temp. of Prs PID Fdb 1	C	76.48	Temp. of Prs PID Fdb 1	F
76.21	Press. of Prs PID Ref 2	bar	76.61	Press. of Prs PID Ref 2	PSI
76.22	Press. of Prs PID Fdb 2	bar	76.62	Press. of Prs PID Fdb 2	PSI
76.23	Flow of Prs PID Ref 2	m^3/h	76.63	Flow of Prs PID Ref 2	GPM
76.24	Flow of Prs PID Fdb 2	m^3/h	76.64	Flow of Prs PID Fdb 2	GPM
76.25	Level of Prs PID Ref 2	m	76.65	Level of Prs PID Ref 2	ft
76.26	Level of Prs PID Fdb 2	m	76.66	Level of Prs PID Fdb 2	ft
76.27	Temp. of Prs PID Ref 2	C	76.67	Temp. of Prs PID Ref 2	F
76.28	Temp. of Prs PID Fdb 2	C	76.68	Temp. of Prs PID Fdb 2	F

PREVIOUS VIEW

6 QUICK START-UP PROCEDURE

The quick motor start procedure allows starting the Drive through a limited number of parameters.

NOTE
The procedure requires the programming of certain parameters of the Drive. Instructions for this operation are summarized below; for more details see chapter 4.
To access the parameter to be programmed press the SHIFT key and then the ▶ key: a window called "ENTER MENU ID" appears.
Enter the number of the desired parameter and press Canc Enter to go to the parameter.
Press Canc Enter to edit the parameter, enter the desired value and press Canc Enter to confirm the new value (when parameter values are edited all four digits shall be used; values with less than four digits shall be preceded by one or more zeroes).
If SHIFT and then Canc Enter is pressed during the programming mode you return to the previous menu and, if you are in edit mode, parameter writing is quitted with no modifications.

NOTE
In parameter **Drive Size [06.01]**, drive size is set. This datum is entered at the factory during testing.
If a spare regulation card is used, check at the **Drive Size [06.01]** parameter if the set size corresponds to the size of the Drive being used.
Drive size can be inferred from the namweplate on the Drive.
For instance, if the Drive code is the following "AD1A053FBNNHN", Drive size shall be "053F".

6.1 DESCRIPTION OF THE QUICK MOTOR START PROCEDURE

For this type of procedure carry out the following steps:

1. Open the Drive Enable terminal: Terminal: XME 27 (DE).
2. Supply the Drive with power; first the auxiliary part shall be supplied, then power supply shall be inserted. If there are no alarms or faults the Drive is predisposed in waiting mode READY TO ON, led "ON" constantly switched on.
3. If any alarm is present, press the RESET key to reset the Drive and to bring it in READY TO ON state.
4. To display all the necessary parameters to the procedure it is necessary to go to programming level 2:
   - Press SHIFT then ◀ to show the "Enter Program Code" window.
   - In the "Enter Program Code" window set 0002, then press Canc Enter.

Program the parameters according to the data of the load and the control method you wish to apply.

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6.1.1 SENSORLESS (VECTOR V/F) CONTROL WITH NAMEPLATE DATA ONLY

5. Set the following parameters:
- 02.01 ÷ 02.09 (INDUCTION MOTOR) Motor nameplate data.
  In order to avoid repeated changes to the parameters, the setting of parameter **Max Speed 1 (pu) [02.09]** must be done keeping in mind that the per-unit normalization of all speed variables depends on this parameter. For example, if the motor works only in the nominal range of speed, the maximum speed must be set to the synchronous speed displayed in parameter **Synchro Speed [02.17]**. If the motor instead works in defluxing mode maximum speed must be set to the upper limit of speed reference.
- 06.01 ÷ 06.31 (Drive, particularly 06.01 and 06.24)
  Drive nameplate parameter.
- 21.05, 21.06 (SPEED CONTROL) Check the defaults values.
- 24.01 ÷ 24.03 (V/f CONTROL) Check the defaults values, later it may need to correct the parameter **Boost Gain [24.03]**.
- For safety, for the first starts it is recommended to reduce the fixed torque limits defined by the parameters **Pos Torque Limit 1 [22.01]** e **Neg Torque Limit 1 [22.02]** to +/- 20%.

6. In order to have an optimal functioning of Drive it is necessary to set correctly the value of the voltage drop over stator resistance parameter **Voltage Drop Over Rs [07.03]**. If the value of this parameter is not know it is possible to use the auto-identification.

WARNING: during this procedure voltage shall be applied to the motor. For auto-identification results to be valid this test should be performed with the rotor locked; often the inertia of the load is sufficient to prevent movements; verify that an eventual rotation does not result in any danger.
For standard motors with output exceeding 20 kW the auto-identification procedure can be also performed without the rotor locked, with adequate results. With special motor or with motor of small power there may be some problems with the identification algorithm. In this case it may be necessary to lock the rotor or to use the default values.

If the inertia of the load is not sufficient to prevent movements, after the auto-identification, you must check that the value of parameter **Voltage Drop Over Rs [07.03]** value is consistent with motor type being used.
To perform the auto-identification first verify that the Drive is in manual mode, then, with Drive in READY TO ON state (the ON led blinking) close the Drive Enable terminal:
Terminal: XME 27 (DE).
In order to enabling the test, set the parameter **Static Test ID 1 [07.01]** (Locked-Rotor ID) to Test On, then confirm with Canc/Enter key and follow the dialog box instructions; finally set the parameter **Static Test ID 1 [07.01]** to Test Done.
If the value of voltage drop over stator resistance is not know and it is not possible to perform the auto-identification, refer initially (for 4 poles motor) to the table below.

1 kW	10 kW	100 kW	500 kW
0,060 pu	0,040 pu	0,020 pu	0,016 pu

7. Check that the parameter **Static Test ID 1 [07.01]** to Test Done.
8. If the per-unit estimated value of voltage drop over stator resistance is correct (parameter **Voltage Drop Over Rs [07.03]**) it is not necessary to modify the boost gain of V/f control (parameter **Boost Gain [24.03]**). Therefore it can remain at the default value.
   The boost gain allows you to apply small changes without changing the voltage drop over the stator resistance. The actual voltage boost is the product of these two parameters: if the motor vibrates around the zero and it don't follow the speed reference it is necessary to increase the boost; However if the motor tries to rotate in the opposite direction it is necessary to decrease the boost.
9. For operation in manual mode (keypad) see paragraph 6.2.

PREVIOUS VIEW

6.2 OPERATION IN MANUAL MODE (FROM KEYPAD)

10. Close the Drive Enable command (Terminal: XME 27 - DE).
    It is a hardware command to be supplied by the user.
11. Press MAN START to select local mode (from the keypad)
    The keypad displays message "Manual Press enter to confirm"
12. Press Canc Enter to confirm.
    At this point the terminal returns in monitor mode and the "On" led blinks to indicate local operation. The Drive is predisposed in READY TO SWITCH ON status.
    If this procedure needs to be quitted, press the SHIFT key and then Canc Enter.
13. To start the motor press the MAN START key, the Drive is predisposed in READY TO OPERATE status and the RUN led is switched on.
14. Now the Drive is working and the speed reference is set to zero.
    The speed reference can be increased/decreased with the ▲ and ▼ keys.
    When the up ▲ and down ▼ keys are pressed, a window appears to the bottom left of the display indicating the reference value sent to the Drive. This window remains for 5 seconds after the up ▲ and down ▼ keys have been released.
15. Check the motor rotation direction. If wrong, invert two phases at the ends of motor U, V, W and check again; it is also possible to set the parameter **Phase Reverse [06.28]**.
16. To stop the motor press the STOP key. When the motor stops the "RUN" led is switched off.

6.3 OPERATION IN AUTOMATIC MODE

After the switching on and pre-charge phase, the Drive is set in "automatic operation" mode; it is in the READY TO SWITCH ON status and the keypad "ON" led is constantly switched on. The speed reference for Drive control comes from the outside.

To operate the following steps need to be complied with:

17. Close the Drive Enable command (Terminal: XME 27 - DE).
18. If in "manual" mode, press the AUTO key to select automatic operation.
    The keypad displays message "Auto Press enter to confirm", press the Canc Enter key to confirm (if this procedure needs to be quitted, press the SHIFT key and then Canc Enter).
19. Set the speed reference source to analog input 1, terminals XME - 33 (AL1-), 34 (AL1+)
    To choose as speed reference the signal coming from analog input 1, "AI1" needs to be set in parameter **Main Speed Ref Sel [32.01]**. The input signal can be 0 - 20mA (4 - 20mA) or 0 - 10V. To have the motor work at the speed defined by the parameter **Synchro Speed [02.17]**, a 10V value needs to be set at analog input 1.
20. Close the Start/Stop command:
    It is a hardware command to be supplied by the user at terminal XME 26. The Drive switches over to the READY status, the "RUN" led is switched on and the motor starts accelerating based on the ramp times until the reference value set.
    The reverse direction of rotation is controlled by the terminal XME 25.
    If the parameter **DI Run Fw/Rv Conntect. [31.10]** is set to "DI1: Run - DI2: Fw/Rv", the direction of rotation depends on the logical value of terminal XME 25.
21. When the Start/Stop command is removed (OFF), the motor stops in ramp and when the motor is stopped the "RUN" led is switched off.

For further information concerning analog and digital inputs and outputs, refer to the User and Maintenance Manual.

PREVIOUS VIEW

7 CONTROL MODE SELECTION AND SETTINGS

AD1000 makes available 2 control mode:
- V/f
- Sensorless

V/f control mode is a standard V/f regulation in which the aim of the Drive is to keep constant the magnet flux of the electric motor supplying the electric motor with frequency proportional to the desired speed (speed reference) and voltage proportional to the frequency in order to keep constant the ratio voltage/frequency (V/f), that is proportional to the flux electric motor. V/f control mode doesn't need encoder feedback.
Sensorless control mode is a more performant control mode. It is a mix of V/f control and vector control derived from FOC (Field Oriented Control), without the need of encoder feedback; also in this case, the magnet flux of the electric motor is constant, but in this case is a consequence of the vector control strategy.

In AD1000 software release and related documents, the 2 control mode are also indicated:
- Scalar V/f for V/f control mode
- Vector V/f for Sensorless control mode

It is possible to set the control mode using the parameter **Scalar V/f En [24.07]**. Default value is On. In order to set Sensorless control mode, set the parameter **Scalar V/f [2407]** to Off.

PREVIOUS VIEW

8 STATES MACHINE AND PROCESS DATA

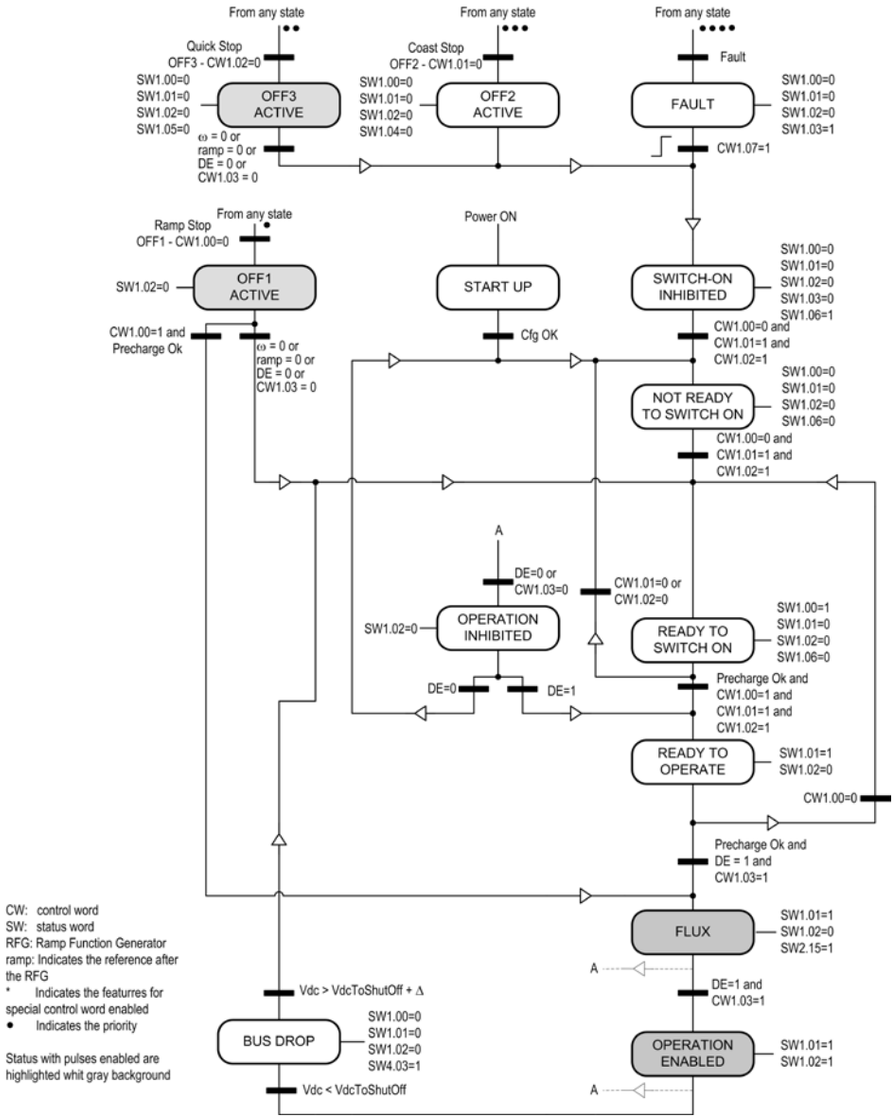
8.1 STATES MACHINE

The interface of the Drive with Basis card is based on the PROFIDrive communication profile for class 1 applications. The first class of PROFIDrive applications represents the most widespread case, that is the "Standard Drive" that always receives the primary set-point, for instance speed, from an external controller (PLC). The second class corresponds to the "Standard Drive with distributed technology controller" and refers to the possibility of implementing PLC-type functions onboard the Drive itself.

The Drive states machine can be controlled from the outside through the bits of the main command word **Cmd Wd 1 [51.06]** and current system status is described by the main status word **Status Wd 1 [52.01]**; both are expressed in the format provided by communication standard PROFIDrive.

Other two command words **(Cmd Wd 2 [51.07], Cmd Wd 4 [51.09])** and other two status words (**Status Wd 2 [52.02], Status Wd 3 [52.03]**) allow controlling Drive auxiliary sequences and functions.
To the words providing information on Drive control current status also alarm words (**Alarm Wd 1 [52.05], Alarm Wd 2 [52.06], Alarm Wd 3 [52.07]** and **Alarm Wd 4 [52.08]**) need to be added.

Figure 8.1 States machine for Basis Drive



PREVIOUS VIEW

8.2 MAIN STATES OF THE SEQUENCE

Please note that, for every status providing more than one output transition, stop commands have a higher priority than any other command and that also among the latter a decreasing priority order exists, as follows:
1) Coast Stop (or Emergency OFF or OFF2), free stop
2) Quick Stop (or Emergency Stop or OFF3), quick ramp stop
3) Ramp Stop (or OFF1), pre-set ramp stop

NOTE
Please note that with motor in Stop we just mean that the internal ramp generator (RFG) completed the expected deceleration trajectory achieving **Zero Speed [32.21]** and not that the motor is actually stopped or that (real or estimated) speed feedback is null.

START-UP
This status immediately follows the reset/power-on command of the control card (Basis card). The Drive control is initialized with the configuration parameters, in particular parameter **Precharge Delay [12.08]** (waiting time for sending the CTLR pre-charge end command). Only at the end of the Drive control initialization operations communication with the fieldbus is enabled.
Drive functions are disabled.

Status Word 1 (bit 15...0)	XXXX XX**0**X XXXX XXXX

NOT READY TO SWITCH - ON
Power can either be present or not in the Drive (based on machine configuration).
Pulses are certainly disabled and no energy is applied to the load.
Drive parameters can be modified (from user interface or PLC with fieldbus).
Drive functions are disabled.

Status Word 1 (bit 15...0)	XXXX XX1X X0XX 000**0**

SWITCH – ON INHIBITED (or SWITCH – ON DISABLE)
Power can either be present or not in the Drive (based on machine configuration).
Pulses are certainly disabled and no energy is applied to the motor.
Drive parameters can be modified (from user interface or PLC with fieldbus).
Drive functions are disabled.

Status Word 1 (bit 15...0)	XXXX XX1X X**1**XX 0000

READY TO SWITCH-ON
The emergency command has been removed and everything is ready for machine power insertion.
Power can either be present or not.
Drive parameters can be modified (from user interface or PLC with fieldbus).
Drive functions are disabled.
For pre-charge management see paragraph 9.26.

Status Word 1 (bit 15...0)	XXXX XX1X X011 000**1**

READY TO OPERATE (or READY or SWITCH – ON)
The machine is supplied and correctly pre-charge, the bypass contactor and the main contactor (if managed) are closed: Drive is Ready.
Drive parameters can be modified.

Status Word 1 (bit 15...0)	XXXX XX1X X011 00**1**1

OPERATION ENABLED
Drive functions (pulses and regulation) are enabled and power is applied to the motor.
This status corresponds to the normal system working status within which also auxiliary sequences can be performed (Fly-Start, Jog, etc.).
For instance, the tests for parameter identification are activated in this status if command CW1.03 is set and the procedure itself is previously enabled through the enable parameter (families **MOTOR ID 1 [07.00]** and **INERTIA ID [10.00]**).
Only those parameters explicitly marked as "modifiable with Drive running" can be updated in this status.

Status Word 1 (bit 15...0)	XXXX XX1X X011 0**1**11

OFF1 ACTIVE (or RAMP STOP)
Controlled ramp stop (OFF1) is performed, during which Drive functions are enabled and power is applied to the motor.
Once **Zero Speed [32.21]** has been reached, the Drive control takes power away from the motor and switches automatically over to status READY TO SWITCH-ON, if there are no other OFF commands active.
If during controlled deceleration the ON command (**Cmd Wd 1 [51.06]**, bit 1) returns to 1, the Drive control starts again from status READY TO OPERATE, unless other interlock conditions are present.
Only those parameters explicitly marked as "modifiable with Drive running" can be updated.

Status Word 1 (bit 15...0)	XXXX XX1X X011 0**0**11
Status Word 2 (bit 15...0)	XXXX **1**XXX XXXX XXXX

PREVIOUS VIEW

OFF2 ACTIVE (or COAST STOP or EMERGENCY OFF)
Free stop is performed (or OFF2 or Emergency OFF); Drive functions are disabled and no power is applied to the motor.
It is not possible to modify Drive control parameters.

Status Word 1 (bit 15...0)	XXXX XX1X X01**0** 00XX

OFF3 ACTIVE (or QUICK STOP or EMERGENCY STOP)
Quick ramp stop (or Emergency Stop) is performed; once **Zero Speed [32.21]** has been reached, the Drive control takes power away from the motor and switches automatically over to status SWITCH-ON INHIBITED.
It is not possible to modify Drive control parameters.

Status Word 1 (bit 15...0)	XXXX XX1X X0**0**1 00XX

FAULT
The protection action associated to a Fault can be modified by a command with higher priority: for instance, the ramp stop action provided for a fault can be interrupted by the quick stop action associated with another fault that intervened in the meantime and the latter can, in turn, be interrupted by an Emergency OFF command (**Cmd Wd 1.01=0**) from the PLC.

Whatever the command sequence is, Drive control ends up anyway in FAULT status and switches over to the following status only if:
- The acknowledge command (0➡1) arrives from operator/controller
- There are no active faults

Exceptions, not programmed as Faults, generate simple Warnings and do not bring to this status.
Transition from one status to the other can be inhibited also in the presence of alarms programmed only as Warnings, such as “DspInitErr” already signaling a wrong configuration during the Drive control initialization phase.

In case of protection it is possible to directly force complete power. As a matter of fact, in the alarms management family parameter **Power Off if HW Fault [36.65]** is provided, to request switching off in case of HW fault (those defined in the **Alarm Wd1 [52.05]**). See paragraph 12.2.

Status Word 1 (bit 15...0)	XXXX XX1X X0XX **1**XXX

PREVIOUS VIEW

8.3 NORMALIZATION OF DATA

Process data and parameter expressed in per-unit are normalized to the characteristic quantity of Drive-motor system. These are set with parameters of families **INDUCTION MOTOR [02.00], Drive [06.00]** and **PER-UNIT BASE DATA [13.00]**.

The reference value of characteristic quantity, in engineering units, are displayed in the family **PER-UNIT BASE DATA [13.00]**.
The following table lists, for each normalized quantity, the reference quantity and the parameter where his value is displayed.
For the selection of IEC or NEMA units of measure refer to paragraph 5.5

Table 8.1 – Per-Unit reference quantity

Quantity type	Normalized to:		Related parameter in family PER-UNIT BASE DATA	
	Parameter	Id	Parameter	Id
Voltage DC	Vdc Bus	06.31	Per-Unit DC-Bus Voltage	13.01
Voltage AC	Rated Voltage	02.03	Per-Unit AC Voltage	13.02
Current	Rated Current	02.04	Per-Unit Current	13.03
Frequency	Max Freq*	02.18	Per-Unit Frequency	13.04
Power [kW]	Rated Power	02.01	Per-Unit Power	13.05
Power [HP]	Rated Power	02.91	Per-Unit Power	13.91
Torque [Nm]	Rated Torque*	02.20	Per-Unit Torque	13.06
Torque [lb*ft]	Rated Torque*	02.92	Per-Unit Torque	13.92
Speed	Max Speed	02.09	Per-Unit Speed	13.07
Pressure 1 [bar]	User Per-Unit Press. 1	13.11	User Per-Unit Press. 1	13.11
Pressure 1 [PSI]	User Per-Unit Press. 1	13.31	User Per-Unit Press. 1	13.11
Flow 1 [m^3/h]	User Per-Unit Flow 1	13.12	User Per-Unit Flow 1	13.12
Flow 1 [GPM]	User Per-Unit Flow 1	13.32	User Per-Unit Flow 1	13.12
Level 1 [m]	User Per-Unit Level 1	13.13	User Per-Unit Level 1	13.13
Level 1 [ft]	User Per-Unit Level 1	13.33	User Per-Unit Level 1	13.13
Temperature 1 [°C]	User Per-Unit Temperature 1	13.14	User Per-Unit Temperature 1	13.14
Temperature 1 [°F]	User Per-Unit Temperature 1	13.34	User Per-Unit Temperature 1	13.34

*The value is not entered by the user but it is automatically calculated by the Drive.

PREVIOUS VIEW

Quantity type	Normalized to:		Related parameter in family PER-UNIT BASE DATA	
	Parameter	Id	Parameter	Id
Pressure 2 [bar]	User Per-Unit Press. 2	13.21	User Per-Unit Press. 2	13.21
Pressure 2 [PSI]	User Per-Unit Press. 2	13.41	User Per-Unit Press. 2	13.21
Flow 2 [m^3/h]	User Per-Unit Flow 2	13.22	User Per-Unit Flow 2	13.22
Flow 2 [GPM]	User Per-Unit Flow 2	13.42	User Per-Unit Flow 2	13.22
Level 2 [m]	User Per-Unit Level 2	13.23	User Per-Unit Level 2	13.23
Level 2 [ft]	User Per-Unit Level 2	13.43	User Per-Unit Level 2	13.23
Temperature 2 [°C]	User Per-Unit Temperature 2	13.24	User Per-Unit Temperature 2	13.24
Temperature 2 [°F]	User Per-Unit Temperature 2	13.44	User Per-Unit Temperature 2	13.44

8.4 PROCESS DATA

8.4.1 COMMAND WORDS

Table 8.2 – Command Words

51 - COMMAND WORDS			
Index	Name	Description	Access Type
51.01	Ext Cmd Wd - Ter Board	Command Word from Terminal Board (see parameter Cmd Wd 1 Sel [31.01])	Read Write
51.02	Ext Cmd Wd 1	Command Word Ext 1	Read Write
51.03	Ext Cmd Wd 2	Command Word Ext 2	Read Write
51.04	Ext Cmd Wd 3	Command Word Ext 3 (reserved)	Read Write
51.05	Ext Cmd Wd 4	Command Word Ext 4	Read Write
51.06	Cmd Wd 1	Command Word 1	Read Write
51.07	Cmd Wd 2	Command Word 2	Read Write
51.08	Cmd Wd 3	Command Word 3 (reserved)	Read Write
51.09	Cmd Wd 4	Command Word 4	Read Write

PREVIOUS VIEW

COMMAND WORD 1
The main Drive control command word complies with STW1 of the PROFIDrive standard used in “Speed Control Mode” and is defined in the following table.

Table 8.3 – Command Word 1

Bit	Val	Name	Description
0	1	ON	Pulse enable possible. Enter "Ready" state if in "Ready to switch-on" state.
	0	Ramp Stop (OFF1)	Ramp stop. At standstill enter the "Not Ready to Switch-ON" state (if OFF 2 or OFF3 are not present). The Ramp Stop can be interrupted by a Switch-ON command.
1	1	No OFF2	No OFF2. ➡ Pulse enable possible.
	0	Coast Stop (OFF2)	Coast to stop, then enter "Switch-ON Inhibited" state. A Coast Stop command is not interruptible (no return to operation).
2	1	No OFF3	No OFF3. Pulse enable possible.
	0	Quick Stop (OFF3)	Quick stop, then enter "Switch-ON Inhibited" state. A Quick Stop command is not interruptible (no return to operation).
3	1	Enable Operation	Enable operation. If bit 0, 1 and 2 of Cmd Wd 1 are set to 1 the power is inserted. Pulse enable possible.
	0	Disable Operation	Inhibit operation. Cancel the pulses to IGBT. The Drive coasts down to a standstill.
4	1	Enable Ramp Generator	Ramp-function generator enabling.
	0	Reset Ramp Generator	Ramp-function generator disabling. Set Ramp-function generator output to zero.
5	1	Unfreeze Ramp Generator	Start Ramp-function generator.
	0	Freeze Ramp Generator	Actual frequency reference from Ramp-function generator is frozen.

PREVIOUS VIEW

Bit	Val	Name	Description
6	1	Enable Setpoint	Ramp-function generator input is enabled.
	0	Disable Setpoint	Ramp-function generator input is set to zero.
7	1	Acknowledge Fault (0 ➡ 1)	Acknowledge faults on positive edge.
	0	No effect	No effect.
8	1	Jog1 ON	Jogging 1 ON. ➡ Prerequisite: Operation is enabled, Drive is in standstill and bit 4, 5, 6 of Status Wd 1 = 0.
	0	Jog1 OFF	Jogging 1 OFF
9	1	Jog2 ON	Jogging 2 ON. ➡ Prerequisite: Operation is enabled, Drive is in standstill and bit 4, 5, 6 of Status Wd 1 = 0
	0	Jog2 OFF	Jogging 2 OFF
10	1	Remote Control	This bit must be set by PLC in order to enable the external commands.
	0	No Remote Control	Process data from PLC are considered invalid. If the freeze option is enabled the “last valid data” are used.
11	1	Reverse	Command to reverse the rotation direction.
	0	No Reverse	Not reverse the rotation direction.
12	1	Configurable	-
	0	Configurable	-
13	1	Configurable	-
	0	Configurable	-
14	1	Configurable	-
	0	Configurable	-
15	1	Configurable	-
	0	Configurable	-

PREVIOUS VIEW

COMMAND WORD 2

Table 8.4 – Command Word 2

Bit	Val	Name	Description
0	1	PRE-FLUX	Enabling the Flux-Up function (see table 10.13).
1	1	TORQUE_FFW_EN	Enabling the torque Feedforward.
2	1	RESET_SPEED_INT	Reset actual speed controller integral part.
3	1	Bit 3	Reserved.
4	1	GENERATOR_OFF	Disable Generator macro output (see table 10.20).
5	1	VDC_CTRL_ON	Switch Generator macro to DC bus voltage control (only if Generator macro is enabled: and CW2.04 = 0) (see table 10.20).
6	1	MF_ON	Activate Master/Follower macro (see table 10.14).
7	1	TORQUE_LIM_SET2	Use the 2nd set of torque limits.
8	1	RAMP_SET2	Use the 2nd set of ramp acceleration/deceleration.
9	1	FIXED_TIME_RAMP	Activate fixed-time ramp operations (see table 10.2).
10	1	GAIN_SET_SEL1	First bit for speed control gain set selection.
11	1	GAIN_SET_SEL2	Second bit for speed control gain set selection.
12	1	Bit 12	Reserved
13	1	RESET_POS_COUNT1	Reset position counters from speed feedback device 1.
14	1	Bit 14	Reserved
15	1	Bit 15	Reserved

PREVIOUS VIEW

COMMAND WORD 3
Command word 3 of the Drive control is for internal use only.

COMMAND WORD 4

Table 8.5 – Command Word 4

Bit	Val	Name	Descriptions
0	1	UP	Digital Potentiometer Up command
1	1	DOWN	Digital Potentiometer Down command
2	1	CLEAR	Digital Potentiometer Clear command
3	1	FIXED_SEL1	First bit for selecting the fixed speed reference (see table 10.3)
4	1	FIXED_SEL2	Second bit for selecting the fixed speed reference (see table 10.3)
5	1	AUX_REF_ON	Command for switchover between Main Speed Ref and External Aux Speed Ref (see table 10.1)
6	1	ADDSPEEDREF_EN	Command to enable Additional Speed Ref
7	1	SPDFFW_EN	Command to enable Speed Feedforward
8	1	TORQUE_LIM_SEL2	Second bit for selecting the torque limit set
9	1	Bit 9	Reserved
10	1	LOWCITY	Command to enable the Low City function
11	1	MOTORSWITCH	Command to enable the Motor Switch function
12	1	AUTOCLEANING	Command to enable the Autocleaning function
13	1	Bit 13	Reserved
14	1	Bit 14	Reserved
15	1	Bit 15	Reserved

PREVIOUS VIEW

8.4.2 STATUS WORD

Table 8.6 – Status Words and Alarms Words

52 - STATUS WORDS			
Index	Name	Description	Access Type
52.01	Status Wd 1	Status Word 1	Read Only
52.02	Status Wd 2	Status Word 2	Read Only
52.03	Status Wd 3	Status Word 3	Read Only
52.04	Status Wd 4	Status Word 4	Read Only
52.05	Alarm Wd 1	Alarm Word 1	Read Only
52.06	Alarm Wd 2	Alarm Word 2	Read Only
52.07	Alarm Wd 3	Alarm Word 3	Read Only
52.08	Alarm Wd 4	Alarm Word 4	Read Only
52.11	First Alarm	First alarm logged in the buffer	Read Only
52.12	Last Alarm	Last alarm logged in the buffer	Read Only

PREVIOUS VIEW

STATUS WORD 1
Status word 1 of the Drive command complies with ZSW1 of the PROFIDrive standard used in "Speed Control Mode" and is defined in the following table.

Table 8.7 – Status Word 1

Bit	Val	Name	Description
0	1	Ready To Switch-On	READY TO SWITCH-ON. Cmd Wd 1 bit 0=0 and bits 1, 2, 10 are set to 1. The emergency command has been removed and everything is ready for power insertion. Power can either be present or not (depends on the Drive configuration). Drive parameters can be modified (from user interface or PLC with fieldbus). Drive functions are disabled.
	0	Not Ready To Switch-on	NOT READY TO SWITCH-ON. Cmd Wd 1 bit 0, 1 or 2 (OFF1, OFF2, OFF3) is set to 0, or the Drive is tripped.
1	1	Ready To Operate	READY TO OPERATE. Cmd Wd 1 bit 0, 1 and 2 are set to 1. The machine is supplied and correctly pre-charge, the bypass contactor and the main contactor (if managed) are closed: Drive is Ready.
	0	Not Ready To Operate	Cmd Wd 1 bit 0, 1 or 2 (OFF1, OFF2, OFF3) is set to 0, or the Drive is tripped.
2	1	Operation Enabled	OPERATION ENABLED. Drive functions (pulses and regulation) are enabled and power is applied to the motor.
	0	Operation Disabled	Operation inhibited. Cmd Wd 1 bit 0, 1, 2 or 3 (OFF1, OFF2, OFF3, Operation disabled) is set to 0, or the Drive is faulted.
3	1	Fault	FAULT. Faults are present. Faults can lead to specific fault reactions. The Drive goes into the "Switch-ON Inhibited" condition once the fault has been acknowledge and the cause has been remedied.
	0	No fault	No active fault
4	1	Coast Stop Not Activated (no OFF2)	No OFF2 active.
	0	Coast Stop Activated (OFF2)	Coast stop active.
5	1	Quick Stop Not Activated (no OFF3)	No OFF3 active.
	0	Quick Stop Activated (OFF3)	Quick stop active.

PREVIOUS VIEW

Bit	Val	Name	Description
6	1	Switch-ON Inhibited	SWITCH-ON INHIBITED. Cmd Wd 1 bit 1 or 2 (OFF2, OFF3) is set to 0 or fault has been acknowledged. A restart is possible through Ramp Stop (OFF1) followed by ON (with No OFF2 and No OFF3).
	0	Switch-On Not Inhibited	Switch-ON not inhibited. Cmd Wd 1 bit 0=0 and bit10=1.
7	1	Warning	Warning is present. No acknowledgement necessary.
	0	No Warning	There is no warning or the warning has disappeared.
8	1	Feedback equal Ref	Actual output frequency does equal frequency set point. Speed error is within tolerance bandwidth.
	0	Feedback not equal Ref	Speed error not within tolerance band.
9	1	Control Requested	This bit is set by the slave if it is prepared to be controlled by the master PLC. The bit is set without waiting for Cmd Wd 1 bit 10 from master. Precondition: the control has to be set to the PROFIBUS interface (see chapter 11).
	0	No Control Requested	Local operation.
10	1	Ref Reached Or Exceeded	Actual value is equal to or greater than the speed reference.
	0	Ref Not Reached	Actual value is lower than the reference.
11	1	DE Input signal received	Drive Enabled signal received.
	0	DE Input not signal received	Drive Enabled signal not received.
12	1	Configurable	-
	0	Configurable	-
13	1	Configurable	-
	0	Configurable	-
14	1	Configurable	-
	0	Configurable	-
15	1	Configurable	-
	0	Configurable	-

PREVIOUS VIEW

Table 8.8 – Status Word 2

Bit	Val	Name	Description
0	1	SPEED_LIM	Speed reference limit reached.
1	1	CURR_LIM	Current reference limit reached.
2	1	TORQUE_LIM	Torque reference limit reached.
3	1	VOLT_LIM	Output voltage limit reached (defluxing, DC bus voltage limit, etc.).
4	1	PRECHARGED	DC bus pre-charged.
5	1	FLUXED	Fluxed motor.
6	1	CTLRM	Line contactor command
7	1	MIN_SPEED	Actual motor speed is lower than the one set in parameter Min Speed [32.19].
8	1	ZERO_SPEED	Actual motor speed is lower than the one set in parameter Zero Speed [32.21].
9	1	FLY_START	Function Fly Start active.
10	1	RAMP_END	Ramp function finished. The ramp output is equal to the input reference value.
11	1	PULSES_ENABLED	Drive command pulses enabled.
12	1	BRAKE_ON	Dynamic Brake Resistor (braking chopper) active.
13	1	OV_CONTROL_ON	DC-Bus overvoltage controller is active.
14	1	UV_CONTROL_ON	DC-Bus undervoltage controller is active
15	1	Bit 15	Reserved

PREVIOUS VIEW

STATUS WORD 3
Status word 3 of the Drive control is for internal use only.

STATUS WORD 4

Table 8.9 – Status Word 4

Bit	Val	Name	Description
0	1	Bit 0	Reserved
1	1	RUN_INHIBITED	Run Inhibited state reached
2	1	DIGIPOT_TRACK_ON	Digital potentiometer tracking enabled
3	1	BUS_DROP	Bus drop state reached
4	1	AUX_PUMP1	Auxiliary pump 1 enabled
5	1	AUX_PUMP2	Auxiliary pump 2 enabled
6	1	AUX_PUMP3	Auxiliary pump 3 enabled
7	1	AUX_PUMP4	Auxiliary pump 4 enabled
8	1	AUX_PUMP5	Auxiliary pump 5 enabled
9	1	AUX_PUMP6	Auxiliary pump 6 enabled
10	1	Bit 10	Reserved
11	1	Bit 11	Reserved
12	1	Bit 12	Reserved
13	1	Bit 13	Reserved
14	1	Bit 14	Reserved
15	1	Bit 15	Reserved

PREVIOUS VIEW

8.4.3 ALARMS WORDS

WARNING
The alarm of Alarm Word 1 are hardware protections. Their action in case of fault is not configurable (except the External Fault).
When an alarm of AW1 is triggered, the bit of this alarm in AW1 is set to 1 and its status does not change, even if the failure cause has disappeared, until receipt an alarm reset command.

The alarm of Alarm Word 2 are software protections. Their action in case of fault is configurable.
In the table below the alarms of AW2 alarms, whose status bit switch over to 0 even in the absence of an alarm reset command if the failure cause has disappeared, are marked with (*).
However, when an alarm is triggered the fault bit of Status Word 1 (SW1.3) is set to 1 and its status does not change, even if the failure cause has disappeared, until receipt an alarm reset command.

Table 8.10 – Alarms

Code	Name	Word.bit	Configuration parameter Id	Default action	Possible actions	Description
01	WatchDog	AW1.00	36.01	Coast Stop	Coast Stop (type of action is not configurable)	Watchdog
02	AC Supply	AW1.01	36.02			AC Line Supply
03	VdcOV	AW1.02	36.03			DC-bus overvoltage
04	IGBTDesat	AW1.03	36.04			IGBT Power Module Fault
05	OverHeat	AW1.04	36.05			Drive overtemperature
06	Earth	AW1.05	36.06			Short-circuit/Earth Fault at motor side based on sum current measurement
07	OverCur	AW1.06	36.07			Drive Output Overcurrent
08	PrcTimeout	AW1.07	36.08			DC-Link Precharge Timeout
09	ExtFault	AW1.08	36.09	Off	Off Coast Stop Quick Stop Ramp Stop	External Fault. If enabled the external fault is associated with DI3 digital input.
10	--	AW1.09	36.10	Coast Stop	Coast Stop (type of action is not configurable)	Reserved
11	VdcUV	AW1.10	36.11			DC-bus undervoltage
12	VminSupply	AW1.11	36.12			Minimum supply at power cards
13	POKFail	AW1.12	36.13			Power Card Failure
14	--	AW1.13	36.14			Reserved
15	--	AW1.14	36.15			Reserved
16	LinePhase	AW1.15	36.16			Line Phase Loss or measurement error

PREVIOUS VIEW

Code	Name	Word.bit	Configuration parameter Id	Default action	Possible actions	Description
17	MotorOL	AW2.00	36.17	Coast Stop	Off Coast Stop Quick Stop Ramp Stop Warning	Motor overload limit exceeded
18	ConvOL	AW2.01	36.18	Coast Stop	Coast Stop Quick Stop Ramp Stop Warning	Drive overload limit exceeded
19	--	AW2.02	36.19	Off	Off Coast Stop Quick Stop Ramp Stop Warning	Reserved
20	--	AW2.03	36.20	Off		Reserved
21	Underload	AW2.04	36.21	Warning		Reserved
22	NoFlux	AW2.05	36.22	Warning		Motor flux-up exceeded configured timeout (see par. 9.17)
23	MaxCurLim	AW2.06	36.23	Off		Motor current exceeded configured threshold (*)
24	SpeedDev	AW2.07	36.24	Warning		Motor speed error between ref. and fdb. is out of tolerance (see. par. 9.19) (*)
25	OverSpeed	AW2.08	36.25	Coast Stop		Motor Overspeed (*)
26	--	AW2.09	36.26	Off		Reserved
27	DSPInitEr	AW2.10	36.27	Coast Stop	Coast Stop (type of action is not configurable)	Data configuration error during initialization
28	DSPParEr	AW2.11	36.28	Warning	Off Coast Stop Quick Stop Ramp Stop Warning	Data configuration error during parameter change
29	UVCtrlLim	AW2.12	36.29	Off		DC-bus voltage < UV Control Limit
30	OVCtrlLim	AW2.13	36.30	Warning		DC-bus voltage > OV Control Limit (*)
31	--	AW2.14	36.31	Off		Reserved
32	ADCAutoCal	AW2.15	36.32	Coast Stop		ADC auto-calibration error

PREVIOUS VIEW

Code	Name	Word.bit	Configuration parameter Id	Default action	Possible actions	Description
33	FlyStartEr	AW3.00	36.33	Coast Stop	Off Coast Stop Warning	FlyStart search failed
34	--	AW3.01	36.34	Off		Reserved
35	--	AW3.02	36.35	Off		Reserved
36	--	AW3.03	36.36	Off		Reserved
37	--	AW3.04	36.37	Off		Reserved
38	--	AW3.05	36.38	Off		Reserved
39	Mon1Alarm	AW3.06	36.39	Off		Analog Monitor, compare analog input with a threshold and a configurable logic
40	Mon2Alarm	AW3.07	36.40	Off	Off Coast Stop Quick Stop Ramp Stop Warning	Analog Monitor, compare analog input with a threshold and a configurable logic
41	AI Loss	AW3.08	36.41	Warning		Analog Command Loss
42	LogicAlarm	AW3.09	36.42	Off		Logic, one of the three possible configurable logic function is active
43	GWMaxTime	AW3.09	36.43	Coast Stop		Bus Drop and Grid Waiting
44	--	AW3.11	36.44	Off		Reserved
45	--	AW3.12	36.45	Off		Reserved
46	PrPidFdbLs	AW3.13	36.46	Warning		Process PID: Analog Feedback Loss, monitor process feedback
47	SfFillTime	AW3.14	36.47	Warning		Soft Fill, sequence timeout
48	--	AW3.15	(36.48)	Off		Reserved

PREVIOUS VIEW

Code	Name	Word.bit	Configuration parameter Id	Default action	Possible actions	Description
49	ProfiEr	AW4.00	36.49	Coast Stop	Off Coast Stop Quick Stop Ramp Stop Warning	Profibus error
50	ModbusEr	AW4.01	36.50	Coast Stop		Modbus slave error
51	BadPar	AW4.02	36.51	Off		Bad parameter (out of range)
52	MCUDSPTout	AW4.03	36.52	Coast Stop	Coast Stop Quick Stop Ramp Stop Warning	MCU ⬅➡ DSP Timout fail (from ETH-PROFI board)
53	MCUDSPSync	AW4.04	36.53	Warning	Off Coast Stop Quick Stop Ramp Stop Warning	MCU ⬅➡ DSP Synchronization fail (from ETH-PROFI board)
54	FrostProt	AW4.05	36.54	Warning		Frost Protection, monitor temperature
55	WDDSleepMd	AW4.06	36.55	Warning		Well Draw Down Sleep Mode
56	LwCityPres	AW4.07	36.56	Warning		Low City or Low Suction Inlet Pressure, monitor inlet pressure switch
57	MotrSwitch	AW4.08	36.57	Warning		Motor Switch, monitor status of the switch between Drive and motor
58	FdbMonitor	AW4.09	36.58	Warning		Process PID: Feedback Supervision, monitor process feedback threshold
59	inPresMon1	AW4.10	36.59	Warning		Process PID: Input Pressure Supervision, monitor inlet pressure threshold 1
60	inPresMon2	AW4.11	36.60	Coast Stop		Process PID: Input Pressure Supervision, monitor inlet pressure threshold 2
61	AutoClnCur	AW4.12	36.61	Warning		Auto-Cleaning Current Threshold
62	--	AW4.13	36.62	Off		Reserved
63	--	AW4.14	36.63	Off		Reserved
64	--	AW4.15	36.64	Off		Reserved

PREVIOUS VIEW

8.4.4 PROCESS DATA FOR SPEED / FREQUENCY CONTROL

Table 8.11

60 - SPEED REF						
Id	Name	Description	Unit	Min Value	Max Value	Access Type
60.01	Ext Main Speed Ref	External main speed reference	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Write
60.02	Ext Aux Speed Ref	External auxiliary speed reference	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Write
60.03	Speed Reference	Speed reference	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Write
60.04	Add Speed Reference	Additional speed reference	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Write
60.05	Speed Feedforward	Speed feedforward	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Write

Table 8.12

61 - SPEED FDB						
Id	Name	Description	Unit	Min Value	Max Value	Access Type
61.01	Speed Ref Used	Actual speed reference	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Only
61.02	Speed Fdb	Speed feedback	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Only
61.03	Speed Ctrl Output	Speed controller output	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
61.04	Speed Ctrl Integral	Speed controller integral	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
61.07	Follower Speed Corr	Speed reference correction used with speed controller Follower Drive	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Only
61.08	Speed Ref Demand	Speed/freq reference demand from all external sources used by the Drive	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Only

PREVIOUS VIEW

8.4.5 PROCESS DATA FOR CURRENT CONTROL

Table 8.13

53 - CURRENT REF						
Id	Name	Description	Unit	Min Value	Max Value	Access Type
53.02	Torque Ref	Torque reference	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Write
53.03	Pos Torque Lim Ref	Positive limit of torque reference	pu	0 @ 0.0 pu	32767 @ 4.0 pu	Read Write
53.04	Neg Torque Lim Ref	Negative limit of torque reference	pu	-32768 @ -4.0 pu	0 @ 0.0 pu	Read Write

PREVIOUS VIEW

Table 8.14

54 - CURRENT FDB						
Id	Name	Description	Unit	Min Value	Max Value	Access Type
54.01	Torque Ref Demand	Actual torque demand	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
54.02	Torque Ref Used	Torque reference used	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
54.05	Iq Ref	Iq reference	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
54.06	Id Ref	Id reference (Vector control only)	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
54.07	Iq Fdb	Iq feedback	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
54.08	Id Fdb	Id feedback	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
54.09	Actual Current	Actual output current	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
54.10	Actual Voltage	Actual output voltage	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Only
54.11	Vsq	Vsq	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Only
54.12	Vsd	Vsd	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Only
54.13	Vu	Vu	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Only
54.14	Vv	Vv	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Only
54.15	Vw	Vw	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Only
54.16	Iu	Iu	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
54.17	Iv	Iv	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
54.18	Iw	Iw	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
54.19	Iq Current Lim	Actual limit for the absolute value of Iq current	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
54.20	Current Fdb	Measured output AC phase current (without filtering)	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
54.22	Flux	Flux	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Only

PREVIOUS VIEW

54 - CURRENT FDB						
Id	Name	Description	Unit	Min Value	Max Value	Access Type
54.23	Pos Torque Lim	Positive torque limit	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
54.24	Neg Torque Lim	Negative torque limit	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
54.25	Electrical Angle	Electrical phase angle	pu	0 @ 0.0 pu	32767 @ 1.0 pu	Read Only
54.26	Iq Ref Norm Iqn	Actual Iq current reference relative to nominal torque current Iqn	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
54.27	Id Ref Norm Idn	Actual Id current reference relative to nominal torque current Idn	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
54.28	Inv Overload	Inv Overload	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Only
54.29	Motor Overload	Motor Overload	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Only

PREVIOUS VIEW

8.4.6 PROCESS DATA FOR DC-BUS CONTROL

Table 8.15

56 - DCBUS FDB						
Id	Name	Description	Unit	Min Value	Max Value	Access Type
56.01	Vdc Fdb	DC-Bus voltage	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Only
56.03	Active Power	Active power	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Only
56.06	Idc Estimated	Estimated DC-Bus current	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
56.07	DC Power	Measured DC-Bus power	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Only

8.4.7 DIGITAL I/O'S

Table 8.16

57 - DIGITAL						
Id	Name	Description	Unit	Min Value	Max Value	Access Type
57.01	DI W1	DI W1 status	#	-	-	Read Only
57.02	DI W2	DI W2 status	#	-	-	Read Only
57.03	DO W1	DO W1 status	#	-	-	Read Only
57.04	DO W2	DO W2 status	#	-	-	Read Only
57.05	SW1.12	Status for cfg output bit 12 in SW1	#	-	-	Read Only
57.06	SW1.13	Status for cfg output bit 13 in SW1	#	-	-	Read Only
57.07	SW1.14	Status for cfg output bit 14 in SW1	#	-	-	Read Only
57.08	SW1.15	Status for cfg output bit 15 in SW1	#	-	-	Read Only
57.10	Logic function OW1	Logic function output W1 status	#	-	-	Read Only

PREVIOUS VIEW

8.4.8 ANALOG INPUTS

Table 8.17

58 - ANALOG						
Id	Name	Description	Unit	Min Value	Max Value	Access Type
58.01	AI1 Value	AI1 value	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
58.02	AI2 Value	AI2 value	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
58.03	AI3 Value	AI3 value	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
58.04	AI4 Value	AI4 value	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
58.09	AI1 Raw Value	AI1 value before filtering	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
58.10	AI2 Raw Value	AI2 value before filtering	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
58.11	AI3 Raw Value	AI3 value before filtering	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
58.12	AI4 Raw Value	AI4 value before filtering	pu	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only

PREVIOUS VIEW

8.4.9 DIAGNOSTICS PROCESS DATA

Table 8.18

64 - DIAGNOSTIC						
Id	Name	Description	Unit	Min Value	Max Value	Access Type
64.04	Drive State	Actual drive state - ... [0] - Init [1] - Switch-On Inhibited [2] - Not ready to SwitchOn [3] - Ready to switch-on [4] - Ready to operate [5] - Fluxup [6] - Operation enabled [7] - Operation inhibited [8] - Ramp stop [9] - Quick stop [10] - Coast stop [11] - Fault [12] - OFF1 Fluxed [13] - Bus Drop [14] - ... [15] - ... [16] - ... [17] - ... [18] - ... [19] - ... [20]	#	0	20	Read Only
64.05	Settling Time	Speed feedback settling time after the speed reference step	#	0	65535	Read Only
64.06	DSP Main Tick	DSP main tick	#	0	0	Read Only
64.07	DSP Bad Par Id	DSP bad parameter ID	#	0	0	Read Only
64.21	AO1	Actual value of the variable sent to AO1	#	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only
64.22	AO2	Actual value of the variable sent to AO2	#	-32768 @ -4.0 pu	32767 @ 4.0 pu	Read Only

PREVIOUS VIEW

8.4.10 LOGS

Table 8.19

50 - ALARM BUFFER						
Id	Name	Description	Unit	Min Value	Max Value	Access Type
50.01	Log 1	Log 1	#	0	30	Read Only
50.02	Log 2	Log 2	#	0	30	Read Only
50.03	Log 3	Log 3	#	0	30	Read Only
50.04	Log 4	Log 4	#	0	30	Read Only
50.05	Log 5	Log 5	#	0	30	Read Only
50.06	Log 6	Log 6	#	0	30	Read Only
50.07	Log 7	Log 7	#	0	30	Read Only
50.08	Log 8	Log 8	#	0	30	Read Only
50.09	Log 9	Log 9	#	0	30	Read Only
50.10	Log 10	Log 10	#	0	30	Read Only

PREVIOUS VIEW

Table 8.20

59 - FAULT HISTORY						
Id	Name	Description	Unit	Min Value	Max Value	Access Type
59.01	Fault History 1	Fault History 1	#	0	30	Read Only
59.02	Fault History 2	Fault History 2	#	0	30	Read Only
59.03	Fault History 3	Fault History 3	#	0	30	Read Only
59.04	Fault History 4	Fault History 4	#	0	30	Read Only
59.05	Fault History 5	Fault History 5	#	0	30	Read Only
59.06	Fault History 6	Fault History 6	#	0	30	Read Only
59.07	Fault History 7	Fault History 7	#	0	30	Read Only
59.08	Fault History 8	Fault History 8	#	0	30	Read Only
59.09	Fault History 9	Fault History 9	#	0	30	Read Only
59.10	Fault History 10	Fault History 10	#	0	30	Read Only
59.11	Fault History 11	Fault History 11	#	0	30	Read Only
59.12	Fault History 12	Fault History 12	#	0	30	Read Only
59.13	Fault History 13	Fault History 13	#	0	30	Read Only
59.14	Fault History 14	Fault History 14	#	0	30	Read Only
59.15	Fault History 15	Fault History 15	#	0	30	Read Only
59.16	Fault History 16	Fault History 16	#	0	30	Read Only
59.17	Fault History 17	Fault History 17	#	0	30	Read Only
59.18	Fault History 18	Fault History 18	#	0	30	Read Only
59.19	Fault History 19	Fault History 19	#	0	30	Read Only

PREVIOUS VIEW

59 - FAULT HISTORY

Id	Name	Description	Unit	Min Value	Max Value	Access Type
59.20	Fault History 20	Fault History 20	#	0	30	Read Only
59.21	Fault History 21	Fault History 21	#	0	30	Read Only
59.22	Fault History 22	Fault History 22	#	0	30	Read Only
59.23	Fault History 23	Fault History 23	#	0	30	Read Only
59.24	Fault History 24	Fault History 24	#	0	30	Read Only
59.25	Fault History 25	Fault History 25	#	0	30	Read Only
59.26	Fault History 26	Fault History 26	#	0	30	Read Only
59.27	Fault History 27	Fault History 27	#	0	30	Read Only
59.28	Fault History 28	Fault History 28	#	0	30	Read Only
59.29	Fault History 29	Fault History 29	#	0	30	Read Only
59.30	Fault History 30	Fault History 30	#	0	30	Read Only
59.66	Fault Log Current Index	Fault Log Current Index	#	0	29	Read Only

PREVIOUS VIEW

Table 8.21

65 - TIME - RTC SETTINGS						
Id	Name	Description	Unit	Min Value	Max Value	Access Type
65.01	Time	Time	#	0	48	Read and Write
65.02	Time Setting - Year	Time Setting - Year	#	2000	2999	Read and Write
65.03	Time Setting - Month	Time Setting - Month	#	1	12	Read and Write
65.04	Time Setting - Day	Time Setting - Day	#	1	31	Read and Write
65.05	Time Setting - Hour	Time Setting - Hour	#	0	23	Read and Write
65.06	Time Setting - Min	Time Setting - Minute	#	0	59	Read and Write
65.07	Time Setting - Sec	Time Setting - Second	#	0	59	Read and Write
65.08	Time Setting – Week Day	Time Setting – Day of week	#	1	7	Read and Write

PREVIOUS VIEW

8.4.11 PROCESS DATA EXPRESSED IN ENGINEERING UNITS

For the selection of IEC or NEMA units of measure refer to paragraph 5.5

Table 8.22

75 - ELECTRICAL DATA						
Id	Name	Description	Unit	Min Value	Max Value	Access Type
75.01	Actual Current [A]	Actual current	A	-	-	Read Only
75.02	Speed Ref [rpm]	Speed reference	rpm	-	-	Read Only
75.03	DC Voltage [V]	DC voltage	V	-	-	Read Only
75.04	DC Current [A]	Measured DC-Bus current	A	-	-	Read Only
75.05	Actual Voltage [V]	Actual voltage	V	-	-	Read Only
75.06	DC Curr Estim [A]	Estimated DC-Bus current	A	-	-	Read Only
75.07	Speed Ref Used [rpm}	Speed reference used	rpm	-	-	Read Only
75.13	Active Power [kW]	Active power	kW	-	-	Read Only
75.91	Active Power [HP}	Active power	HP	-	-	Read Only
75.14	Actual Freq [Hz]	Actual frequency	Hz	-	-	Read Only
75.15	Freq Ref [Hz]	Frequency reference	Hz	-	-	Read Only
75.16	Actual Speed [rpm]	Actual speed	rpm	-	-	Read Only
75.21	Actual Ref Source	Reference source in use - Off [0] - Fixed [1] - AI1 [2] - AI2 [3] - AI3 [4] - AI4 [5] - Profibus [6] - Modbus [7] - Digital Pot [9] - PrsPID [10] - Keypad [11]	#	0	10	Read Only

PREVIOUS VIEW

65 - ELECTRICAL						
Id	Name	Description	Unit	Min Value	Max Value	Access Type
75.22	Active Curr [A]	Active current [A]	A	-	-	Read Only
75.23	React Curr [A]	Reactive current [A]	A	-	-	Read Only

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For the selection of IEC or NEMA units of measure refer to paragraph 5.5

Table 8.23

76 - HYDRAULIC						
Id	Name	Description	Unit	Min Value	Max Value	Access Type
76.01	Press. of Prs PID Ref 1	Pressure of Process PID Reference 1 [bar]	bar	-	-	Read Only
76.41	Press. of Prs PID Ref 1	Pressure of Process PID Reference 1 [PSI]	PSI	-	-	Read Only
76.02	Press. of Prs PID Fdb 1	Pressure of Process PID Feedback 1 [bar]	bar	-	-	Read Only
76.42	Press. of Prs PID Fdb 1	Pressure of Process PID Feedback 1 [PSI]	PSI	-	-	Read Only
76.03	Flow of Prs PID Ref 1	Flow of Process PID Reference 1 [m^3/h]	m^3/h	-	-	Read Only
76.43	Flow of Prs PID Ref 1	Flow of Process PID Reference 1 [GPM]	GPM	-	-	Read Only
76.04	Flow of Prs PID Fdb 1	Flow of Process PID Feedback 1 [m^3/h]	m^3/h	-	-	Read Only
76.44	Flow of Prs PID Fdb 1	Flow of Process PID Feedback 1 [GPM]	GPM	-	-	Read Only
76.05	Level of Prs PID Ref 1	Level of Process PID Reference 1 [m]	m	-	-	Read Only
76.45	Level of Prs PID Ref 1	Level of Process PID Reference 1 [ft]	ft	-	-	Read Only
76.06	Level of Prs PID Fdb 1	Level of Process PID Feedback 1 [m]	m	-	-	Read Only
76.46	Level of Prs PID Fdb 1	Level of Process PID Feedback 1 [ft]	ft	-	-	Read Only
76.07	Temp. of Prs PID Ref 1	Temperature of Process PID Reference 1 [°C]	C	-	-	Read Only
76.47	Temp. of Prs PID Ref 1	Temperature of Process PID Reference 1 [°F]	F	-	-	Read Only

PREVIOUS VIEW

76 - HYDRAULIC

Id	Name	Description	Unit	Min Value	Max Value	Access Type
76.08	Temp. of Prs PID Fdb 1	Temperature of Process PID Feedback 1 [°C]	C	-	-	Read Only
76.48	Temp. of Prs PID Fdb 1	Temperature of Process PID Feedback 1 [°F]	F	-	-	Read Only
76.21	Press. of Prs PID Ref 2	Pressure of Process PID Reference 2 [bar]	bar	-	-	Read Only
76.61	Press. of Prs PID Ref 2	Pressure of Process PID Reference 2 [PSI]	PSI	-	-	Read Only
76.22	Press. of Prs PID Fdb 2	Pressure of Process PID Feedback 2 [bar]	bar	-	-	Read Only
76.62	Press. of Prs PID Fdb 2	Pressure of Process PID Feedback 2 [PSI]	PSI	-	-	Read Only
76.23	Flow of Prs PID Ref 2	Flow of Process PID Reference 2 [m^3/h]	m^3/h	-	-	Read Only
76.63	Flow of Prs PID Ref 2	Flow of Process PID Reference 2 [GPM]	GPM	-	-	Read Only
76.24	Flow of Prs PID Fdb 2	Flow of Process PID Feedback 2 [m^3/h]	m^3/h	-	-	Read Only
76.64	Flow of Prs PID Fdb 2	Flow of Process PID Feedback 2 [GPM]	GPM	-	-	Read Only
76.25	Level of Prs PID Ref 2	Level of Process PID Reference 2 [m]	m	-	-	Read Only
76.65	Level of Prs PID Ref 2	Level of Process PID Reference 2 [ft]	ft	-	-	Read Only
76.26	Level of Prs PID Fdb 2	Level of Process PID Feedback 2 [m]	m	-	-	Read Only
76.66	Level of Prs PID Fdb 2	Level of Process PID Feedback 2 [ft]	ft	-	-	Read Only
76.27	Temp. of Prs PID Ref 2	Temperature of Process PID Reference 2 [°C]	C	-	-	Read Only
76.67	Temp. of Prs PID Ref 2	Temperature of Process PID Reference 2 [°F]	F	-	-	Read Only
76.28	Temp. of Prs PID Fdb 2	Temperature of Process PID Feedback 2 [°C]	C	-	-	Read Only
76.68	Temp. of Prs PID Fdb 2	Temperature of Process PID Feedback 2 [°F]	F	-	-	Read Only

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8.4.12 COMMUNICATION DIAGNOSTICS PROCESS DATA

Table 8.24

67 - COMMUNICATIONS						
Id	Name	Description	Unit	Min Value	Max Value	Access Type
67.01	Profibus error counter	Profibus error counter	#	-	-	Read Only
67.02	Modbus PKW1 In	Modbus PKW1 In	#	-32768	32767	Read Only
67.03	Modbus PKW2 In	Modbus PKW2 In	#	-32768	32767	Read Only
67.04	Modbus PKW3 In	Modbus PKW3 In	#	-32768	32767	Read Only
67.05	Modbus PKW4 In	Modbus PKW4 In	#	-32768	32767	Read Only
67.06	Modbus PKW1 Out	Modbus PKW1 Out	#	-32768	32767	Read Only
67.07	Modbus PKW2 Out	Modbus PKW2 Out	#	-32768	32767	Read Only
67.08	Modbus PKW3 Out	Modbus PKW3 Out	#	-32768	32767	Read Only
67.09	Modbus PKW4 Out	Modbus PKW4 Out	#	-32768	32767	Read Only
67.11	1 Data Exchange Area	1 Data Exchange Area	#	0	16	Read Only
67.12	2 Data Exchange Area	2 Data Exchange Area	#	0	16	Read Only
67.25	Profibus State	Profibus State	#	-	-	Read Only
67.26	Ethernet State	Ethernet State	#	-	-	Read Only
67.30	Profibus IPZ	Profibus IPZ	#	0	10	Read Only

8.4.13 AUX PROCESS DATA

Table 8.25

63 - AUX						
Id	Name	Description	Unit	Min Value	Max Value	Access Type
63.16	Prs PID Ref 1	Process PID Reference 1	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Write
63.17	Prs PID Fdb 1	Process PID Feedback 1	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Write
63.18	Prs PID Ref 2	Process PID Reference 2	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Write
63.19	Prs PID Fdb 2	Process PID Feedback 2	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu	Read Write

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9 FUNCTIONS

The following functions and macros are available:

9.1 HOA – Hand/off/auto
9.2 Stop mode
9.3 Speed demand
9.4 Ramps
9.5 S-ramp
9.6 2-Ramps vs. Threshold frequencies
9.7 Preset speed
9.8 Digital potentiometer
9.9 Critical speeds avoidance
9.10 Analog monitor
9.11 Analog command loss
9.12 VDC undervoltage control
9.13 VDC overvoltage control
9.14 Bus drop and grid waiting
9.15 Fly start
9.16 Loss of output phase/output short circuit
9.17 Flux up
9.18 Torque limits control
9.19 Speed deviation
9.20 Underload
9.21 Energy optimization
9.22 Voltage boost
9.23 Motor ID
9.24 Multiple gains
9.25 Regulator autotuning
9.26 Precharge management
9.27 Auto on/off
9.28 Auto reset and restart
9.29 Motor switch
9.30 Jog (flushing)
9.31 Anti-blocking
9.32 Auto-cleaning
9.33 Frost protection
9.34 Process PID
9.35 Process PID: dead band delay
9.36 Process PID: feedforward
9.37 Process PID: feedback supervision
9.38 Process PID: input pressure supervision
9.39 Process PID: analog feedback loss
9.40 Process PID: auxiliary pumps
9.41 Process PID: pressure, flow and level view
9.42 Soft fill
9.43 Motor pause
9.44 Well draw down control (suction control via constant pressure)
9.45 Low city or low suction inlet pressure
9.46 Logic

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9.1 HOA – HAND/OFF/AUTO

HOA Hand/Off/Auto function parameters are available in the family **START/STOP MODE [33.00]**.

HOA – Hand/Off/Auto function allows to manage the following options:
- Man mode vs. Auto mode command source selection
- Man mode command and reference source
- Start/Stop command management selection active on edge, level or pulse

Parameters:
- **HOA Start/Stop type [33.12]:** pick list to select how to manage the Start and Stop command (active on edge if set to Edge Start/Stop, active on level if set to Level Start/Stop or active on pulse if set to Pulse Start/Stop)
- **HOA Man/Auto OnFly Cmd [33.13]:** enables the possibility to switch from Man mode to Auto mode and vice versa also in Run state, without stopping the Drive, but keeping it in Run state
- **HOA Man Ref Src Sel [33.16]:** pick list to select the source of the speed reference in Man mode
- **HOA Man/Auto Cmd Sel [33.17]:** pick list to select the source of the command to switch from Man mode to Auto mode and vice versa
- **HOA Man Start Cmd Sel [33.18]:** pick list to select the source of the start command in Man mode
- **HOA Man P Stop Cmd Sel [33.19]:** pick list to select the source of the stop command in Man mode, when the parameter **HOA Start/Stop type [33.12]** is set to Pulse Start/Stop
- **HOA Auto P Stop Cmd Sel [33.20]:** pick list to select the source of the stop command in Auto mode, when the parameter **HOA Start/Stop type [33.12]** is set to Pulse Start/Stop

9.1.1 MAN/AUTO MODE

The parameter **HOA Man/Auto Cmd Sel [33.17]** allows the operator to select the source of the command to switch from Man mode to Auto mode and vice versa; it allows also the operator to disable Man mode, that means there isn't any Man mode command source that can be enabled.
The default value is Keypad Auto/Man: it is possible to switch from Man mode to Auto mode and vice versa using MAN key and AUTO key or using the virtual keypad on DVM (Drive Manager). It is necessary a confirmation from keypad.
In case the source of the command to switch from Man mode to Auto mode and vice versa is set to DIx or others, the switch from Man mode to Auto mode must be performed using the active selection (that is DIx or others). It is not necessary any confirmation from keypad.
If the parameter **HOA Man/Auto OnFly Cmd [33.21]** is set to Disable, then switch from Man mode to Auto mode and vice versa causes the Drive to stop. It is necessary a new edge start command even if the parameter **HOA Start/Stop type [33.12]** is set to Level Start/Stop.

The virtual keypad on DVM (Drive Manager) can be enabled only if:
- Parameter **HOA Man Ref Src Sel [33.16]** is set to Keypad
- Parameter **HOA Man/Auto Cmd Sel [33.17]** is set to Keypad Auto/Man
- Parameter **HOA Man Start Cmd Sel [33.18]** is set to Keypad Start
- Parameter **HOA Man P Stop Cmd Sel [33.19]** is set to Keypad Stop

If the parameter **HOA Man Ref Src Sel [33.16]** is set to Keypad, it is possible to modify the speed reference using the up and down arrow keys of the keypad and also of the virtual keypad on DVM (Drive Manager).
Note that in Man mode, it is not possible to select the reference source selection for speed PI controller from Process PID regulator; in Man mode, Process PID and related functions are not active.

PREVIOUS VIEW

9.1.2 START/STOP COMMANDS

In Man mode, the Start command is active on edge with the parameter **HOA Start/Stop type [33.12]** set both to Edge Start/Stop and to Level Start/Stop.
In Man mode, the Start command is active on pulse with the parameter **HOA Start/Stop type [33.12]** set to Pulse Start/Stop.
In Auto mode, the parameter **HOA Start/Stop type [33.12]** is active only with command source selection from terminal strip; in particular, with Start command from DI1.
In Auto mode, with command source selection from Profibus or Modbus, the parameter **HOA Start/Stop type [33.12]** is not active. In Auto mode, with command source selection from Profibus or Modbus, commands are always active on the edge; in case, it is the upper level logic (for example, Automation) that must manage the commands in a different desired mode.

In brief, for Auto mode:
- Edge Start/Stop:
  - Start command is active on positive edge of DI1
  - it is necessary to keep DI1 set to 1, otherwise the Drive stops
  - once stopped, it is necessary a new positive edge of DI1
  - only one command for Start and Stop
- Level Start/Stop:
  - Start command is active when DI1 is set to 1
  - it is necessary to keep DI1 set to 1, otherwise the Drive stops
  - once stopped, it is not strictly necessary a new positive edge of DI1: if DI1 is still set to 1, the Drive starts again
  - only one command for Start and Stop
- Pulse Start/Stop:
  - Start command is active on positive edge of DI1
  - it is not necessary to keep DI1 set to 1: the Drive is still in Run state also if DI1 is set to 0
  - once stopped, it is necessary a new positive edge of DI1
  - one command for Start and one command for Stop

The previous points summarize the main difference between the 3 mode (Edge Start/Stop, Level Start/Stop and Pulse Start/Stop) of Start and Stop management. In the following paragraphs, more detailed descriptions of the 3 mode (Edge Start/Stop, Level Start/Stop and Pulse Start/Stop), in Man mode and Auto mode, are reported.

9.1.3 EDGE START/STOP

The parameter **HOA Start/Stop type [33.12]** is set to Edge Start/Stop.

Man mode:
- Start command: press MAN key on keypad or positive edge on the **HOA Man Start Cmd Sel [33.18]** selected value; Start command is on the edge, but it must remain set to 1 to keep the Drive in Run state, otherwise the Drive stops (see the first condition of the following points for the Stop command)
- Stop command (at least one of the following conditions):
  - **HOA Man Start Cmd Sel [33.18]** set to 0
  - press STOP key on keypad
  - Coast command
  - Quick Stop command
  - Fault
  - DE (Drive Enable) set to 0
  - Switch from Man mode to Auto mode (if the parameter **HOA Man/ Auto OnFly Cmd [33.13]** set to Off)

When stop command is no more active (none of the previous points), it is necessary a new pressure of MAN key on keypad or a new positive edge on the **HOA Man Start Cmd Sel [33.18]** selected value to start again (to go in RUN state).

Auto mode:
- Start command: positive edge of DI1; Start command is on the edge, but DI1 must remain set to 1 to keep the Drive in Run state, otherwise the Drive stops (see the first condition of the following points for the Stop command)
- Stop command (at least one of the following conditions):
  - DI1 set to 0
  - Coast command
  - Quick Stop command
  - Fault
  - DE (Drive Enable) set to 0
  - CW1.03 (Enable Operation) set to 0
  - Switch from Auto mode to Man mode (if the parameter **HOA Man/ Auto OnFly Cmd [33.13]** set to Off)

When Stop command is no more active (none of the previous points), it is necessary a new positive edge of DI1 to start again and go in Run state.

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9.1.4 LEVEL START/STOP

The parameter **HOA Start/Stop type [33.12]** is set to Level Start/Stop.

Man mode:
- Start command: press MAN key on keypad or positive edge on the **HOA Man Start Cmd Sel [33.18]** selected value; Start command is on the edge, but it must remain set to 1 to keep the Drive in Run state, otherwise the Drive stops (see the first condition of the following points for the Stop command)
- Stop command (at least one of the following conditions):
  - **HOA Man Start Cmd Sel [33.18]** set to 0
  - press STOP key on keypad
  - Coast command
  - Quick Stop command
  - Fault
  - DE (Drive Enable) set to 0
  - Switch from Man mode to Auto mode (if the parameter **HOA Man/ Auto OnFly Cmd [33.13]** set to Off)

When stop command is no more active (none of the previous points), it is necessary a new pressure of MAN key on keypad or a new positive edge on the **HOA Man Start Cmd Sel [33.18]** selected value to start again (to go in RUN state).

Auto mode:
- Start command: DI1 set to 1; DI1 must remain set to 1 to keep the Drive in Run state, otherwise the Drive stops (see the first condition of the following points for the stop command)
- Stop command (at least one of the following conditions):
  - DI1 set to 0
  - Coast command
  - Quick Stop command
  - Fault
  - DE (Drive Enable) set to 0
  - CW1.03 (Enable Operation) set to 0
  - Switch from Auto mode to Man mode (if the parameter **HOA Man/ Auto OnFly Cmd [33.13]** set to Off)

When Stop command is no more active, if the DI1 is still set to 1, the Drive starts again and to go in Run state.
Instead, after a switch from Man mode to Auto mode and vice versa, it is necessary a new positive edge of DI1 to start again and go in RUN state.

9.1.5 PULSE START/STOP

The parameter **HOA Start/Stop type [33.12]** is set to Pulse Start/Stop.

NOTE
It is not possible set the parameter **HOA Start/Stop type [33.12]** to Pulse Start/Stop if at least one of the following function is enabled: Auto On/ Off, Auto Reset and Restart, Motor Switch, Motor Pause, Well Draw Down Control and/or Low City or Low Suction Inlet Pressure.
In case the operator tries to set the parameter **HOA Start/Stop type [33.12]** to Pulse Start/Stop when at least one of the previous functions are enabled, the error DSPParEr is generated and the parameter **HOA Start/ Stop type [33.12]** is set to the last value.

Man mode:
- Start command: press MAN key on keypad or positive edge on the **HOA Man Start Cmd Sel [33.18]** selected value; Start command is on the edge and can go to 0 still keeping the Drive in RUN state
- Stop command (at least one of the following conditions):
  - **HOA Man Stop Cmd Sel [33.19]** set to 0
  - press STOP key on keypad
  - Coast command
  - Quick Stop command
  - Fault
  - DE (Drive Enable) set to 0
  - switch from Man mode to Auto mode (if the parameter **HOA Man/ Auto OnFly Cmd [33.13]** set to Off)

When stop command is no more active, it is necessary a new pressure of MAN key on keypad or a new positive edge on the **HOA Man Start Cmd Sel [33.18]** value to start again and go in Run state.
HOA Man stop cmd sel [33.19] set to 0 has higher priority than a positive edge of **HOA Man Start Cmd Sel [33.18]**: the Drive stops or remain stopped.

Auto mode:
- Start command: positive edge of DI1; Start command is on the edge and can go to 0 still keeping the Drive in Run state
- Stop command (at least one of the following conditions):
  - **HOA Auto Stop Cmd Sel [33.20]** set to 0
  - Coast command
  - Quick Stop command
  - Fault

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- DE (Drive Enable) set to 0
- CW1.03 (Enable Operation) set to 0
- Switch from Auto mode to Man mode

When Stop command is no more active, it is necessary a new positive edge of DI1 to start again and go in Run state.

9.1.6 RUN/FORWARD/REVERSE COMMAND

The parameter **DI Run/Fw/Rv connect [31.10]** allows to select the following options:

- Parameter **DI Run/Fw/Rv connect [31.10]** set to DI1: Run: DI1 is the start command; speed direction depends only on speed reference sign
- Parameter **DI Run/Fw/Rv connect [31.10]** set to DI1: Run – DI2: Fw/Rv: DI1 is the start command; DI2 set the negative of the speed reference
- Parameter **DI Run/Fw/Rv connect [31.10]** set to DI1: RunFw – DI2: RunRv: DI1 is the start command with unmodified speed reference sign (forward); DI2 is the start command with modified speed reference sign (reverse)

If the parameter **DI Run/Fw/Rv connect [31.10]** is set to DI1: Run – DI2: Fw/Rv, then also DI2 behavior is set by parameter **HOA Start/Stop type [33.12]**. If parameter **HOA Start/Stop type [33.12]** is set to Pulse, the Drive reacts also to DI2 pulse. If DI2 pulse occurs when the Drive is in RUN state in forward direction, then a reverse direction command becomes active; and vice versa.

9.2 STOP MODE

Three different stop modes are available:

- Ramp Stop
- Quick Stop
- Coast Stop

The three stop modes are also associated to the different types of alarms according to what is specified in the parameters of family **ALARM SETTINGS [36.00]** and discussed in the chapter 12.
The command is implemented based on what is imposed in the bit 0, 1, 2 of Command Word 1 (for the explanation of this refer to chapter 8).

9.2.1 RAMP STOP

This mode provides motor stop according to the deceleration ramp set in the parameter **Ramp Stop Time [33.10]**. The default value set is 15 seconds. When the **Zero Speed [32.21]** has been reached the AD1000 switches over to status READY TO SWITCH ON.
To activate this stop mode, it is necessary to set to Off the bit 0 of Command Word 1.

As specified in the states machine (Figure 9.1) this stop mode can be interrupted by a run command; if the run command is given again the AD1000 switches over to status READY TO OPERATE, both in case the command is given with motor already stopped and in case the motor is still decelerating.

9.2.2 QUICK STOP

This mode is used when the motor needs to be stopped in the shortest possible time and provides motor stop according to the deceleration ramp set in parameter **Quick Stop Time [33.11]**. The default value set is 5 seconds. Only when the **Zero Speed [32.21]** has been reached the AD1000 switches over to status SWITCH-ON INHIBITED.
To activate this stop mode, it is necessary to set to Off the bit 2 of Command Word 1.

As specified in the states machine (Figure 9.1) this stop mode cannot be interrupted by a run command.
If no alarms are present, machine restart can take place only after a new start command (set CW1.2 to On, then set CW1.0 to Off and then to On).

9.2.3 COAST STOP

This mode provides motor stop inhibiting the start pulses sent to the Drive. The motor shall therefore continue to turn due to inertia. Stop time depends on the motor and load mechanical time constant.
The AD1000 switches over to status SWITCH-ON INHIBITED even if the motor has not stopped yet.
To activate it, it is necessary to set to Off bit 1 of Command Word 1.

As specified in the states machine (Figure 9.1) this stop mode cannot be interrupted by a run command.
If no alarms are present, machine restart can take place only after a new start command (set CW1.1 to On, then set CW1.0 to Off and then to On).

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9.3 SPEED DEMAND

Speed Demand function parameters are available in the family **SPEED REFERENCE [32.00]**. This parameters family allows setting functions relevant to speed control (references, limits, acceleration or deceleration times, pre-set references or special functions).

Four different speed references are defined:
- Main Speed Ref: the main reference
- Aux Speed Ref: the auxiliary reference used as an alternative to the main one
- Add Speed Ref: the additional reference added upstream the ramp
- Speed Feedforward: the additional reference added downstream the ramp

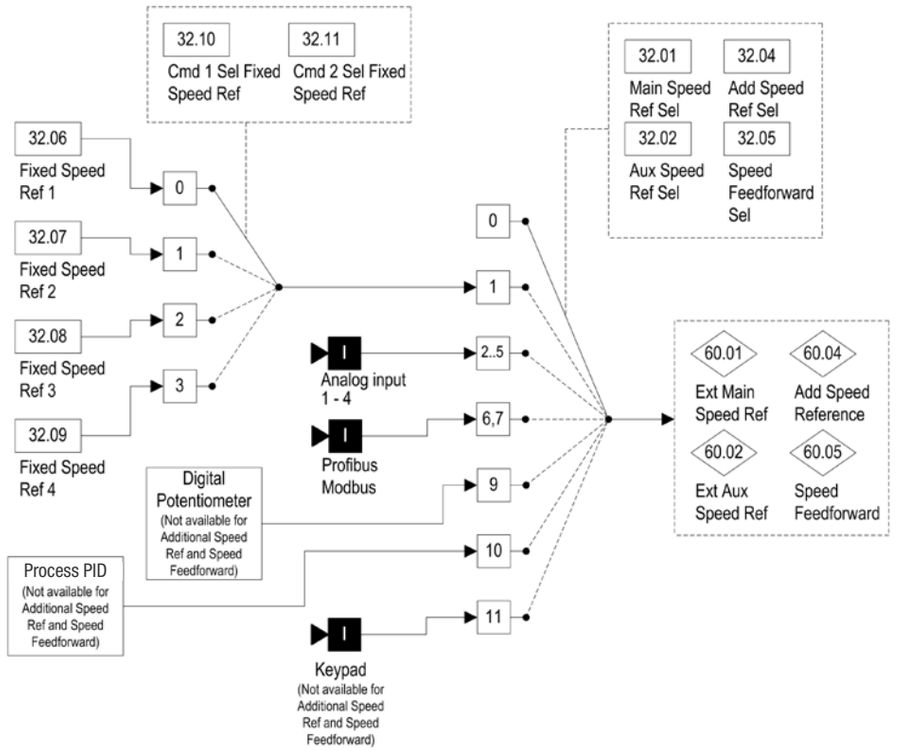
For all four references the source can be chosen from which to obtain the value to be applied. The parameters allowing this selection are:
- **Main Speed Ref Sel [32.01]:** main speed reference source selection
- **Aux Speed Ref Sel [32.02]:** auxiliary speed reference source selection
- **Add Speed Ref Sel [32.04]:** additional speed reference source selection
- **Speed Feedforward Sel [32.05]:** speed feedforward source selection

The possibilities of choice are:
- **Off:** reference deactivated (default value)
- **Fixed:** the reference corresponds to a constant value set in one of parameters **Fixed Speed Ref 1 [32.06]**, **Fixed Speed Ref 2 [32.07]**, **Fixed Speed Ref 3 [32.08]** and **Fixed Speed Ref 4 [32.09]**, whose choice is made through parameters **Cmd 1 Sel Fixed Speed Ref [32.10]** and **Cmd 2 Sel Fixed Speed Ref [32.11]** (see table 10.3).
- **AI1, AI2 (AI3 Option, AI4 Option):** the reference is the signal at analog input selected (AI1: terminals 33 - 34; AI2: terminals 35 - 36); after choosing this option, it is necessary to properly set, based on the type of signal available (+/- 0-10V, +/- 0-20mA, +/- 4-20mA, etc.), the parameters family **ANALOG INPUTS [17.00]** relevant to such input.
- **Profibus, Modbus:** the reference comes from the selected fieldbus; after choosing this option, it is necessary to enable the desired fieldbus (see the parameters of family **Profibus [81.00]** or **Modbus [82.00]**).
- **Digital Potentiometer:** the reference comes from the digital potentiometer; after selecting this option, it is necessary to enable the digital potentiometer and set it following the indications given in table 10.4; this option is available only for parameters **Main Speed Ref Sel [32.01]** and for parameter **Aux Speed Ref Sel [32.02]**.
- **Prs PID:** the reference comes from Process PID controller; after selecting this option, it is necessary to enable the Process PID function; this option is available only for parameter **Main Speed Ref Sel [32.01]** and for parameter **Aux Speed Ref Sel [32.02].**

The selection between main (Main Speed Ref) or auxiliary (Aux Speed Ref) reference is implemented by digital signals that can be selected through the parameter **Aux Speed Ref Cmd [32.03]**. As default setting, the main reference is selected.

The additional speed reference and speed feedforward must be enabled with parameters **Enable Add Speed Cmd [32.32]** and **Enable Ffw Speed Cmd [32.33]**.

Figure 9.1 - Speed Demand



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9.3.1 REVERSAL OF ROTATION DIRECTION

The user has the possibility to choose three different modes for reversal of the motor rotation direction based on the value of the parameter **DI Run/Fw/Rv Connections [31.10]**:

- Parameter **DI Run/Fw/Rv Connections [31.10]** set to DI1: Run: the Run command is provided through digital input 1 (DI1 - terminal 48) and the speed reference is allowed to reverse the run direction based on the sign of the reference itself
- Parameter **DI Run/Fw/Rv Connections [31.10]** set to DI1: Run – DI2: Fw/Rv: the Run command is provided through digital input 1 (DI1 - terminal 48) and the reversal of the rotation direction can be actuated bringing to 1 (On) digital input 2 (DI2 - terminal 49)
- Parameter **DI Run/Fw/Rv Connections [31.10]** set to DI1: RunFw – DI2:RunRv: the forward Run command is provided through digital input 1 (DI1 - terminal 48), while the backward Run command is provided through digital input 2 (DI2 - terminal 49); in this case any simultaneous activation of digital inputs DI1 and DI2 imposes a null speed reference to the motor that therefore stops in ramp

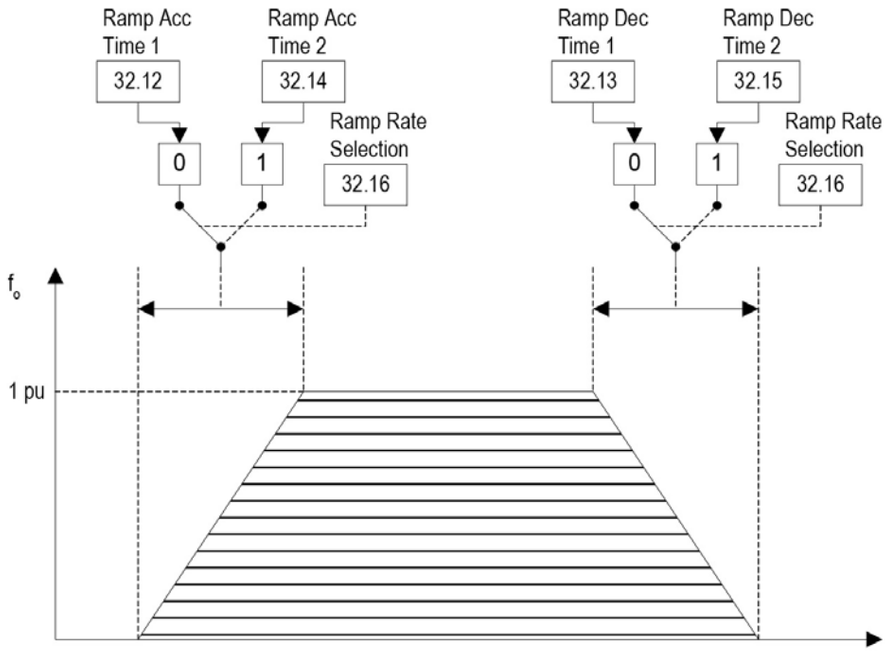
9.4 RAMPS

The main and auxiliary speed references (added to any upstream addition reference) pass to a ramp-generating function that allows avoiding sudden variations of the reference itself, having the variation follow the trend of a fixed slope ramp.
In the AD1000 it is possible to choose between two sets of accelerating and decelerating ramps with the slope described by the following parameters:

- **Ramp Acc Time 1 [32.12]:** standard acceleration time, set 1; this parameter represents the time necessary for the speed reference to go from 0 to 1 pu and it is expressed in seconds
- **Ramp Dec Time 1 [32.13]:** standard deceleration time, set 1; this parameter represents the time necessary for the speed reference to go from 1 to 0 pu and it is expressed in seconds
- **Ramp Acc Time 2 [32.14]:** standard acceleration time, set 2; this parameter represents the time necessary for the speed reference to go from 0 to 1 pu and it is expressed in seconds
- **Ramp Dec Time 2 [32.15]:** standard deceleration time, set 2; this parameter represents the time necessary for the speed reference to go from 1 to 0 pu and it is expressed in seconds

It is possible to cancel the effect of acceleration and deceleration ramps bringing the value of the four parameters to 0 seconds.
The meaning of such parameters is illustrated in the following figure.

Figure 9.2 - Acceleration and deceleration times



The choice between the first ramp set (parameters **Ramp Acc Time 1 [32.12]** and **[Ramp Dec Time 1 [32.13]**) and the second (parameters **Ramp Acc Time 2 [32.14]** and **Ramp Dec Time 2 [32.15]**) takes place through digital signals that can be selected through the parameter **Ramp Rate Sel [32.16]**. When the selected signal (for instance a digital input) has got 0 value (Off) the first set is selected, otherwise the second. It is also possible to constantly select the first or second set through the parameter **Ramp Rate Sel [32.16]**.

Besides the usual "constant slope" ramps, also "constant time" ramps are managed, which are especially useful if trajectories need to be generated synchronized with other events or with machines that are working at different speeds.
To activate the fixed time ramp, it is necessary:

- current ramp operation finished
- set bit 9 of Cmd Wd 2
- set a speed reference requiring a variation greater than 3% of the last requested reference

In this way, the new reference shall be reached exactly in the time defined by the current set of acceleration/deceleration times and with a variable slope based on the last reference reached.

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9.4.1 SPEED REFERENCE LIMITS

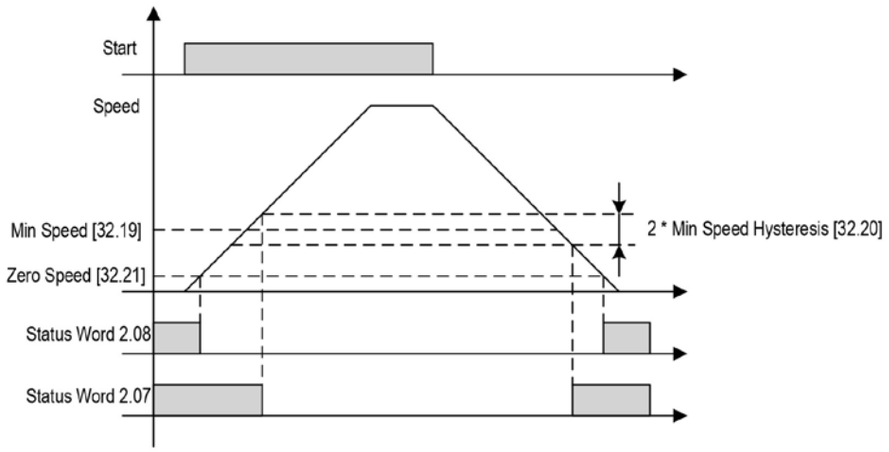
The speed reference limitation is performed both before and after the application of the ramp function and is defined by the parameters **Max Pos Ref [32.22]** (positive limit) and **Max Neg Ref [32.23]** (negative limit). The values of such parameters, expressed in pu, represent the values beyond which the speed reference cannot go.

The parameter **Overspeed Threshold [32.18]** expresses the pu value of the speed feedback beyond which alarm OverSpeed (code 25, bit 8 of Alarm Word 2, AW2.08) becomes active. The operation to be performed if this threshold is exceeded is set by parameter **Overspeed [36.25]** of family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output.

The parameter **Zero Speed [32.21]** establishes a window around the null speed inside which bit 8 of Status Word 2 is set to On. The value is expressed in pu.

The parameter **Min Speed [32.19]** establishes the pu value below which bit 7 of Status Word 2 is set to On. To prevent the minimum speed signaling to be too sensitive to the feedback signal, it is possible to set a hysteresis band through the parameter **Min Speed Hysteresis [32.20]**. The minimum speed bit is set to On when speed goes below the value (**Min Speed [32.19]** - **Min Speed Hysteresis [32.20]**) and is set to Off if the speed goes above the value (**Min Speed [32.19]** + **Min Speed Hysteresis [32.20]**).

Figure 9.3 - Min Speed and Zero Speed

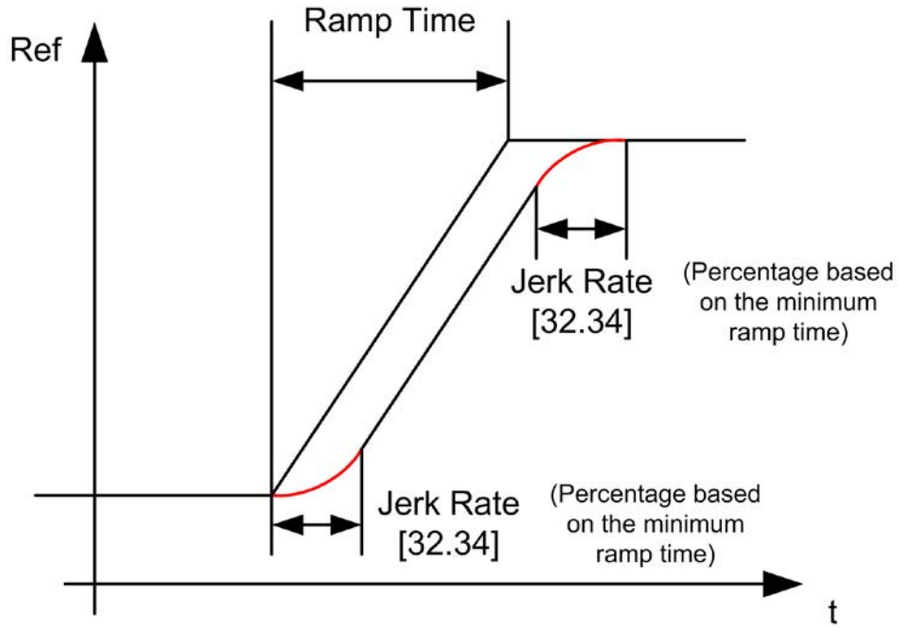


9.5 S-RAMP

S-Ramp function is enabled if parameter **Jerk Rate [32.34]** is set different from 0. This parameter is settable only when the Drive is stopped. S-Ramp function parameter is available in the family **SPEED REFERENCE [32.00]**.

The parameter **Jerk Rate [32.34]** allows the speed profile become smoothly linked at speed changes.

Figure 9.4 - S-Ramp



The parameter **Jerk Rate [32.34]** represents a percent of the smallest value between all ramp time parameters (both enabled or disabled):

- **Ramp Acc Time 1 [32.12]:** standard acceleration time, set 1
- **Ramp Dec Time 1 [32.13]:** standard deceleration time, set 1
- **Ramp Acc Time 2 [32.14]:** standard acceleration time, set 2
- **Ramp Dec Time 2 [32.15]:** standard deceleration time, set 2
- **TB Ramp Acc Time 1 [32.41]:** Thrust Bearing acceleration time, set 1
- **TB Ramp Dec Time 1 [32.42]:** Thrust Bearing deceleration time, set 1
- **TB Ramp Acc Time 2 [32.44]:** Thrust Bearing acceleration time, set 2
- **TB Ramp Dec Time 2 [32.45]:** Thrust Bearing deceleration time, set 2
- **Ramp Stop Time [33.10]:** deceleration time in ramp stop
- **Quick Stop Time [33.11]:** deceleration time in quick stop

For example, the parameter **Jerk Rate [32.34]** set to 10% means that the time of the smoothly profile is calculated based on the smallest value of the above mentioned parameters.

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S-Ramp function extends the ramp up time or the ramp down time of a time proportional to the parameter **Jerk Rate [32.34]** and to the smallest value between all the ramp time parameters. From practical point of view, S-Ramp function inserts an additional delay. For this reason, it is recommended not to use S-Ramp function (or to set a small value of the parameter **Jerk Rate [32.34]**) when Process PID function is used, so to avoid the insertion of an additional delay between Process PID regulator and speed PID regulator, avoiding possible instability; anyway, the Process PID regulator itself, when well tuned, has a similar effect to the speed reference as the S-Ramp function.

The guidelines for the settings of this parameter are:
- If the speed reference varies slowly over time, parameter **Jerk Rate [32.34]** can be set to a greater value (anyway lower than 10%, that is the maximum accepted value for this parameter)
- If the speed reference varies rapidly over time, parameter **Jerk Rate [32.34]** must be set to a smaller value

Analog speed reference varying with continuity has a similar effect to the speed reference as the S-Ramp function; so, in that case, S-Ramp function can be not so necessary (parameter **Jerk Rate [32.34]** set to 0 or to a small value).

NOTE
The value of parameter **Jerk Rate [32.34]** must be smaller than the 10% of between all ramp time parameters (both enabled or disabled).

NOTE
S-Ramp function is not active with at least one of the following functions enabled and active: Jog (Flushing), Auto-Cleaning, Anti-Blocking and/or Frost Protection functions.

9.6 2-RAMPS VS. THRESHOLD FREQUENCIES

2-Ramps vs. Threshold Frequency function can be used in applications where faster ramp times are needed when the pump is starting or stopping (running below a threshold speed) in order to prevent excess motor wear, in particular of the bearing; for this reason, this function is also called Thrust Bearing function.

2-Ramps vs. Threshold Frequency function (Thrust Bearing function) is configured setting the following parameters:
- When speed reference is between 0 and **TB Thresh Speed 1 [32.43]**, then Drive is inside first speed zone and active ramp is defined by the following first set of acceleration/deceleration time:
  - **TB Ramp Acc Time 1 [32.41]:** thrust bearing acceleration time, set 1
  - **TB Ramp Dec Time 1 [32.42]:** thrust bearing deceleration time, set 1
- When speed reference is between **TB Thresh Speed 1 [32.43]** and **TB Thresh Speed 2 [32.46]**, then Drive is inside second speed zone and active ramp is defined by the following second set of acceleration/deceleration time:
  - **TB Ramp Acc Time 2 [32.44]:** thrust bearing acceleration time, set 2
  - **TB Ramp Dec Time 2 [32.45]:** thrust bearing deceleration time, set 2
- When speed reference is between 0 and **TB Thresh Speed 1 [32.43]**, then Drive is inside standard speed zone and active ramp is defined by the standard acceleration and deceleration time:
  - **Ramp Acc Time 1 [32.12]:** standard acceleration time, set 1
  - **Ramp Dec Time 1 [32.13]:** standard deceleration time, set 1
  - **Ramp Acc Time 2 [32.14]:** standard acceleration time, set 2
  - **Ramp Dec Time 2 [32.15]:** standard deceleration time, set 2
  - **Ramp Rate Selection [32.16]:** switch to select between standard set 1 and standard set 2 (0 = standard set 1, 1 = standard set 2)

2-Ramps vs. Threshold Frequency function can be enabled setting at least one of the following parameters different from zero:
- **TB Thresh Speed 1 [32.43]:** thrust bearing first threshold speed, speed zone 1
- **TB Thresh Speed 2 [32.46]:** thrust bearing second threshold speed, speed zone 2

2-Ramps vs. Threshold Frequency function can be disabled setting to 0 both previous parameters.

NOTE
The value of parameter **TB Thresh Speed 1 [32.43]** must be smaller than the value of parameter **TB Thresh Speed 2 [32.46]**, otherwise second zone is skipped.

NOTE
Ramp generator works on speed reference; so, the switch from one speed zone to another speed zone is detected using speed reference (not speed feedbacks).

NOTE
2-Ramps vs. Threshold Frequencies (Thrust Bearing) ramps, as standard ramps, do not affect the behavior of the Drive during Ramp Stop and Quick Stop: in case a stop command or an alarm condition occur, than Ramp Stop ramp or Quick Stop ramp override the 2-Ramps vs. Threshold Frequencies (Thrust Bearing) ramps and standard ramps.

PREVIOUS VIEW

9.7 PRESET SPEED

The AD1000 makes four different fixed speed values available, corresponding to parameters **Fixed Speed Ref 1 [32.06], Fixed Speed Ref 2 [32.07], Fixed Speed Ref 3 [32.08]** and **Fixed Speed Ref 4 [32.09]** whose values are expressed in pu.

The choice of which of the four to apply is made through digital signals that can be configured through parameters **Cmd 1 Sel Fixed Speed Ref [32.10]** and **Cmd 2 Sel Fixed Speed Ref [32.11]** according to the binary combination contained in Table 9.1.

Table 9.1 - Selection of fixed references

Status of digital signal selected by parameter		Selected value
[32.10]	[32.11]	
0	0	Fixed Speed Ref 1 [32.06]
1	0	Fixed Speed Ref 2 [32.07]
1	1	Fixed Speed Ref 3 [32.08]
0	1	Fixed Speed Ref 4 [32.09]

The status of parameters **[32.10]** and **[32.11]** is Off (0) by default, and choosing the Fixed source the speed reference obtained is the value set in parameter **[32.06]**.
To apply to one of the for speed references (Main, Aux, Add Speed Ref or Speed Feedforward) a fixed speed reference it is necessary to set the reference source selection parameters as indicated in paragraph 10.1.

9.8 DIGITAL POTENTIOMETER

Digital Potentiometer function is enabled if parameter **DigPot Enable [42.01]** is set to On. This parameter is settable only when the Drive is stopped. Digital Potentiometer function parameters are available in the family **DIGIT. POTENTIOMETER [42.00]**.

Digital Potentiometer function can be enabled on the main speed reference with parameter **Main Speed Ref Sel [32.01]** set to Digital Pot or on the auxiliary speed reference with parameter **Aux Speed Ref Sel [32.02]** set to Digital Pot.

Enable cannot be implemented on more than one reference at the same time. The selection on the additional speed reference set by parameter **Add Speed Ref Sel [32.04]** or on the speed feedforward reference set by parameter **Speed Feedforward Sel [32.05]** is not possible.

Digital Potentiometer function modifies the speed reference with increase (up) or decrease (down) commands. The up and down commands are provided through digital signal. The source of the up command is determined through parameter **DigPot Up Cmd Sel [42.07]**; the source of the down command is determined through parameter **DigPot Down Cmd Sel [42.08]**.
At every up/down pulse the reference value is increased/decreased by the delta respectively set in parameters **DigPot Step Up [42.03]** and DigPot **Step Down [42.04]**. If the up/down commands are maintained for a period of time longer than the one defined by parameter **DigPot Cmd Delay [42.09]**, the speed reference, after the first step, is increased/decreased following a slope ramp determined by parameter **DigPot Up/Dw Ramp Time [42.10]**.
If up/down commands are simultaneous, reference coming from the digital potentiometer remain fixed (doesn't change, not increase and not decrease).
When the up/down command is released, the reference coming from the digital potentiometer shall be equal to the current reference value after the ramp (see item (a) in Figure 9.5), which means that the motor remains at the speed reached when the pushbutton is released.
The reference coming from the digital potentiometer is up limited by the parameter **DigPot Pos Lim [42.05]** and down limited by the parameter **DigPot Neg Lim [42.06]**.
As default, the function adjusts the speed reference between 0 and 100% of the maximum speed. It is possible to extend the speed range also to negative values, setting parameter **DigPot Neg Range En [42.02]** to On.
Therefore the regulation ranges in the two cases are:

- Speed range 0 ± 100%, if parameter **DigPot Neg Range En [42.02]** is set to Off (default value);
- Speed field ± 100%, if parameter **DigPot Neg Range En [42.02]** is set to On.

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9.8.1 SPEED REFERENCE MEMORIZATION

The last speed reference set with the digital potentiometer can be stored. To do this, it is necessary to set parameter **DigPot Mem Ref En [42.13]** to On. When the Stop command reaches the AD1000, the value is stored in parameter **DigPot Mem Ref Value [42.14]** (read only) and actuated at the following restart.
At any time it is possible to set to zero the stored reference from the digital potentiometer through a digital signal (edge from 0 to 1), that can be selected through parameter **DigPot Clear Cmd Sel [42.11]**.

9.8.2 SPEED REFERENCE TRACKING

If the digital potentiometer is enabled on auxiliary speed reference (parameter **Aux Speed Ref Sel [32.02]**) and the parameter DigPot **Aux-Main Track [42.12]** is set to On, it is possible to have the digital potentiometer reference follows the value of main reference.
Therefore if the reference source switch over from main reference to auxiliary reference, the value of auxiliary reference is the same as the main reference and there are no sharp variations of used reference.

Figure 9.5 - Connections between commands and feedback for digital potentiometer with parameter DigPot Mem Ref En [42.13] set to On

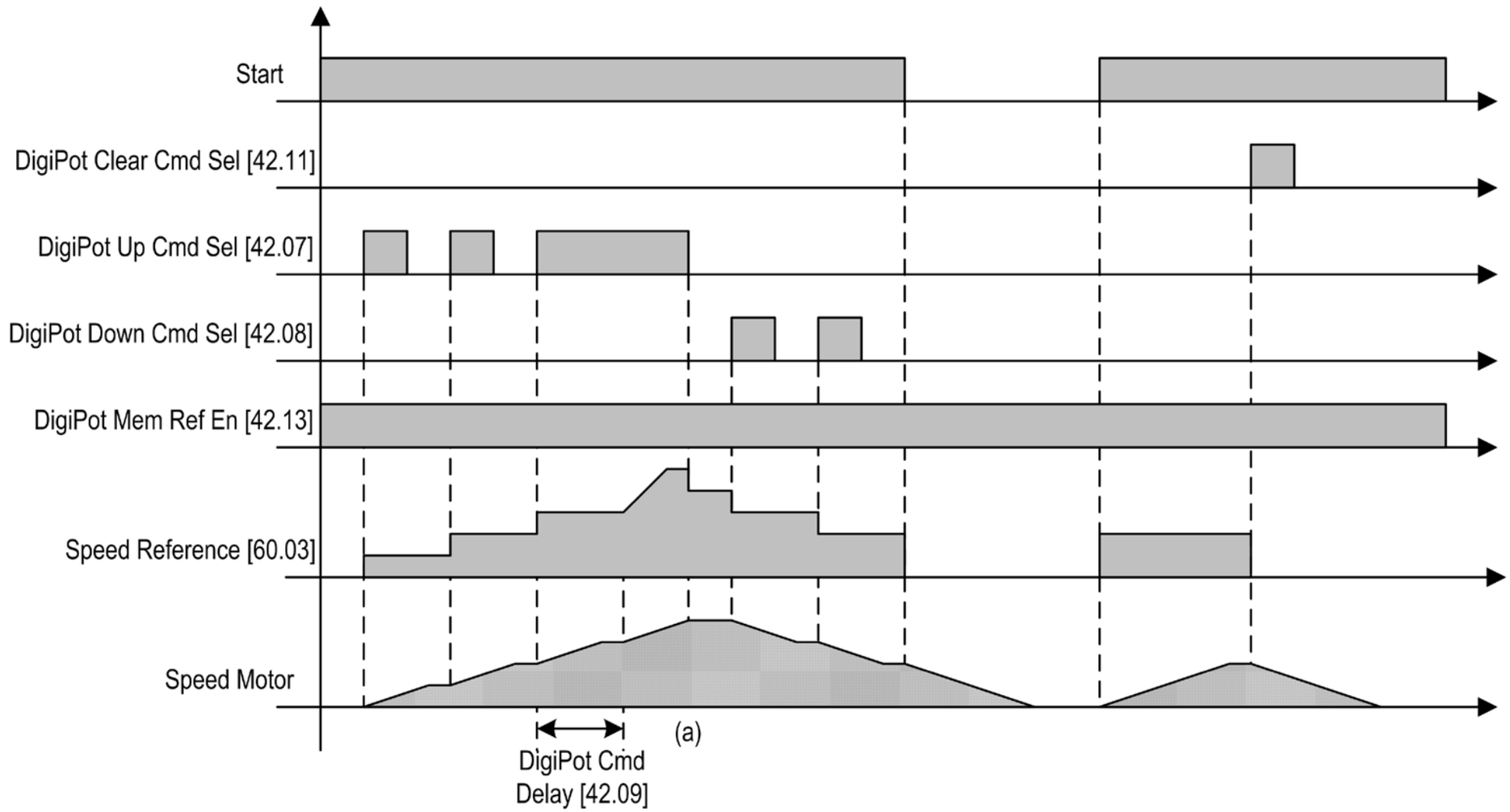

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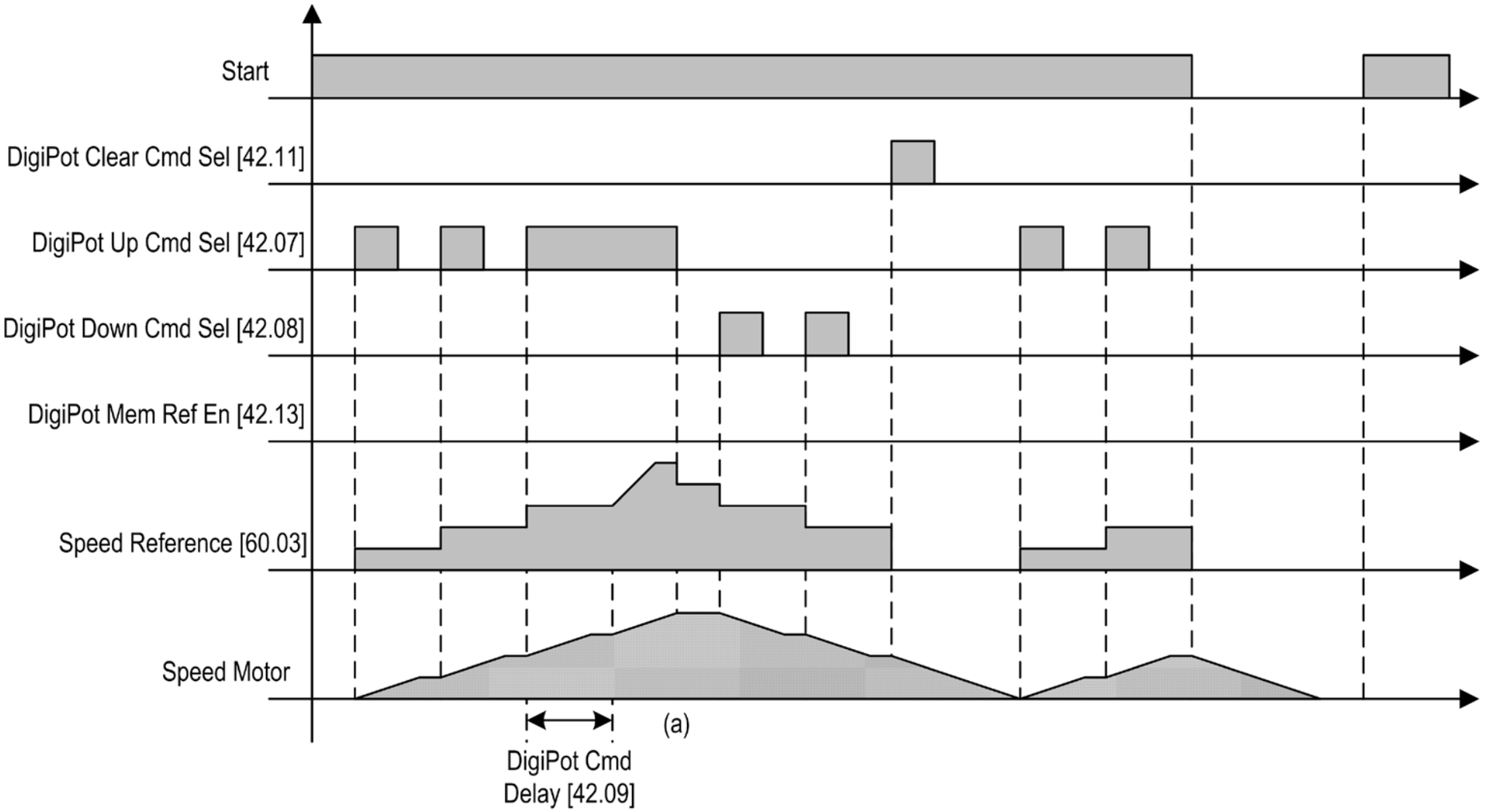
Figure 9.6 - Connections between commands and feedback for digital potentiometer with parameter DigPot Mem Ref En [42.13] set to Off



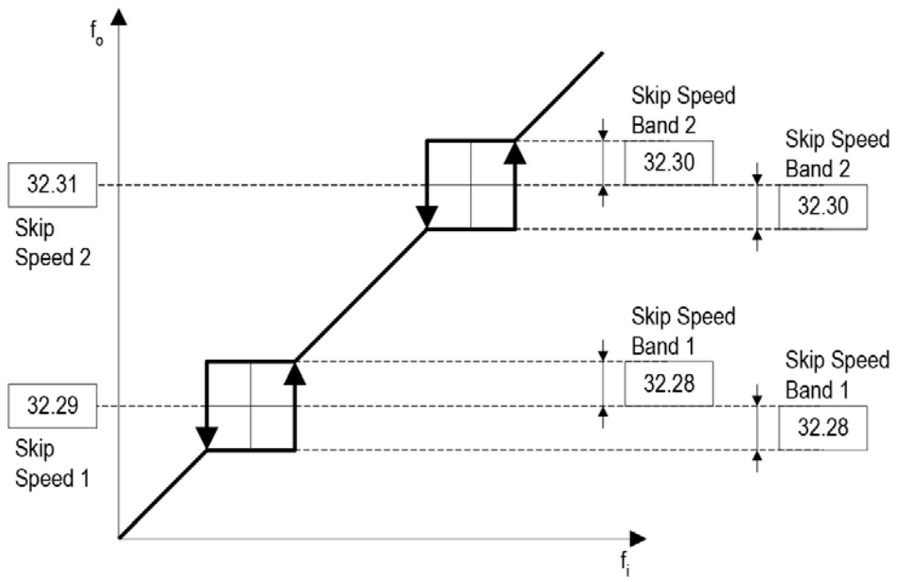
PREVIOUS VIEW

9.9 CRITICAL SPEEDS AVOIDANCE

In some cases it can happen that certain motor rotation speeds bring about mechanical resonances that are unpleasant for the user and/or harmful for the motor and system.
The AD1000 makes a critical speed avoidance function available that prevents the upstream ramp speed reference to stop in a band around these.
Please consider that the Speed Feedforward reference is not influenced by this.

Two different frequencies with the relevant bands can be set. The set frequency is avoided in both "forward" and "backward" rotation.
The two parameters **Skip Freq 1 [32.29]** and **Skip Freq 2 [32.31]** establish the band center frequency expressed in Hz. If set to 0, the function **Critical Speed Avoidance** associated to the parameter is disabled.
The two parameters **Skip Freq Band 1 [32.28]** and **Skip Freq Band 2 [32.30]** establish the respective half-band relevant to avoidance amplitude, as illustrated in Figure 9.7.
If, for instance, parameter **Skip Freq 1 [32.29]** is set to 40 Hz and parameter **Skip Freq Band 1 [32.28]** to 5 Hz, any increasing speed reference stops at 35 Hz and would then skip to 45 Hz (vice versa in case of decreasing reference). Since the avoidance takes place before the ramp, the downstream ramp reference can anyway pass through 40 Hz, but cannot stop there.
In case of band overlapping, the greater of the upper limits and the smaller of the lower limits are considered.

Figure 9.7 - Critical speeds avoidance function



9.10 ANALOG MONITOR

Analog Monitor function enables to compare up to two analog inputs at the same time with a settable threshold and a configurable logic.

Each analog input can be choose between all four analog input available (AI1 and AI2 standard on BASIS board, AI3 and AI4 with optional board) using respectively the parameter **Monitor 1 AI Sel [17.29]** and the parameter **Monitor 2 AI Sel [17.30]**. The thresholds are set using the parameter **Monitor Level 1 [17.31]** and the parameter **Monitor Level 2 [17.32]**. The logic used to compare the analog input selected with the threshold level set is defined using the parameters **Monitor 1 Alarm En [17.33]** and the parameters **Monitor 2 Alarm En [17.34]**.

When comparison is true, that means analog input compare with threshold respect the logic set, then alarm **Mon1Alarm** (code 39, bit 6 of Alarm Word 3, AW3.06) and **Mon2Alarm** (code 40, bit 7 of Alarm Word 3, AW3.07) become active respectively. The operation to be performed if these events occur are set by parameter **AI Monitor 1 Alarm [36.39]** and parameter **AI Monitor 2 Alarm [36.40]**. of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output.

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9.11 ANALOG COMMAND LOSS

Analog Command Loss function can be used for all the available analog inputs: AI1 and AI2 on BASIS board (±10V, ±20mA), AI3 and AI4 on GIABA input expansion board (±10V, ±20mA).
Analog Command Loss function works on analog input, regardless of the fact that the analog input is used as a reference for a regulator (for example, Process PID or speed PID) or as a feedback of a regulator (for example, Process PID or speed PID) or as a monitor only.
This function can be used, for example, in order to manage the speed command loss when the speed reference comes from an analog input.
Note that this is only a possible use: Analog Command Loss is a general purpose function that works on analog inputs, regardless of the use made by other control functions.
This function is enabled individually on every analog input, using the parameters **AI1 Loss [17.43], AI2 Loss [17.44], AI3 Loss [17.45]** and **AI1 Loss [17.46]**.
The analog command loss condition occurs when the analog input value decreases below the corresponding parameter **AI1 Threshold [17.51], AI2 Threshold [17.52], AI3 Threshold [17.53]** or **AI4 Threshold [17.54]**.
If an analog command loss condition occurs (for example due to a broken wire), then the control system reacts with one of three possible response as defined in parameters **AI1 Loss [17.43], AI2 Loss [17.44], AI3 Loss [17.45]** and **AI1 Loss [17.46]**:

- **No Action:** the Analog Command Loss function is not enabled
- **Freeze to Last Value:** control system elaborates the latest analog command before loss
- **Freeze to Preset Value:** control system elaborates the preset analog command in **AI1 Preset Value [17.59], AI2 Preset Value [17.60], AI3 Preset Value [17.61]** and **AI4 Preset Value [17.62]**
- **Prs PID Disable:** pick-up value not related to this function (see Process PID: Analog Feedback Loss function)

Parameters related to Analog Command Loss function are present in family **ANALOG INPUTS [17.00]**.

When analog command loss occurs, then alarm then alarm **AI Loss** (code 41, bit 8 of Alarm Word 3, AW3.08) becomes active. The operation to be performed if this event occurs is set by parameter **AI Loss [36.41]** of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output.

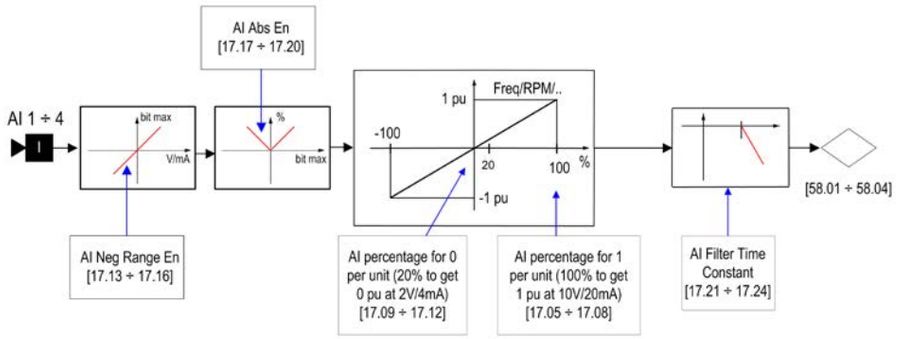
Note for the calculation of the following parameters expressed in [%]:

- **AI1 Threshold [17.51], AI2 Threshold [17.52], AI3 Threshold [17.53]** and **AI4 Threshold [17.54]**
- **AI1 Preset Value [17.59], AI2 Preset Value [17.60], AI3 Preset Value [17.61]** and **AI4 Preset Value [17.62]**

Remember that analog inputs are set using the following [%] parameters:

- **AI1 Value for 1 pu [17.05], AI2 Value for 1 pu [17.06], AI3 Value for 1 pu [17.07]** and **AI4 Value for 1 pu [17.08]**
- **AI1 Value for 0 pu [17.09], AI2 Value for 0 pu [17.10], AI3 Value for 0 pu [17.11]** and **AI4 Value for 0 pu [17.12]**

with particular attention to the type of analog input (for example, 4÷20 [mA] or 0÷10 [V])



For example, for an analog input 4÷20 [mA], it is necessary to set

- **AI1 Value for 1 pu [17.05]** set to 100 [%]
- **AI1 Value for 0 pu [17.09]** set to 20 [%]

in order to have:

- 4 [mA] = 20 [%] = 0 [pu]
- 20 [mA] = 100 [%] = 1 [pu]

with the consequence that:

- 0 [mA] = 0 [%] = -0.25 [pu]

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Same calculations are valid for the following parameters:
- **AI1 Threshold [17.51], AI2 Threshold [17.52], AI3 Threshold [17.53]** and **AI4 Threshold [17.54]**
- **AI1 Preset Value [17.59], AI2 Preset Value [17.60], AI3 Preset Value [17.61]** and **AI4 Preset Value [17.62]**

So, both the threshold and preset values used in Analog Command Loss functions are
- 0 [%] = -0.25 [pu] = (if referred to an analog input 4÷20 [mA]) = 0 [mA]
- 20 [%] = 0 [pu] = (if referred to an analog input 4÷20 [mA]) = 4 [mA]
- 100 [%] = 1 [pu] = (if referred to an analog input 4÷20 [mA]) = 20 [mA]

Formula to convert per-unit value [pu] in per-cent [%] value with an analog input 4÷20 [mA] set as 4 [mA] = 0 [pu] and 20 [mA] = 1 [pu]:
- per-cent value [%] = 80 [%/pu] * per-unit [pu] + 20 [%]

Example to set a preset value equal to 0.3 [pu] in case of analog input 4÷20 [mA]:
- per-cent value [%] = 80 [%/pu] * 0.3 [pu] + 20 [%] = 24 [%] + 20 [%] = 44 [%]

Example to set a threshold value equal to 0.0 [pu] in case of analog input 4÷20 [mA]:
- per-cent value [%] = 80 [%/pu] * 0.0 [pu] + 20 [%] = 20 [%]

AI2 Threshold [17.52] value, for example, to trigger the Analog Command Loss function active when analog input 2 falls to a value below of 0 [pu]
- **AI1 Threshold [17.51]** set to 20 [%]

AI2 Preset Value [17.60] value, for example, to preset the analog input 2 value to 0.3 [pu] when the Analog Command Loss function is enabled and active:
- **AI1 Preset Value [17.60]** set to 44 [%]

9.12 VDC UNDERVOLTAGE CONTROL

If a supply voltage decrease occurs, the VDC Undervoltage Control function reduces the driving torque and therefore the motor speed in order to maintain the DC-bus voltage constant, recovering energy for the DC-bus from the load kinetic energy (Ride Through).

The regulator of this function intervening when DC-bus voltage goes below the threshold set with the parameter **DC UV Control Limit [12.15]**. When this threshold has been exceeded, then alarm **UvCtrlLimit** (code 29, bit 12 of Alarm Word 2, AW2.12) becomes active. The operation to be performed if this event occurs is set by parameter **DC UV Control Limit [36.29]** of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output. The alarm **UvCtrlLimit** is managed even if this function is not enabled.

If the DC-bus voltage goes below the threshold set through parameter **DC UV Trip Level [12.03]**, alarm **VdcUV** (code 11, bit 10 of Alarm Word 1, AW1.10) becomes active. It is not possible to select the control system behavior: control system intervenes with a Coast stop. The parameter **Vdc UV [36.11]** of the family **ALARM SETTINGS [36.00]** is a read only parameter. It is possible to connect the alarm with a digital output.

If the Undervoltage Control is active the bit 14 of Status Word 2 is On.

The Drive stand-by time with no protection intervention depends on the kinetic energy stored by the load.

9.13 VDC OVERVOLTAGE CONTROL

The function keeps the DC-bus voltage below a certain threshold limiting the braking torque and dissipating in the motor the power generated during braking.
This function can be enabled by parameter **DC-Bus Overvolt Mng [12.01]**.

The function regulator intervenes to maintain DC-bus voltage below the threshold set through parameter **DC OV Control Level [12.04]**.
If the factory threshold is lower than the threshold set by the user, the factory threshold is used by the function.
When threshold has been exceeded, then alarm **OVCtrlLim** (code 30, bit 13 of Alarm Word 2, AW2.13) becomes active. The operation to be performed if this event occurs is set by parameter **DC OV Control Limit [36.30]** of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output.

If the DC-bus voltage goes above the factory threshold, then alarm **VdcOV** (code 03, bit 2 of Alarm Word 1, AW1.02) becomes active. It is not possible to select the control system behavior: control system intervenes with a Coast stop. The parameter **Vdc OV [36.03]** of the family **ALARM SETTINGS [36.00]** is a read only parameter. It is possible to connect the alarm with a digital output.

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9.14 BUS DROP AND GRID WAITING

Bus Drop and Grid Waiting functions can be enabled setting parameter **BDrop GWait Sel [12.30]** to Bus Drop or Grid Waiting.

These functions allow to manage DC-bus voltage drops by turning off the firing pulses.

If Bus Drop and Grid Waiting functions are disabled (the parameter **BDrop GWait Sel [12.30]** is set to Off) and if the DC-bus voltage goes below the threshold set through parameter **DC UV Trip Level [12.03]**, alarm **VdcUV** (code 11, bit 10 of Alarm Word 1, AW1.10) becomes active. It is not possible to select the control system behavior: control system intervenes with a Coast stop. The parameter **Vdc UV [36.11]** of the family **ALARM SETTINGS [36.00]** is a read only parameter. It is possible to connect the alarm with a digital output.

9.14.1 BUS DROP

Bus Drop function can be enabled setting parameter **BDrop GWait Sel [12.30]** to Bus Drop.

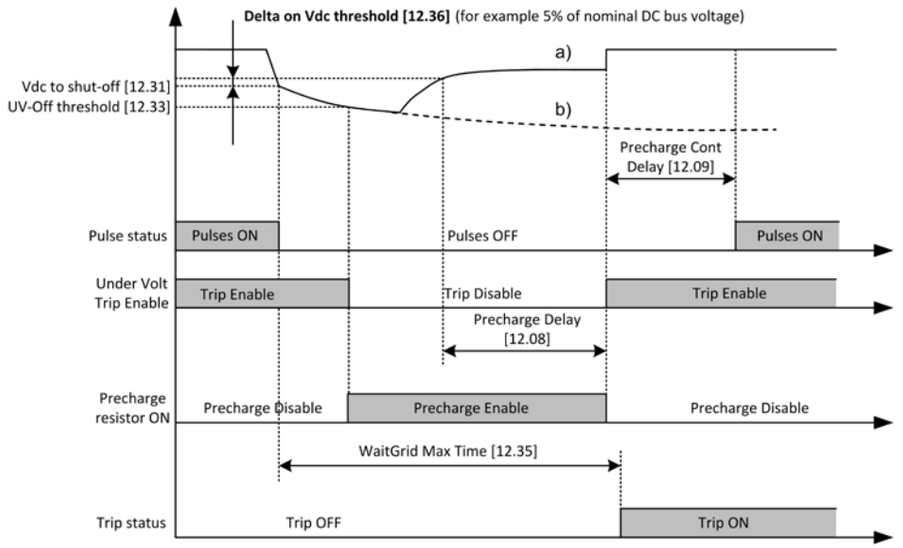
If the VDC-bus voltage goes below the parameter threshold **VDC to shut-off [12.31]**, the control turns off the firing pulses.
Then, if the DC-bus voltage goes above the threshold sum of the parameters **VDC to shut-off [12.31]** + **Delta on Vdc Threshold [12.36]**, after the delay set through parameter **Precharge Cont Delay [12.09]**, the control turns on the firing pulses.

If the DC-bus voltage goes below the threshold set through parameter **DC UV Trip Level [12.03]**, alarm **VdcUV** (code 11, bit 10 of Alarm Word 1, AW1.10) becomes active. It is not possible to select the control system behavior: control system intervenes with a Coast stop. The parameter **Vdc UV [36.11]** of the family **ALARM SETTINGS [36.00]** is a read only parameter. It is possible to connect the alarm with a digital output.

9.14.2 GRID WAITING

Grid Waiting function can be enabled setting parameter **BDrop GWait Sel [12.30]** to Grid Waiting.
If the VDC-bus voltage goes below the parameter threshold **VDC to shut-off [12.31]**, the control turns off the firing pulses. If the DC-bus voltage continues to decrease and goes below the parameter threshold **UV-Off Threshold [12.33]**, the control masks the undervoltage trip and closes the precharge circuit.

Figure 9.8 - Bus Drop with Grid Waiting management



If the voltage comes back (see trend a in Figure 9 .8), when its value reaches the threshold sum of the parameters **VDC to shut-off [12.31]** + **Delta on Vdc Threshold [12.36]**, after the delay set through parameter **Precharge Delay [12.08]**, the control disables the precharge circuit and unmasks the undervoltage trip. After the time set through the parameter **Precharge Cont Delay [12.09]**, the control turns on the firing pulses.
If the voltage doesn't come back (see trend b in), after the time set through the parameter **WaitGrid Max Time [12.35]**, starting from the instant when the firing pulses are turned off, then then alarm **GWMaxTime** (code 43, bit 9 of Alarm Word 3, AW3.09) becomes active. The operation to be performed if this event occurs is set by parameter **GWMaxTime [36.43]** of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output.

NOTE
In order to modify the parameter **Precharge Delay [12.08]** and Precharge **Cont Delay [12.09]**, the user must consider also the effect on the precharge circuit (see paragraph 9.26).

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NOTE
The threshold set to the parameter **VDC to shut-off [12.31]** must be greater than the threshold set through parameter **UV-Off Threshold [12.33]**.
The threshold set to the parameter **UV-Off Threshold [12.33]** must be greater than the undervoltage trip threshold.

NOTE
If the DC-bus voltage drop happens with the Drive in Ready status, the Grid Waiting function doesn't work; the undervoltage trip is anyway active.
It is possible to have the signal of the software trip GWMaxTime on a digital output through a proper selection.

9.15 FLY START

Fly Start function can be enabled setting the parameter **FlyStart En [24.05]** to On.
Fly Start function allows to restart the run of the motor that is yet not stopped.

When the motor start-up the control algorithm estimates the actual frequency of the load and then it switch over to OPERATION ENABLED status and begins the tracking of speed reference.
The parameter **FlyStart Current Error [24.06]** represents the current error value below which the speed control is considered to be "On-hook".

When threshold has been exceeded, then alarm **FlyStartEr** (code 33, bit 0 of Alarm Word 3, AW3.00) becomes active. The operation to be performed if this event occurs is set by parameter **Fly Start Error [36.33]** of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output.

9.16 LOSS OF OUTPUT PHASE/OUTPUT SHORT CIRCUIT

The AD1000 provides two parameters for management the loss of an output phase or output short circuit:

Earth Fault Protection [06.29] to enable this function and
Earth Fault Threshold [06.30] to establish the threshold beyond which the protection shall intervene.

If loss of output phase or output short circuit occur, then alarm **Earth** (code 06, bit 5 of Alarm Word 1, AW1.05) becomes active. It is not possible to select the control system behavior: control system intervenes with a Coast stop. The parameter **Earth [36.06]** of the family **ALARM SETTINGS [36.00]** is a read only parameter. It is possible to connect the alarm with a digital output.

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9.17 FLUX UP

The AD1000 makes a function available for motor fluxing in order to obtain a start with maximum torque available and/or simultaneously with other events (release of mechanical brake, etc.).

This function modifies the Drive Start mode and its operation is managed by the parameters of family **START MODE [33.00]**.

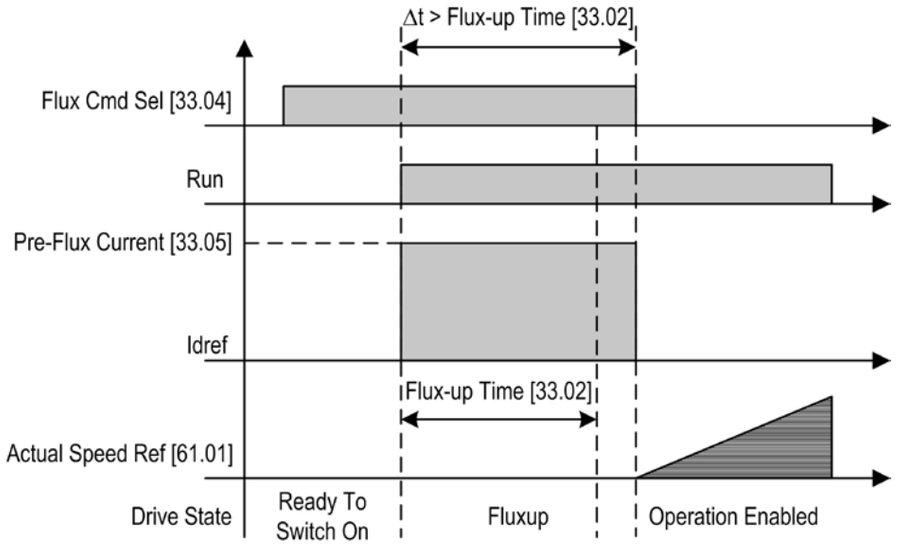
Parameter **Flux-up Time [33.02]** imposes a constant magnetization time (with a current equal to rated magnetizing current) from the start command if parameter **Start mode [33.01]** is set to Flux-Up Time. Through parameter **Flux-up Timeout [33.03]** it is possible to set a maximum time expressed in seconds beyond which the AD1000 switches over to alarm if the fluxing operation is not finished.

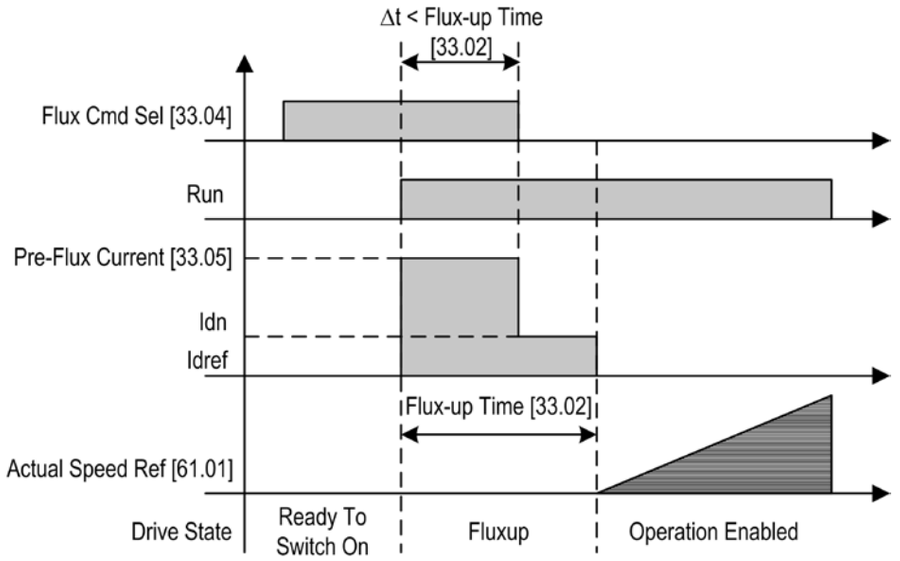
When timeout has been exceeded, then alarm **NoFlux** (code 22, bit 5 of Alarm Word 2, AW2.05) becomes active. The operation to be performed if this event occurs is set by parameter **Fluxup Timeout [36.22]** of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output.

The parameter **Flux Cmd Sel [33.04]** offers the following possibilities for the fluxing mode:
Off: fluxing function disabled. Fluxing operation starting from the Start command with current equal to rated magnetizing current.
On: fluxing function enabled permanently. The fluxing command is always active.
Digital Signals: the fluxing command is provided through the selected digital signal (digital input, configurable bit of CW1, dedicated bit of CW2).
When the fluxing signal is On, at Run command arrival a current is applied equal to the one expressed by parameter **Flux Cmd Current [33.05]** for a time equal to fluxing command; if **Start Mode [33.01]** is set to Flux-Up Time and fluxing command is released before **Flux-up Time [33.02]**, then after the fluxing command release the current is applied equal to the rated magnetizing current up to **Flux-up Tim [33.02]**; if **Start Mode [33.01]** is set to Flux-Up Time and if fluxing command is released after **Flux-up Time [33.02]**, then Drive starts; if **Start Mode [33.01]** is set to Auto, then after the fluxing command release the Drive starts.

The function time chart is shown in Figure 9.9.

Figure 9.9 - Flux up





PREVIOUS VIEW

9.18 TORQUE LIMITS CONTROL

The AD1000 makes four set of fixed positive and negative torque limits available: **Pos Torque Limit 1 [22.01], Neg Torque Limit 1 [22.02], Pos Torque Limit 2 [22.03], Neg Torque Limit 2 [22.04], Pos Torque Limit 3 [22.22], Neg Torque Limit 3 [22.23], Pos Torque Limit 4 [22.24], Neg Torque Limit 4 [22.25]** that can be selected with bit 7 of Command Word 2 and bit 8 of Command Word 4. The source of the selection signal of the set of limits being used can be set from parameter **Cmd 1 Torque Limit Set [22.05] and Cmd 2 Torque Limit Set [22.26]**.

It is possible to impose dynamic torque limits. The source of this dynamic limits must be set through parameters **Pos Torque Limit Set [22.08]** and **Neg Torque Limit Set [22.09]**.
This dynamic limit is anyway saturated with respect to the fixed positive and negative torque limits chosen by the operator.

Parameter **Torque Limit Type [22.06]** allows choosing between:
Pos/Neg: management of the current fixed torque limit set based only on its sign (default);
Motor/Gen: management of the current User torque limit set based on the Drive operating quadrant.

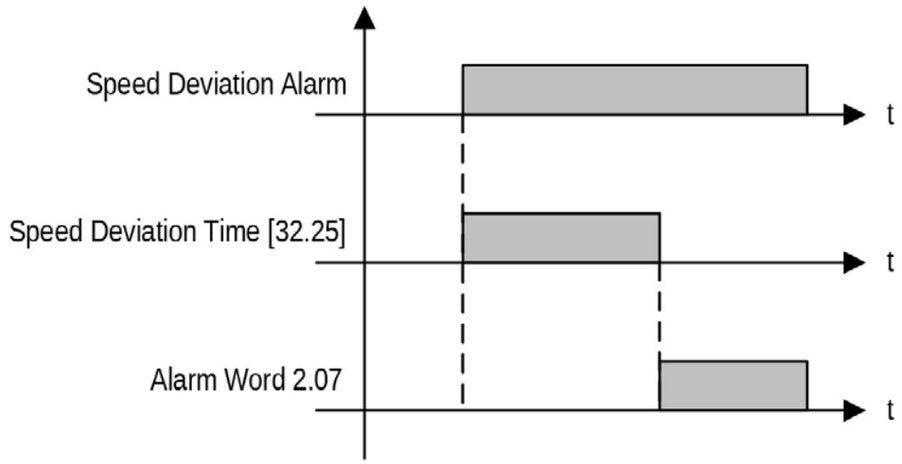
With this latter selection and fixed limit sets being equal (for instance Set 1), there are 2 possible situations, managed in an entirely automatic way:
When the load operates from motor (working quadrants I and III) limits **Pos Torque Limit 1 [22.01]** and **Neg Torque Limit 1 [22.02]** are applied, as entered by the user;
When the load operates from generator (working quadrants II and IV) limits **Pos Torque Limit 1 [22.01]** as absolute positive limit and **Neg Torque Limit 1 [22.02]** as absolute negative limit are applied.
It is also possible to set a second order filter on the torque reference with a bandwith that can be selected from parameter **Torque Ref Filter BW [22.07]**.

9.19 SPEED DEVIATION

It is possible to set a filter for management of the maximum speed error alarm. When speed error has been exceeded, then alarm **SpeedDev** (code 24, bit 7 of Alarm Word 2, AW2.07) becomes active. The operation to be performed if this event occurs is set by parameter **DC OV Speed Deviation [36.24]** of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output.

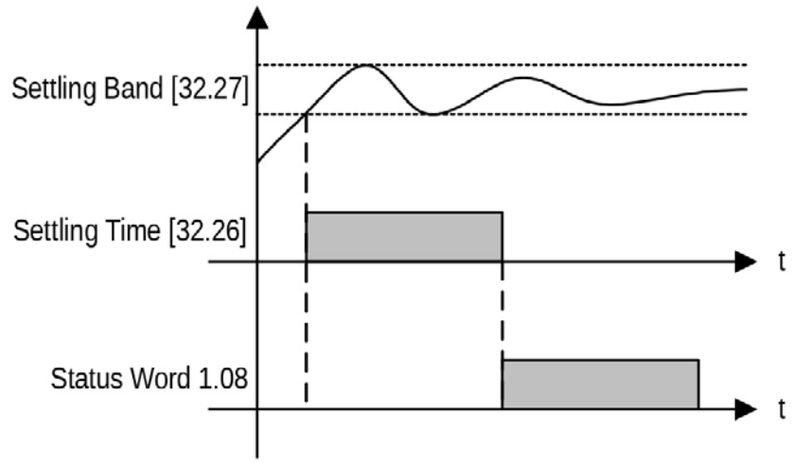
Through the parameter **Speed Deviation Time [32.25]** is entered the minimum time for which the Speed Deviation condition shall last before a signaling and/or intervention occurs.

Figure 9.10 - Speed Deviation



The error threshold between speed feedback and speed reference to establish if you are under Speed Deviation conditions is given by parameter **Settling Band [32.27]**. When the error is within this threshold and remains there for a period of time longer than the one set in parameter **Settling Time [32.26]** you consider that the speed reached corresponds to the one set by the reference. In this case bit 8 is set of **Status Word 1**.

Figure 9.11 - Settling Time



PREVIOUS VIEW

9.20 UNDERLOAD

Underload function can be enabled setting the parameter **Underload Enable [35.10]** to On. This parameter is settable only when the Drive is stopped. Underload function parameters are available in the family **MOTOR UNDER/OVERLOAD [35.00]**.

Underload function permits to detect an underload condition. Typically, this feature is used on pumps that are required to maintain a minimum flow or load level for lubrication requirements.

The parameter **Underload Level [35.11]** is used to set a percent of the motor nominal current defined by the parameter **Rated Current [02.04]** in order to define a threshold for the underload condition detection.
The formula used :

- if (feedback stator current / **Rated Current [02.04]**) * 100 is lower than the parameter **Underload Level [35.11]** for a time longer than the time defined by the parameter **Underload Time [35.12]**
- then an underload alarm is generated, defined by the parameter **Underload [36.21]**

When underload condition occurs, then alarm **Underload** (code 21, bit 4 of Alarm Word 2, AW2.04) becomes active. The operation to be performed if this event occurs is set by parameter **Underload [36.21]** of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output.

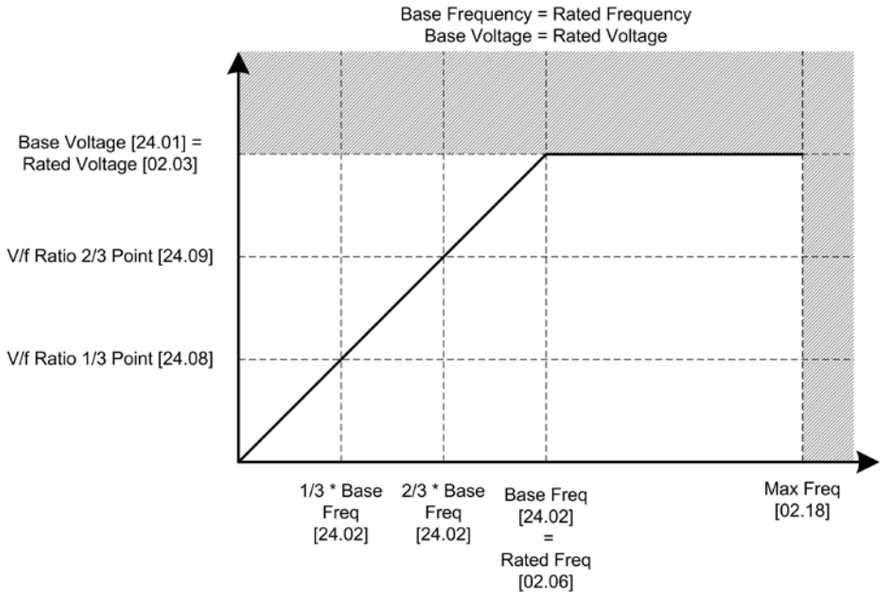
9.21 ENERGY OPTIMIZATION

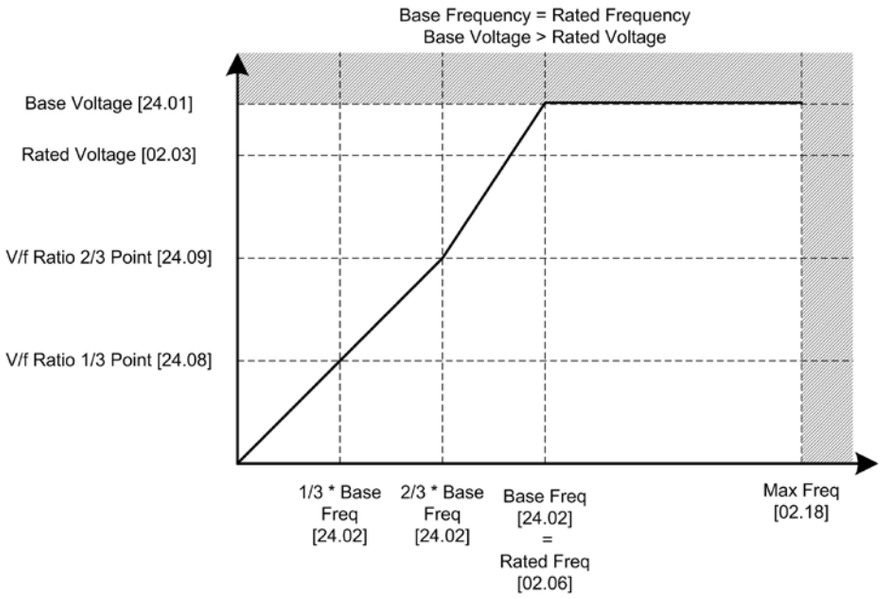
Energy Optimization function can be enabled setting parameters **V/f Ratio 1/3 Point [24.09]** and **V/f Ratio 2/3 Point [24.10]** to value different from the default. Energy Optimization function parameter are available in the family **V/f CONTROL [24.00]**.

Energy Optimization function ensures high operating efficiency by reducing motor voltage when the load requirements are lower than the rated values (torque lower than 100%). Motor losses are minimized and the power factor is maintained at optimal value.
Energy Optimization function is integrated inside the standard V/f characteristic management: parameters **Base Voltage [24.01]** and **Base Frequency [24.02]** determine the slope of the V/Hz line.

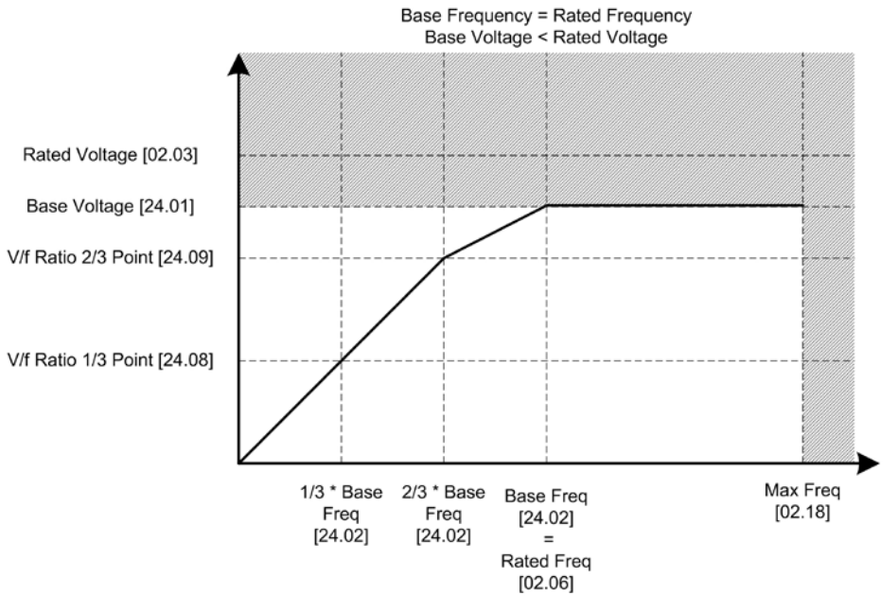
If parameters **Base Voltage [24.01]** and **Base Freq / Rated Freq [24.02]** are both greater than parameters **Rated Voltage [02.03]** and **Rated Freq [02.06]** respectively, the characteristic corresponds to a polygonal chain reaching point (**Rated Freq [02.06], Rated Voltage [02.03]**) and then point
(**Base Freq / Rated Freq [24.02], Base Voltage [24.01]**) as shown in the following figures.

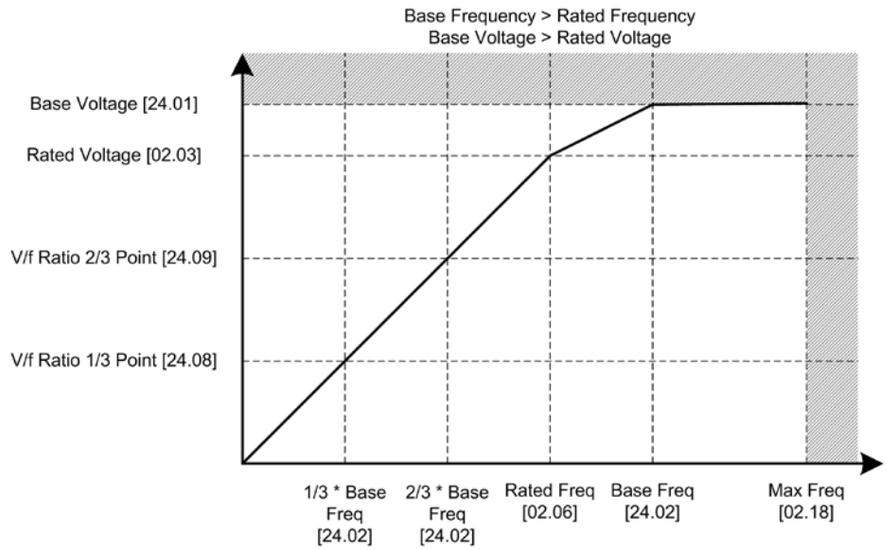
Figure 9.12 – Standard V/f characteristic





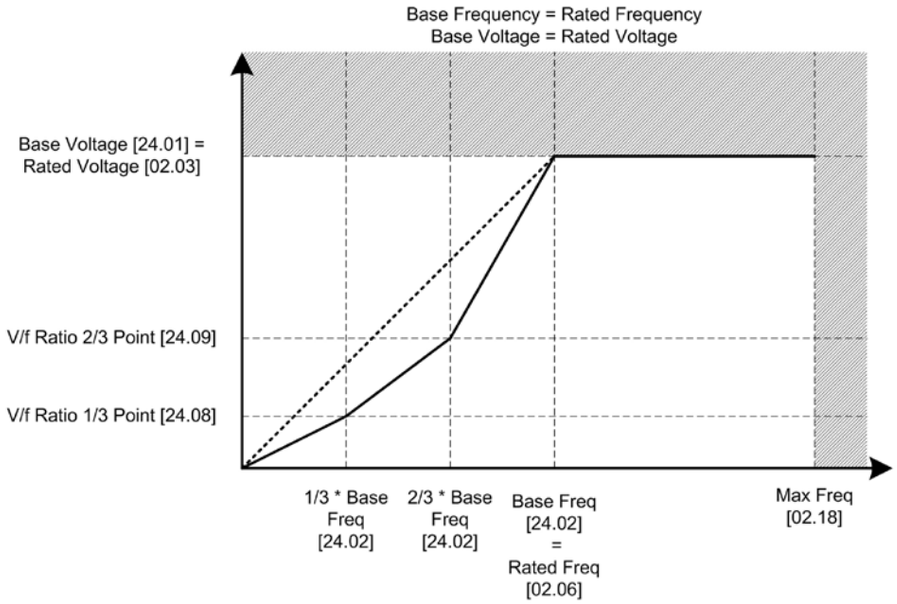
PREVIOUS VIEW





Energy Optimization parameters **V/f Ratio 1/3 Point [24.09]** and **V/f Ratio 2/3 Point [24.10]** work reducing the flux value in the polygonal chain.

Figure 9.13 – V/f characteristic modified by Energy Optimization function



PREVIOUS VIEW

9.22 VOLTAGE BOOST

The AD1000 allows setting a gain to be applied to the voltage reference of the Vector V/f control to compensate for the resistive drop on the motor stator at low speed. Such gain is expressed in percentage and corresponds to parameter **Boost Gain [24.03]**.
The default value is 80% and allows the reference to pass unaltered through this function.

9.23 MOTOR ID

This is a procedure performed off-line by the operator for identifying the main parameters in motor.
It consists of two tests that can be activated independently: **Motor ID 1** and **Inertia ID**. The first one is static, the second takes place with rotating motor. It is possible to know the status of procedures through process variable **Test Status [75.20]**, common to all tests.
During the test external reference or additional torque should not be applied to the motor.
For more information see paragraph 6.2.

9.23.1 MOTOR ID 1

Motor ID 1 is managed by the parameters of family **Motor ID 1 [07.00]**. Parameter **Locked-Rotor ID [07.01]** enables the procedure that is started after the arrival of the Run command. Calculated data overwrite those present in parameters **Voltage Drop Over Ls [07.02], Voltage Drop Over Rs [07.03]** and **Dead Time Comp [07.04]**.

A calculation procedure of the three above mentioned parameters is also available, starting from the motor nameplate data without the execution of a real test on the motor. To activate such procedure set parameter **Locked-Rotor ID [07.01]** on "Preset from equivalent circuit data". The execution of the procedure shall take place immediately (with no need for the Run command) and, also in this case, the existing values shall be overwritten in parameters **Voltage Drop Over Ls [07.02], Voltage Drop Over Rs [07.03]** and **Dead Time Comp [07.04]**.

9.23.2 INERTIA ID

The **Inertia ID** test calculation of the time constant relevant to the motor moment of inertia. It is an acceleration test that can be performed off-line by the operator to estimate inertia of the whole motor+load system, managed by the parameters of family **INERTIA ID [10.00]**.

The enable parameter is **Inertia Id Test [10.01]**. It is necessary to set the start and stop speed of the test through parameter **Test Start Speed [10.02]** and parameter **Test Stop Speed [10.03]**.

The value calculated at the end of the test is saved in parameter **Inertia Time Constant [10.03]** and overwrites the previous datum.

PREVIOUS VIEW

9.24 MULTIPLE GAINS

The AD1000 makes multiple sets of speed regulator gains and ramps available, in order to allow the user to select every time the one most appropriate to the function to be achieved.

For the speed regulator four sets of proportional and integrative gains are available. The four gains of the proportional parts are stored in parameters **Proportional Gain 1 [21.05], Proportional Gain 2 [21.07], Proportional Gain 3 [21.09]** and **Proportional Gain 4 [21.11]**, while the time constants of the integrative parts correspond to parameters **Integral Time 1 [21.06], Integral Time 2 [21.08], Integral Time 3 [21.10]** and **Integral Time 4 [21.12]**.

The selection among these four sets comes from digital signals. The source setting is delegated to parameters **Cmd 1 Gain Set Sel [21.03]** and **Cmd 2 Gain Set Sel [21.04]**.
The selection is performed as shown in the Table 9 .2.

Table 9.2 - Selection of the speed regulator gains set

Status of digital signal selected by parameter		Selected value
[21.04]	[21.03]	
0	0	**Set 1 [21.05-21.06]**
0	1	**Set 2 [21.07-21.08]**
1	0	**Set 3 [21.09-21.10]**
1	1	**Set 4 [21.11-21.12]**

9.25 REGULATOR AUTOTUNING

This function exploits the parameters calculated in the **Motor ID** procedures and present in the relevant families to automatically set the gains of the speed regulator.
The parameters are used:
for speed regulator autotuning only if parameter **Speed Ctrl Autotune [21.01]** is set to On.

The desired band for the regulation loop is set in parameter **Speed Ctrl Bandwidth [21.02]**. Calculated parameters do not overwrite the gains of the regulator set by the user, but replace them only when the relevant enable parameter is set to On. Returning the latter to Off, the gains previously set by the user are available again.

PREVIOUS VIEW

9.26 PRECHARGE MANAGEMENT

The AD1000 allows managing the Drive precharge phase in case the latter is performed internally.

The precharge is performed on READY TO SWITCH-ON status.

After the precharge start command StartPrc, the AD1000 waits for a time equal to the parameter **Precharge Delay [12.08]**. At the end, the DC-bus voltage shall exceed the threshold defined by the parameter **DC Precharge Level [12.07]**, normally set to a value between 80% and 90% of rated voltage (default value 80%).

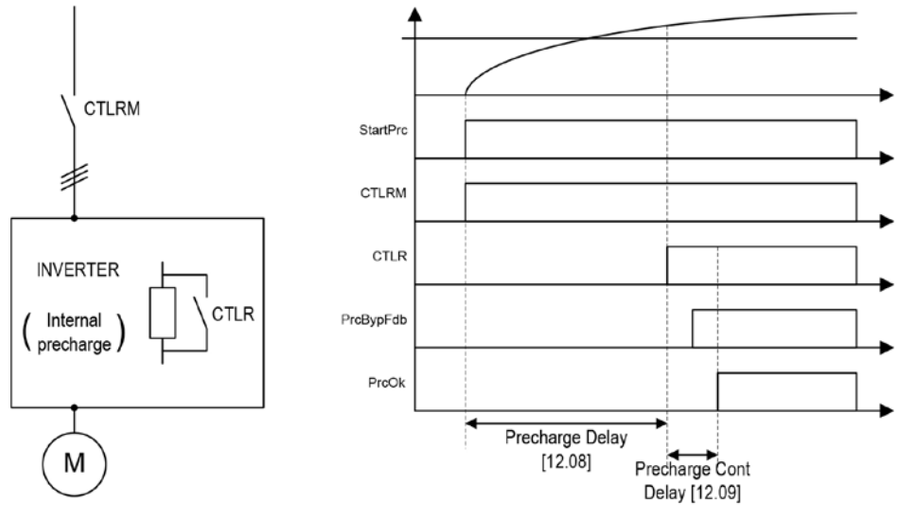
If the condition is not met, then alarm **PrcTimeout** (code 08, bit 7 of Alarm Word 1, AW1.07) becomes active. It is not possible to select the control system behavior: control system intervenes with a Coast stop. The parameter **Prc Timeout [36.08]** of the family **ALARM SETTINGS [36.00]** is a read only parameter. It is possible to connect the alarm with a digital output.
If after the **Precharge Delay [12.08]** the DC-bus voltage is higher than **DC Precharge Level [12.07]** and lower than **DC OV Control Limit [12.16]**, the AD1000 gives the precharge end command (bypass) and waits for a time equal to the parameter **Precharge Cont Delay [12.09]**. When this period of time has elapsed, the AD1000 checks that the bypass-accomplished feedback has arrived, to recognize that the precharge phase has terminated.

The parameter **DC UV Trip Level [12.03]** defines a threshold, set to a value below the threshold defined by the parameter **DC Precharge Level [12.07]**, used to generate the alarm **VdcUV** (code 11, bit 10 of Alarm Word 1, AW1.10). It is not possible to select the control system behavior: control system intervenes with a Coast stop. The parameter **Vdc UV [36.11]** of the family **ALARM SETTINGS [36.00]** is a read only parameter. It is possible to connect the alarm with a digital output.

The threshold defined by the parameter **DC UV Trip Level [12.03]** shall be considered lower by at least 75% than the rated voltage value (default value 70%).

Precharge start is done with contactor CTLRM.

Figure 9.14 – Precharge sequence



NOTE
Parameters **Precharge Delay [12.08]** and **Precharge Cont Delay [12.09]** are also used in the functions Bus Drop and Grid Waiting (see paragraph 9.14).

PREVIOUS VIEW

9.27 AUTO ON/OFF

Auto On/Off function can be enabled setting the parameter **Auto OnOff Enable [33.21]** to On. This parameter is settable only when the Drive is stopped. Auto On/Off function parameters are available in the family **START/STOP MODE [33.00]**.

In order to use this function, an analog input must be set as the main source for the speed reference. Auto On/Off function allows the Drive to be started if the main speed reference from an analog input is greater than a predefined threshold, set using the parameter **Auto OnOff Start Thresh [33.23]**, and allows the Drive to be stopped if the main speed reference is lower than a predefined threshold, set using the parameter **Auto OnOff Stop Thresh [33.22]**.

When the main speed reference becomes lower than the parameter **Auto OnOff Stop Thresh [33.22]**, the Drive is stopped and set in Sleep Mode. The Drive restarts if the main speed reference becomes greater than the parameter **Auto OnOff Start Thresh [33.23]** or if one of the following enabled functions become active: Frost Protection, Anti-Blocking and/or Jog (Flushing); the Drive resets Sleep Mode, restarts and sets Run state.

Auto On/Off function operates in AND logic with the Start command used for normal operation; Auto On/Off function is active only if the following conditions are satisfied:

- Auto On/Off function is enabled: the parameter **Auto OnOff Enable [33.21]** is set to On
- Speed reference set from main speed reference
- Speed reference comes from an analog input

Auto On/Off function doesn't work on auxiliary speed reference; anyway, auxiliary speed reference can still be connected and used with other speed reference.
The values of parameters **Auto OnOff Stop Thresh [33.22]** and **Auto OnOff Start Thresh [33.23]** are entered in pu of the maximum input voltage (10 V) or current (20 mA) accepted by analog input. The speed that corresponds to parameters **Auto OnOff Stop Thresh [33.22]** and **Auto OnOff Start Thresh [33.23]** must be read on the same scale defined for the analog input that convert the input V or mA signal into a frequency or speed reference.

After the speed reference becomes greater than the **Auto OnOff Start Thresh [33.23]**, the start of the Drive can be delayed by a time specified in the parameter **Auto OnOff Start Delay [33.25]**.

After the speed reference becomes lower than the **Auto OnOff Stop Thresh [33.22]**, the stop of the Drive can be delayed by a time specified in the parameter **Auto OnOff Start Delay [33.25]**.

NOTE
The parameter **Auto OnOff Stop Thresh [33.22]** must be lower than the speed set into the parameter **Auto OnOff Start Thresh [33.23]**. Trying to set the parameter **Auto OnOff Stop Thresh [33.22]** greater than the parameter **Auto OnOff Start Thresh [33.23]**, than **Auto OnOff Stop Thresh [33.22]** is automatically limited to **Auto OnOff Start Thresh [33.23]**.

WARNING
With Auto On/Off function enabled and Start command active (set to On), the Drive can automatically restart the machine without the need of any other command.

WARNING
If Auto On/Off function is disabled when Drive is in Sleep Mode, the Drive can automatically restart the machine without the need of any other command.

WARNING
With Auto On/Off function enable and Drive is in Sleep Mode, if speed reference switch from main speed reference to auxiliary speed reference, the Drive can automatically restart the machine without the need of any other command.

WARNING
The user is responsible for enabling of this function according to safety rules according to safety rules. Nidec ASI S.p.A. declaims any liability due to inappropriate use of this function. Make sure that the automatic restart of the machine will not cause physical injury and/or damage equipment. Refer to standards IEC 60204-1.

NOTE
It is not possible set the parameter **Auto OnOff Enable [33.21]** to On if the parameter **HOA Start/Stop type [33.12]** is set to Pulse Start/Stop. In case the operator tries to set the parameter **Auto OnOff Enable [33.21]** to On when **HOA Start/Stop type [33.12]** is set to Pulse Start/Stop, the error DSPParEr is generated and the **Auto OnOff Enable [33.21]** is automatically reset to Off.

PREVIOUS VIEW

9.28 AUTO RESET AND RESTART

Auto Reset and Restart function can be enabled setting the parameter **Auto Reset Enable [34.01]** to On. This parameter is settable only when the Drive is stopped. Auto Reset and Restart function parameters are available in the family **AUTORESET [34.00]**.

When a fault occurs, if the Auto Reset and Restart function is enabled for that fault, the Drive attempts to reset, precharge and start; Drive performs all these actions after the time selected by means of the parameter **Auto Reset Time [34.02]** has elapsed.
If one of the following conditions occur (or a combination of them):

- the attempt to reset the Drive fails
- the attempt to reset the Drive successes but after that the same or another fault occurs

for a number of time equal to that specified by use of parameter Auto Reset Attempt [34.03], the Drive is shut down and a manual reset is required.
The Drive should operate at least for **Reset Memory Time [34.04]** without a fault before the auto reset attempt counter is set back to 0.

Auto Reset and Restart function allows automatic resetting of a trip and restarting of the Drive. When this function is enabled, any type of trip can be recovered, except some critical trips that must be selected by the following parameters:

- **Reset Desaturation [34.05]** (related to alarm **IGBTDesat** defined by parameter **IGBT Desat [36.04]**)
- **Reset IOC [34.06]** (related to alarm **OverCur** defined by parameter **OverCur [36.07]**)
- **Reset Overvoltage [34.07]** (related to alarm **VdcOV** defined by parameter **Vdc OV [36.03]**)
- **Reset Undervoltage [34.08]** (related to alarm **PrcTimeout** defined by parameter **Vdc UV [36.11]**)
- **Reset Therm. Ovld [34.09]** (related to alarm **OverHeat** defined by parameter **Overheat [36.05]**)

NOTE
The parameter **Reset Memory Time [34.04]** must be bigger than the parameter **Auto Reset Time [34.02]**, otherwise the Drive doesn't attempt to reset, precharge and restart.

WARNING
With Auto Reset and Restart function enabled and Start command active (set to On), the Drive can automatically restart the machine without the need of any other command (the Drive automatically attempts to reset, precharge and restart trying to go in Run state).

WARNING
With Auto Reset and Restart function enabled and Start command active (set to On), if the operator resets a trip with manual command (for example, by pressing the Reset button on the DVM tool or on the keypad), the Drive immediately restarts the machine without the need of any other command.

WARNING
With Auto Reset and Restart function set to On (enabled) when Drive in Fault state and Start command active (set to On), the Drive can automatically restart the machine without the need of any other command (the Drive automatically attempts to reset, precharge and restart trying to go in Run state).

WARNING
The user is responsible for enabling of this function according to safety rules. Nidec ASI S.p.A. declaims any liability due to inappropriate use of this function. Make sure that the automatic restart of the machine will not cause physical injury and/or damage equipment. Refer to standards IEC 60204-1.

NOTE
It is not possible set the parameter **Auto Reset Enable [34.01]** to On if the parameter **HOA Start/Stop type [33.12]** is set to Pulse Start/Stop.
In case the operator tries to set the parameter **Auto Reset Enable [34.01]** to On when **HOA Start/Stop type [33.12]** is set to Pulse Start/Stop, the error DSPParEr is generated and the **Auto Reset Enable [34.01]** is automatically reset to Off.

NOTE
Auto Reset and Restart function has a different behavior if Drive is in Man mode (see HOA – Hand/Off/Auto function). Auto reset is still true, but not restart.

PREVIOUS VIEW

9.29 MOTOR SWITCH

Motor Switch function can be enabled setting the parameter **Motor Switch Enable [33.50]**. This parameter is settable only when the Drive is stopped. Motor Switch function parameters are available in the family **START/STOP MODE [33.00]**.

Motor Switch function is typically used if there is a switch between the Drive and the motor. This switch is used to make sure that an electrical circuit can be completely de-energized from the motor for service and/or maintenance.

The Drive uses a dedicated digital input set using the parameter **Motor Switch Cmd Sel [33.51]**: an auxiliary contact of the switch is used as digital input of the Drive to monitor the state of the switch and perform Motor Switch function.
When Motor Switch function is enabled and the motor switch is open to disconnect the running motor, the Drive detects the loss of the motor without tripping, is stopped and set in Hard Sleep Mode and alarm **MotorSwitch** (code 57, bit 8 of Alarm Word 4, AW4.08) becomes active. The operation to be performed if this event occurs is set by parameter **Motor Switch [36.57]** of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output.

After motor service and/or maintenance is completed, the switch is reclosed and the motor is reconnected: the Drive detects the motor connection and runs the motor in the same normal operation as before the service and/or maintenance operation. The Drive resets Hard Sleep Mode, restarts and set Run state.

WARNING
Do not use Jog (Flushing) function with Motor Switch enabled and active, otherwise the Drive can trip.

NOTE
It is not possible set the parameter **Motor Switch Enable [33.50]** to On if the parameter **HOA Start/Stop type [33.12]** is set to Pulse Start/Stop.
In case the operator tries to set the parameter **Motor Switch Enable [33.50]** to On when **HOA Start/Stop type [33.12]** is set to Pulse Start/Stop, the error DSPParEr is generated and the **Motor Switch Enable [33.50]** is automatically reset to Off.

9.30 JOG (FLUSHING)

Jog (Flushing) function can be enabled setting the parameter **Jog En [41.01]** to On. Jog (Flushing) function parameters are available in the family J**OG [41.00]**.

The Jog (Flushing) function allows the user to start the motor with a pre-set speed reference. Two preset speeds are available; dedicated parameters are available for each set:
- **Jog 1 Cmd Sel [41.06]:** digital signal to select Jog (Flushing) speed 1 preset
- **Jog 1 Speed Ref [41.02]:** Jog (Flushing) speed 1 preset
- **Jog Time 1 [41.04]:** Jog (Flushing) ramp up and down time used for speed 1 preset, defined as the time to accelerate the Drive from 0 to maximum speed and tom decelerate the Drive from maximum speed to 0
- **Jog 2 Cmd Sel [41.07]:** digital signal to select Jog (Flushing) speed 2 preset
- **Jog 2 Speed Ref [41.03]:** Jog (Flushing) speed 2 preset
- **Jog Time 2 [41.05]:** Jog (Flushing) ramp up and down time used for speed 2 preset, defined as the time to accelerate the Drive from 0 to maximum speed and tom decelerate the Drive from maximum speed to 0

The speed reached by the motor when commanded by a Jog (Flushing) function is set in parameters **Jog 1 Speed Ref [41.02]** and **Jog 2 Speed Ref [41.03]**. The reaching of this reference takes place with a ramp defined by parameters **Jog Time 1 [41.04]** and **Jog Time 2 [41.05]**, expressing the duration in seconds of the ramp from 0 to the maximum speed. Such ramp is also used in the deceleration phase.

The Jog command is activate with bit 8 (Jog 1) or bit 9 (Jog 2) of CW1. These bits are associated with digital signal set through parameters **Jog 1 Cmd Sel [41.06]** and **Jog 2 Cmd Sel [41.07]** respectively. When the selected signal is set to On, the Drive starts with the speed reference of the selected Jog (Flushing).
If the two commands Jog 1 and Jog 2 are given simultaneously, both functions are inhibited until such situation has decayed.

The Jog (Flushing) function is active only if the following conditions are satisfied:
- Jog (Flushing) function is enabled: the parameter **Jog En [41.01]** is set to On
- The Drive is in Stop state or in Sleep Mode
- The two Jog (Flushing) commands are not activated simultaneously

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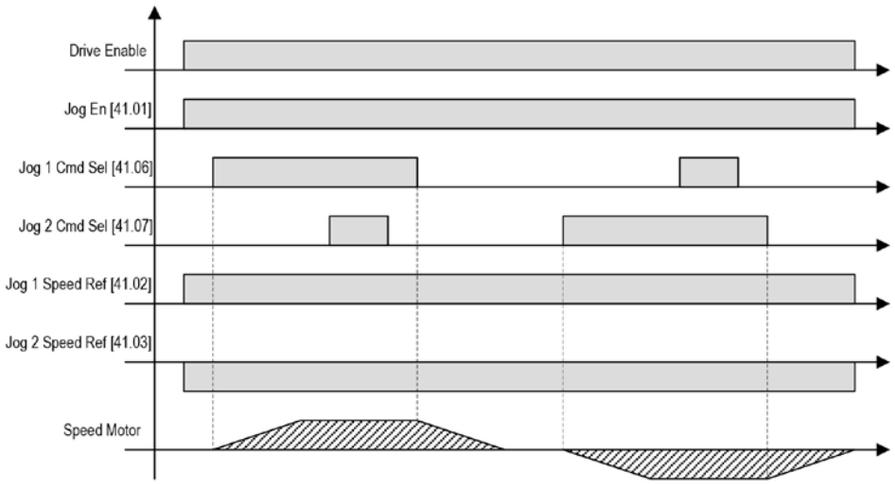
The Start command has no effect if applied during execution of the Jog (Flushing) functions. If during a Jog (Flushing) sequence the other Jog (Flushing) reference is commanded as well, the latter shall be ignored and the Drive shall maintain the first Jog reference activated.

The current Jog (Flushing) reference sign can be inverted with the usual Reverse command (CW 2.03) applicable for instance through Digital Input 2 (if parameter **DI Run/Fw/Rv Connections [31.10]** has been properly set).

During Jog (Flushing) operations, references, Aux and Add Speed Ref (pre- and post-ramp) are not considered, and the same goes for any modifications produced by macro-functions present and enabled before the **Ramp** function (**Critical Speed Avoidance, Digital Potentiometer**, etc.). The macro-functions applied after ramp, if enabled, and torque additions, remain active and shall be suitably managed by plant automation during **Jog**.

Figure 9.15 - Activation of Jog functions



WARNING
Jog (Flushing) function overrides command and reference; with Jog (Flushing) function active, the Drive can start from Stop state and Sleep Mode; once Drive is started (Run state), the other functions are locked, until Jog (Flushing) finishes (Stop state).

WARNING
With Jog (Flushing) function active, the Drive resets Sleep Mode (due to Motor Pause, Auto On/Off, Well Draw Down Control and/or Low City or Low Suction Inlet pressure), restarts and set Run state.

WARNING
Do not use Jog (Flushing) function with Motor Switch enabled and active, otherwise the Drive can trip.

9.31 ANTI-BLOCKING

Anti-Blocking function can be enabled setting the parameter **AntiBlocking Enable [33.60]** to On. This parameter is settable only when the Drive is stopped. Anti-Blocking function parameters are available in the family **START/STOP MODE [33.00]**.

Anti-Blocking function is designed to protect the pump from blocking: if the Drive is in Sleep Mode for too long, the Drive periodically and automatically starts the pump at a constant speed.

If the Drive is in Sleep Mode for a time longer than the parameter **AntiBlocking Runtime [33.62]**, the Drive starts the pump at a constant speed defined by the parameter **AntiBlocking Speed Ref [33.63]** for a time equal to the parameter **AntiBlocking Interval [33.61]**. When Anti-Blocking function cycle is finished, the Drive automatically stops and set again in Sleep Mode.

WARNING
With Anti-Blocking function active, the Drive resets Sleep Mode (due to Motor Pause, Auto On/Off, Well Draw Down Control and/or Low City or Low Suction Inlet pressure), restarts and set Run state.

WARNING
The user is responsible for enabling of this function according to safety rules. Nidec ASI S.p.A. declaims any liability due to inappropriate use of this function. Make sure that the automatic restart of the machine will not cause physical injury and/or damage equipment. Refer to standards IEC 60204-1.

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9.32 AUTO-CLEANING

Auto-Cleaning function can be enabled setting the parameter **AutoClean Enable [33.70]** to a value different from Off. This parameter is settable only when the Drive is stopped. Auto-Cleaning function parameters are available in the family **START/STOP MODE [33.00]**.
Auto-Cleaning function is designed to free the pump blade of debris in waste water applications so that the pump do not risk to damage and can work properly.
Auto-Cleaning function can be enabled in 4 different modes:

- Parameter **AutoClean Enable [33.70]** set to Digital Input: Auto-Cleaning cycles activation comes from digital input defined using the parameter **AutoClean Cmd Sel [33.71]**
- Parameter **AutoClean Enable [33.70]** set to Current Threshold: Auto-Cleaning cycles activation is determined by the comparison of the actual current with a threshold current defined by the parameter **AutoClean Curr Thres [33.72]**; if actual current is bigger than parameter **AutoClean Curr Thres [33.72]** for a time longer parameter **AutoClean Curr Delay [33.73]**, then Auto-Clean cycles are activated and alarm AutoClnCur (code 61, bit 12 of Alarm Word 4, AW4.12) become active; the operation to be performed if this event occurs is set by parameter **AutoClean Curr Thres [36.61]** of the family **ALARM SETTINGS [36.00]**; it is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output
- Parameter **AutoClean Enable [33.70]** set to Time Interval: Auto-Cleaning cycles activation is periodic with a period defined by the parameter **AutoClean Time Interval [33.74]**
- Parameter **AutoClean Enable [33.70]** set to Start Command: Auto-Cleaning cycles activation is simultaneous with Drive Start command

Auto- Cleaning function is realized with a base cycle:

- Drive runs in forward direction at speed defined by the parameter **AutoClean Forward Speed [33.76]**, for a time defined by the parameter **AutoClean Forward Time [33.77]**
- Drives stands at zero speed for a time defined by the parameter **AutoClean OffDelay Time [33.82]**
- Drive runs in reverse direction at speed defined by the parameter **AutoClean Reverse Speed [33.78]**, for a time defined by the parameter **AutoClean Reverse Time [33.79]**
- Drives stands at zero speed for a time defined by the parameter **AutoClean OffDelay Time [33.82]**

The Drive ramps the speed using the following parameter:

- Parameter **AutoClean Ramp Acc Time [33.80]** defines the acceleration time from 0 speed to maximum speed
- Parameter **AutoClean Ramp Dec Time [33.81]** defines the deceleration time from maximum speed to 0 speed

The number of cycles for Auto-Cleaning procedure is defined by the parameter **AutoClean Cycles Number [33.75]**.

NOTE
Parameter **AutoClean Forward Speed [33.76]** and parameter **AutoClean Reverse Time [33.79]** must be lower in absolute value than parameter **Max Pos Ref [32.22]** and parameter Max Neg Ref [32.23] respectively.

9.33 FROST PROTECTION

Frost Protection function can be enabled and configured (analog input selection) setting the parameter **Frost Prot. Enable [33.30]**. This parameter is settable only when the Drive is stopped. Frost Protection function parameters are available in the family **START/STOP MODE [33.00]**.
Frost Protection function is designed to protect the pump from frost damages: if the Drive is in Sleep Mode and the measured temperature of the pump or of other monitored element of the hydraulic circuit is below a threshold, the Drive automatically starts the pump at a constant speed. If the Drive is in Sleep Mode and the measured temperature goes below the parameter **Frost Prot. Low Temp. [33.31]**, the Drive starts the pump at a constant speed defined by the parameter **Frost Prot. Speed Ref [33.33]** and alarm FrostProt (code 54, bit 5 of Alarm Word 4, AW4.05) becomes active.
The operation to be performed if this event occurs is set by parameter **Frost Protection [36.54]** of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output. It is suggested to set parameter **Frost Protection [36.54]** to Warning, otherwise the function behaviour will be different; anyway, if desired, it is possible to set the alarm behaviour also in a different way, changing a different the Drive response. When the measured temperature goes above **Frost Prot. High Temperature [33.32]**, the Drive automatically stops and set again in Sleep Mode.

WARNING
With Frost Protection function active, the Drive resets Sleep Mode (due to Motor Pause, Auto On/Off, Well Draw Down Control and/or Low City or Low Suction Inlet pressure), restarts and set Run state.

WARNING
The user is responsible for enabling of this function according to safety rules. Nidec ASI S.p.A. declaims any liability due to inappropriate use of this function. Make sure that the automatic restart of the machine will not cause physical injury and/or damage equipment. Refer to standards IEC 60204-1.

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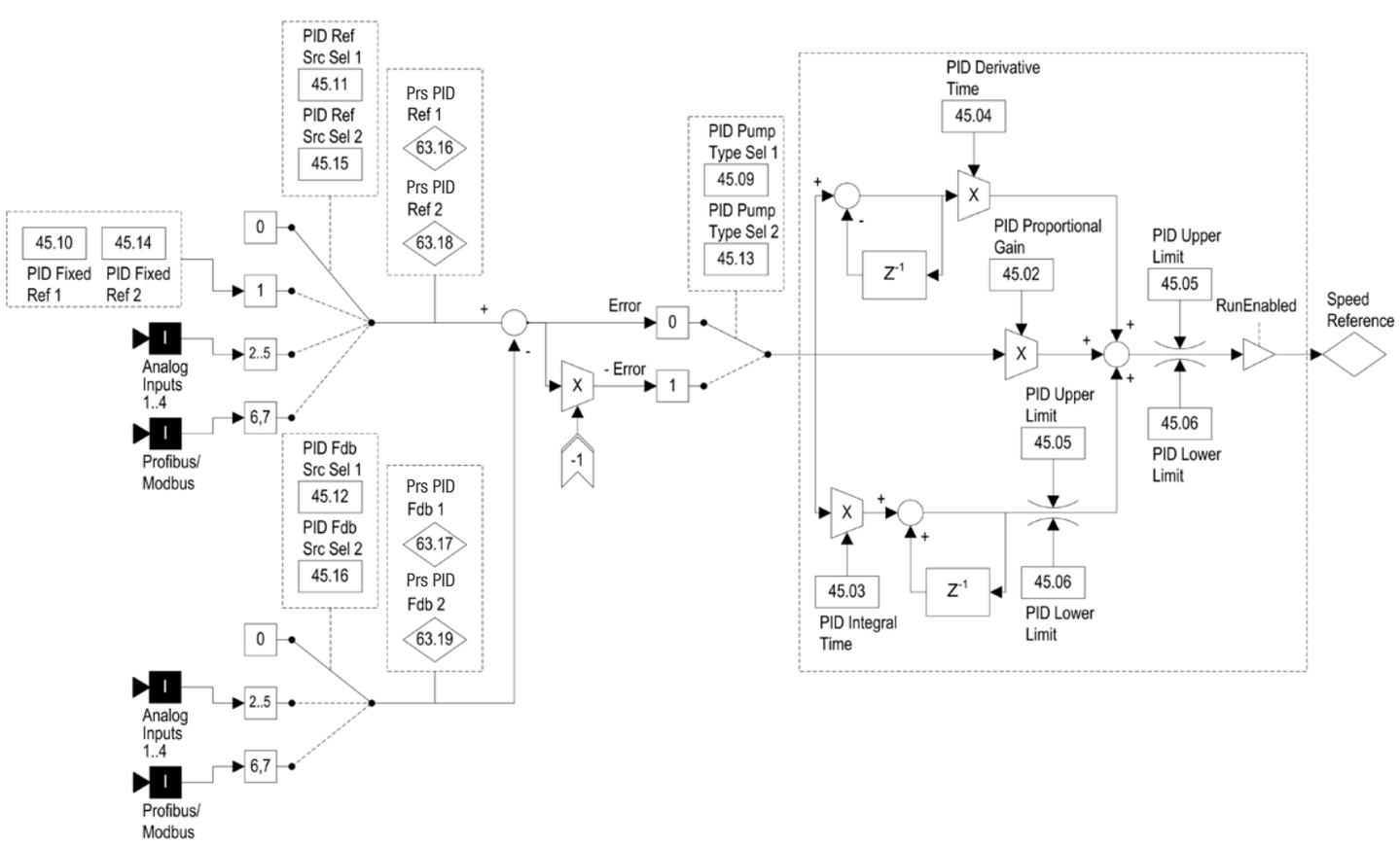
9.34 PROCESS PID

Process PID function can be enabled setting the parameter **PID Enable [45.01]** to On (necessary condition, but not sufficient). This parameter is settable only when the Drive is stopped. Process PID function parameters are available in the family **PROCESS PID [45.00]**.

Process PID regulator allows the user to control in a closed loop a selected variable of pump application.
Typical application variables for pump application are:
- Pressure
- Flow
- Level

Anyway, it is possible to control with Process PID regulator any other application variable that in turn is directly controlled varying the speed of the electric motor using electric Drive. In fact, the output of the Process PID regulator is used as the speed reference for the Drive.

Figure 9.16 - Process PID regulator



The other necessary (and sufficient) conditions to really enable Process PID function are:
- Auto mode (see HOA – Hand/Off/Auto function)
- Jog, Frost Protection, Anti-Blocking and Auto-Cleaning functions not active; these functions can be enabled, but not running to have Process PID really enabled
- at least **Main Speed Ref Sel [32.01]** or **Aux Speed Ref Sel [32.02]** set to Prs PID (see family **SPEED REFERENCE [32.00]**), that means that the Process PID regulator output must be connected at least to one of the speed reference, main or auxiliary

If one or more of the previous conditions is not fulfilled, Process PID regulator is not active and the behavior of the Drive depends on other parameter settings.
Example: with **PID Enable [45.01]** set to **On and Main Speed Ref Sel [32.01]** set to **Fixed and Aux Speed Ref Sel [32.02]** set to Off, Process PID regulator is disabled and speed regulator is enabled with fixed reference (one between **Fixed Speed Ref 1 [32.06]**, **Fixed Speed Ref 2 [32.07]**, **Fixed Speed Ref 3 [32.08]** or **Fixed Speed Ref 4 [32.09]**,

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depending on **Cmd 1 Sel Fixed Speed Ref [32.10]** and **Cmd 2 Sel Fixed Speed Ref [32.11]**).
Process PID regulator output can be connected to:
- or main speed reference **Main Speed Ref Sel [32.01]**
- or to the auxiliary speed reference **Aux Speed Ref Sel [32.02]** using Prs PID selection.

Enable cannot be implemented on more than one reference at the same time. The choice between main and auxiliary reference takes place through parameter **Aux Speed Ref Cmd [32.03]**. Process PID is not active in Manual mode.
The sources for reference and feedback signals are selected using parameters **PID Ref Src Sel 1 [45.11]** and **PID Fdb Src Sel 1 [45.12]**.
Reference of Process PID can be also fixed; in this case, it is necessary to set parameter **PID Fixed Ref 1 [45.10]**. Feedback of Process PID is always a measure acquired through analog input or fieldbus (not a fixed value).
Process PID regulator has got a first set of reference and feedback signals, called main:
- Selection of main source reference: **PID Ref Src Sel 1 [45.11]**
- Selection of main source feedback: **PID Fdb Src Sel 1 [45.12]**
- Selection of main fixed reference: **PID Fixed Ref 1 [45.10]**

Process PID regulator foresees also a second set of reference and feedback signals, called auxiliary:
- Selection of auxiliary source reference: **PID Ref Src Sel 2 [45.15]**
- Selection of auxiliary source feedback: **PID Fdb Src Sel 2 [45.16]**
- Selection of auxiliary fixed reference: **PID Fixed Ref 2 [45.14]**

This second set is called auxiliary and it is used in particular functions: PID: Input Pressure Supervision and Well Draw Down Control. In these functions, Process PID regulator controls main process values monitoring at the same time auxiliary process values and, if particular conditions occur, Process PID regulator switches main with auxiliary and vice versa.
Reference and feedback signals refer to per-unit value that are converted in engineering value with the following parameters, depending on process regulated value:
- 1 pu equivalence to pressure [bar]: **User Per-Unit Pressure [13.11]**
- 1 pu equivalence to flow [m^3/h]: **User Per-Unit Flow [13.12]**
- 1 pu equivalence to level [m]: **User Per-Unit Level [13.13]**
- 1 pu equivalence to temperature [°C]: **User Per-Unit Temp. 1 [13.14]**

In this section only the parameters and process data with IEC units of measure are shown. For the selection of the ones with NEMA units of measure refer to paragraph 5.5.
For example, parameter **PID Fixed Ref 1 [45.10]** set to 0.4 [pu] means that Process PID reference is set to 40 [%] of the per-unit value of the process value that is equal to **User Per-Unit Pressure [13.11]**, if for example regulated application variable is pressure.

It is possible to monitor reference and feedback signals of Process PID regulator using process data **HYDRAULIC [76.00]**.
Process data with suffix 1 refer to Process PID main process reference and feedback:
- Main pressure reference of Process PID: **Press. of Prs PID Ref 1 [76.01]**
- Main pressure feedback of Process PID: **Press. of Prs PID Fdb 1 [76.02]**
- Main flow reference of Process PID: **Flow of Prs PID Ref 1 [76.03]**
- Main flow feedback of Process PID: **Flow of Prs PID Fdb 1 [76.04]**
- Main level reference of Process PID: **Level of Prs PID Ref 1 [76.05]**
- Main level feedback of Process PID: **Level of Prs PID Fdb 1 [76.06]**
- Main temperature reference of Process PID: **Temp. of Prs PID Ref 1 [76.07]**
- Main temperature feedback of Process PID: **Temp. of Prs PID Fdb 1 [76.08]**

Process data with suffix 2 refer to Process PID auxiliary process reference and feedback; auxiliary process values refer to other more complicated functions (PID: Input Pressure Supervision and Well Draw Down Control):
- Auxiliary pressure reference of Process PID: **Press. of Prs PID Ref 2 [76.21]**
- Auxiliary pressure feedback of Process PID: **Press. of Prs PID Fdb 2 [76.22]**
- Auxiliary flow reference of Process PID: **Flow of Prs PID Ref 2 [76.23]**
- Auxiliary flow feedback of Process PID: **Flow of Prs PID Fdb 2 [76.24]**
- Auxiliary level reference of Process PID: **Level of Prs PID Ref 2 [76.25]**
- Auxiliary level feedback of Process PID: **Level of Prs PID Fdb 2 [76.26]**
- Auxiliary temperature reference of Process PID: **Temp. of Prs PID Ref 2 [76.27]**
- Auxiliary temperature feedback of Process PID: **Temp. of Prs PID Fdb 2 [76.28]**

Note that process data (pressure, flow, level) are different from zero only if corresponding per-unit value is different from zero. It is necessary to set a non null value only for the per-unit process value that it is necessary to regulate (one for main and one for auxiliary, if present), in order to read non null values in process data correctly referred to the right reference and process signals (main and auxiliary, if present).
Parameter **PID Pump Type Sel 1 [45.09]** defines how the error signal is built using the reference and feedback signals:
- Lift: error = reference – feedback; note: standard mode
- Force: error = feedback – reference

Process PID regulator is a standard PID regulator that requires to set 3 main parameters:
- Proportional gain: **PID Proportional Gain [45.02]**
- Integral time constant: **PID Integral Time [45.03]**
- Derivative time constant: **PID Derivative Time [45.04]**

If the value of the parameter **PID Integral Time [45.03]** is zero, then the integral action is disabled.

NOTE
Setting a wrong value into the integral parameter **PID Integral Time [45.03]**, it may results in undesired overshoots; in this case, it is recommended that the integral parameter is set to zero.

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WARNING
In order to use the derivative parameter **PID Derivative Time [45.04]**, the user must consider the effect of the derivative action (for example: the instability of the process). In general, it is better to let the default value, that is 0; set a non null value only for specific and well known applications.

As a standard PID regulator, Process PID regulator has got other 2 other important parameters:
- Upper limit: **PID Upper Limit [45.05]**
- Lower Limit: **PID Lower Limit [45.06]**

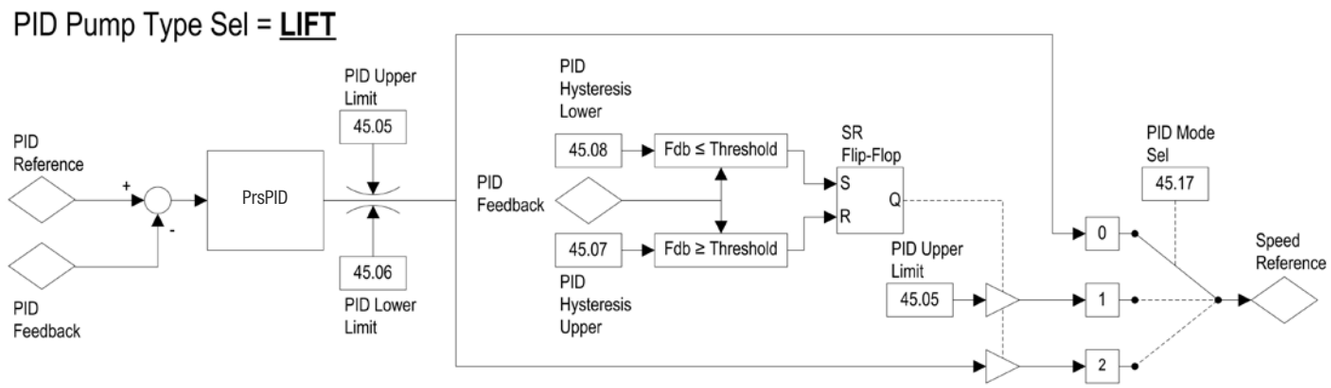
Note that the output of the Process PID regulator is the reference of the speed regulator; so, the upper limit of the Process PID regulator is one of the upper limits of the speed reference and, in the same way, the lower limit of the Process PID regulator is one of the lower limits of the speed reference: see family **SPEED REFERENCE [32.00]**.
Active upper limit of speed reference is the smaller absolute value of the following speed limits:
- Process PID upper limit: **PID Upper Limit [45.05]**
- Maximum allowable positive speed command before and after ramp: **Max Pos Ref [32.22]**

Active lower limit of speed reference is the smaller absolute value of the following speed limits:
- Process PID lower limit: **PID Lower Limit [45.06]**
- Maximum allowable negative speed command before and after ramp: **Max Neg Ref [32.23]**

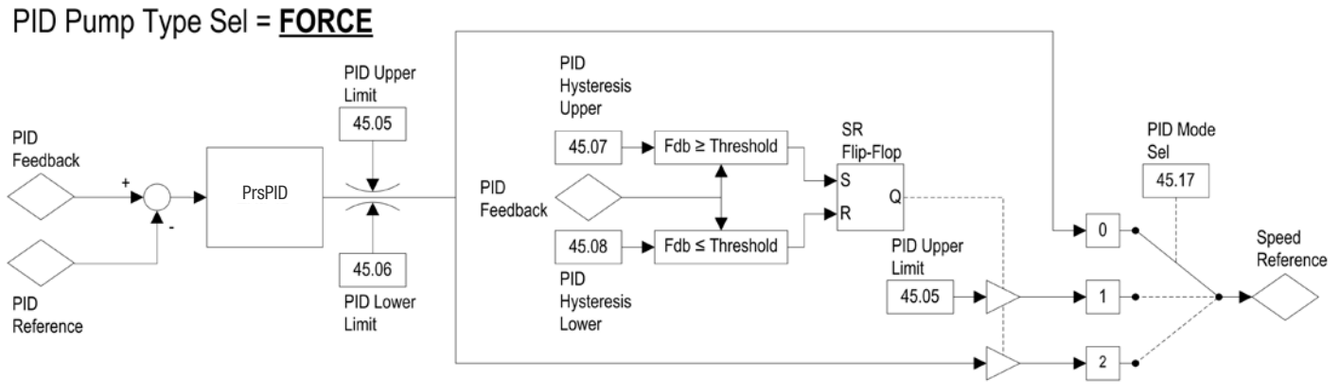
WARNING
If reverse rotation of the motor must be prevented, then the lower limit of Process PID regulator must be set to zero (parameter **PID Lower Limit [45.06]**), so to prevent negative speed reference.

By use of parameter **PID Mode Sel [45.17]**, Process PID function can be used in 3 different modes:
- Continuous: continuous reference control
- On/Off: hysteresis control with fixed speed reference
- Both: hysteresis control with continuous reference control

Process PID mode selection, lift



Process PID mode selection, force



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9.34.1 CONTINUOUS SPEED REFERENCE CONTROL

This operating mode is enabled setting the parameter **PID Mode Sel [45.17]** to Continuous.
This operating mode is the standard for Process PID functions. The operating principle of this operating mode is described in the previous paragraph.

9.34.2 ON/OFF: HYSTERESIS CONTROL WITH FIXED SPEED REFERENCE

This operating mode is enabled setting the parameter **PID Mode Sel [45.17]** to On/Off.
In this operating mode, Process PID regulator is no more really active: this operating mode is more similar to a bang-bang control (On/Off control), that switched between two states, than to a PID regulator control.
The On/Off command is a logic AND between the two following conditions:

- Start command of the Drive used for normal operation
- Hysteresis control done by comparing Process PID regulator feedback with 2 thresholds that can be configured through parameters **PID Hysteresis Upper [45.07]** and **PID Hysteresis Lower [45.08]**

The operating principle of this operating mode can be summarized in these two conditions:

- when feedback of Process PID regulator (pressure, flow, level) is lower than **PID Hysteresis Lower [45.08]**, reference of speed regulator is set to **PID Upper Limit [45.05]**
- when feedback of Process PID regulator (pressure, flow, level) is greater than **PID Hysteresis Upper [45.07]**, reference of speed regulator is set to 0

9.34.3 BOTH: HYSTERESIS CONTROL WITH CONTINUOUS SPEED REFERENCE

This operating mode is enabled setting the parameter **PID Mode Sel [45.17]** to Both.
In this operating mode, Process PID regulator is partially active: this operating mode is a mix between a bang-bang control (On/Off control), that switched between two states, and a PID regulator control. This operating mode is a combination of the two operating modes descripted in the previous paragraphs.
The On/Off command is a logic AND between the two following conditions:

- Start command of the Drive used for normal operation
- Hysteresis control done by comparing Process PID regulator feedback with 2 thresholds that can be configured through parameters **PID Hysteresis Upper [45.07]** and **PID Hysteresis Lower [45.08]**

The operating principle of this operating mode can be summarized in these two conditions:

- when feedback of Process PID regulator (pressure, flow, level) is lower than **PID Hysteresis Lower [45.08]**, reference of speed regulator is set equal to the output of the Process PID regulator
- when feedback of Process PID regulator (pressure, flow, level) is greater than **PID Hysteresis Upper [45.07]**, reference of speed regulator is set to 0

With respect to the continuous speed reference control mode, in this case the integral gain control can be used without significant restrictions.
In this operating mode, from the moment that the Process PID regulator is again really active, in particular when feedback of Process PID regulator (pressure, flow, level) is lower than **PID Hysteresis Lower [45.08]**, it is necessary to set the reference, using main source reference (that can be set to Fixed) or fixed source reference (that can be set to Fixed).
If reference of Process PID regulator is set to a value that is between **PID Hysteresis Lower [45.08]** and **PID Hysteresis Upper [45.07]**, the behavior become continuous (in practice, no more bang-bang control, On/Off control).

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9.35 PROCESS PID: DEAD BAND DELAY

Process PID: Dead Band Delay function is enabled if parameter **Dead Band Enable [45.80]** is set to On.
The Process PID regulator output is locked if the feedback stays within the dead band area around the reference, defined by the parameters **Dead Band Low Lim [45.81]** and **Dead Band Up Lim [45.82]**, for a predefined time delay, parameter **Dead Band Time Delay [45.83]**. The Process PID regulator output locked value is the output value at the end of the time delay.
Process PID regulator output is unlocked as soon as the feedback goes outside the dead band area around the reference, defined by the parameters **Dead Band Low Lim [45.81]** and **Dead Band Up Lim [45.82]**. Note that the hysteresis is managed by the time delay used to enter the locked state.
Note that parameters **Dead Band Low Lim [45.81]** and **Dead Band Up Lim [45.82]** must be set in pu values; these values are absolute and not relative to reference value; this means that these parameters refer to pu value and don't change if reference value changes. Both values must be positive; data base settings automatically prevent the user to insert a negative number.

9.36 PROCESS PID: FEEDFORWARD

Process PID: Feedforward function is enabled if parameter **Enable Ffw Speed Cmd [32.33]** is set to On or set to a source bit (from terminal strip or command word) that is at high level. Process PID: Feedforward is not active in Manual mode. This parameter is settable only when the Drive is stopped. Process PID: Feedforward function parameters are available in the family **SPEED REFERENCE [32.00]**.

Usually in a standard PID regulator, as Process PID regulator is, the feedforward signal needs an accurate model of the controlled process. In some particular simple case, it is possible to use a signal, a gain and an offset to create a useful feedforward signal to connect to PID regulator feedforward.
In Process PID regulator, feedforward can be implemented starting from a signal that is indirectly related to the application variable to be controlled:
- feedback of the application variable (pressure, flow, level) remains the main signal used to control the process
- an additional signal (pressure, flow, level) that indirectly affect the application variable to be controlled (feedback of Process PID regulator) can be used to speed up the Process PID regulator response

Process PID feedforward is implemented using the following variables:
- signal source selected using parameter **Speed Feedforward Sel [32.05]**
- gain set with parameter **Speed Ffw Gain [32.38]**
- offset set with parameter **Speed Ffw Offset [32.39]**

and the following rule:
- signal which source is selected using parameter **Speed Feedforward Sel [32.05]*** gain set with parameter **Speed Ffw Gain [32.38]** + offset set with parameter **Speed Ffw Offset [32.39]**

Feedforward is implemented outside Process PID regulator. In this mode, if for some reason the output of the Process PID regulator is set to 0, for example due to an analog feedback loss, the Drive can still regulate the process, in particular the application variable (pressure, flow, level), using only the feedforward signal; this last condition is very similar to an open loop control.
A typical application for this function is a Drive with a pump used to control the water level in a tank or in well.
The feedback of the process is the level. The pump is used to supply water to the tank or to the well in case water level decrease or vice versa to remove water from the tank or from the well in case water level increase.
Pump control the input or the output of the water inside tank or well.
External users and/or suppliers remove or supply water from tank or well.
Using flow feedback from users and/or suppliers as signal for Process PID: Feedforward function, it is possible to improve the time response of the Process PID regulator used to control the water level.
From control system point of view, the water flow inside and/or outside the tank or the well can be considered as a disturbance on the system that Process PID regulator tries to control: feedforward tries to compensate this disturbance and Process PID regulator will react faster to the changes in water supply and consumption by supplier and user.

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9.37 PROCESS PID: FEEDBACK SUPERVISION

Process PID: Feedback Supervision function is enabled if parameter **Fdb Mon Enable [45.60]** is set to On. Process PID function must also enabled and active. This parameter is settable only when the Drive is stopped.
Process PID: Feedback Supervision function parameters are available in the family **PROCESS PID [45.00]**.
Process PID: Feedback Supervision function is used to be sure that the feedback process value (for example: pressure, flow or level) remains between predefined limits. This function is used to detect pump malfunctioning or circuit problems (leakage, broken pipe, rubbles that block the water flow in the pipe or something else.)
Upper and lower limits around the reference are set using the following parameters:

- lower tolerance with respect to the reference: parameter **Fdb Mon Low Lim [45.61]**
- upper tolerance with respect to the reference: parameter **Fdb Mon Up Lim [45.62]**

When the feedback of the process value (feedback of Process PID regulator) goes above or below the limits set with parameters **Fdb Mon Low Lim [45.61]** and **Fdb Mon Up Lim [45.62]**, a counter starts counting up towards a timeout, parameter **Fdb Mon Timeout [45.63]**. When the actual value is within the allowed area, the same counter counts down instead.
Whenever the counter is higher than the timeout, then alarm FdbMonitor (code 58, bit 9 of Alarm Word 4, AW4.09) becomes active. The operation to be performed if this event occurs is set by parameter **Fdb Monitor [36.58]** of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output.

9.38 PROCESS PID: INPUT PRESSURE SUPERVISION

Process PID: Input Pressure Supervision function is enabled if parameter **In Press Mon Enable [45.70]** is set to On. Process PID function must also enabled and active. This parameter is settable only when the Drive is stopped. Process PID: Feedback Supervision function parameters are available in the family **PROCESS PID [45.00]**.

Process PID: Input Pressure Supervision function is used to supervise that there is enough pressure in the inlet of the pump, in order to:

- prevent the pump from sucking air or causing suction cavitation, avoiding damages of the pump
- prevent the complete consumption of a resource, for example the water in a well or in a tank, trying to save it

Process PID: Input Pressure Supervision function uses Process PID controller. In normal operation, when there is enough pressure in the inlet of the pump, Process PID controller regulates the main process variables (for example: pressure, flow or level), typically on the output of the pump. In case there isn't enough pressure in the inlet of the pump, Process PID controller reduces the main process reference of a value defined by the parameter **In Press Mon Ref Delta [45.73]**, in order to re-establish the correct water pressure at the input of the pump).

Process PID: Input Pressure Supervision function configuration:

- Main process variable (for example: pressure, flow or level), typically on the output of the pump set using parameter **PID Fdb Src Sel 1 [45.12]**
- Inlet pressure of the pump (auxiliary process variable) set using parameter **PID Fdb Src Sel 2 [45.16]**

Inside AD1000 there are 3 functions very similar:

- Well Draw Down Control function
- Low City or Low Suction Inlet Pressure
- PID: Input Pressure Supervision

In all above mentioned functions, the scope is to supervise that there is enough water in the inlet of the pump, to prevent the pump from sucking air or causing suction cavitation or to prevent the complete consumption of a resource:

- Well Draw Down Control uses a dedicated auxiliary analog input (typically water level or water pressure) with a complex logic (pressure control mode, level control mode and Sleep Mode)
- Low City or Low Suction Inlet Pressure function uses a dedicated digital input (water pressure) with a simplified logic (pressure control mode and Sleep Mode)
- PID: Input Pressure Supervision uses a dedicated analog input (water pressure) with an average complex logic (pressure control mode, reduced pressure control mode and stop mode)

From the moment that these functions are very similar, only one function at a time can be enabled. The user is responsible to select the more appropriate for the application.

NOTE
It is not possible set the parameter **In Press Mon Enable [45.70]** to On if the parameter **Low City Press. Enable [33.40]** or the parameter **WDD Enable [45.50]** are set to On. In case the operator tries to set the parameter **In Press Mon Enable [45.70]** to On when the parameter Low City Press. **Enable [33.40]** or the parameter **WDD Enable [45.50]** are set to On, the error DSPParEr is generated and the **In Press Mon Enable [45.70]** is automatically reset to Off.

PREVIOUS VIEW

Example:
- Main process variable: water pressure at the output of the pump
- Auxiliary process variable: water pressure at the input of the pump

In normal operation, when water pressure at the input of the pump is upper the threshold defined by parameter **In Press Mon Alm Thres [45.71]**, Process PID controller regulates the main process variable, that in this example is the output pressure of the pump. This operation mode is called: pressure control mode.
In abnormal operation, when water pressure is lower the threshold defined by parameter In **Press Mon Alm Thres [45.71]**, Process PID controller reduces the main process reference of a value defined by the parameter **In Press Mon Ref Delta [45.73]**. This operation mode is called: reduced pressure control mode. An alarm **InPresMon1** (code 59, bit 10 of Alarm Word 4, AW4.10) becomes active. The operation to be performed if this event occurs is set by parameter **In Press Monitor Thres1 [36.59]** of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. Anyway, it is suggested to let the default value, that is Warning. It is also possible to connect the alarm with a digital output.

The transition from pressure control mode to reduced control mode and vice versa is immediate.
In case, in abnormal operation, that means in reduced pressure control mode, water pressure at the input of the pump continues to decrease and goes below the threshold defined by the parameter **In Press Mon Trip Thres [45.72]**, a second An alarm **InPresMon2** (code 60, bit 11 of Alarm Word 4, AW4.11) becomes active. The operation to be performed if this event occurs is set by parameter **In Press Monitor Thres2 [36.60]** of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. Anyway, it is suggested to let the default value, that is Coast Stop. It is also possible to connect the alarm with a digital output.

9.39 PROCESS PID: ANALOG FEEDBACK LOSS

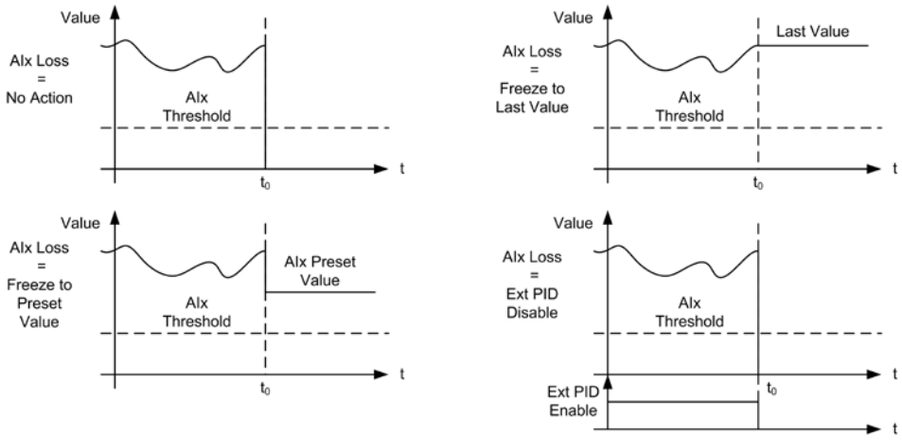
Process PID: Analog Feedback Loss function can be used to control analog input, used as feedback of the Process PID regulator (for more details, see Process PID function). This function is active only if Process PID regulator is active.
The analog inputs available are: AI1 and AI2 on BASIS board (±10V, ±20mA), AI3 and AI4 on GIABA input expansion board (±10V, ±20mA).
If an analog feedback loss condition occurs (for example due to a broken wire), then the control system allows to diagnose the malfunctioning assuring in any case the continuity of the plant operation.
Process PID: Analog Feedback Loss function is enabled if parameters **AI1 Loss [17.43], AI2 Loss [17.44], AI3 Loss [17.45]** and **AI1 Loss [17.46]** are set to Prs PID Disable:
- Process PID: Analog Feedback Loss function is enabled on analog input 1 setting parameter **AI1 Loss [17.43]** to Prs PID Disable; note that the other values in the pick list are used by Analog Command loss function.
- Process PID: Analog Feedback Loss function is enabled on analog input 2 setting parameter **AI2 Loss [17.44]** to Prs PID Disable; note that the other values in the pick list are used by Analog Command loss function.
- Process PID: Analog Feedback Loss function is enabled on analog input 3 setting parameter **AI3 Loss [17.45]** to Prs PID Disable; note that the other values in the pick list are used by Analog Command loss function.
- Process PID: Analog Feedback Loss function is enabled on analog input 4 setting parameter **AI4 Loss [17.46]** to Prs PID Disable; note that the other values in the pick list are used by Analog Command loss function.

It is possible to enable Process PID: Analog Feedback Loss function on more than one analog input at the same time. For example, it is possible to enable the function on analog input 1, for example used as main process feedback, and on analog input 2, for example used as auxiliary process feedback. Note that the auxiliary process feedback is used in particular functions: PID: Input Pressure Supervision and Well Draw Down Control. In these functions, Process PID regulator controls main process values monitoring at the same time auxiliary process values and, if particular conditions occur, Process PID regulator switches main with auxiliary and vice versa. Process PID: Analog Feedback Loss can be enabled on both analog inputs, but it is active only on the active process feedback, that is the one used as feedback by Process PID at the moment.
The analog feedback loss condition occurs when the analog input value decreases below the corresponding parameter **AI1 Loss Threshold [17.51], AI2 Loss Threshold [17.52], AI3 Loss Threshold [17.53]** or **AI4 Loss Threshold [17.54]**.

If parameters **AI1 Loss [17.43], AI2 Loss [17.44], AI3 Loss [17.45]** and **AI1 Loss [17.46]** are set to Prs PID Disable and the feedback loss condition occurs, then the control system disables the Process PID regulator. In particular, the output and the state (memory) of the Process PID regulator are fixed to zero, avoiding the saturation of the regulator itself and the racing of the pump to maximum speed.
The motor reaches the speed set by the additional speed reference term, that is usually summed to the term generated by the output of Process PID regulator; the source of additional speed reference is set using parameter **Add Speed Ref Sel [32.04]**. If additional speed reference value is null, then motor stops.

When the analog feedback loss condition occurs, then alarm **PrPidFdbLs** (code 46, bit 13 of Alarm Word 3, AW3.13) becomes active. The operation to be performed if this event occurs is set by parameter **Prs PID Fdb Loss [36.46]** of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output.

Figure 9.23 – Analog feedback loss (t_0 = AI Loss detection)

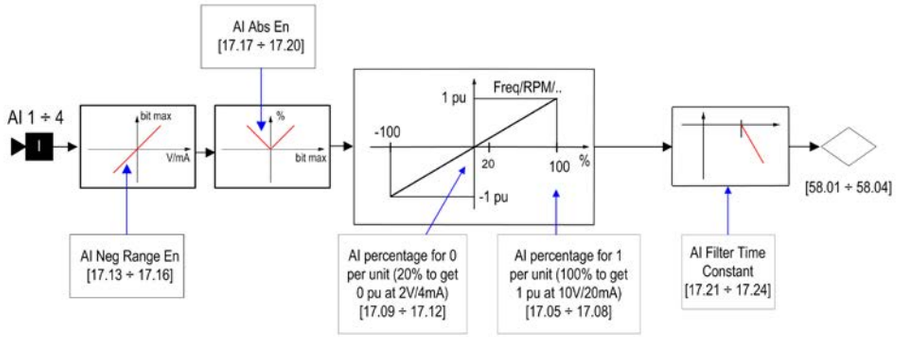


Note for the calculation of the following parameters expressed in [%]:
- **AI1 Threshold [17.51], AI2 Threshold [17.52], AI3 Threshold [17.53]** and **AI4 Threshold [17.54]**

Remember that analog inputs are set using the following [%] parameters:
- **AI1 Value for 1 pu [17.05], AI2 Value for 1 pu [17.06], AI3 Value for 1 pu [17.07]** and **AI4 Value for 1 pu [17.08]**
- **AI1 Value for 0 pu [17.09], AI2 Value for 0 pu [17.10], AI3 Value for 0 pu [17.11]** and **AI4 Value for 0 pu [17.12]**

with particular attention to the type of analog input (for example, 4÷20 [mA] or 0÷10 [V])

Figure 9.24 – Analog feedback management



For example, for an analog input 4÷20 [mA], it is necessary to set
- **AI1 Value for 1 pu [17.05]** set to 100 [%]
- **AI1 Value for 0 pu [17.09]** set to 20 [%]

in order to have:
- 4 [mA] = 20 [%] = 0 [pu]
- 20 [mA] = 100 [%] = 1 [pu]

with the consequence that:
- 0 [mA] = 0 [%] = -0.25 [pu]

Same calculations are valid for the following parameters:
- **AI1 Threshold [17.51], AI2 Threshold [17.52], AI3 Threshold [17.53]** and **AI4 Threshold [17.54]**

So, the threshold values used in Process PID: Analog Feedback Loss functions are
- 0 [%] = -0.25 [pu] = (if referred to an analog input 4÷20 [mA]) = 0 [mA]
- 20 [%] = 0 [pu] = (if referred to an analog input 4÷20 [mA]) = 4 [mA]
- 100 [%] = 1 [pu] = (if referred to an analog input 4÷20 [mA]) = 20 [mA]

Formula to convert per-unit value [pu] in per-cent [%] value with an analog input 4÷20 [mA] set as 4 [mA] = 0 [pu] and 20 [mA] = 1 [pu]:
- per-cent value [%] = 80 [%/pu] * per-unit [pu] + 20 [%]

Example to set a threshold value equal to 0.0 [pu] in case of analog input 4÷20 [mA]:
- per-cent value [%] = 80 [%/pu] * 0.0 [pu] + 20 [%] = 20 [%]

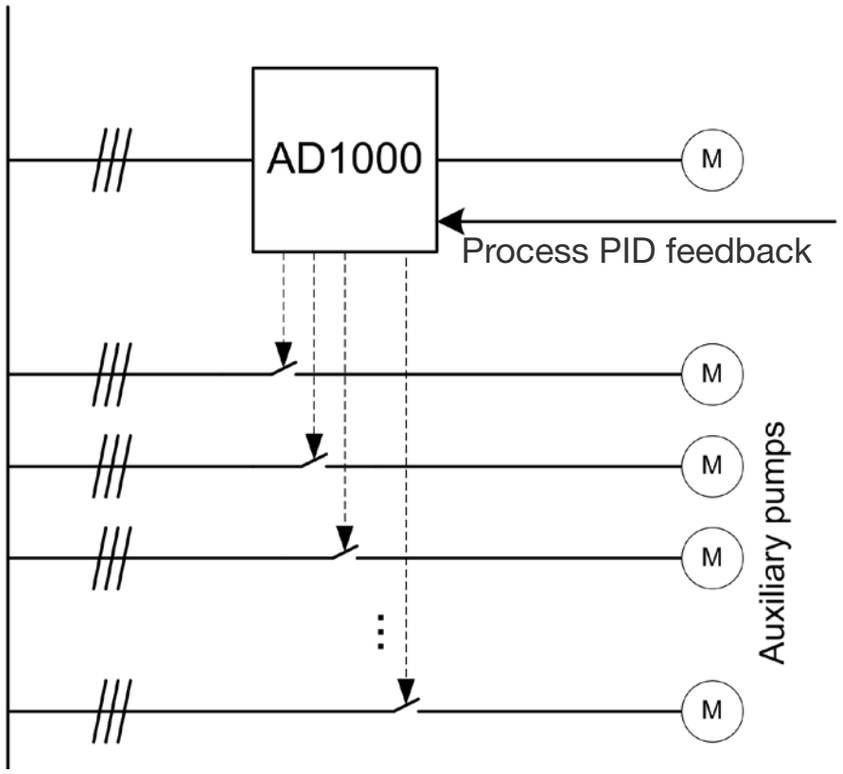
AI2 Threshold [17.52] value, for example, to trigger the Process PID: Analog Feedback Loss function active when analog input 2 falls to a value below of 0 [pu]
- **AI1 Threshold [17.51]** set to 20 [%]

PREVIOUS VIEW

9.40 PROCESS PID: AUXILIARY PUMPS

Auxiliary Pumps function must be enabled setting the parameter **Aux Pumps Enable [45.30]** to On. Auxiliary Pumps function works only when Process PID function is enabled. If the auxiliary pumps are running, Motor Pause function doesn't work.
The parameters are available in the family **PROCESS PID [45.00]**.
The parameter **Aux Pumps Enable [45.30]** works together with the process feedback (for example: pressure, flow or level) of the Process PID function.
Auxiliary Pumps function helps the Process PID regulator to keep the plant process feedback (for example: pressure, flow or level) on the set point within a tolerance band by starting and stopping the auxiliary pumps according to the required pressure, flow or level rate.
It's necessary to set the parameter **Aux Pumps Number [45.35]** in order to define the number of auxiliary pumps present in the system. At least one auxiliary pump must be present; otherwise, it is necessary to set the parameter **Aux Pumps Enable [45.30]** to Off. Maximum auxiliary pumps is 6: 3 auxiliary pumps with BASIS card and other 3 auxiliary pumps with GIABB optional card. Configure the digital output used to command start/stop of the auxiliary pumps using parameters in the family **DIGITAL OUTPUTS [16.00]**.

Figure 9.25 - Auxiliary Pumps function, main diagram



The start of the first auxiliary pump occurs once that the plant process feedback (that is Process PID regulator feedback) falls below **Aux Pumps On Thres [45.32]**.
In Figure 9.26, the start of the auxiliary pump has brought the process feedback above the threshold **Aux Pumps On Thres [45.32]** within the time set by **Aux Pumps On Wait [45.34]**. The plant process feedback is inside band tolerance around reference: it isn't necessary to start another (second) auxiliary pump and the system remains in run with an auxiliary (first) pump on and the main pump regulating.
In Figure 9.27, that is case of high process demand, the start of the first auxiliary pump does not succeed in bringing the process feedback above the lower threshold and so, after the time set by **Aux Pumps On Wait [45.34]**, the start of the second auxiliary pump is commanded. After the second pump start, if the plant process feedback is inside band tolerance around reference, it isn't necessary to start another (third) auxiliary pump and the system remains in run with two auxiliary (first and second) pumps on and the main pump regulating.
Same logic for other auxiliary pumps (if present).

Figure 9.26 - Start of the first auxiliary pump

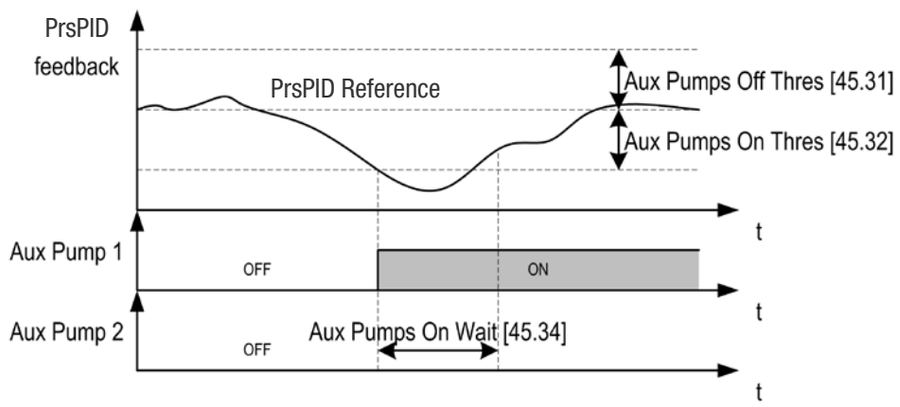
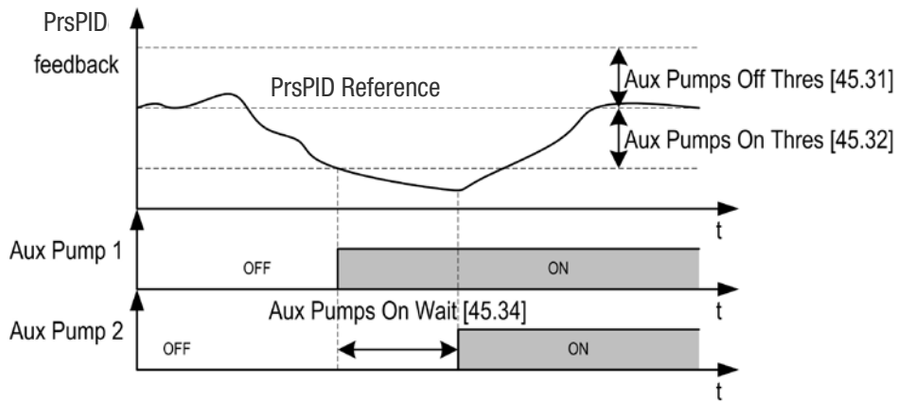


Figure 9.27 - Start of the first auxiliary pump and of the second auxiliary pump



The stop of the pumps occurs when the process feedback increases above the parameter **Aux Pumps Off Thres [45.31]**. If this situation occurs while more than one auxiliary pumps are running, then the stop of the last auxiliary pumps previously started is immediate, while the stop of the next auxiliary pump depends on the value reached by the process feedback after a the time set in the parameter **Aux Pumps Off Wait [45.33]**.
After this time has elapsed, if the process feedback falls under the stop threshold, that is comes back into the tolerance band, the system remains running with only one pump less (Figure 9 .28), otherwise also the next auxiliary pump is stopped (Figure 9 .29).
Auxiliary pumps are stopped in the reverse order used to start them, that for example means: auxiliary pump 1 start ➡ auxiliary pump 2 start ➡ auxiliary pump 3 start ➡ auxiliary pump 3 stop ➡ auxiliary pump 2 stop ➡ auxiliary pump 1 stop.

Figure 9.28 - Stop of the first auxiliary pump

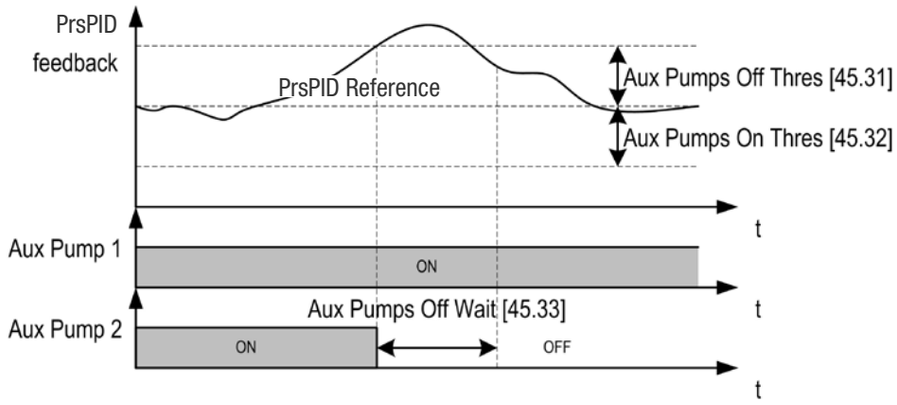
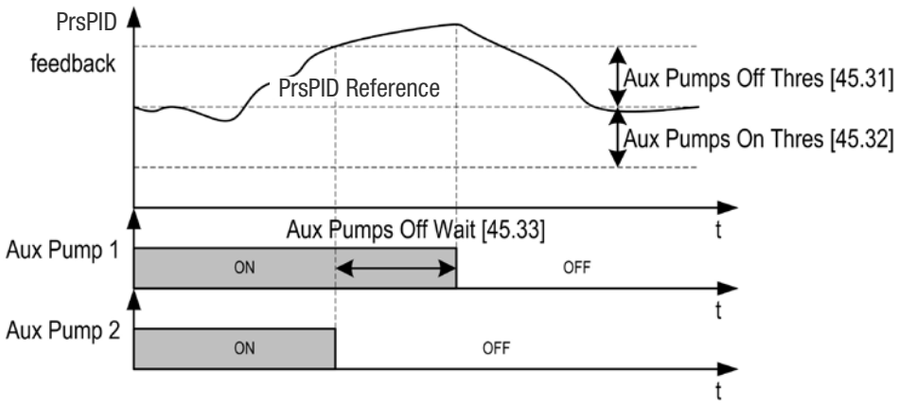
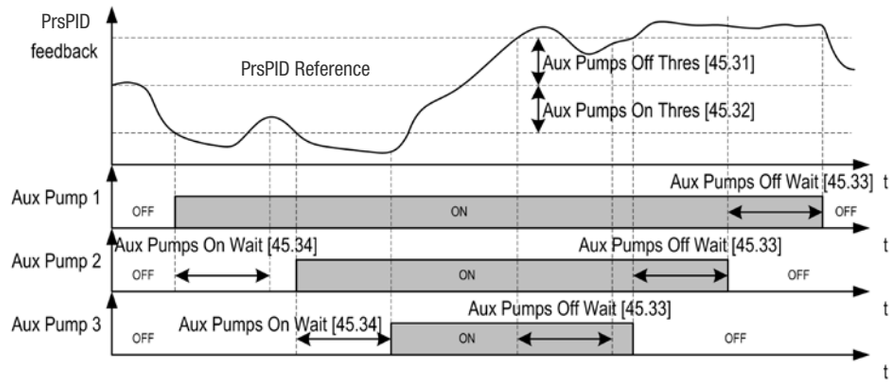


Figure 9.29 - Stop of the first auxiliary pump and of the second auxiliary pump



The parameter **Number of Aux Pumps [45.26]** sets the number of auxiliary pumps: if one, the start and stop occurs without waiting time.
In order to select the digital outputs to connect with the start/stop command of the auxiliary pumps, it is necessary to set the parameter in the family **DIGITAL OUTPUTS [16.00]**.
The start/stop command of the first auxiliary pump is in bit 4 of status word 4 (ID.bit 520404). The start/stop command of the second auxiliary pump is in bit 5 of status word 4 (ID.bit 520405). And so up to the start/stop command of the sixth auxiliary pump is in bit 9 of status word 4 (ID. bit 520404).
Example: to connect the first auxiliary pump to DO1, then set **DO1 Select [16.01]** to SW4.04-Aux Pump 1 and to connect the second auxiliary pump di DO2, then set **DO2 Select [16.03]** to SW4.05-Aux Pump 2.



PREVIOUS VIEW

9.41 PROCESS PID: PRESSURE, FLOW AND LEVEL VIEW

This function converts in engineering values the per-unit values of the reference and feedback signals for Process PID function. Process reference and feedback for Process PID comes from two different sources:
- First set: main process
- Second set: auxiliary process

This second set is called auxiliary and it is used in particular functions: PID: Input Pressure Supervision and Well Draw Down Control. In these functions, Process PID regulator controls main process values monitoring at the same time auxiliary process values and, if particular conditions occur, Process PID regulator switches main with auxiliary and vice versa.
It is possible to read directly the transducer signals in [bar], [m^3/h] [m] and [°C] displaying them on the process data, family **HYDRAULIC [76.00]**. In this section only the parameters and process data with IEC units of measure are shown. For the selection of the ones with NEMA units of measure refer to paragraph 5.5
- Pressure reference for Process PID, set 1: **Press. of Prs PID Ref 1 [76.01]**
- Pressure feedback for Process PID, set 1: **Press. of Prs PID Fdb 1 [76.02]**
- Flow reference for Process PID, set 1: **Flow of Prs PID Ref 1 [76.03]**
- Flow feedback for Process PID, set 1: **Flow of Prs PID Fdb 1 [76.04]**
- Level reference for Process PID, set 1: **Level of Prs PID Ref 1 [76.05]**
- Level feedback for Process PID, set 1: **Level of Prs PID Fdb 1 [76.06]**
- Temperature reference for Process PID, set 1: **Temp. of Prs PID Ref 1 [76.07]**
- Temperature feedback for Process PID, set 1: **Temp. of Prs PID Fdb 1 [76.08]**
- Pressure reference for Process PID, set 2: **Press. of Prs PID Ref 2 [76.21]**
- Pressure feedback for Process PID, set 2: **Press. of Prs PID Fdb 2 [76.22]**
- Flow reference for Process PID, set 2: **Flow of Prs PID Ref 2 [76.23]**
- Flow feedback for Process PID, set 2: **Flow of Prs PID Fdb 2 [76.24]**
- Level reference for Process PID, set 2: **Level of Prs PID Ref 2 [76.25]**
- Level feedback for Process PID, set 2: **Level of Prs PID Fdb 2 [76.26]**
- Temperature reference for Process PID, set 2: **Temp. of Prs PID Ref 2 [76.27]**
- Temperature feedback for Process PID, set 2: **Temp. of Prs PID Fdb 2 [76.28]**

It is possible also to read directly the transducer signals in [pu] displaying them on the process data, family **AUX [63.00]**:
- Reference for Process PID, set 1: **Prs PID Ref 1 [63.16]**
- Feedback for Process PID, set 1: **Prs PID Fdb 1 [63.17]**
- Reference for Process PID, set 2: **Prs PID Ref 2 [63.18]**
- Feedback for Process PID, set 2: **Prs PID Fdb 2 [63.19]**

Reference and feedback signals are converted in engineering values, that are [bar], [m^3/h] and [m], using the per-unit value and the following parameters, process values corresponding to 1 pu (full scale value).
The parameters are available in family **PER-UNIT BASE DATA [13.00]**:
- 1 pu equivalence to pressure [bar]: **User Per-Unit Press. 1 [13.11]**
- 1 pu equivalence to flow [m^3/h]: **User Per-Unit Flow 1 [13.12]**
- 1 pu equivalence to level [m]: **User Per-Unit Level 1 [13.13]**
- 1 pu equivalence to temperature [°C]: **User Per-Unit Temp. 1 [13.14]**
- 1 pu equivalence to pressure [bar]: **User Per-Unit Press. 2 [13.21]**
- 1 pu equivalence to flow [m^3/h]: **User Per-Unit Flow 2 [13.22]**
- 1 pu equivalence to level [m]: **User Per-Unit Level 2 [13.23]**
- 1 pu equivalence to temperature [°C]: **User Per-Unit Temp. 2 [13.24]**

WARNING
There are two set of process values corresponding to 1 pu (full scale value): **User Per-Unit Press. 1 [13.11], User Per-Unit Flow 1 [13.12], User Per-Unit Level 1 [13.13], User Per-Unit Temp. 1 [13.14]** and **User Per-Unit Press. 2 [13.21], User Per-Unit Flow 2 [13.22], User Per-Unit Level 2 [13.23], User Per-Unit Temp. 2 [13.24]**. First set is used for main process values (reference and feedback). Second set is used for auxiliary process values (reference and feedback).
So, if for example, main process values (reference and feedback) are pressures and auxiliary process values (reference and feedback) are levels, then it is necessary to set parameter **User Per-Unit Press. 1 [13.11]** and **User Per-Unit Level 2 [13.23]** different from zero.

WARNING
The user is responsible to correctly set the parameters related to this function and to correctly read the data process. It is necessary to set different from zero only one value for each set, corresponding to the type of process variable (pressure, flow or level). If more than one value is different from zero, one or more value do not correspond to a real process value.
If auxiliary process value is not used, it is necessary to set to zero all values of the related set (second set).

PREVIOUS VIEW

9.42 SOFT FILL

Soft Fill function can be enabled setting the parameter **Soft Fill Mode [45.40]** to a value different from Off (Horizontal mode, Vertical simple mode or Vertical complex mode). This parameter is settable only when the Drive is stopped. Soft Fill function parameters are available in the family **PROCESS PID [45.00]**.

Soft Fill function is designed to start a pumping system in a controlled manner. Rather than turning on the Process PID to control the process immediately at start up, Soft Fill function operates at a fixed speed to pre-fill the piping or the storage tank before switching to Process PID to control. Soft Fill function avoids water hammers and sudden pressure peaks that could otherwise break the pipes and/or cause other possible malfunctioning or damage to the pump or the system in general.
Depending on Soft Fill function mode selected, after the initial fixed speed reference, Soft Fill function can use the Process PID with a fixed reference and ramp before to switch to control the process in normal operation.
Soft Fill function is designed to work with Process PID function: enable Process PID function is a necessary condition to enable Soft Fill function.
Soft Fill function controls the same process value that is controlled by Process PID function. Possible process values controlled: pressure, flow, level. The most common process value is pressure.

Soft Fill function is designed for different piping systems: horizontal and vertical piping systems. Using the parameter **Soft Fill Mode [45.40]**, it is possible to select three different operating modes:

- Parameter **Soft Fill Mode [45.40]** set to Horizontal mode enables Soft Fill function for horizontal piping systems
- Parameter **Soft Fill Mode [45.40]** set to Vertical simple mode enable Soft Fill function for vertical piping systems, simple solution
- Parameter **Soft Fill Mode [45.40]** set to Vertical complex mode enable Soft Fill function for vertical piping systems, complex solution

9.42.1 HORIZONTAL PIPING SYSTEMS

The parameter **Soft Fill Mode [45.40]** is set to Horizontal mode.

The electric motor starts with a fixed speed reference and the Process PID controller disabled. The speed reference is the sum of main or auxiliary speed reference (main or auxiliary depends where the output of the Process PID controller is connected; the configuration is done using dedicated parameters) and additional speed reference. Main or auxiliary speed reference is null in this first period. Additional speed reference is linked to fixed speed reference.

The parameter **Add Speed Ref Sel [32.04]** is set to Fixed and the fixed speed reference is set using one of the following parameters:

- **Fixed Speed Ref 1 [32.06]**
- **Fixed Speed Ref 2 [32.07]**
- **Fixed Speed Ref 3 [32.08]**
- **Fixed Speed Ref 4 [32.09]**

The selection between fixed speed reference is done using the following parameters:

- **Cmd 1 Sel Fix Speed Ref [32.10]**
- **Cmd 2 Sel Fix Speed Ref [32.11]**

The speed reference is actuated through a speed ramp, that is the standard speed ramp already present in the control system.
Once reached the fixed speed reference (parameter **Add Speed Ref Sel [32.04]**), the system remains in stand still condition until a timeout set using the parameter **Soft Fill Timeout [45.41]** is elapsed.
After that, Process PID controlled is enabled: soft fill procedure is concluded and normal operation for Process PID controller started.

In normal operation, additional speed reference is still linked to fixed speed reference (parameter **Add Speed Ref Sel [32.04]**), but main or auxiliary speed reference is no more null and is now linked to the output of the activated Process PID controller (main or auxiliary depend from dedicated parameters values); this guarantees that there aren't jumps on speed reference, switching from soft fill procedure to normal operation; at the same time, this solution forces the output of the Process PID controller to negative values in case normal process demands for a speed lower than the fixed speed reference (parameter **Add Speed Ref Sel [32.04]**). Particular attention must be dedicated to the Process PID controller saturation management due to the additional speed reference always active.

Time sequence:

- t0: soft fill procedure starts
- t0 ÷ t1: motor ramps from null speed to fixed speed, linked to additional speed reference (parameter **Add Speed Ref Sel [32.04]**)
- t1 ÷ t2: motor remains at fixed speed, linked to additional speed reference (parameter **Add Speed Ref Sel [32.04]**)
- (t2 – t1) = timeout (set using the parameter **Soft Fill Timeout [45.41]**)
- t2: soft fill procedure stops, normal operation starts (Process PID controller); the system follows the pressure reference desired from the process, that can be fixed or variable (for example, from analog input or from fixed value or from fieldbus)

PREVIOUS VIEW

9.42.2 VERTICAL PIPING SYSTEMS, SIMPLE SOLUTION

The parameter **Soft Fill Mode [45.40]** is set to Vertical simple mode.

The electric motor starts with a fixed speed reference and the Process PID controller disabled. The speed reference is the sum of main or auxiliary speed reference (main or auxiliary depends where the output of the Process PID controller is connected; the configuration is done using dedicated parameters) and additional speed reference. Main or auxiliary speed reference is null in this first period. Additional speed reference is linked to fixed speed reference.

The parameter **Add Speed Ref Sel [32.04]** is set to Fixed and the fixed speed reference is set using one of the following parameters:
- **Fixed Speed Ref 1 [32.06]**
- **Fixed Speed Ref 2 [32.07]**
- **Fixed Speed Ref 3 [32.08]**
- **Fixed Speed Ref 4 [32.09]**

The selection between fixed speed reference is done using the following parameters:
- **Cmd 1 Sel Fix Speed Ref [32.10]**
- **Cmd 2 Sel Fix Speed Ref [32.11]**

The speed reference is actuated through a speed ramp, that is the standard speed ramp already present in the control system.
Once reached the fixed speed reference (parameter **Add Speed Ref Sel [32.04]**), the system remains in stand still condition until a pressure (or any other process value, for example flow or level) reference (parameter **Soft Fill Threshold [45.42]**) is reached (control system checks the Process PID controller feedback).
After that, Process PID controlled is enabled: soft fill procedure is concluded and normal operation for Process PID controller started.

In case the system doesn't reach the pressure (or any other process value, for example flow or level) reference (**Soft Fill Threshold [45.42]**) in a timeout set using the parameter **Soft Fill Timeout [45.41]**, alarm SfFillTime (code 47, bit 14 of Alarm Word 3, AW3.14) becomes active. The operation to be performed if this event occurs is set by parameter **Soft Fill Timeout [36.47]** of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output.

In normal operation, additional speed reference is still linked to fixed speed reference (parameter **Add Speed Ref Sel [32.04]**), but main or auxiliary speed reference is no more null and is now linked to the output of the activated Process PID controller (main or auxiliary depend from dedicated parameters values); this guarantees that there aren't jumps on speed reference, switching from soft fill procedure to normal operation; at the same time, this solution forces the output of the Process PID controller to negative values in case normal process demands for a speed lower than the fixed speed reference (parameter **Add Speed Ref Sel [32.04]**). Particular attention must be dedicated to the Process PID controller saturation management due to the additional speed reference always active.

Time sequence:
- t0: soft fill procedure starts
- t0 ÷ t1: motor ramps from null speed to fixed speed, linked to additional speed reference (parameter **Add Speed Ref Sel [32.04]**)
- t1 ÷ t2: motor remains at fixed speed, waiting until a fixed pressure (or any other process value, for example flow or level) is reached (**Soft Fill Threshold [45.42]**)
- if (t2 – t1) < parameter **Soft Fill Timeout [45.41]**, then soft fill procedure stops, normal operation starts (Process PID controller); the system follows the pressure reference (or any other process value) desired from the process, that can be fixed or variable (for example, from analog input or from fixed value or from fieldbus)
- else alarm SfFillTime active (parameter **Soft Fill Timeout [36.47]**)

9.42.3 VERTICAL PIPING SYSTEMS, COMPLEX SOLUTION

The parameter **Soft Fill Mode [45.40]** is set to Vertical complex mode.

The electric motor starts with a fixed speed reference and the Process PID controller disabled. The speed reference is the sum of main or auxiliary speed reference (main or auxiliary depends where the output of the Process PID controller is connected; the configuration is done using dedicated parameters) and additional speed reference. Main or auxiliary speed reference is null in this first period. Additional speed reference is linked to fixed speed reference.

PREVIOUS VIEW

The parameter **Add Speed Ref Sel [32.04]** is set to Fixed and the fixed speed reference is set using one of the following parameters:
- **Fixed Speed Ref 1 [32.06]**
- **Fixed Speed Ref 2 [32.07]**
- **Fixed Speed Ref 3 [32.08]**
- **Fixed Speed Ref 4 [32.09]**

The selection between fixed speed reference is done using the following parameters:
- **Cmd 1 Sel Fix Speed Ref [32.10]**
- **Cmd 2 Sel Fix Speed Ref [32.11]**

The speed reference is actuated through a ramp, that is the standard speed ramp already present in the control system.
Once reached the fixed speed reference (parameter **Add Speed Ref Sel [32.04]**), the Process PID controller is enabled.
Process PID controller is at the beginning activated with a pressure (or any other process value, for example flow or level) reference (parameter **Soft Fill Threshold [45.42]**), that is usually lower than the final pressure (or any other process value, for example flow or level) reference (desired for the process). Control system set the Process PID controller reference. This pressure (or any other process value, for example flow or level) reference (parameter **Soft Fill Threshold [45.42]**) is actuated through a pressure ramp (parameter **Soft Fill Ramp Time [45.44]**).
Once the pressure (or any other process value, for example flow or level) feedback (control system checks the Process PID controller feedback) reaches the pressure (or any other process value, for example flow or level) reference (parameter **Soft Fill Threshold [45.42]**) plus or minus a band defined by the parameter **Soft Fill Band [45.43]**, the pressure set point switches to final pressure (or any other process value, for example flow or level) set point (desired for the process), in this case without a pressure (or any other process value, for example flow or level) ramp: soft fill procedure is concluded and normal operation for Process PID controller started.

In case the systems doesn't reach the pressure (or any other process value, for example flow or level) reference (parameter **Soft Fill Threshold [45.42]**) in a timeout set using the parameter **Soft Fill Timeout [45.41]**, an alarm **SfFillTime** (code 47, bit 14 of Alarm Word 3, AW3.14) becomes active. The operation to be performed if this event occurs is set by parameter **Soft Fill Timeout [36.47]** of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output.

In normal operation, additional speed reference is still linked to fixed speed reference (parameter **Add Speed Ref Sel [32.04]**), but main or auxiliary speed reference is no more null and is now linked to the output of the activated Process PID controller (main or auxiliary depend from dedicated parameters values); this guarantees that there aren't jumps on speed reference, switching from soft fill procedure to normal operation; at the same time, this solution forces the output of the Process PID controller to negative values in case normal process demands for a speed lower than the fixed speed reference (parameter **Add Speed Ref Sel [32.04]**). Particular attention must be dedicated to the Process PID controller saturation management due to the additional speed reference always active.

Time sequence:
- t0: soft fill procedure starts
- t0 ÷ t1: motor ramps from null speed to fixed speed, linked to additional speed reference (parameter **Add Speed Ref Sel [32.04]**)
- t1 ÷ t2: the system ramps the pressure (or any other process value, for example flow or level) (Process PID controller) with a fixed pressure (or any other process value, for example flow or level) ramp (parameter **Soft Fill Ramp Time [45.44]**) until a fixed pressure (parameter **Soft Fill Threshold [45.42]**) is reached; the fixed pressure (or any other process value, for example flow or level) ramp starts from the pressure (or any other process value, for example flow or level) feedback, that is the pressure that the system reaches at t1 when fixed speed, linked to additional speed reference (parameter **Add Speed Ref Sel [32.04])**, is reached
- if fixed pressure (or any other process value, for example flow or level) reference (parameter **Soft Fill Threshold [45.42]**) plus or minus a band defined by the parameter **Soft Fill Band [45.43]** is reached at (t2 – t1) < parameter **Soft Fill Timeout [45.41]**, then soft fill procedure stops and normal operation starts (Process PID controller); the system follows the pressure (or any other process value, for example flow or level) reference desired from the process, that can be fixed or variable (for example, from analog input or from fixed value or from fieldbus)
- else alarm **SfFillTime** active (parameter **Soft Fill Timeout [36.47]**)

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9.43 MOTOR PAUSE

Motor Pause function can be enabled setting the parameter **Motor Pause Enable [45.20]** to On. This parameter is settable only when the Drive is stopped. Motor Pause function parameters are available in the family **PROCESS PID [45.00]**. Motor Pause function allows to automatically stops the motor if the selected application variable (for example: pressure, flow or level) is near a specific value or if the motor speed is under a threshold. When the selected application variable (for example: pressure, flow or level) drops, the motor is automatically restarted. This operation allows saving energy, by starting the pump only when this is required by the selected application variable.

Motor Pause function is managed by the following parameters:

- **Motor Pause Enable [45.20]**
- **Motor Pause Curr Limit [45.21]**
- **Motor Pause Time Limit [45.22]**
- **Motor Pause Fdb Thres [45.23]**

Motor Pause function can work also when Process PID function is not enabled, but anyway it is necessary a process feedback (for example: pressure, flow or level) connected to the feedback of the Process PID regulator: regulator **PID Fdb Src Sel 1 [45.12]** must be set different to Off (or **PID Fdb Src Sel 2 [45.16]** must be set different to Off), for example connected to an analog input. Note that the second feedback source selection, the auxiliary one, is used in particular functions: PID: Input Pressure Supervision and Well Draw Down Control; in these functions, Process PID regulator controls main process values monitoring at the same time auxiliary process values and, if particular conditions occur, Process PID regulator switches main with auxiliary and vice versa; anyway, in this functions, Process PID regulator is enabled and so it is no more the case previously descripted in which Motor Pause function is enabled with Process PID function disabled.

Motor Pause function is active only if the following conditions are satisfied:

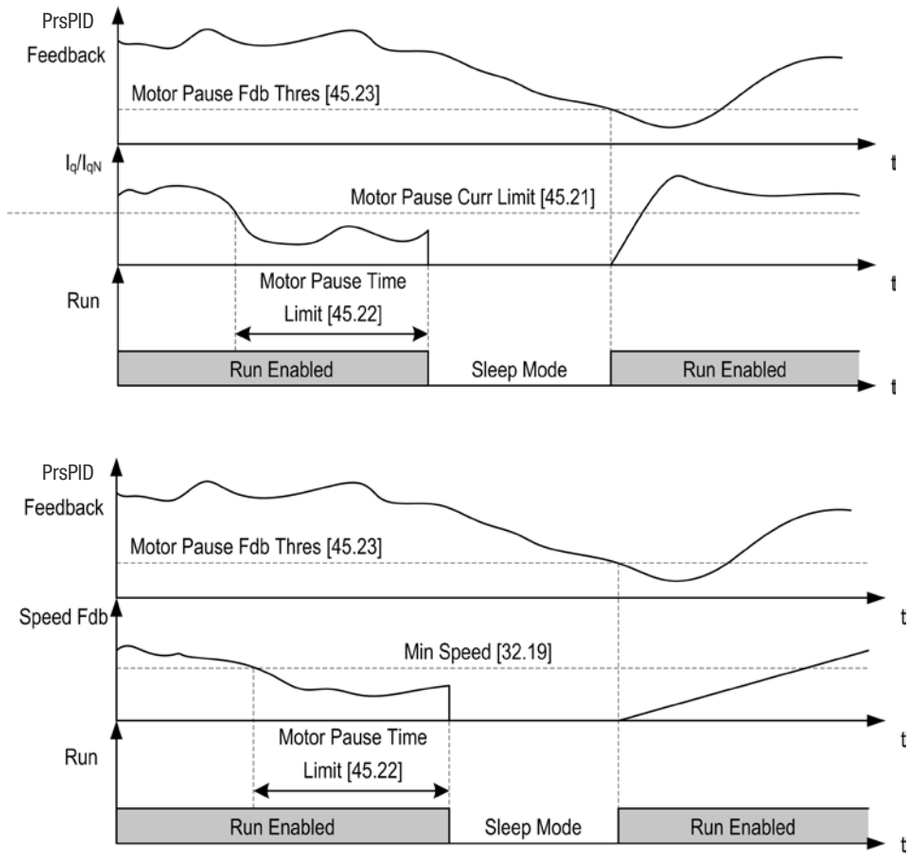
- Motor Pause function is enabled: the parameter **Motor Pause Enable [45.20]** is set to On
- Process PID function disabled or not active
- Process PID function enabled and active and parameter **PID Mode Sel [45.17]** set to On/Off or set to Both

If Motor Pause function is enabled, when motor speed reference goes below **Min Speed [32.19]** or when motor current goes below **Motor Pause Curr Limit [45.21]** and this condition persists continuously for a time longer than **Motor Pause Time Limit [45.22]**, then the Drive is stopped and set in Sleep Mode. The parameter **Motor Pause Curr Limit [45.21]** is used to set a percent of **Rated Current [02.04]** in order to define a threshold for the motor pause action:

- if (feedback stator current / **Rated Current [02.04]**)* 100 < **Motor Pause Curr Limit [45.21]**
- then motor stops (the Drive is stopped and set in Sleep Mode)

When the selected application variable goes below the level established with parameter **Motor Pause Fdb Thres [45.23]**, then the Drive resets Sleep Mode, restarts and sets Run state. The following diagram shows a sequence of the operation of the function pressure control (Process PID used to regulate pressure value) with Motor Pause function.

Figure 9.30 – Sequence of the operation of the Motor Pause function



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If parameter **PID Mode Sel [45.17]** is set to Continuous, then the Drive Start/Stop command depends on the Start/Stop command only.

WARNING
With Motor Pause function enabled and Start command active (set to On), the Drive can automatically restart the machine without the need of any other command.

WARNING
The user is responsible for enabling this function. Nidec ASI S.p.A. declaims any liability due to inappropriate use of this function, Make sure that the automatic restart of the machine will not cause physical injury and/or equipment damage.

NOTE
It is not possible set the parameter **Motor Pause Enable [45.20]** to On if the parameter **HOA Start/Stop type [33.12]** is set to Pulse Start/Stop. In case the operator tries to set the parameter **Motor Pause Enable [45.20]** to On when **HOA Start/Stop type [33.12]** is set to Pulse Start/Stop, the error DSPParEr is generated and the parameter **Motor Pause Enable [45.20]** is automatically reset to Off.

9.44 WELL DRAW DOWN CONTROL (SUCTION CONTROL VIA CONSTANT PRESSURE)

Well Draw Down Control function can be enabled setting the parameter **WDD Enable [45.50]** to On. This parameter is settable only when the Drive is stopped. Well Draw Down Control function parameters are available in the family **PROCESS PID [45.00]**.

Well Draw Down Control function is used to supervise that there is enough water in the inlet of the pump, in order to:
- prevent the pump from sucking air or causing suction cavitation, avoiding damages of the pump
- prevent the complete consumption of a resource, for example the water in a well or in a tank, trying to save it

Enough water in the inlet of the pump means that there is enough pressure; pressure can be obtained from a water column (for example in case of a well or of a tank).
Well Draw Down Control function uses Process PID controller. In normal operation, when there is enough water in the inlet of the pump, Process PID controller regulates the main process variables (for example: pressure, flow or level), typically on the output of the pump. In case there isn't enough water in the inlet of the pump, Process PID controller switches and starts to regulate an auxiliary process variable (typically pressure or level) in order to re-establish the correct water pressure at the input of the pump and so to prevent damages to the pump itself (due to air suction or cavitation).

Example:
- Main process variable: water pressure at the output of the pump
- Auxiliary process variable: water level of a tank that supplies the input of the pump

In normal operation, when water level is enough, that means water level is upper the threshold defined by parameter **WDD Threshold 1 [45.51]**, Process PID controller regulates the main process variable, that in this example is the output pressure of the pump. This operation mode is called: pressure control mode.
In abnormal operation, when water level is not enough, that means water level is lower the threshold defined by parameter **WDD Threshold 1 [45.51]** for a time longer than parameter **WDD Timeout 1 [45.52]**, Process PID controller regulates the auxiliary process variable, that in this example is the water level, for example of a well or of a tank that supplies the input of the pump. This operation mode is called: level control mode.
The transition from pressure control mode to level control is delayed by parameter **WDD Timeout 1 [45.52]**; same for the transition from level control mode to pressure control mode.
In case, in abnormal operation, that means in level control mode, water level continues to decrease and goes below the threshold defined by the parameter **WDD Threshold 2 [45.53]** for a time longer than parameter **WDD Timeout 2 [45.54]**, the Drive is stopped and set in Sleep Mode. Alarm WDDSleepMd (code 55, bit 6 of Alarm Word 4, AW4.06) becomes active. The operation to be performed if this event occurs is set by parameter **WDD Sleep Mode [36.55]** of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output.

The Drive resets Sleep Mode, restarts and sets Run state in normal operation, that means in pressure control mode, only if water level is upper the threshold defined by parameter **WDD Threshold 3 [45.55]** for a time longer than parameter **WDD Timeout 3 [45.56]**.

Well Draw Down Control function is realized with a Finite State Machine, with relative states and transitions, explained in the previous example and summarized in the following table.

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Table 1: Finite State Machine for Well Down Draw Control function

from to	Pressure control mode	Level control mode	Sleep Mode
Pressure control mode	X	Threshold 1	Threshold 3
Level control mode	Threshold 1	X	/
Sleep Mode	/	Threshold 2	X

In most of the case, pressure control mode means constant pressure control at the output of the pump; flow is an independent variable, that depends only on utilities' request.
It is possible that the flow request from the utilities is higher than the filling rate of the well or of the tank and so water level decreases, until it goes below a goes below the threshold defined by the parameter **WDD Threshold 1 [45.51]**.
After a time defined by the parameter **WDD Timeout 1 [45.52]**, the Drive switches from pressure control mode to level control mode.
Once in level control mode, the Drive starts to regulate water level to water level reference, defined by the parameter **PID Ref Src Sel 2 [45.15]**, that can be set to a fixed value, defined by the parameter **PID Fixed Ref 2 [45.14]**. The water level feedback is configured using the dedicated parameter **PID Fdb Src Sel 2 [45.16]**.
If water demand from utilities decreases, than Drive needs less speed to control water level; more water demand from utilities decreases, more motor speed decreases, until motor reaches zero speed; at that point, Drive cannot contrast the increase of water level in the tank, although level control mode is active: in level control mode, in this condition (low water demand from utilities), output of the Process PID controller will saturate due to the negative speed limit set to zero (pump cannot run reverse); water level starts to increases until it goes above the threshold defined by the parameter **WDD Threshold 1 [45.51]** for a time defined by the parameter **WDD Timeout 1 [45.52]**.
The Drive switches from level control mode to pressure control mode.

Inside AD1000 there are 3 functions very similar:
- Well Draw Down Control function
- Low City or Low Suction Inlet Pressure
- PID: Input Pressure Supervision

In all above mentioned functions, the scope is to supervise that there is enough water in the inlet of the pump, to prevent the pump from sucking air or causing suction cavitation or to prevent the complete consumption of a resource:
- Well Draw Down Control uses a dedicated auxiliary analog input (typically water level or water pressure) with a complex logic (pressure control mode, level control mode and Sleep Mode)
- Low City or Low Suction Inlet Pressure function uses a dedicated digital input (water pressure) with a simplified logic (pressure control mode and Sleep Mode)
- PID: Input Pressure Supervision uses a dedicated analog input (water pressure) with an average complex logic (pressure control mode, reduced pressure control mode and stop mode)

From the moment that these functions are very similar, only one function at a time can be enabled. The user is responsible to select the more appropriate for the application.

NOTE
It is not possible set the parameter **WDD Enable [45.50]** to On if the parameter **Low City Press. Enable [33.40]** or the parameter I**n Press Mon Enable [45.70]** are set to On.
In case the operator tries to set the parameter **WDD Enable [45.50]** to On when the parameter **Low City Press. Enable [33.40]** or the parameter **In Press Mon Enable [45.70]** are set to On, the error DSPParEr is generated and the **WDD Enable [45.50]** is automatically reset to Off.
Well Draw Down Control function is not active during soft fill procedure.

Attention:
- Well Draw Down Control function can be enabled and disabled only when the Drive is stopped
- in Sleep Mode, the Drive is equivalent to Drive stopped
- this means that enabling/disabling parameter can be changed in Sleep Mode
- if Well Draw Down Control function is disabled during Sleep Mode, the motor immediately restart from the moment that Drive Enable and Start command are still active

Operative setting parameter procedure to run Well Drawn Down function as in the previous example:
- Enable Process PID function: set parameter **PID Enable [45.01]** to On and active (see Process PID function)
- Configure reference source selection for speed controller: set parameter **Main Speed Ref Sel [32.01]** to Prs PID
- Set minimum pump speed to zero (if pump cannot rotate in reverse direction): set parameter **Max Neg Ref [32.23]** to 0

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- Set Process PID output minimum value (that is minimum pump speed) to zero (if pump cannot rotate in reverse direction): set parameter **PID Lower Limit [46.06]** to 0
- Enable Well Draw Down Function: set parameter **WDD Enable [45.50]** to On
- Set 1 pu equivalence of the main process variable; in the case of the previous example, set parameter **User Per-Unit Press. 1 [13.11]** to the full-scale value expressed in [bar]
- Set 1 pu equivalence of the auxiliary process variable; in the case of the previous example, set parameter **User Per-Unit Level. 2 [13.23]** to the full-scale value expressed in [m]
- Configure feedback source selection for main process variable: set parameter **PID Fdb Src Sel 1 [45.12]** for example to AI1
- Configure feedback source selection for auxiliary process variable: set parameter **PID Fdb Src Sel 2 [45.16]** for example to AI2
- Configure reference source selection for main process variable: set parameter **PID Ref Src Sel 1 [45.11]** for example to Fixed
- Configure reference source selection for auxiliary process variable: set parameter **PID Ref Src Sel 2 [45.15]** for example to Fixed
- Set fixed reference value for main process variable: set parameter **PID Fixed Ref 1 [45.10]** to the desired value, for example 0.2 [pu], that in this example means 20 [%] of the full-scale value of pressure set with parameter **User Per-Unit Press. 1 [13.11]**
- Configure how error signal is built using the reference and the feedback: set parameter **PID Pump Type Sel 1 [45.09]** to the desired value, for example Lift (typically for regulation at the output of the pump)
- Configure how error signal is built using the reference and the feedback: set parameter **PID Pump Type Sel 2 [45.13]** to the desired value, for example Force (typically for regulation at the input of the pump)
- Set fixed reference value for auxiliary process variable: set parameter **PID Fixed Ref 2 [45.14]** to the desired value, for example 0.2 [pu], that in this example means 20 [%] of the full-scale value of pressure set with parameter **User Per-Unit Level 2 [13.23]**
- Set threshold to switch from normal operation, in this example pressure control mode, to abnormal operation, in this example level control mode: set parameter **WDD Threshold 1 [45.51]** to the desired value, for example 0.25 [pu]
- Set timeout to switch from normal operation, in this example pressure control mode, to abnormal operation, in this example level control mode: set parameter **WDD Timeout 1 [45.52]** to the desired value, for example 60 [s]
- Set threshold to switch from abnormal operation, in this example level control mode, to Sleep Mode: set parameter **WDD Threshold 2 [45.53]** to the desired value, for example 0.20 [pu]
- Set timeout to switch from abnormal operation, in this example level control mode, to Sleep Mode: set parameter **WDD Timeout 2 [45.54]** to the desired value, for example 60 [s]
- Set threshold to switch from Sleep Mode to normal operation, in this example pressure control mode: set parameter **WDD Threshold 3 [45.55]** to the desired value, for example 0.30 [pu]
- Set timeout to switch from Sleep Mode to normal operation, in this example pressure control mode: set parameter **WDD Timeout 2 [45.54]** to the desired value, for example 60 [s]

WARNING
With Well Draw Down Control (Suction Control via Constant Pressure) function enabled and Start command active (set to On), the Drive can automatically restart the machine without the need of any other command.

WARNING
The user is responsible for enabling of this function according to safety rules. Nidec ASI S.p.A. declaims any liability due to inappropriate use of this function. Make sure that the automatic restart of the machine will not cause physical injury and/or damage equipment. Refer to standards IEC 60204-1.

NOTE
It is not possible set the parameter **WDD Enable [45.50]** to On if the parameter **HOA Start/Stop type [33.12]** is set to Pulse Start/Stop.
In case the operator tries to set the parameter **WDD Enable [45.50]** to On when **HOA Start/Stop type [33.12]** is set to Pulse Start/Stop, the error DSPParEr is generated and the **WDD Enable [45.50]** is automatically reset to Off.

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9.45 LOW CITY OR LOW SUCTION INLET PRESSURE

Low City or Low Suction Inlet Pressure function can be enabled setting the parameter **Low City Press. Enable [33.40]** to On. This parameter is settable only when the Drive is stopped. Low City or Low Suction Inlet Pressure function parameters are available in the family **START/STOP MODE [33.00].**

Low City or Low Suction Inlet Pressure function is used with low suction inlet pressure. An inlet pressure switch enables and disables the pump system when the inlet supply is at a low demand and when running the pump system in this condition will cause damage.

Inside AD1000 there are 3 functions very similar:
- Well Draw Down Control function
- Low City or Low Suction Inlet Pressure
- PID: Input Pressure Supervision

In all above mentioned functions, the scope is to supervise that there is enough water in the inlet of the pump, to prevent the pump from sucking air or causing suction cavitation or to prevent the complete consumption of a resource:
- Well Draw Down Control uses a dedicated auxiliary analog input (typically water level or water pressure) with a complex logic (pressure control mode, level control mode and Sleep Mode)
- Low City or Low Suction Inlet Pressure function uses a dedicated digital input (water pressure) with a simplified logic (pressure control mode and Sleep Mode)
- PID: Input Pressure Supervision uses a dedicated analog input (water pressure) with an average complex logic (pressure control mode, reduced pressure control mode and stop mode)

From the moment that these functions are very similar, only one function at a time can be enabled. The user is responsible to select the more appropriate for the application.

NOTE
It is not possible set the parameter **Low City Press. Enable [33.40]** to On if the parameter **WDD Enable [45.50]** or the parameter **In Press Mon Enable [45.70]** are set to On.
In case the operator tries to set the parameter **Low City Press. Enable [33.40]** to On when the parameter **WDD Enable [45.50]** or the parameter **In Press Mon Enable [45.70]** are set to On, the error DSPParEr is generated and the **Low City Press. Enable [33.40]** is automatically reset to Off.

The pressure switch is wired directly into the Drive using one of the digital input terminals, selected using the parameter **Low City Press. Cmd Sel [33.41]**.
If the pressure switch is active, the inlet pressure is too low and the Drive is stopped and set in Sleep Mode. Alarm LwCityPres (code 56, bit 7 of Alarm Word 4, AW4.07) becomes active. The operation to be performed if this event occurs is set by parameter **Low City Pressure [36.56]** of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output.

If the pressure switch is not active for a time longer than the parameter **Low City Press. Timeout [33.42]**, a sufficient inlet pressure is available and so the Drive will operate normally; if the Drive was previously in Sleep Mode, the Drive resets Sleep Mode, restarts and sets Run state.

WARNING
With Low City or Low Suction Inlet Pressure function enabled and Start command active (set to On), the Drive can automatically restart the machine without the need of any other command.

WARNING
The user is responsible for enabling of this function according to safety rules. Nidec ASI S.p.A. declaims any liability due to inappropriate use of this function. Make sure that the automatic restart of the machine will not cause physical injury and/or damage equipment. Refer to standards IEC 60204-1.

NOTE
It is not possible set the parameter **Low City Press. Enable [33.40]** to On if the parameter **HOA Start/Stop type [33.12]** is set to Pulse Start/Stop.
In case the operator tries to set the parameter **Low City Press. Enable [33.40]** to On when **HOA Start/Stop type [33.12]** is set to Pulse Start/Stop, the error DSPParEr is generated and the parameter **Low City Press. Enable [33.40]** is automatically reset to Off.

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9.46 LOGIC

Logic function enable to configure up to 3 logic functions that work on 2 digital signals each.
- Logic function 1 defined by parameter **Logic function 1 [16.40]** uses digital signal A and digital signal B
- Logic function 2 defined by parameter **Logic function 2 [16.41]** uses digital signal C and digital signal D
- Logic function 3 defined by parameter **Logic function 3 [16.42]** uses digital signal E and digital signal F

Each logic function foreseen the following options that can be used:
- (first digital signal) AND (second digital signal)
- (first digital signal) OR (second digital signal)
- (first digital signal) XOR (second digital signal)
- NOT (first digital signal)
- positive edge on (first digital signal)

Note: first signal is A, C and E respectively for each functions; second signal is B, D and F respectively for each functions.
The source of the digital signals must be set using the following parameters: **Signal A from ID.bit [16.45], Signal B from ID.bit [16.47], Signal C from ID.bit [16.49], Signal D from ID.bit [16.51], Signal E from ID.bit [16.53]** and **Signal F from ID.bit [16.55]**.
Each digital inputs can be Drive using the following parameters: **Invert signal A [14.46], Invert signal B [14.48], Invert signal C [14.50], Invert signal D [14.52], Invert signal E [14.54]** and **Invert signal F [14.56]**.

Using parameter **Logic function alarm [16.60]**, it is possible to select which of the 3 available functions (or none of them) connect to the dedicated alarm LogicAlarm (code 42, bit 9 of Alarm Word 3, AW3.09). The operation to be performed if this event occurs is set by parameter **Logic Alarm [36.42]** of the family **ALARM SETTINGS [36.00]**. It is possible to select between the following control system behaviors: Off, Warning, Coast Stop, Quick Stop or Ramp Stop. It is also possible to connect the alarm with a digital output.

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10 FIELDBUS

10.1 PROFIBUS (OPTIONAL CARD)

10.1.1 INTRODUCTION

Profibus is a fieldbus initially defined by standard DIN 19245, later incorporated in EN 50170. From 1999 it is standardized in standards IEC 61158 ("Digital data communications for measurement and control - Fieldbus for use in industrial control systems") and IEC 61784 ("Digital data communications for measurement and control").
Profibus enjoys a wide range of applicability, especially in factory and process automation, and can be used when high speed communications and/or complex applications are required.

It makes a wide range of communication technologies, protocols and profiles available. Among them, communication protocol Profibus DP implements a simple, quick, cyclic and deterministic data exchange between a master device and one or more slave devices.

The AD1000 is equipped with a Profibus interface based on the PROFIDrive communication profile for class 1 applications ("Standard Drive").

10.1.2 GENERAL CHARACTERISTICS

Table 10.1 sums up the main characteristics of the AD1000 Profibus interface available with the optional card Eth-Profi.
Refer to AD1000 User and Maintenance Manual for further information.

Table 10.1 - Main characteristics of the Profibus interface

Transmission technology	**RS 485**	Connector	Sub D 9-pin female
		Cable	Shielded pair
		Transmission speed	From 9.6 kBit/s to 12 Mb/s
Communication protocol	**Profibus DP**	Managed PPO's	1, 2, 3, 4, 5

Table 10.2 contains the main characteristics of a Profibus DP network with RS485 physical interface.

Table 10.3 contains the parameters of the cables used for communication. For the choice of the connectors to be used refer to Table 10.4.

Table 10.2 - Main characteristics of Profibus DP

Topology	Linear with termination resistances at the ends
Access control to the bus	Token passing between master, polling between a master and its slaves
Transmission speed	From 9.6 kBit/s to 12 Mb/s
Maximum length of a segment	From 100 to 1,200 m, based on the transmission speed adopted
Cable	Twisted pair
Maximum number of devices	32 per segment with no repeater, 126 with repeater (maximum 9 repeaters)

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Table 10.3 - Electric parameters of Profibus cables

Parameter	Type A cable	Type B cable
Impedance	135 ... 165 Ω (3 to 20 Mhz)	100 ... 130 Ω (f > 100kHz)
Capacity	< 30 pF/m	< 60 pF/m
Resistance	< 110 Ω/ km	-
Conductor diameter	> 0,64 mm	> 0,53 mm
Conductor cross-section	> 0,34 mm2	> 0,22 mm2

NOTE
Strictly use the above mentioned connector.
For further information on Profibus refer to the above mentioned standards.

10.1.3 CONNECTIONS

The Profibus connector, located on the ETH-PROFI card and identified with code **J2** is of the sub D 9 pin female type; pin configuration can be seen in Table 10.5.

Table 10.5 - Profibus connector signals

Signal	Connector (pin)	Description
Shield	1	Cable shield
VP	6	Power supply voltage (+5V)
RxD/TxD-P	3	Receive/Transmit data – positive (B)
RxD/TxD-N	8	Receive/Transmit data – negative (A)
DGND	5	0V (reference potential for VP)

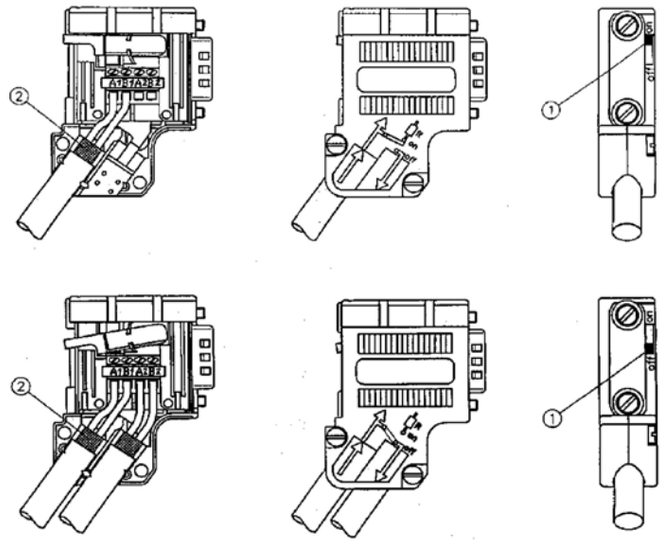
Table 10.4 - Profibus cables and connectors

Type	Order Code
9P connector for networks	ELC226056
Cable	ELC226058 o 229306
Ex. The following cables can be used	Belden Profibus Data Cable 3079A
	Siemens SINEC L2 LAN cable for Profibus 6XV1 830-0AH10

Figure 10.1 represents the Profibus network connector, highlighting the switch for insertion of the termination resistance in the last slave line.

Special care shall be put in ensuring shield continuity, which can be achieved laying the cable braiding bare on the metal connector (ref. 2 of the figure); moreover, the slave connection cable shall be always connected to the left, following the color sequence for connection to the screw terminal board inside the connector.

Figure 10.1 - Profibus connector



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10.1.4 LED

Communication status is indicated by LED DL1 on ETH-PROFI card, see Table 10.6.

Table 10.6 - Led meaning

LED	Status	Meaning
DL1 - Green	On	Normal communication between Master and AD1000. The Profibus interface is exchanging data with the Master.
	Off	Communication not working between Master and AD1000. No data exchange underway.

10.1.5 PROTOCOL

The AD1000 is presented to the Profibus network as a slave, enabled to data exchange functions. Data Exchange is implemented according to the PROFIDrive communication profile.

The protocol used is Profibus-DP; with this standard, the message exchanged between master and slave can have five structure types, identified with codes: PPO1, PPO2, PPO3, PPO4, PPO5.
The above mentioned codes define univocally, for the messages received and sent from the Drive protocol, both message size (number of words) and position and typology of every datum present in the message.

The types of data present in the messages are divided into two categories:
- parameterization data (PKW);
- process data (PZD).

The Drive control is able to manage both PKW parameterization data and PZD process data.

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10.1.6 STRUCTURE OF MESSAGES SENT AND RECEIVED THROUGH PROFIBUS NETWORK

The following tables report the structure of every message received or sent by the AD1000 control according to the PPO used, the typology and meaning of every word:

Table 10.7 - Structure of received message

STRUCTURE OF RECEIVED MESSAGE							
Word	Mnemonic	Typology and meaning	PPO1	PPO2	PPO3	PPO4	PPO5
1	PKW1	PKW – Parameterization datum	•	•			•
2	PKW2	PKW – Parameterization datum	•	•			•
3	PKW3	PKW – Parameterization datum	•	•			•
4	PKW4	PKW – Parameterization datum	•	•			•
5	Command Word [1]	PZD – Bitword for commands from network	•	•	•	•	•
6	Speed Reference [2]	PZD – Speed reference	•	•	•	•	•
7	IPZD3	PZD – Configurable meaning		•		•	•
8	IPZD4	PZD – Configurable meaning		•		•	•
9	IPZD5	PZD – Configurable meaning		•		•	•
10	IPZD6	PZD – Configurable meaning		•		•	•
11	IPZD7	PZD – Configurable meaning					•
12	IPZD8	PZD – Configurable meaning					•
13	IPZD9	PZD – Configurable meaning					•
14	IPZD0	PZD – Configurable meaning					•

[1]: The meaning of every bit of command word 1 is contained in paragraph 8.4.1.
[2]: Speed reference is normalized to ±1 pu equal to ±16384. 1 pu is the motor maximum speed.

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Table 10.8 - Structure of sent message

STRUCTURE OF SENT MESSAGE							
Word	Mnemonic	Typology and meaning	PPO1	PPO2	PPO3	PPO4	PPO5
1	PKW1	PKW – Parameterization datum	•	•			•
2	PKW2	PKW – Parameterization datum	•	•			•
3	PKW3	PKW – Parameterization datum	•	•			•
4	PKW4	PKW – Parameterization datum	•	•			•
5	Status Word [3]	PZD – Bitword for Drive status	•	•	•	•	•
6	Feedback speed [4]	PZD – Speed feedback	•	•	•	•	•
7	OPZD3	PZD – Configurable meaning		•		•	•
8	OPZD4	PZD – Configurable meaning		•		•	•
9	OPZD5	PZD – Configurable meaning		•		•	•
10	OPZD6	PZD – Configurable meaning		•		•	•
11	OPZD7	PZD – Configurable meaning					•
12	OPZD8	PZD – Configurable meaning					•
13	OPZD9	PZD – Configurable meaning					•
14	OPZD0	PZD – Configurable meaning					•

[3]: The meaning of every bit of status word 1 is contained in paragraph 8.4.1.
[4]: Speed feedback is normalized to ±1 pu equal to ±16384. 1 pu is the motor maximum speed.

The meaning of configurable words, present in both messages, is selected with the parameters described in the next paragraph.

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10.1.7 PROFIBUS CONFIGURATION PARAMETERS

The parameters for communication configuration with the Profibus network belong to family **PROFIBUS [81.00]**.
Communication enable on the Profibus network takes place through parameter **Profibus En [81.01]**.
The selection of the structure of the message to be adopted is carried out through parameter **PPO Type [81.20]**; the possible settings and relevant meanings are contained in the following table:

Table 10.9 – PPO types

PPO setting	Meaning
PPO1	Profibus communication enabled with PPO1 type message
PPO2	Profibus communication enabled with PPO2 type message
PPO3	Profibus communication enabled with PPO3 type message
PPO4	Profibus communication enabled with PPO4 type message
PPO5	Profibus communication enabled with PPO5 type message

Once the message type has been selected, it is necessary to assign to every Drive the Profibus address univocally identifying it as a node of the Profibus network; such Profibus address is assigned through parameter **Slave Address [81.02]**.

PREVIOUS VIEW

10.1.8 WORD SETTING FOR RECEIVED MESSAGE CONFIGURATION

Parameters **IPZ03 Sel [81.21], IPZ04 Sel [81.22], IPZ05 Sel [81.23], IPZ06 Sel [81.24], IPZ07 Sel [81.25], IPZ08 Sel [81.26], IPZ09 Sel [81.27], IPZ10 Sel [81.28]** are used to assign the meaning of configurable words of the received message; these words can be used to:

- Receive references;
- Receive commands for the command words.

The values that can be set for such parameters are contained in the following table, with the relevant meaning and resulting typology of received datum:

Table 10.10 – IPZ code

IPZx PARAMETER SETTINGS			
Setting	Meaning	Data type	Normalization
0	Off, Datum not used	--	--
1	Auxiliary speed reference	Analogic	-32768@ - 2pu; 32767@ 2 pu
2	Additional speed reference	Analogic	-32768@ - 2pu; 32767@ 2 pu
3	Speed feedforward	Analogic	-32768@ - 2pu; 32767@ 2 pu
4	Command word 2	Bit significant	--
5	Command word 3	Bit significant	--
6	Command word 4	Bit significant	--
7	Positive torque limit reference	Analogic	-32768@ - 4pu; 32767@ 4 pu
8	Negative torque limit reference	Analogic	-32768@ - 4pu; 32767@ 4 pu
9	Torque reference	Analogic	-32768@ - 4pu; 32767@ 4 pu
21	Torque feedforward	Analogic	-32768@ - 4pu; 32767@ 4 pu
12	Analog output 1	Analogic	-32768@ - 2pu; 32767@ 2 pu
13	Analog output 2	Analogic	-32768@ - 2pu; 32767@ 2 pu
65	Process PID reference 1	Analogic	-32768@ - 2pu; 32767@ 2 pu
66	Process PID feedback 1	Analogic	-32768@ - 2pu; 32767@ 2 pu
67	Process PID reference 2	Analogic	-32768@ - 2pu; 32767@ 2 pu
68	Process PID feedback 2	Analogic	-32768@ - 2pu; 32767@ 2 pu

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10.1.9 WORD SETTING FOR SENT MESSAGE CONFIGURATION

Parameters **OPZ03 Sel [81.31], OPZ04 Sel [81.32], OPZ05 Sel [81.33], OPZ06 Sel [81.34], OPZ07 Sel [81.35], OPZ08 Sel [81.36], OPZ09 Sel [81.37]** and **OPZ10 Sel [81.38]**, are used to assign the meaning of configurable words of the sent message; these words can be used to:

- Send the signals that can normally be displayed through analog outputs;
- Send bit significant information for identification of any intervened hardware and/or software protections;
- Send bit significant information concerning Drive status;
- Send bit significant information concerning status of the microprocessor card (Basis card) digital inputs and outputs;
- Send bit significant information concerning status of the DO expansion digital inputs.

Any of these parameters can be associated to any process data ID, with the limitation that they shall be of Word size.
For the data normalization see paragraph 8.3.

10.1.10 MANAGEMENT OF LOSS OF COMMUNICATION WITH THE PROFIBUS MASTER

In case of loss of communication with the Profibus master, Drive control can act with different modes established through parameters **Timeout [81.03], Freeze En [81.04]** and **Delay Com Restore [81.05]**.

Parameter **Timeout [81.03]** is used to set waiting time on restoring communication with the master; it is possible to set a value between 0.01 s. and 10 s. The default value is 0.01 s.

In case of loss of communication with the master, when the Timeout expires an alarm is generated (**Profibus Error [36.49]**); for the management of this alarm refer to paragraphs 12.3 and 12.5.

During the waiting time for restoring communication, it is possible to freeze the references and Command Word received via Profibus using the values received before loss of communication; this can be achieved by setting parameter **Freeze En [81.04]** to On.
Once the freeze has been enabled, it intervenes based on the status of bit 10 of CmdWd1. If the latter is On, the CmdWd and reference are considered to be valid; if the latter is OFF, the CmdWd and reference are not considered to be valid and those valid and previously stored are used.

10.1.10.1 FUNCTION FOR COMMANDS/REFERENCE UPDATE DELAY VIA PROFIBUS IN CASE OF SERIAL TEAR-OFF
Parameter **Delay Com Restore [81.05]** sets a delay in command/reference update following communication restoring. During such delay the previously stored commands/references are maintained.

10.1.11 COMMAND WORD, STATUS WORD, ALARM STATUS WORD

Command words are used to send commands to the AD1000 through Profibus network; for the meaning of every command word bit see paragraph 8.4.1.
Status words are used by the control to provide information concerning Drive status; for the type of information transmitted and the meaning of the relevant logic states see paragraph 8.4.2.
Through the alarm status words the control provides information concerning Drive alarm status; for decoding of the alarm status word bits see paragraph 8.4.3.

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10.1.12 CONTROL PARAMETERIZATION VIA PROFIBUS

Drive configuration parameter setting can be implemented via Profibus using the PKW parameterization data of messages exchanged between master and slave (Drive). Such data are used by the Profibus master to transmit or receive slave configuration parameter values; through PKW data storing of the chosen parameterization is automatically performed. PKW parameterization data are supported only with PPO1, PPO2 and PPO5 type messages; each of them has got 4 PKW data available both in the message sent by the master to the slave and in the message sent by the slave to the master.

10.1.12.1 PARAMETERIZATION MESSAGE SENT BY THE MASTER TO THE SLAVE

Such message consists of 4 words.

Table 10.11 - Structure of PKW message from master to slave

Word	Meaning
1st word (PKW1)	Type of operation code: - PKW1 = 1 Reading of required value parameter in 32 bit integer formatt - PKW1 = 2 Reading of required value parameter in 32 bit float format - PKW1 = 3 Writing of required value parameter in 32 bit integer format - PKW1 = 4 Writing of required value parameter in 32 bit float format
2nd word (PKW2)	Parameter ID of the configuration datum on which to perform the operation defined by the PKW1 word.
3rd word (PKW3)	Most significant part of the processed datum (MSW). Only for operation code 3 and 4.
4th word (PKW4)	Least significant part of the processed datum (LSW). Only for operation code 3 and 4.

WARNING

For proper operation of the Drive parameterization protocol, it is recommended that the master continues to send the message until receiving the reply from the slave. After that, the master can avoid sending again the message.

NOTE

For list type parameters, the parameter value to indicate the choice is given in the relevant parameter tables under Annex A; and more precisely, it is the value appearing to the side of the description of the choice

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10.1.12.2 PARAMETERIZATION MESSAGE SENT BY THE SLAVE TO THE MASTER

This message consists of 4 words as well.

Table 10.12 - Structure of PKW message from slave to master

Word	Meaning
1st word (PKW1)	Type of operation code: If the operation requested by the master cannot be admitted, the most significant bit of word 1 (PKW1)is set to 1. The error code is written on word 3 (PKW3) - PKW1 = 1 Reading of required value parameter in 32 bit integer format - PKW1 = 2 Reading of required value parameter in 32 bit float format - PKW1 = 3 Writing of required value parameter in 32 bit integer format - PKW1 = 4 Writing of required value parameter in 32 bit float format
2nd word (PKW2)	Parameter ID of the configuration datum on which to perform the operation defined by the PKW1 word.
3rd word (PKW3)	Most significant part of the processed datum (MSW). If the requested by the master cannot be admitted (most significant bit of word 1 = 1) the error code is written in this word: - PKW3 = 2: Non-existent parameter - PKW3 = 3: Non-existent operation code - PKW3 = 4: Non-writable parameter - PKW3 = 7: Writing attempt of single value on buffer parameter - PKW3 = 10: Value out of range
4th word (PKW4)	Least significant part of the processed datum (LSW).

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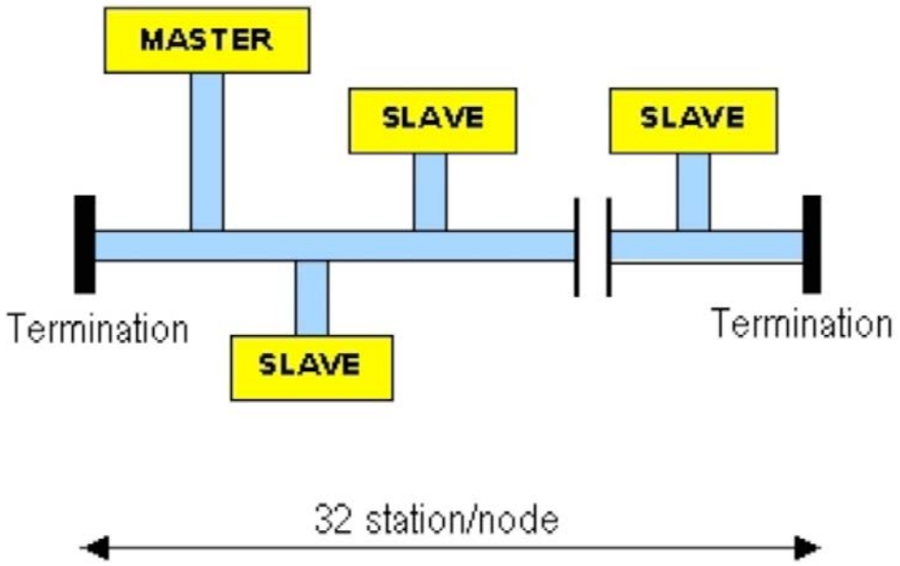
10.2 MODBUS

10.2.1 INTRODUCTION

Modbus is a serial communication protocol for a wide range of industrial and automation applications.
Drive AD1000 can be considered by Modbus communication as a slave.
Data exchange is implemented through the Modicom Modbus Reference Guide (PI-MBUS-300 Rev.J).
The communication type is master-slave in which only the master can start the transaction (calling 'queries'). The slave responds either providing the datum requested by the master or implementing the requested command.

Drive AD1000 supports the RTU (standard on Basis board) and TCP/IP (on optional ETH-PROFI card, see paragraph 10.3) Modbus protocols.

Figure 10.2 - Modbus network



10.2.2 GENERAL CHARACTERISTICS

Tables below show the main features of the AD1000 Modbus interface for both technologies available.

Table 10.13 - Modbus RTU

Transmission technology Modbus RTU	
Connector	Terminal Board ME1 ÷ ME4
Data transmission method	RS-485, Half-duplex
Cable	Shielded three-pole
Transmission speed	From 300 to 115200 baud
Parity type	300 ÷ 115200, N, 8, 1 300 ÷ 115200, N, 8, 2 300 ÷ 115200, E, 8, 1 300 ÷ 115200, ODD, 8, 1
Slave address	1 ÷ 247

Table 10.14 - Modbus TCP/IP

Transmission technology TCP/IP	
Connector	RJ45, connector J6 on optional card.
Data transmission method	TCP/IP
Cable	Standard Ethernet network
Transmission speed	10/100 Mbps
Slave address	1 ÷ 247

NOTE
Modbus TCP/IP is available with ETH-PROFI optional card only.

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10.2.3 MODBUS FUNCTIONS

Unless not specified in a different way, numeric values (as addresses, codes or data) are expressed as decimal values in the text of this section. They are expressed as hexadecimal values in the message fields of figures.

10.2.3.1 FUNCTIONS CODES

Table below show the function code available on AD1000.

Table 10.15 - Available functions codes

Code (decimal)	Function	Description
01	Reads Coils	Reading of one or more contiguous bits
03	Read Holding Registers	Reading of one or more contiguous Holding Register
05	Write Single Coil	Writing of one bit
06	Write Holding Registers	Writing of only one Holding Register (single)
15	Write Multiple Coil	Writing of one contiguous group of bits
16	Write Holding Registers	Writing of one group of Holding Register (multiple)
20	Read File Record	Reading of string parameter
21	Write File Record	Writing of string parameter

10.2.3.2 READ HOLDING REGISTER

The function code “Read Holding Register” reads the binary contents of maintenance registers (4XXXX references) in the slave. The broadcast message is not supported.

Every process data can be read using 4+ID number as modbus address. For example, to read data process **Status Wd 1 [52.01]** the address will be 45201. For the scaling of the data refer to chapter 8.

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10.2.3.3 WRITE HOLDING REGISTERS
Reads the binary contents of maintenance registers (4XXXX references) in the slave. The broadcast message is not supported.

Table 10.17 - Write Holding Register

Write Holding Registers					
Modbus Register	Process Data	Description	Unit	Minimum Value	Maximum Value
45106	Cmd Wd 1	Command Word 1	-	-	-
45107	Cmd Wd 2	Command Word 2	-	-	-
45109	Cmd Wd 4	Command Word 4	-	-	-
45301	Torque Ffw	Torque Feedforward	pu	-32768 @ -4.0 pu;	32767 @ 4.0 pu
45302	Torque Ref	Torque Reference	pu	-32768 @ -4.0 pu;	32767 @ 4.0 pu
45303	Pos Torque Lim Ref	Positive limit of torque reference	pu	-32768 @ -4.0 pu;	32767 @ 4.0 pu
45304	Neg Torque Lim Ref	Negative limit of torque reference	pu	-32768 @ -4.0 pu;	32767 @ 4.0 pu
46002	Ext Aux Speed Ref	External Auxiliary Speed Ref	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu
46002	Ext Aux Speed Ref	External Auxiliary Speed Ref	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu
46003	Speed Reference	Speed reference	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu
46004	Add Speed Reference	Additional speed reference	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu
46005	Speed Feedforward	Speed feedforward	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu
46316	PrsPID Reference 1	Reference 1 for Process PID	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu
46317	PrsPID Feedback 1	Feedback 1 for Process PID	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu
46318	PrsPID Reference 2	Reference 2 for Process PID	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu
46319	PrsPID Feedback 2	Feedback 2 for Process PID	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu

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10.2.3.4 COIL LIST

Table 10.18 - Coil List

Coil id (max.512)	Process Data	Bit	Description
1	5201	SW1.b00	Status Word 1
2	5201	SW1.b01	Status Word 1
3	5201	SW1.b02	Status Word 1
4	5201	SW1.b03	Status Word 1
5	5201	SW1.b04	Status Word 1
6	5201	SW1.b05	Status Word 1
7	5201	SW1.b06	Status Word 1
8	5201	SW1.b07	Status Word 1
9	5201	SW1.b08	Status Word 1
10	5201	SW1.b09	Status Word 1
11	5201	SW1.b10	Status Word 1
12	5201	SW1.b11	Status Word 1
13	5201	SW1.b12	Status Word 1
14	5201	SW1.b13	Status Word 1
15	5201	SW1.b14	Status Word 1
16	5201	SW1.b15	Status Word 1
17	5202	SW2.b00	Status Word 2
18	5202	SW2.b01	Status Word 2
19	5202	SW2.b02	Status Word 2
20	5202	SW2.b03	Status Word 2
21	5202	SW2.b04	Status Word 2
22	5202	SW2.b05	Status Word 2
23	5202	SW2.b06	Status Word 2
24	5202	SW2.b07	Status Word 2
25	5202	SW2.b08	Status Word 2
26	5202	SW2.b09	Status Word 2
27	5202	SW2.b10	Status Word 2
28	5202	SW2.b11	Status Word 2
29	5202	SW2.b12	Status Word 2
30	5202	SW2.b13	Status Word 2
31	5202	SW2.b14	Status Word 2
32	5202	SW2.b15	Status Word 2
33	5203	SW3.b00	Status Word 3
34	5203	SW3.b01	Status Word 3
35	5203	SW3.b02	Status Word 3
36	5203	SW3.b03	Status Word 3
37	5203	SW3.b04	Status Word 3
38	5203	SW3.b05	Status Word 3
39	5203	SW3.b06	Status Word 3
40	5203	SW3.b07	Status Word 3

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Coil id (max.512)	Process Data	Bit	Description
41	5203	SW3.b08	Status Word 3
42	5203	SW3.b09	Status Word 3
43	5203	SW3.b10	Status Word 3
44	5203	SW3.b11	Status Word 3
45	5203	SW3.b12	Status Word 3
46	5203	SW3.b13	Status Word 3
47	5203	SW3.b14	Status Word 3
48	5203	SW3.b15	Status Word 3
49	5204	SW4.b00	Status Word 4
50	5204	SW4.b01	Status Word 4
51	5204	SW4.b02	Status Word 4
52	5204	SW4.b03	Status Word 4
53	5204	SW4.b04	Status Word 4
54	5204	SW4.b05	Status Word 4
55	5204	SW4.b06	Status Word 4
56	5204	SW4.b07	Status Word 4
57	5204	SW4.b08	Status Word 4
58	5204	SW4.b09	Status Word 4
59	5204	SW4.b10	Status Word 4
60	5204	SW4.b11	Status Word 4
61	5204	SW4.b12	Status Word 4

Coil id (max.512)	Process Data	Bit	Description
62	5204	SW4.b13	Status Word 4
63	5204	SW4.b14	Status Word 4
64	5204	SW4.b15	Status Word 4
65	5106	CW1.b00	Command word 1
66	5106	CW1.b01	Command word 1
67	5106	CW1.b02	Command word 1
68	5106	CW1.b03	Command word 1
69	5106	CW1.b04	Command word 1
70	5106	CW1.b05	Command word 1
71	5106	CW1.b06	Command word 1
72	5106	CW1.b07	Command word 1
73	5106	CW1.b08	Command word 1
74	5106	CW1.b09	Command word 1
75	5106	CW1.b10	Command word 1
76	5106	CW1.b11	Command word 1
77	5106	CW1.b12	Command word 1
78	5106	CW1.b13	Command word 1
79	5106	CW1.b14	Command word 1
80	5106	CW1.b15	Command word 1
81	5107	CW2.b00	Command word 2
82	5107	CW2.b01	Command word 2

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Coil id (max.512)	Process Data	Bit	Description
83	5107	CW2.b02	Command word 2
84	5107	CW2.b03	Command word 2
85	5107	CW2.b04	Command word 2
86	5107	CW2.b05	Command word 2
87	5107	CW2.b06	Command word 2
88	5107	CW2.b07	Command word 2
89	5107	CW2.b08	Command word 2
90	5107	CW2.b09	Command word 2
91	5107	CW2.b10	Command word 2
92	5107	CW2.b11	Command word 2
93	5107	CW2.b12	Command word 2
94	5107	CW2.b13	Command word 2
95	5107	CW2.b14	Command word 2
96	5107	CW2.b15	Command word 2
97	5108	CW3.b00	Command word 3
98	5108	CW3.b01	Command word 3
99	5108	CW3.b02	Command word 3
100	5108	CW3.b03	Command word 3
101	5108	CW3.b04	Command word 3
102	5108	CW3.b05	Command word 3
103	5108	CW3.b06	Command word 3
104	5108	CW3.b07	Command word 3
105	5108	CW3.b08	Command word 3

Coil id (max.512)	Process Data	Bit	Description
106	5108	CW3.b09	Command word 3
107	5108	CW3.b10	Command word 3
108	5108	CW3.b11	Command word 3
109	5108	CW3.b12	Command word 3
110	5108	CW3.b13	Command word 3
111	5108	CW3.b14	Command word 3
112	5108	CW3.b15	Command word 3
113	5109	CW4.b00	Command word 4
114	5109	CW4.b01	Command word 4
115	5109	CW4.b02	Command word 4
116	5109	CW4.b03	Command word 4
117	5109	CW4.b04	Command word 4
118	5109	CW4.b05	Command word 4
119	5109	CW4.b06	Command word 4
120	5109	CW4.b07	Command word 4
121	5109	CW4.b08	Command word 4
122	5109	CW4.b09	Command word 4
123	5109	CW4.b10	Command word 4
124	5109	CW4.b11	Command word 4
125	5109	CW4.b12	Command word 4
126	5109	CW4.b13	Command word 4
127	5109	CW4.b14	Command word 4
128	5109	CW4.b15	Command word 4

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10.2.4 ERRORS RETURNED IN THE MODBUS PROTOCOL (MODBUS EXCEPTION CODE)

Except for broadcast messages, when a master device send a query to a slave device, it expects a response.
If a transmission is not successful, the response contains a code indicating the type of error detected. The code are listed in the Table 10.19.

Table 10.19 - Error codes

Code	Name	Meaning
01	ILLEGAL FUNCTION	The function code received in the query is not an action allowed for the slave. If a Poll Program Complete command has been issued, this code indicates that no program function preceded it.
02	ILLEGAL DATA ADDRESS	The data address received in the query is not an acceptable address for the slave.
03	ILLEGAL DATA VALUE	A value contained in the query data field is not an acceptable value for the slave.
04	SLAVE DEVICE FAILURE	An irreversible error occurred while the slave was trying to perform the requested action.

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10.2.5 MODBUS CONFIGURATION PARAMETERS

Modbus communication settings take place through the parameters family **MODBUS [82.00]**.

Table 10.20 – Modbus parameters

82 - MODBUS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
82.01	Modbus En	Modbus enable - Off [0] - RTU [1] - TCP/IP [2] - RTU & TCP/IP [3]	#	Def: OFF	Read and Write	All	2	Yes
82.02	Slave Address	Slave address	#	Min: 1 Def: 3 Max: 247	Read and Write	All	2	Yes
82.03	RTU Baud Rate	Baud rate - 300 [300] - 600 [600] - 1200 [1200] - 2400 [2400] - 4800 [4800] - 9600 [9600] - 19200 [19200] - 28800 [28800] - 38400 [38400] - 57600 [57600] - 115200 [115200]	#	Def: 9600	Read and Write	All	2	Yes
82.04	RTU Parity Type	Parity type - None + 1 Stop bit [0] - None + 2 Stop bit [1] - Even [2] - Odd [3]	#	Def: None + 1 Stop bit	Read and Write	All	2	Yes
82.05	RTU Timeout	Timeout for alarm 53 (0 = disabled)	s	Min: 0 Def: 3 Max: 250	Read and Write	All	2	Yes
82.06	Min Slave Reaction Time	Minimum slave reaction time	ms	Min: 0 Def: 20 Max: 150	Read and Write	All	2	Yes
82.07	Mod Exchange Area In	Selection of input auxiliary exchange area (from Modbus to Drive)	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

10.2.6 LOSS OF MODBUS COMMUNICATION

If the "RTU" communication mode has been chosen, if the communication fails, the system generates the alarm ModbusEr. The action that shall generate such error is determined by the setting chosen in parameter **Modbus Error [36.53]**.

10.2.7 CONTROL PARAMETERIZATION VIA MODBUS

Drive configuration parameter setting can be implemented via Modbus using the PKW parameterization data of messages exchanged between master and slave (Drive). Such data are used by the Modbus master to transmit or receive slave configuration parameter values; through PKW data storing of the chosen parameterization is automatically performed.

10.2.7.1 MODBUS PARAMETERIZATION MESSAGE SENT BY THE MASTER TO THE SLAVE
Such message consists of 4 words.

Table 10.21 - Structure of PKW message from master to slave

Word	Meaning
1st word (PKW1) **Modbus PKW1 In [67.02]**	Type of operation code: - PKW1 = 1 Reading of required value parameter in 32 bit integer format - PKW1 = 2 Reading of required value parameter in 32 bit float format - PKW1 = 3 Writing of required value parameter in 32 bit integer format - PKW1 = 4 Writing of required value parameter in 32 bit float format
2nd word (PKW2) **Modbus PKW2 In [67.03]**	Parameter ID of the configuration datum on which to perform the operation defined by the PKW1 word.
3rd word (PKW3) **Modbus PKW3 In [67.04]**	Most significant part of the processed datum (MSW). Only for operation code 3 and 4.
4th word (PKW4) **Modbus PKW4 In [67.05]**	Least significant part of the processed datum (LSW). Only for operation code 3 and 4.

WARNING
For proper operation of the Drive parameterization protocol, it is recommended that the master continues to send the message until receiving the reply from the slave. After that, the master can avoid sending again the message.

NOTE
For list type parameters, the parameter value to indicate the choice is given in the relevant parameter tables under Annex A; and more precisely, it is the value appearing to the side of the description of the choice

PREVIOUS VIEW

10.2.7.2 MODBUS PARAMETERIZATION MESSAGE REQUESTED BY THE MASTER AND SENT TO THE SLAVE
This message consists of 4 words as well.

Table 10.22 - Structure of PKW message from slave to master

Word	Meaning
1st word (PKW1) **Modbus PKW1 Out [67.06]**	Type of operation code: If the operation requested by the master cannot be admitted, the most significant bit of word 1 (PKW1)is set to 1. The error code is written on word 3 (PKW3) - PKW1 = 1 Reading of required value parameter in 32 bit integer format - PKW1 = 2 Reading of required value parameter in 32 bit float format - PKW1 = 3 Writing of required value parameter in 32 bit integer format - PKW1 = 4 Writing of required value parameter in 32 bit float format
2nd word (PKW2) **Modbus PKW2 Out [67.07]**	Parameter ID of the configuration datum on which to perform the operation defined by the PKW1 word.
3rd word (PKW3) **Modbus PKW3 Out [67.08]**	Most significant part of the processed datum (MSW). If the requested by the master cannot be admitted (most significant bit of word 1 = 1) the error code is written in this word: - PKW3 = 2: Non-existent parameter - PKW3 = 3: Non-existent operation code - PKW3 = 4: Non-writable parameter - PKW3 = 7: Writing attempt of single value on buffer parameter - PKW3 = 10: Value out of range
4th word (PKW4) **Modbus PKW4 Out [67.09]**	Least significant part of the processed datum (LSW).

10.2.8 DATA EXCHANGE AREA

10.2.8.1 DATA EXCHANGE AREA CONFIGURATION PARAMETERS
The Data Exchange Area allows to access to 16 configurable input words and 16 configurable output words in order to save Modbus bandwidth.
The parameters for communication configuration of the data exchange area belong to family **EXCH AREA 1/2 CONFIG [87.00]**.
Communication enable on the Modbus network takes place through parameter **En Exch Area 1/2 Config [87.01]**.
It is possible to enable the input area only, the output only or both.
Once the area has been selected, it is necessary to assign the input area to Modbus setting the parameter **Mod Exchange Area In [82.07]** to “1 Data Exchange Area”. After the configuration of the Exchange Area it is possible to access the input area using the address 46711 and the output area using the address 46712 reading and writing 1 to 16 words.

10.2.8.2 WORD SETTING FOR RECEIVED MESSAGE CONFIGURATION
Parameters from **Area 1 Input Wd 01 Sel [87.04]** to **Area 1 Input Wd 16 Sel [87.19]** are used to assign the meaning of configurable words of the received message; these words can be used to:
- Receive references;
- Receive commands for the digital outputs of the microprocessor card;
- Receive values to be sent on the analog outputs of the microprocessor card.

The values that can be set for such parameters are contained in the following table, with the relevant meaning and resulting typology of received datum:

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Table 10.23 - Data Exchange Area Parameter Settings

DATA EXCHANGE AREA PARAMETER SETTINGS			
Setting	Meaning	Data type	Normalization
0	Off, Datum not used	--	--
98	Main speed reference	Analogic	-32768@ - 2pu; 32767@ 2 pu
1	Auxiliary speed feedback	Analogic	-32768@ - 2pu; 32767@ 2 pu
2	Additional speed reference	Analogic	-32768@ - 2pu; 32767@ 2 pu
3	Speed feedforward	Analogic	-32768@ - 2pu; 32767@ 2 pu
99	Command word 1	Bit significant	--
4	Command word 2	Bit significant	--
5	Command word 3	Bit significant	--
6	Command word 4	Bit significant	--
7	Positive torque limit reference	Analogic	-32768@ - 4pu; 32767@ 4 pu
8	Negative torque limit reference	Analogic	-32768@ - 4pu; 32767@ 4 pu
9	Torque reference	Analogic	-32768@ - 4pu; 32767@ 4 pu
21	Torque feedforward	Analogic	-32768@ - 4pu; 32767@ 4 pu
12	Analog output 1	Analogic	-32768@ - 2pu; 32767@ 2 pu
13	Analog output 2	Analogic	-32768@ - 2pu; 32767@ 2 pu
65	Process PID reference 1	Analogic	-32768@ - 2pu; 32767@ 2 pu
66	Process PID feedback 1	Analogic	-32768@ - 2pu; 32767@ 2 pu
67	Process PID reference 2	Analogic	-32768@ - 2pu; 32767@ 2 pu
68	Process PID feedback 2	Analogic	-32768@ - 2pu; 32767@ 2 pu

10.2.8.3 WORD SETTING FOR SENT MESSAGE CONFIGURATION

Parameters from **Area 2 Output Wd 01 Sel [87.52]** to **Area 2 Output Wd 16 Sel [87.67]** are used to assign the meaning of configurable words of the sent message; these words can be used to:

- Send the signals that can normally be displayed through analog outputs;
- Send bit significant information for identification of any intervened hardware and/or software protections;
- Send bit significant information concerning Drive status;
- Send bit significant information concerning status of the control card (Basis card) digital inputs and outputs;

Any of these parameters can be associated to any process data ID, with the limitation that they shall be of Word size.
For the data normalization see paragraph 8.3.

PREVIOUS VIEW

10.3 ETHERNET (OPTIONAL CARD)

10.3.1 INTRODUCTION

The Basis card can be connected to the Ethernet with TCP/IP protocol with the ETH-PROFI optional card.

This interface is used to connect to Basis card with DVM interface program in order to configure the Drive.
Refer to the appropriate user guide for these programs using.

10.3.2 PHYSICAL INTERFACE

The connector of network interface is the J6 connector on the ETH-PROFI optional card.
Refer to AD1000 User and Maintenance Manual for further information.

WARNING
In order to avoid any possible failure to the PC Ethernet port PAY ATTENTION to the label on the ports of the board. The Ethernet communication port is tagged J6 on the board.

10.3.3 NETWORK INTERFACE CONFIGURATION

The default IP address of the board is 192.168.1.1, and subnet mask is 255.255.255.0.
While connecting the board to a network the IP address and subnet mask must be modified accordingly to the network configuration.

The IP and subnet mask can be changed both with DVM and keypad modifying the following parameters:

For IP address:
- **IP Address - Octet 1 [88.11]**
- **IP Address - Octet 2 [88.12]**
- **IP Address - Octet 3 [88.13]**
- **IP Address - Octet 4 [88.14]**

The IP address is modified only after parameter **IP Address - Octet 4 [88.14]** change.

For subnet mask:
- **Subnet mask - Octet 1 [88.15]**
- **Subnet mask - Octet 2 [88.16]**
- **Subnet mask - Octet 3 [88.17]**
- **Subnet mask - Octet 4 [88.18]**

The subnet mask is modified after parameter **Subnet mask - Octet 4 [88.18]** change.

For the default gateway:
- **Default Gateway - Octet 1 [88.21]**
- **Default Gateway - Octet 2 [88.22]**
- **Default Gateway - Octet 3 [88.23]**
- **Default Gateway - Octet 4 [88.24]**

The default gateway is modified after parameter **Default Gateway - Octet 4 [88.24]** change.

To check the IP address of the board see parameter **IP Address [88.01]**.

The parameters family for addresses setup and visualization is **ETHERNET – TCP/IP [88.00]**.

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Table 10.23 - Ethernet - TCP/IP parameters

88 - Ethernet - TCP/IP								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
88.01	IP Address	IP address	#	Min: 0 Def: 192.168.1.1 Max: 20	Write at Stop Only	All	2	Yes
88.02	Subnet Mask	Subnet mask	#	Min: 0 Def: 255.255.255.0 Max: 20	Write at Stop Only	All	2	Yes
88.03	Default Gateway	Default Gateway	#	Min: 0 Def: 0.0.0.0 Max: 20	Read Only	All	2	Yes
88.11	IP Address - Octet 1	IP address - Octet 1	#	Min: 0 Def: 192 Max: 255	Write at Stop Only	All	2	Yes
88.12	IP Address - Octet 2	IP address - Octet 2	#	Min: 0 Def: 168 Max: 255	Write at Stop Only	All	2	Yes
88.13	IP Address - Octet 3	IP address - Octet 3	#	Min: 0 Def: 1 Max: 255	Write at Stop Only	All	2	Yes
88.14	IP Address - Octet 4	IP address - Octet 4	#	Min: 0 Def: 1 Max: 255	Write at Stop Only	All	2	Yes
88.15	Subnet mask - Octet 1	Subnet mask - Octet 1	#	Min: 0 Def: 255 Max: 255	Write at Stop Only	All	2	Yes
88.16	Subnet mask - Octet 2	Subnet mask - Octet 2	#	Min: 0 Def: 255 Max: 255	Write at Stop Only	All	2	Yes

PREVIOUS VIEW

88 - Ethernet - TCP/IP

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
88.17	Subnet mask - Octet 3	Subnet mask - Octet 3	#	Min: 0 Def: 255 Max: 255	Write at Stop Only	All	2	Yes
88.18	Subnet mask - Octet 4	Subnet mask - Octet 4	#	Min: 0 Def: 0 Max: 255	Write at Stop Only	All	2	Yes
88.20	Host Name	Host Name	#	Min: 0 Def: Drive Max: 16	Read and Write	All	2	Yes
88.21	Default Gateway - Octet 1	Default Gateway - Octet 1	#	Min: 0 Def: 0 Max: 255	Write at Stop Only	All	2	Yes
88.22	Default Gateway - Octet 2	Default Gateway - Octet 2	#	Min: 0 Def: 0 Max: 255	Write at Stop Only	All	2	Yes
88.23	Default Gateway - Octet 3	Default Gateway - Octet 3	#	Min: 0 Def: 0 Max: 255	Write at Stop Only	All	2	Yes
88.24	Default Gateway - Octet 4	Default Gateway - Octet 4	#	Min: 0 Def: 0 Max: 255	Write at Stop Only	All	2	Yes
99.17	MAC Address	MAC address	#	Min: 0 Def: 0 Max: 6	Read Only	All	2	No

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11 I/O CONFIGURATION

The configuration of the card I/O's is available from programming level 2 onwards.

11.1 DIGITAL INPUT

Six digital inputs are available, of which two are dedicated (Drive Enable and Start/Stop command) and four are programmable.
Three additional and programmable digital inputs named DI6, DI7 and DI8 are available on optional GIABA board. Refer to AD1000 User and Maintenance Manual for further information.
To enable these digital inputs the parameter **Expansion boards [06.70]** must be set to Input board.

For the external pre-arrangement and their wiring see User and Maintenance Manual.

Table 11.1 - Digital input on Basis control card

Function	Terminal ME	Name	Description
Programmable optoisolated digital inputs (referred to DI / DO ground)	22	DI3	Programmabke optoidolated digital inputs Voltage range: 0÷36Vdc Rated voltage 24Vdc Rated absorbition: 5mA For information about programmable digital input D13 see warning 2
	23	DI4	
	24	DI5	
I/O power reference	31	DI / DO ground	Reference for programmable optoisolated digital inputs and for P24VI/O
Optoisolated digital inputs (referred to DI / DO gruond	27	DE	Drive Enable
	26	DI1-RUN	Start/stop command
	25	DI2-RV	Programmable digital input (see warning 1)
I/O power supply	30	P24V I/O	24Vcd-100mA digitl I/O power supply (analog through DC/DC coverter)

WARNING

1) If digital input "DI2-RV" is configured through parameter **DI Run/Fw/Rv Connect. [31.10]**, the possible options are:
   a) DI1:Run = run.
   b) DI1:Run - DI2:Fw/Rv = run/stop with DI1 and reverse direction with DI2.
   c) DI1:RunFw - DI2: RunRv = run/stop forward with DI1 and run/stop backward with DI2.
2) The "External Fault", if enabled, can only operate on DI3

PREVIOUS VIEW

11.1.1 DIGITAL INPUT CONFIGURATION

The programmable digital input must be configured according to settings provided by functions. To use an input on a function see the chapter where the function is explained. The combination of inputs to parameters is displayed in the family **DIGITAL INPUTS [15.00]**. It is possible to invert the value of digital inputs from DI4 to DI8. In order to do this use parameters from **Invert DI4 [15.24]** to **Invert DI8 [15.32]**.

Table 11.2 - Parameters that show the allocation of digital inputs

15 - DIGITAL INPUTS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
15.01	DI1 Used by	[ME26] DI1 Used by	#	-	Read Only	All	2	No
15.02	DI2 Used by	[ME25] DI2 Used by	#	-	Read Only	All	2	No
15.03	DI3 Used by	[ME22] DI3 Used by	#	-	Read Only	All	2	No
15.04	DI4 Used by	[ME23] DI4 Used by	#	-	Read Only	All	2	No
15.05	DI5 Used by	[ME24] DI5 Used by	#	-	Read Only	All	2	No
15.06	DI6 Used by	[ME38] DI6 Used by	#	-	Read Only	All	2	No
15.07	DI7 Used by	[ME39] DI7 Used by	#	-	Read Only	All	2	No
15.08	DI8 Used by	[ME40] DI8 Used by	#	-	Read Only	All	2	No
15.10	CW1.12 Used by	CW1.12 Used by	#	-	Read Only	All	2	No
15.11	CW1.13 Used by	CW1.13 Used by	#	-	Read Only	All	2	No
15.12	CW1.14 Used by	CW1.14 Used by	#	-	Read Only	All	2	No
15.13	CW1.15 Used by	CW1.15 Used by	#	-	Read Only	All	2	No
15.21	Invert DI1	Inversion of digital input 1	#	-	Read Only	All	2	Yes
15.22	Invert DI2	Inversion of digital input 2	#	-	Read Only	All	2	Yes
15.23	Invert DI3	Inversion of digital input 3	#	-	Read Only	All	2	Yes
15.24	Invert DI4	Inversion of digital input 4	#	-	Read and Write	All	2	Yes
15.25	Invert DI5	Inversion of digital input 5	#	-	Read and Write	All	2	Yes
15.26	Invert DI6	Inversion of digital input 6	#	-	Read and Write	All	2	Yes
15.27	Invert DI7	Inversion of digital input 7	#	-	Read and Write	All	2	Yes
15.32	Invert DI8	Inversion of digital input 8	#	-	Read and Write	All	2	Yes

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11.1.2 STATUS OF DIGITAL INPUT

The status of the digital inputs can be seen together through the process data DI W1 [57.01].
Table 11.3 shows the relationship between bits of data process and digital input.

The status of Drive Enable (DE) digital input is also shown by bit 11 of Status Word 1 (**Status Word 1 [52.01]**). See Table 8.7.

Table 11.3 – Bit of digital input

Input	Bit on DI W1 [57.01]
DI1	0
DI2	1
DI3	2
DI4	3
DI5	4
DI6	5
DI7	6
DI8	7
DE	15

PREVIOUS VIEW

11.2 DIGITAL OUTPUT

The available digital outputs are four, one is dedicated (Fault Relay) and three programmable.

For the external pre-arrangement and their wiring see User and Maintenance Manual.

Table 11.4 – Digital output on Basis control card

Function	Terminal ME	Name	Description	
Fault relay	17	Fault NO	NA	Normally energized fault relay 1 A – 250 Vac
	18	Fault C	COM	
	19	Fault NC	NC	
Programmable static output	28	DO1		Programmable static output configured with **DO1 Select [16.01]** 10 mA - 24 Vdc
	29	DO2		Programmable static output configured with **DO2 Select [16.03]** 10 mA - 24 Vdc
Programmable relay	20	DO3 NO	NA	Programmable relay configured with **DO3 Select [16.05]** 1 A – 250 Vac
	21	DO3 C	C	

The Fault Relay output is normally at a high logic status and switches over to low logic status, when a protection occurs, based on the logic:

Fault Relay de-energized = There is an active protection
Fault Relay energized = No active protection

For programmable relay digital outputs the following logic is used:

Digital Output = 0: contact open (Off)
Digital Output = 1: contact closed (On)

11.2.1 DIGITAL OUTPUT CONFIGURATION

Programmable outputs are configured trough the parameters of family **DIGITAL OUTPUT [16.00]**.

Parameters **DO1 Select [16.01], DO2 Select [16.03]** and **DO3 Select [16.05]** allow you to associate one of the signals of the selection list to the digital output. The signals of the selection list are bits of Status Word 1, Status Word 2 and configurable word of Command Word 1. The last item on the list (DO1 from ID.bit on parameter **DO1 Select [16.01]**, DO2 from ID.bit on parameter **DO2 Select [16.03]**, DO3 from ID.bit on parameter **DO3 Select [16.05]**), allows associating to the chosen output the status of digital signal not available on the list setting in the following parameters (**DO1 from ID.bit [16.02], DO2 from ID.bit [16.04]** and **DO3 from ID.bit [16.06]**) the ID number and the bit of the signal.

For instance, to associate the **DO1 digital output to bit 11 of Command Word 1** (whose process data associated is 5106 Cmd Wd1):

- choose in the selection list of parameter **DO1 Select [16.01]** the item **DO1 from ID.bit**;
- set on parameter **DO1 from ID.bit [16.02]** the value 5106.11.

It is possible to invert the value of digital outputs using parameters **Invert DO1 [16.27], Invert DO2 [16.28]** and **Invert DO3 [16.29]**.

PREVIOUS VIEW

11.2.2 CONFIGURATION OF CONFIGURABLE BITS OF STATUS WORD 1

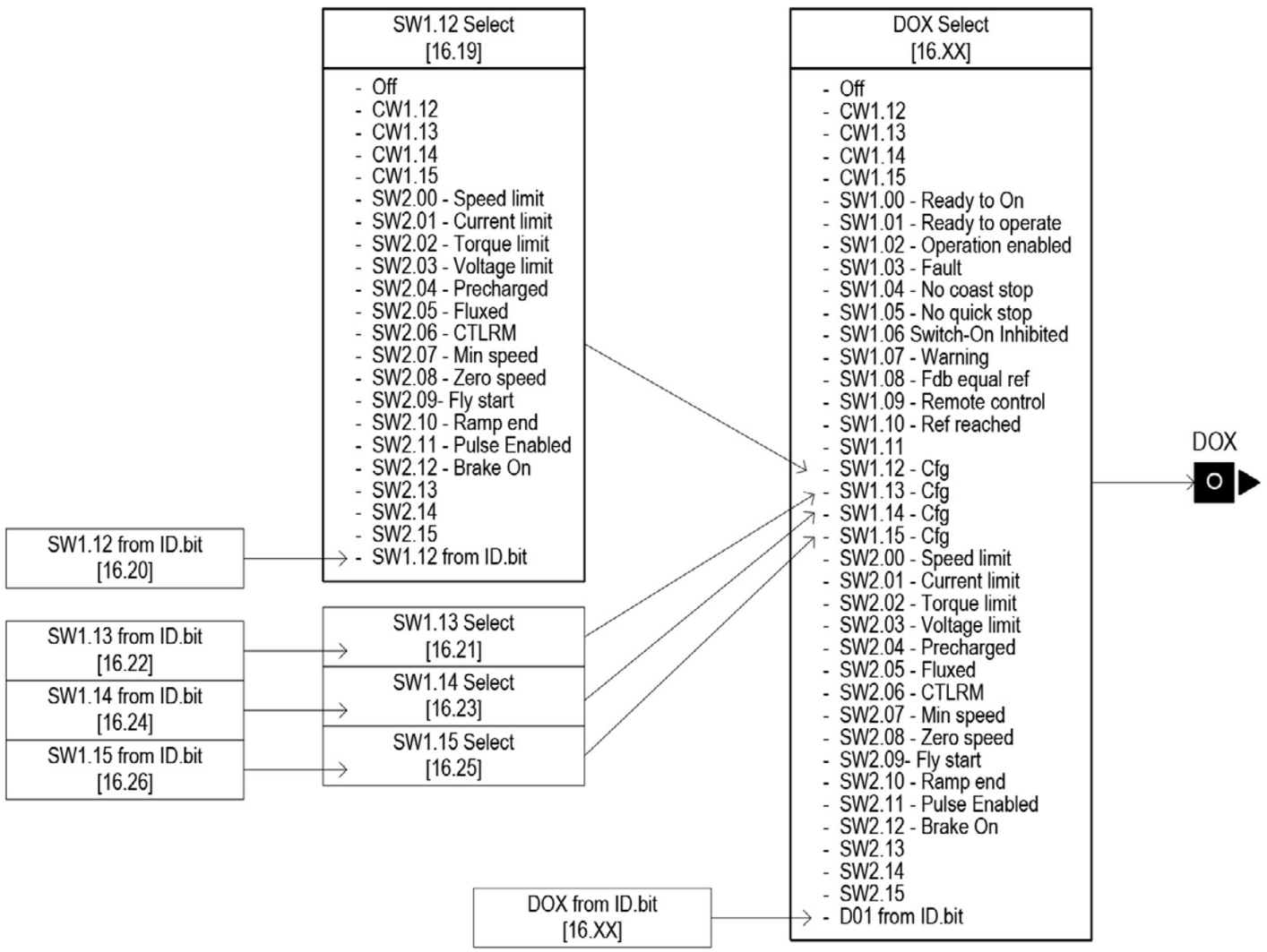
Four configurable bits are available in Status Word 1 (bits 12, 13, 14, 15). In a similar way to the digital outputs it is possible to associate this bits with a digital signals.

The selection parameters are **SW1.12 Select [16.19], SW1.12 from ID.bit [16.20], SW1.13 Select [16.21], SW1.13 from ID.bit [16.22], SW1.14 Select [16.23], SW1.14 from ID.bit [16.24], SW1.15 Select [16.25], SW1.15 from ID.bit [16.26]**.

The configurable bits of Status Word 1 can be associated to digital outputs through the item of selection list: SW1.12 – Cfg, SW1.13 – Cfg, SW1.14 – Cfg, SW1.15 – Cfg.

Figure 11.1 show this configuration.

Figure 11.1 - Block diagram for digital output configuration



PREVIOUS VIEW

11.3 ANALOG INPUT

Two configurable analog inputs are available on the Basis control card.
For the external pre-arrangement and their wiring see User and Maintenance Manual.
Two additional and configurable analog inputs are available on GIABA and GIABB optional boards.

Refer to AD1000 User and Maintenance Manual for further information.
To enable these analog inputs the parameter **Expansion boards [06.70]** must be set to Input board.

Table 11.5 - Analog input on Basis control card

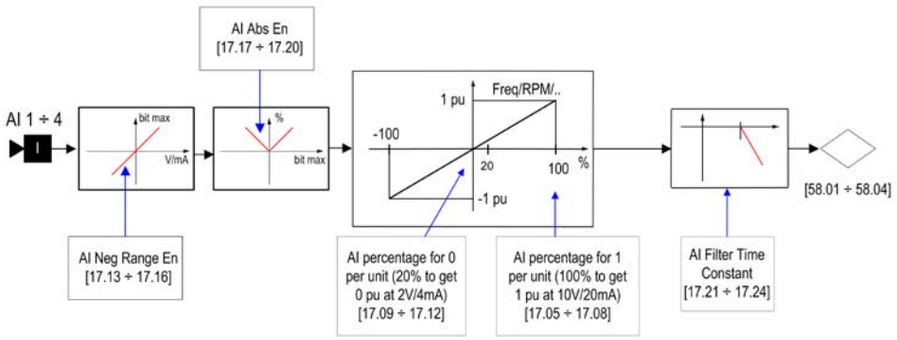
Function	Terminal ME	Name	Description
Analog references	32	AI / AO ground	0V analog I/O's
	37	AI / AO ground	0V analog I/O's
Programmable optoisolated analog inputs (referred to AI / AO ground)	33	AI1-	Programmable optoisolated analog inputs ± 10V or ±20mA differential configuration
	34	AI1+	
	35	AI2-	
	36	AI2+	

It is possible to manage a current reference signal with range 4 ÷ 20mA, using jumpers **P6 – P7** (see User and Maintenance Manual) and acting on parameters **AI1 Value for 0 pu [17.09]** and **AI2 Value for 0 pu [17.10]**. See example 2.

The inputs range (+/- 100%) corresponds to:

±10 V if the analog input signal is a voltage signal
±20 mA if the analog input signal is a current signal

Figure 11.2 - Block diagram for analog input processing



This means that the transduced signal have a value equal to 100% when the signal to the terminals reaches 10V (20mA).

For instance, if input AI1 is used as input for the speed reference and input parameters settings are the default ones, after setting equal parameter **Max Speed (1 pu) [02.09]** at a value equal to 1500 rpm, the motor reaches the set value when the input reaches 10V (20mA).
This correspondence can be modified adjusting the linear characteristic of the analog input as illustrated below.

NOTE
To convert input signals in the per unit internal variable, the two points of the conversion characteristic are defined.
Please note that, if two points of the transduction characteristic are both equal to X%, the internal value will be equal to X/100 pu.

PREVIOUS VIEW

11.3.1 ANALOG INPUT CONFIGURATION

The following table indicates configuration parameters.

Table 11.6 - Configuration parameters for analog inputs

17 - ANALOG INPUTS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
17.05	AI1 Value for 1 pu	AI1 Percentage for 1 per-unit (100% to get 1 pu at 10V/20mA)	%	Min: -400 Def: 100 Max: 400	Read and Write	All	2	Yes
17.06	AI2 Value for 1 pu	AI2 Percentage for 1 per-unit (100% to get 1 pu at 10V/20mA)	%	Min: -400 Def: 100 Max: 400	Read and Write	All	2	Yes
17.07	AI3 Value for 1 pu	AI3 Percentage for 1 per-unit (100% to get 1 pu at 10V/20mA)	%	Min: -2000 Def: 100 Max: 2000	Read and Write	All	2	Yes
17.08	AI4 Value for 1 pu	AI4 Percentage for 1 per-unit (100% to get 1 pu at 10V/20mA)	%	Min: -2000 Def: 100 Max: 2000	Read and Write	All	2	Yes
17.09	AI1 Value for 0 pu	AI1 Percentage for 0 per-unit (20% to get 0 pu at 2V/4mA)	%	Min: -400 Def: 0 Max: 400	Read and Write	All	2	Yes
17.10	AI2 Value for 0 pu	AI2 Percentage for 0 per-unit (20% to get 0 pu at 2V/4mA)	%	Min: -400 Def: 0 Max: 400	Read and Write	All	2	Yes
17.11	AI3 Value for 0 pu	AI3 Percentage for 0 per-unit (20% to get 0 pu at 2V/4mA)	%	Min: -2000 Def: 0 Max: 2000	Read and Write	All	2	Yes
17.12	AI4 Value for 0 pu	AI4 Percentage for 0 per-unit (20% to get 0 pu at 2V/4mA)	%	Min: -2000 Def: 0 Max: 2000	Read and Write	All	2	Yes
17.13	AI1 Neg Range En	AI1 Option to use negative input values - Off [0] - On [1]	#	Def: On	Read and Write	All	2	Yes
17.14	AI2 Neg Range En	AI2 Option to use negative input values	#	Def: On	Read and Write	All	2	Yes
17.15	AI3 Neg Range En	AI3 Option to use negative input values - Off [0] - On [1]	#	Def: On	Read and Write	All	2	Yes

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17 - ANALOG INPUTS

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
17.16	AI4 Neg Range En	AI4 Option to use negative input values - Off [0] - On [1]	#	Def: On	Read and Write	All	2	Yes
17.17	AI1 Abs En	AI1 Option to use absolute value of input - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
17.18	AI2 Abs En	AI2 Option to use absolute value of input	#	Def: Off	Read and Write	All	2	Yes
17.19	AI3 Abs En	AI3 Option to use absolute value of input - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
17.20	AI4 Abs En	AI4 Option to use absolute value of input - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
17.21	AI1 Filter Time Constant	AI1 Time constant of low-pass filter	s	Min: 0 Def: 0 Max: 1000	Read and Write	All	2	Yes
17.22	AI2 Filter Time Constant	AI2 Time constant of low-pass filter	s	Min: 0 Def: 0 Max: 1000	Read and Write	All	2	Yes
17.23	AI3 Filter Time Const	AI3 Time constant of low-pass filter	s	Min: 0 Def: 0 Max: 100	Read and Write	All	2	Yes
17.24	AI4 Filter Time Const	AI4 Time constant of low-pass filter	s	Min: 0 Def: 0 Max: 100	Read and Write	All	2	Yes

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11.3.2 EXAMPLES

A few examples of analog inputs configuration are given hereunder.

EXAMPLE 1

Configuration of the analog input AI1 to obtain a speed reference ranging from 0 to motor maximum speed, having available a voltage signal ranging from 0 to + 10V.

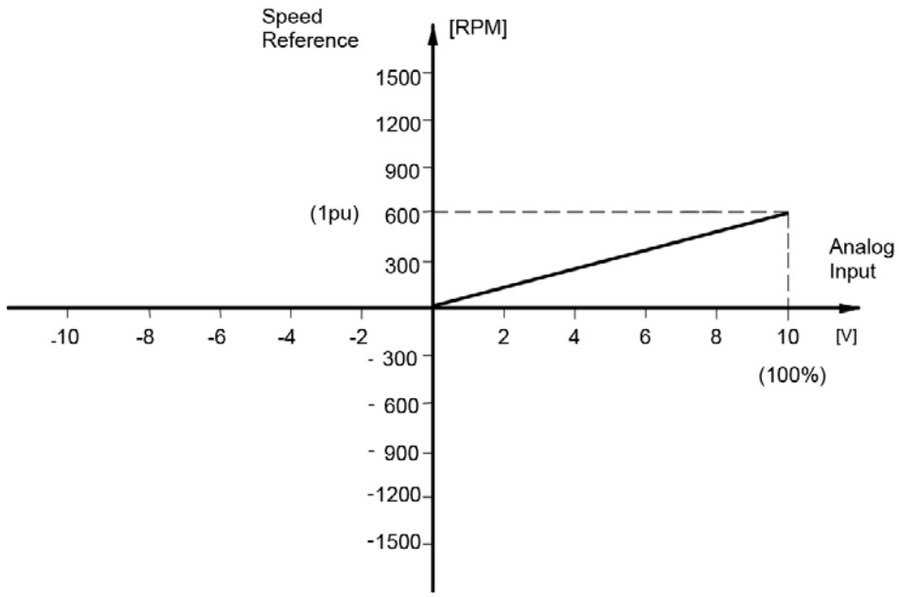
Suppose the maximum motor speed to be equal to 600 rpm.
The two points of the transduction characteristic are:

600 rpm	=	1.0 pu @ +10V (100%)
0 rpm	=	0 pu @ 0V (0%)

It is therefore necessary to set:

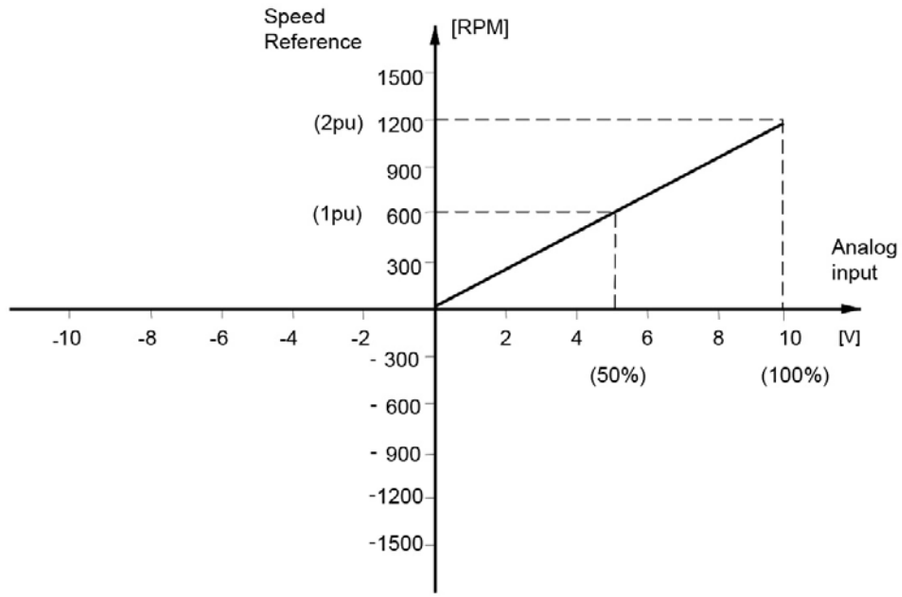
AI1 Value for 1 pu	= 100%
AI1 Value for 0 pu	= 0%
AI1 Neg Range En	= Off
AI1 Abs En	= Off
AI1 Filter Time Constant	= 0 s
Max Speed	= 600 rpm

Figure 11.3 – Example 1 – Maximum at 1 pu



If, with the same input reference, we want to bring the motor to a speed equal to 2.0 pu, parameter **AI1 Value for 1 pu [17.01]** shall be set at 50%.

Figure 11.4 – Example 1 - Maximum at 2 pu



EXAMPLE 2

Configuration of the analog signal AI1 to obtain a speed reference ranging from 0 to motor maximum speed, having available a current signal 4 ÷ 20 mA..

Suppose the maximum motor speed to be equal to 1500 rpm.
The two points of the transduction characteristic are:

1500 rpm	=	1.0 pu @ 20 mA (100%)
0 rpm	=	0 pu @ 4 mA (20%)

It is therefore necessary to set:

AI1 Value for 1 pu	= 100%
AI1 Value for 0 pu	= 20%
AI1 Neg Range En	= Off
AI1 Abs En	= Off
AI1 Filter Time Constant	= 0 s
Max Speed	= 1500 rpm

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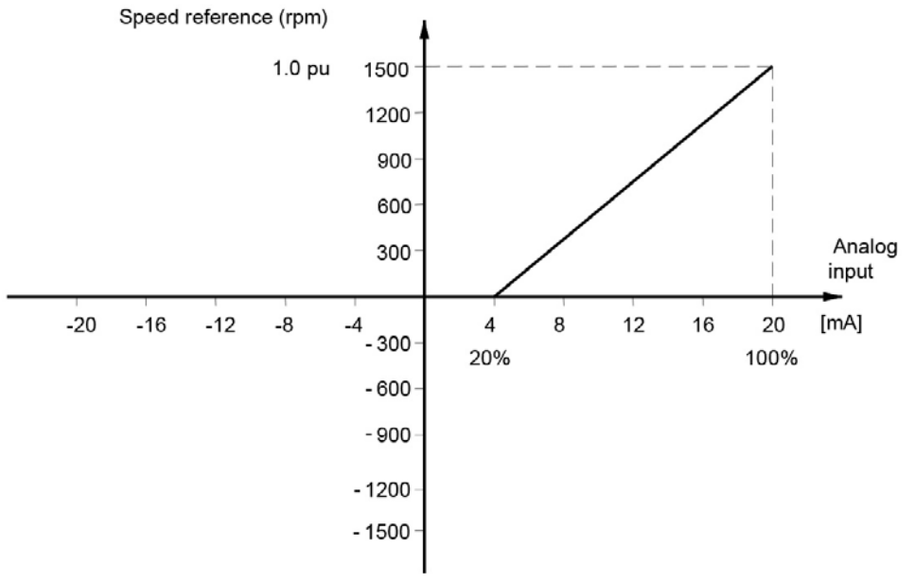
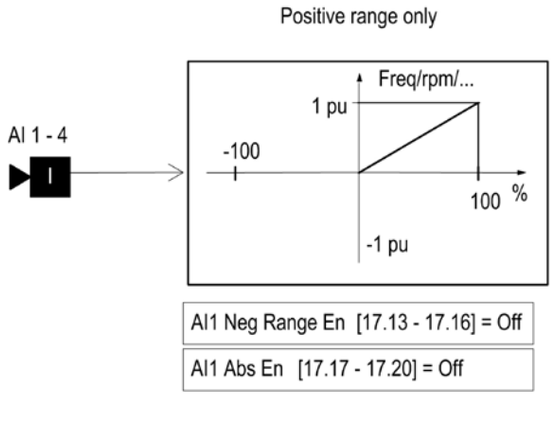
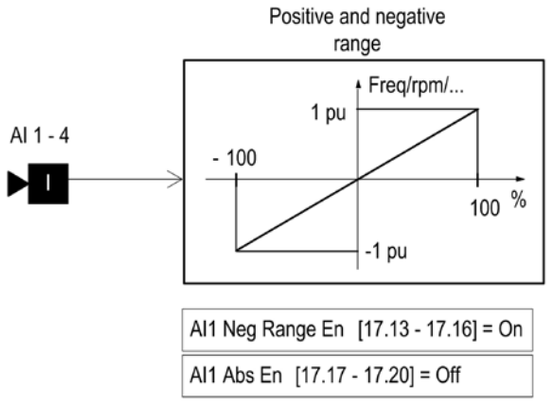
Figure 11.5 – Example 2

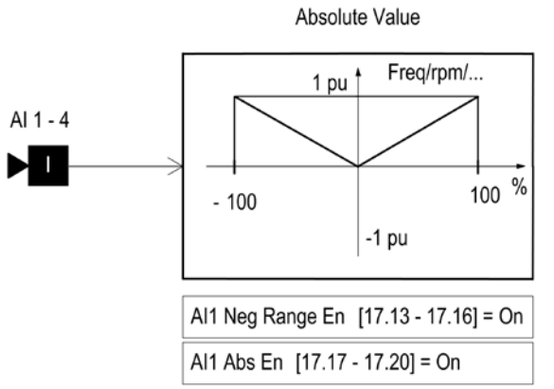


EXAMPLE 3
The following diagrams illustrate how parameters **AIx Neg Range En [17.13 - 17.14]** and **AIx Abs En [17.17 - 17.18]** need to be set based on the range you want to work with.

Figure 11.6 – Example 3







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11.4 ANALOG OUTPUT

Two analog outputs are available that can be configured with parameters of family **ANALOG OUTPUTS [18.00]**.

For the external pre-arrangement and their wiring see User and Maintenance Manual.

Table 11.7 - Analog output on Basis control card

Function	Terminal ME	Name	Description
Analog references	32	AI/AO ground	0V analog I/O's
	37	AI/AO ground	
Programmable optoisolated analog outputs (referred to AI/AO ground)	13	AO1	Programmable optoisolated analog outputs ±10V, 2 mA (also 4 ÷ 20mA for outputs AO1, AO2)
	14	AO2	

Outputs AO1 and AO2 can also be managed as current outputs (4-20mA). In this case:

- Jumpers **P6** and **P7** shall be set (see User and Maintenance Manual).
- Set parameters **AO1 Value for 0 pu [18.09]** and **AO2 Value for 0 pu [18.10]** as described in example 2.
- Set parameter **AO1 Neg Range En [18.13]** and **AO2 Neg Range En [18.14]** to Off.

The output rated range is:

±10 V if the analog input signal is a voltage signal

0 ÷ 20 mA if the analog input signal is a current signal

In order to configure the outputs so that ±1.0 pu range of the chosen (internal) variable be equivalent to ±10V range set parameters:

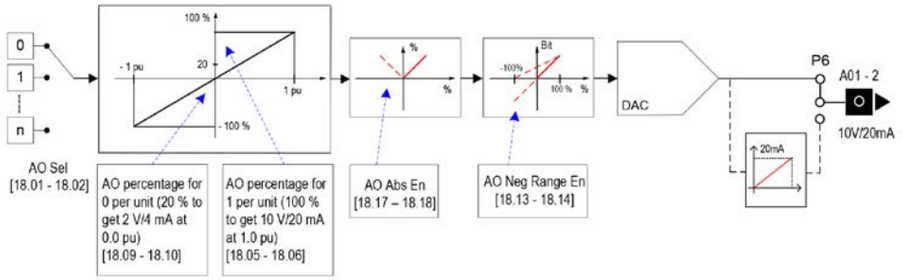
- **AOx Value for 1 pu [18.05 ÷ 18.06]** to 100%;
- **AOx Value for 0 pu [18.09 ÷ 18.10]** to 0%.

In order to configure the outputs so that ±1.0 pu range of the chosen (internal) variable be equivalent to 0 ÷ 20mA range set parameters:

- **AOx Value for 1 pu [18.05 ÷ 18.06]** to 100%;
- **AOx Value for 0 pu [18.09 ÷ 18.10]** to 0%.

For instance, in order to monitor speed feedback signal SpeedFdb with a ±10V bidirectional signal on AO1 output, it is necessary to set 2 at parameter **AO1 Sel [18.01]**, and leave as default parameters **AO1 Value for 1 pu** (100%) and **AO1 Value for 0 pu** (0%).
To monitor the same signal with a current signal (0 ÷ 20mA) the parameter **AO1 Value for 0 pu** must to be set to 50%.

Figure 11.7 – Block diagram for output processing



NOTE
To convert per unit internal variables to output signals, the two points of the conversion characteristic are defined.
Please note that, if two points of the transduction characteristic are both equal to X%, the internal value will be equal to X/100 pu.

PREVIOUS VIEW

11.4.1 ANALOG OUTPUT CONFIGURATION

The following table show the configuration parameters:

Table 11.8 - Configuration parameters for analog outputs

18 - ANALOG OUTPUTS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
18.01	AO1 Sel	[ME42] AO1 Signal selection	#	Min: 0 Def: 1 Max: 200	Read and Write	All	2	Yes
18.02	AO2 Sel	[ME43] AO2 Signal selection	#	Min: 0 Def: 2 Max: 200	Read and Write	All	2	Yes
18.05	AO1 Value for 1 pu	AO1 Percentage at 1 per-unit (100% to get 10V/20mA at 1 pu)	%	Min: -400 Def: 100 Max: 400	Read and Write	All	2	Yes
18.06	AO2 Value for 1 pu	AO2 Percentage at 1 per-unit (100% to get 10V/20mA at 1 pu)	%	Min: -400 Def: 100 Max: 400	Read and Write	All	2	Yes
18.09	AO1 Value for 0 pu	AO1 Percentage at 0 per-unit (20% to get 2V/4mA at 0 pu)	%	Min: -400 Def: 0 Max: 400	Read and Write	All	2	Yes
18.10	AO2 Value for 0 pu	AO2 Percentage at 0 per-unit (20% to get 2V/4mA at 0 pu)	%	Min: -400 Def: 0 Max: 400	Read and Write	All	2	Yes
18.13	AO1 Neg Range En	AO1 Option to use negative output values - Off [0] - On [1]	#	Def: On	Read and Write	All	2	Yes
18.14	AO2 Neg Range En	AO2 Option to use negative output values	#	Def: On	Read and Write	All	2	Yes
18.17	AO1 Abs En	O1 Option to use only absolute value of signal - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
18.18	AO2 Abs En	AO2 Option to use only absolute value of signal	#	Def: Off	Read and Write	All	2	Yes

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11.4.2 VARIABLES ASSOCIATED TO ANALOG OUTPUTS

The following table lists the variables that can be programmed on the analog outputs.

To assign a variable to an analog output, the code of quantity in the below table must to be set on analog output selection parameter.

Table 11.9 - Variables that can be associated to analog outputs

Code	Variable	Description	1 pu value (engineering units)
0	Off	--	--
1	Speed Ref Demand	Speed/freq reference demand from all external sources used by the Drive	Per-Unit Speed [13.07]
2	Speed Fdb	Speed feedback	Per-Unit Speed [13.07]
3	Iq Fdb	Iq feedback	Per-Unit Current [13.03]
4	Id Fdb	Id feedback	Per-Unit Current [13.03]
5	Iq Ref	Iq reference	Per-Unit Current [13.03]
6	Id Ref	Id reference	Per-Unit Current [13.03]
7	Speed Ref Used	Actual speed reference	Per-Unit Speed [13.07]
8	Torque Ref Used	Torque reference used	Per-Unit Torque [13.06]
9	Torque Ffw	Actual torque feedforward	Per-Unit Torque [13.06]
10	Actual Current	Actual output current	Per-Unit Current [13.03]
11	Actual Voltage	Actual output voltage	Per-Unit Voltage [13.02]
12	Vq Ref	Voltage reference Vq	Per-Unit Voltage [13.02]
13	Vd Ref	Voltage reference Vd	Per-Unit Voltage [13.02]
14	Vdc	DC-Bus Voltage	Per-Unit DC-Bus Voltage [13.01]
15	Ia	Phase current	Per-Unit Current [13.03]
16	Ib	Phase current	Per-Unit Current [13.03]
17	Ic	Phase current	Per-Unit Current [13.03]
18	Va	Phase voltage	Per-Unit Voltage [13.02]
19	Vb	Phase voltage	Per-Unit Voltage [13.02]
20	Vc	Phase voltage	Per-Unit Voltage [13.02]

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Code	Variable	Description	1 pu value (engineering units)
21	Line Voltage Fdb	Voltage feedback from line	Per-Unit Voltage [13.02]
22	Flux	Flux	± 100% Rated Flux
23	Flux Angle	Flux angle	360°
24	Flux Frequency	Flux Frequency	Per-Unit frequency [13.04]
27	Speed Controller Output	Speed controller output	Per-Unit Speed [13.07]
28	Speed Controller Integral	Speed controller integral	
29	AI1	AI1 Value	± 100 % input value
30	AI2	AI2 Value	± 100 % input value
31	AI3 (option)	AI1 Value (option)	± 100 % input value
32	AI4 (option)	AI2 Value (option)	± 100 % input value
33	Raw AI1	Raw AI1 Value	± 100 % input value
34	Raw AI2	Raw AI2 Value	± 100 % input value
35	Raw AI3 (option)	Raw AI3 Value (option)	± 100 % input value
36	Raw AI4 (option)	Raw AI4 Value (option)	± 100 % input value
41	Pos Torque Limit	Positive Torque Limit	Per-Unit Torque [13.06]
42	Neg Torque Limit	Negative Torque Limit	Per-Unit Torque [13.06]
50	Active Power	Active Power	Per-Unit Power [13.05]
51	Line Reactive Power	Reactive Power	Per-Unit Power [13.05]
52	DC Power	Measured DC-Bus power	Per-Unit Power [13.05]
53	Idc Estimated	Estimated DC-Bus current	Per-Unit Current [13.03]
54	Idc Fdb	DC-Bus Current	Per-Unit Current [13.03]
55	Vab Ref	Voltage reference Vab	Per-Unit Voltage [13.02]
56	Vbc Ref	Voltage reference Vbc	Per-Unit Voltage [13.02]

Code	Variable	Description	1 pu value (engineering units)
57	Vca Ref	Voltage reference Vac	Per-Unit Voltage [13.02]
58	Speed Ffw	Speed feedforward	Per-Unit Speed [13.07]
59	Torque Ref Demand	Torque reference	Per-Unit Torque [13.06]
66	Is Fdb	Output phase current (unfiltered)	Per-Unit Current [13.03]
67	Vs Ref	Output voltage reference (unfiltered)	Per-Unit Voltage [13.02]
68	Iq Max Limit	Maximum absolute value of q current	Per-Unit Current [13.03]
69	Iq Ref Norm Iqn	Axis-Q current reference normalized 1 pu = Iqn	Per-Unit Current [13.03]
70	Id Ref Norm Idn	Axis-D current reference normalized 1 pu = Idn	Per-Unit Current [13.03]
74	Speed Controller Output pre saturation	Speed controller output before saturation	Per-Unit Speed [13.07]
79	Actual Process PID Reference	Actual Process PID Reference	User Per-Unit Pressure [13.11], Flow [13.12], Level [13.13] or Temperature [13.14] – Set 1 or User Per-Unit Pressure [13.21], Flow [13.22], Level [13.23] or Temperature [13.24] – Set 2
80	Actual Process PID Feedback	Actual Process PID Feedback	User Per-Unit Pressure [13.11], Flow [13.12], Level [13.13] or Temperature [13.14] – Set 1 or User Per-Unit Pressure [13.21], Flow [13.22], Level [13.23] or Temperature [13.24] – Set 2
81	Process PID Reference Set 1	Process PID Reference Set 1	User Per-Unit Pressure [13.11], Flow [13.12] or Level [13.13] – Set 1
82	Process PID Feedback Set 1	Process PID Feedback Set 1	User Per-Unit Pressure [13.11], Flow [13.12] or Level [13.13] – Set 1
83	Process PID Reference Set 2	Process PID Reference Set 2	User Per-Unit Pressure [13.21], Flow [13.22] or Level [13.23] – Set 2
84	Process PID Feedback Set 2	Process PID Feedback Set 2	User Per-Unit Pressure [13.21], Flow [13.22] or Level [13.23] – Set 2

NOTE
The value in engineering units at 1 pu of the transduced quantity is displayed in the parameters of family **PER-UNIT BASE DATA [13.00]**.

NOTE
Please consider that in the default situation an output voltage/current equal to 10V/20 mA is obtained when the chosen variable is equal to 1 pu and the output stage gain (parameters **[18.05 ÷ 18.08]**.) is equal to 100%.
NOTE
Analog outputs are updated at the switching frequency or, if it is less than or equal to 4 kHz, at twice of switching frequency. Anyway in a time equal to or less than 1ms.

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11.4.3 EXAMPLES

A few examples of analog inputs configuration are given hereunder.

EXAMPLE 1

Configuration of the analog output AO1 to monitor the internal variable relevant to speed feedback and obtain an output signal with range ± 10V at ± 1.0 pu.

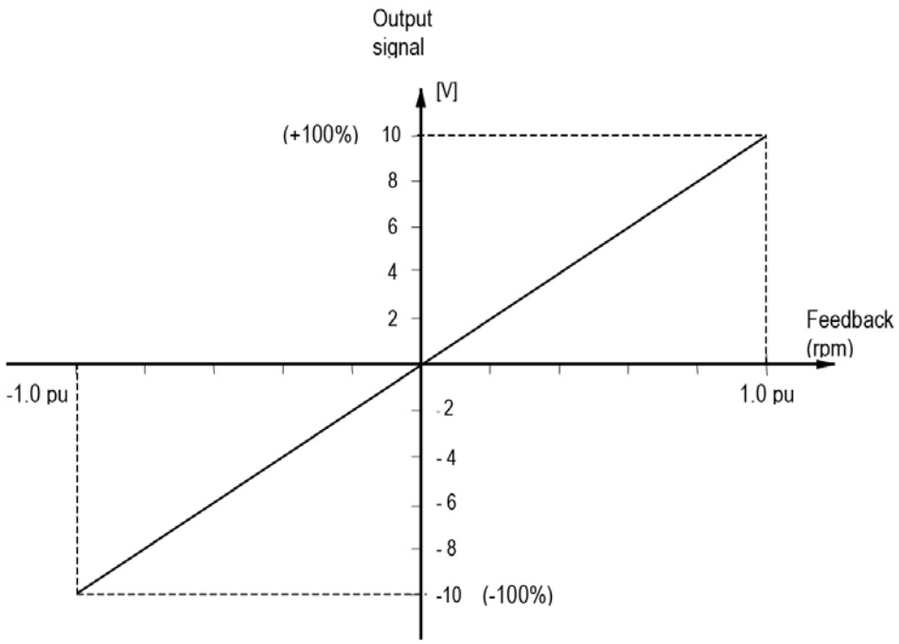
The two points of the transduction characteristic are:

+ 10 V	=	100 % @ + 1.0 pu
0 V	=	0 % @ 0.0 pu

It is therefore necessary to set:

AO1 Sel	=	2 (SpeedFdb)
AO1 Value for 1 pu	=	100 %
AO1 Value for 0 pu	=	0 %
AO1 Neg Range En	=	On
AO1 Abs En	=	Off

Figure 11.8 – EXAMPLE 1



EXAMPLE 2

Configuration of the analog output AO1 to monitor an internal variable with range 0.0 ÷ + 1.0 pu and obtain an output current signal with range 4 ÷ 20mA.

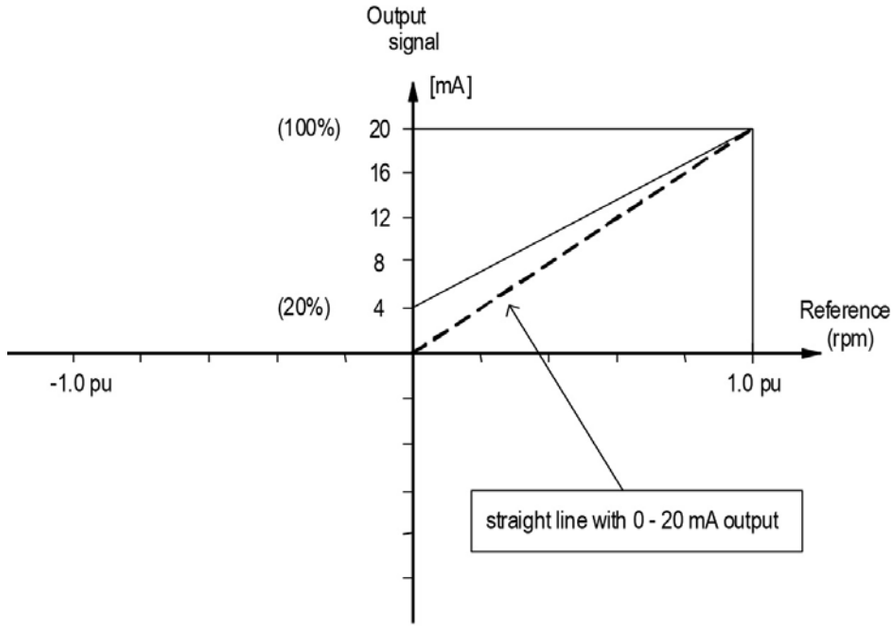
Suppose internal variable is the speed reference.
The two points of the transduction characteristic are:

20 mA	=	100 % @ + 1.0 pu
4 mA	=	20 % @ 0.0 pu

It is therefore necessary to set:

AO1 Sel	=	1 (SpeedCmd)
AO1 Value for 1 pu	=	100 %
AO1 Value for 0 pu	=	20 %
AO1 Neg Range En	=	Off
AO1 Abs En	=	Off

Figure 11.9 – EXAMPLE 2



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EXAMPLE 3
Configuration of the analog output AO1 to monitor an internal variable with range ± 1.0 pu and obtain an output current signal with range 4 ÷ 20mA.

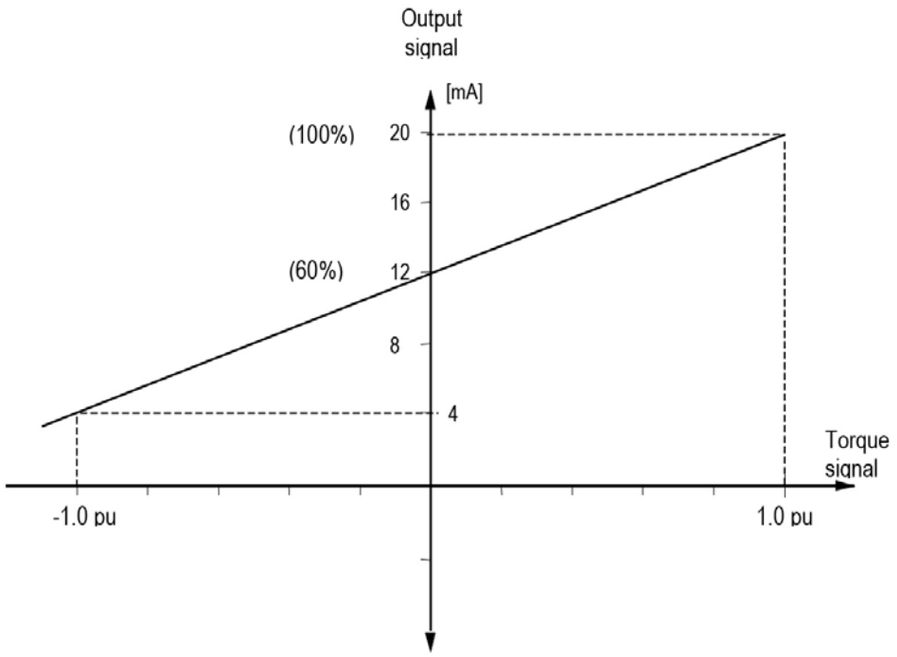
Suppose internal variable is the torque reference.
The two points of the transduction characteristic are:

20 mA = 100 % @ + 1.0 pu
12 mA = 60 % @ 0.0 pu

It is therefore necessary to set:

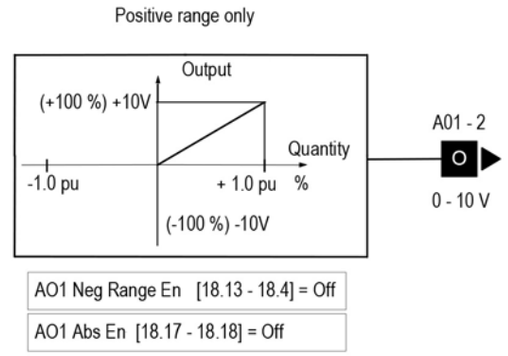
AO1 Sel	=	8 (TorqueRef)
AO1 Value for 1 pu	=	100 %
AO1 Value for 0 pu	=	60 %
AO1 Neg Range En	=	Off
AO1 Abs En	=	Off

Figure 11.10 – EXAMPLE 3



EXAMPLE 4
How to set the parameters **AOx Neg Range En [18.13 - 18.14]** and **AOx Abs En [18.17 ÷ 18.18]** depending on the desired range

Figure 11.11 – EXAMPLE 4



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12 PROTECTIONS AND TROUBLESHOOTING INSTRUMENTS

12.1 WARNING AND FAULT

Most alarms, if enabled, are programmable as Faults or as Warnings.
See the paragraphs 4.2.9 and 4.2.10 for information on how to display them on the keypad.

12.1.1 WARNINGS

A **Warning** is a signal the Drive send to the outside through the bits of words **Alarm Wd 1 [52.05], Alarm Wd 2 [52.06], Alarm Wd 3 [52.07], Alarm Wd 4 [52.08]** and the cumulative bit (bit 7) present in **Status Wd 1 [52.01]**.
Some Warnings can anyway inhibit the passage to the following status of the control sequence.
The bits corresponding to some Warnings return to the logic state 0, after their intervention, even in the absence of a reset command when the alarm condition is over.

12.1.2 FAULTS

A **Fault** is a status always providing a protection action with motor stop (normal, quick or free) and/or Drive stop; also switching off of the power section can be provided.
When a protection occurs, the Drive control enters in Fault status and exits only if no other faults are active and if the reset command arrives from the controller/operator.
The bits corresponding to alarms programmed as Faults, and the Fault bit (bit 3) of Status Word 1 remain to logic state 1 until the alarm condition continues. They can be reset, if the alarm condition is over, only with the reset command.

Based on the configured action, the following protection types can be present in decreasing priority:
- Fault with Coast Stop;
- Fault with Quick Stop;
- Fault with Ramp Stop.

Stop reaction protections with higher priority overwrite those with lower priority stop reactions. For further details on the stop types refer to paragraph 8.2.

12.1.3 NOT PROGRAMMABLE FAULTS

Except for the External Fault, all hardware faults defined in the first alarm word **Alarm Wd 1 [52.05]** are hardware protections, and cannot be configured by the operator.
Their intervention always causes Drive disablement (pulse cutting with coast stop) and, where provided (Table 13), the power section is also disconnected.

12.1.4 EXTERNAL FAULT

The External Fault is the only one among the hardware protections defined in the **Alarm Wd 1 [52.05]** that can be directly enabled/disabled by the operator.
The possible settings are:
- Off (disable);
- Coast Stop;
- Quick Stop;
- Ramp Stop.

The action can be associated only to terminal DI3 and the protection is activated when this input goes to logic state 0.

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12.2 DISCONNECTION OF THE POWER

In case of protection it is possible to directly force complete power disconnection.
To do this it is necessary:

- Set the parameter **Power Off if HW Fault [36.65]** (family **ALARM SETTINGS [36.00]**) to On.
- Assign to a programmable digital output the signal CTLRM (SW2.06). This digital output must to be used for the main line management.

The following table lists list the hardware trips with main line control action:

Table 12.1 – List of hardware protections

HW Protection	Description	If the protection occurs
AC Supply	No AC Supply	Power turn-off if **Power Off if HW Fault [36.65] = On**
VdcOV	DC-link Overvoltage	Power turn-off if **Power Off if HW Fault [36.65] = On**
IGBTDesat	IGBT Power Module Fault	Power turn-off if **Power Off if HW Fault [36.65] = On**
OverHeat	Drive overtemperature	Power turn-off if **Power Off if HW Fault [36.65] = On**
Earth	Short-circuit/Earth Fault at motor side based on sum current measurement	Power turn-off if **Power Off if HW Fault [36.65] = On**
OverCur	Drive Output Overcurrent	Power turn-off if **Power Off if HW Fault [36.65] = On**
PrcTimeout	DC-Link Precharge Timeout	Power turn-off
ExtFault	External fault	Power turn-off if **Power Off if HW Fault [36.65] = On**
VdcUV	Bus DC undervoltage	Power turn-off
VminSupply	Minimum supply at power cards	Power turn-off
POKFail	Power Card Failure	Power turn-off if **Power Off if HW Fault [36.65] = On**
LinePhase	Line Phase Loss or measurement error	Power turn-off if **Power Off if HW Fault [36.65] = On**

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12.3 ALARMS LIST

The table below show the alarms of the Drive.

Table 12.2 – List of alarms

Code	Name	Word.bit	Configuration parameter Id	Default action	Possible actions	Description
01	WatchDog	AW1.00	36.01	Coast Stop	Coast Stop (type of action is not configurable)	Watchdog
02	AC Supply	AW1.01	36.02			AC Line Supply
03	VdcOV	AW1.02	36.03			DC-bus overvoltage
04	IGBTDesat	AW1.03	36.04			IGBT Power Module Fault
05	OverHeat	AW1.04	36.05			Drive overtemperature
06	Earth	AW1.05	36.06			Short-circuit/Earth Fault at motor side based on sum current measurement
07	OverCur	AW1.06	36.07			Drive Output Overcurrent
08	PrcTimeout	AW1.07	36.08			DC-Link Precharge Timeout
09	ExtFault	AW1.08	36.09	Off	Off Coast Stop Quick Stop Ramp Stop	External Fault. If enabled the external fault is associated with DI3 digital input.
10	--	AW1.09	36.10	Coast Stop	Coast Stop (type of action is not configurable)	Reserved
11	VdcUV	AW1.10	36.11			DC-bus undervoltage
12	VminSupply	AW1.11	36.12			Minimum supply at power cards
13	POKFail	AW1.12	36.13			Power Card Failure
14	--	AW1.13	36.14			Reserved
15	--	AW1.14	36.15			Reserved
16	LinePhase	AW1.15	36.16			Line Phase Loss or measurement error

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Code	Name	Word.bit	Configuration parameter Id	Default action	Possible actions	Description
17	MotorOL	AW2.00	36.17	Coast Stop	Off Coast Stop Quick Stop Ramp Stop Warning	Motor overload limit exceeded
18	ConvOL	AW2.01	36.18	Coast Stop	Coast Stop Quick Stop Ramp Stop Warning	Drive overload limit exceeded
19	--	AW2.02	36.19	Off	Off Coast Stop Quick Stop Ramp Stop Warning	Reserved
20	--	AW2.03	36.20	Off		Reserved
21	Underload	AW2.04	36.21	Warning		Reserved
22	NoFlux	AW2.05	36.22	Warning		Motor flux-up exceeded configured timeout (see par. 9.17)
23	MaxCurLim	AW2.06	36.23	Off		Motor current exceeded configured threshold (*)
24	SpeedDev	AW2.07	36.24	Warning		Motor speed error between ref. and fdb. is out of tolerance (see. par. 9.19) (*)
25	OverSpeed	AW2.08	36.25	Coast Stop		Motor Overspeed (*)
26	--	AW2.09	36.26	Off		Reserved
27	DSPInitEr	AW2.10	36.27	Coast Stop	Coast Stop (type of action is not configurable)	Data configuration error during initialization
28	DSPParEr	AW2.11	36.28	Warning	Off Coast Stop Quick Stop Ramp Stop Warning	Data configuration error during parameter change
29	UVCtrlLim	AW2.12	36.29	Off		DC-bus voltage < UV Control Limit
30	OVCtrlLim	AW2.13	36.30	Warning		DC-bus voltage > OV Control Limit (*)
31	--	AW2.14	36.31	Off		Reserved
32	ADCAutoCal	AW2.15	36.32	Coast Stop		ADC auto-calibration error

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Code	Name	Word.bit	Configuration parameter Id	Default action	Possible actions	Description
33	FlyStartEr	AW3.00	36.33	Coast Stop	Off Coast Stop Warning	FlyStart search failed
34	--	AW3.01	36.34	Off	Off Coast Stop Quick Stop Ramp Stop Warning	Reserved
35	--	AW3.02	36.35	Off		Reserved
36	--	AW3.03	36.36	Off		Reserved
37	--	AW3.04	36.37	Off		Reserved
38	--	AW3.05	36.38	Off		Reserved
39	Mon1Alarm	AW3.06	36.39	Off		Analog Monitor, compare analog input with a threshold and a configurable logic
40	Mon2Alarm	AW3.07	36.40	Off		Analog Monitor, compare analog input with a threshold and a configurable logic
41	AI Loss	AW3.08	36.41	Warning		Analog Command Loss
42	LogicAlarm	AW3.09	36.42	Off		Logic, one of the three possible configurable logic function is active
43	GWMaxTime	AW3.09	36.43	Coast Stop		Bus Drop and Grid Waiting
44	--	AW3.11	36.44	Off		Reserved
45	--	AW3.12	36.45	Off		Reserved
46	PrPidFdbLs	AW3.13	36.46	Warning		Process PID: Analog Feedback Loss, monitor process feedback
47	SfFillTime	AW3.14	36.47	Warning		Soft Fill, sequence timeout
48	--	AW3.15	(36.48)	Off		Reserved

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Code	Name	Word.bit	Configuration parameter Id	Default action	Possible actions	Description
49	ProfiEr	AW4.00	36.49	Coast Stop	Off Coast Stop Quick Stop Ramp Stop Warning	Profibus error
50	ModbusEr	AW4.01	36.50	Coast Stop		Modbus slave error
51	BadPar	AW4.02	36.51	Off		Bad parameter (out of range)
52	MCUDSPTout	AW4.03	36.52	Coast Stop	Coast Stop Quick Stop Ramp Stop Warning	MCU ⬅➡ DSP Timout fail (from ETH-PROFI board)
53	MCUDSPSync	AW4.04	36.53	Warning	Off Coast Stop Quick Stop Ramp Stop Warning	MCU ⬅➡ DSP Synchronization fail (from ETH-PROFI board)
54	FrostProt	AW4.05	36.54	Warning		Frost Protection, monitor temperature
55	WDDSleepMd	AW4.06	36.55	Warning		Well Draw Down Sleep Mode
56	LwCityPres	AW4.07	36.56	Warning		Low City or Low Suction Inlet Pressure, monitor inlet pressure switch
57	MotorSwitch	AW4.08	36.57	Warning		Motor Switch, monitor status of the switch between Drive and motor
58	FdbMonitor	AW4.09	36.58	Warning		Process PID: Feedback Supervision, monitor process feedback threshold
59	inPresMon1	AW4.10	36.59	Warning		Process PID: Input Pressure Supervision, monitor inlet pressure threshold 1
60	inPresMon2	AW4.11	36.60	Coast Stop		Process PID: Input Pressure Supervision, monitor inlet pressure threshold 2
61	AutoClnCur	AW4.12	36.61	Warning		Auto-Cleaning Current Threshold
62	--	AW4.13	36.62	Off		Reserved
63	--	AW4.14	36.63	Off		Reserved
64	--	AW4.15	36.64	Off		Reserved

PREVIOUS VIEW

12.4 FAULT HISTORY

Each First Fault is recorded within a 30 items circular buffer.
The items of this buffer are displayed by the family **FAULT HISTORY [59.00]**.

The index of the last fault occurred is show by **Fault Log Current Index [59.66]**.

Cleaning of the buffer is performed by setting parameter **Clear Fault Log [59.65]** to Clear Log. After the cleaning the system set the parameter to Off.

12.5 TROUBLESHOOTING

WARNING
Perform all checks relevant to equipment or motor windings wiring conditions (insulation) with no voltage applied to power circuits and after a waiting period (at least 10 seconds) to allow for condenser battery discharging.

12.5.1 RESET PROCEDURES

Where in the following table a Reset procedure is requested, proceed as indicated below.
If the performed operation is not successful, go on with the following one.

- Pressing key [Reset] on the keypad.
- Pressing pushbutton Reset SW1 on the card or removing auxiliary power supply: this operation excludes power supply to the AD1000 control card and allows its restart.
- Replacing the card.
- Getting in touch with Service.

PREVIOUS VIEW

12.5.2 TROUBLESHOOTING

Table 12.3 – Troubleshooting

ID	Name	Description/Cause	Solution
01	Watchdog	Controller error.	Start reset procedures.
02	AC Supply	No power supply.	Check power supply on the terminals of AD1000 and power fuses, if present.
03	VdcOV	Overvoltage on DC bus: the DC bus voltage instantaneous value exceeds the protection trip threshold.	Deceleration time is too short. Increase deceleration time. If the braking chopper is present, check: •Braking resistor; •Braking unit fuse.
04	IGBTDesat	IGBT driving abnormality, IGBT desaturation, power fault of firing circuits, defective operation detected on a firing circuit.	Check IGBTs and firing circuits power supplies. Sometimes this protection can occur due to overcurrent; in this case refer to what is indicated for the Fault OverCur.
05	OverHeat	Overheat of one or more Drive dissipators detected by thermal switch (OH).	The normally closed contacts of thermal sensors are placed in series and monitored by control diagnostics as one sensor only. Check proper operation of the cooling system.
06	Earth	Short circuit/Earth discharge through the frame. The instantaneous value of the sum of Drive output currents exceeded the protection trip threshold.	A loss of insulation occurred in either connection cables or motor windings. The protection can trip only if an output phase is connected to earth at any point.
07	OverCur	Overcurrent at Drive output.	•Check that there is neither short circuit between motor phases nor a fault to the grounded phase; •Check wiring and proper operation of the encoder and its mechanical coupling (only for the FOC control); •Check that the acceleration ramp time is not too short; •Check the upper limits of torque reference and torque current.
08	PrcTimeout	Timeout on DC bus pre-charge.	•No pre-charge circuit power supply; •Check auxiliary power supply (220 - 440 V); •Check that the DC bus voltage value is not null after sending the pre-charge command; •Check on the keypad that parameter AC Input Voltage [06.24] has been set to an adequate value.
09	ExtFault	External protection. The dedicated digital input (DI3) is at a low logic level.	Check: •status of the contacts connected to the terminal board to implement such logic input; •any other external protections active.

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ID	Name	Description/Cause	Solution
11	VdcUV	Undervoltage on the DC bus. The DC bus voltage instantaneous value decreased below the set threshold value with value set on DC Undervolt Level [12.03].	Check the value of DC bus voltages measured by voltage transducers controlling VDC parameters on the keypad display (in "Monitor" mode).
12	VminSupply	Minimum supply at power cards	• If the power cards are powered by DC bus check the value of DC bus voltages. • If the power cars are powered by an auxiliary power supply check the auxiliary power supply and the fuses.
13	POKFail	Power Card Failure	If it occurs on its own get in touch with Service.
16	LinePhase	No input phase or measurement error.	A power supply phase is missing.Check power connection to the Drive.
17	MotorOl	Motor overload limit exceeded.	The motor worked under overload conditions for a period of time longer than the maximum value allowed.
18	ConvOl	Drive overload limit exceeded.	The Drive worked under overload conditions for a period of time longer than the maximum value allowed.
21	Underload	Motor underload limit exceeded.	The motor worked under underload conditions for a period of time longer than the maximum value allowed.
22	NoFlux	Fluxing timeout exceeded (see par. 9.17).	The fluxing operation did not terminate within the time set in parameter Flux-up Timeout [33.02].
23	MaxCurLim	Maximum motor current threshold exceeded.	Motor instantaneous current exceeded the value set in parameter Max Current [02.08].
24	SpeedDev	Comparison between reference and speed feedback out of tolerance (see par. 9.19).	The error between speed reference and feedback exceeded the value set at parameter Speed Deviation Error [32.24] for a period of time longer than the one set in parameter Speed Deviation Time [32.25].
25	OverSpeed	Motor overspeed.	Motor instantaneous speed exceeded the value set in parameter Max Speed [02.07].
27	DSPInitEr	Error during control card initialization.	Check process datum Bad Par [64.07] to know the ID of the wrong parameter. Check microprocessor card and possibly start Reset procedures.
28	DSPParEr	Configuration error during parameter modification.	
29	UVCtrlLim	Vdc < DC UV Control Level [12.15].	The DC bus voltage instantaneous value decreased below the value set in parameter DC UV Control Level [12.15] (see par. 9.12).
30	OVCtrlLim	Vdc > DC OV Control Level [12.04].	The DC bus voltage instantaneous value exceeded the value set in parameter DC OV Control Level [12.04] (see par. 9.13).

PREVIOUS VIEW

ID	Name	Description/Cause	Solution
32	AdcAutoCal	ADC auto-calibration error	If it occurs on its own get in touch with Service.
33	FlystartEr	Flystar Error	The flystart function has failed to hook up the motor in rotation
39	Mon1Alarm	Analog input compared with threshold respect the configured logic	Check parameters and signals related to Analog Monitor function
40	Mon2Alarm	Analog input compared with threshold respect the configured logic	Check parameters and signals related to Analog Monitor function
41	AI Loss	Analog input loss (AI1, AI2, AI3 or AI4)	Check parameters and signals related to AI Loss function.
42	LogicAlarm	Logic, one of the three possible configurable logic function is active	Check parameters and signals related to Logic function
43	GWMaxTime	Grid waiting maximum time.	Check parameters related to Bus Drop & Grid Waiting function. Check AC Supply and DC-bus voltage.
46	PrPidFdbLs	Process PID feedback loss	Check parameters and signals related to Process PID function. Check analog inputs signals used as feedback for Process PID.
47	SfFillTime	Soft fill time	Check parameters related to Soft Fill function. The Process PID feedback didn't reach the preconfigured threshold within the timeout.
49	ProfibusEr	Profibus communication error	Check: •The status of the Master that shall be active. •Check that the Profibus connection cable between the AD1000 and the network master is not damaged. •Check coherence between Profibus node setting, parameter Slave Address [81.02], and the Drive serial address sent by the network master.
50	ModbusEr	Modbus communication error	Check: •The status of the Master that shall be active. •Check that the Modbus connection cable between the AD1000 and the network master is not damaged. •Check coherence between Modbus node setting, parameter Slave Address [82.02], and the Drive serial address sent by the network master.
51	BadPar	Parameter error (out of range)	Check process datum Bad Par [64.07] to know the ID of the wrong parameter.
52	MCUDSPTout	MCU ➡ DSP Timeout	Check if the ETH_PROFI card is properly installed on the Basis card.
53	MCUDSPSync	MCU ⬅ ➡ DSP Synchronization fail	Start reset procedures

PREVIOUS VIEW

ID	Name	Description/Cause	Solution
54	FrostProt	Frost protection function activated	Check parameters related to Frost Protection function and the water temperature.
55	WDDSleepMd	The Drive is in sleep mode due to Well draw down function request.	Check parameters related to Well Draw Down Control function and the water level.
56	LwCityPres	Low city pressure alarm	Check parameters related to Low City Pressure function and the inlet pressure of the pump.
57	MotrSwitch	Motor switch activated	Check parameters related to Motor Switch function and the status of hardware related to Motor Switch.
58	FdbMonitor	PID Feedback monitor or PID feedback supervision error	Check parameters related to PID Feedback Supervision. Check analog inputs signals used as feedback for Process PID.
59	inPresMon1	Input pressure monitor 1 alarm	Check parameters related to PID Input Pressure Supervision. Check analog inputs signals used as feedback (set 2) for Process PID.
60	inPresMon2	Input pressure monitor 2 trip	Check parameters related to PID Input Pressure Supervision. Check analog inputs signals used as feedback (set 2) for Process PID.
61	AutoClnCur	Auto-cleaning in current mode activated	When Auto-Cleaning function is enabled, the motor worked under preconfigured load conditions for a period of time longer than the maximum value allowed.

PREVIOUS VIEW

ANNEX A PARAMETERS LISTS

A-1 INDUCTION MOTOR

2 - INDUCTION MOTOR								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
02.01	Rated Power	Motor rated power	kW	Min: 0.1 Def: 15 Max: 8000	Read and Write	Scalar; Vector; Sls	1	Yes
02.91	Rated Power	Motor rated power	HP	Min: 0.134 Def: 20.115 Max: 10728.176	Read and Write	Scalar; Vector; Sls	1	Yes
02.02	Poles	Motor number of poles	#	Min: 2 Def: 4 Max: 16	Write at Stop Only	Scalar; Vector; Sls	1	Yes
02.03	Rated Voltage	Motor RMS rated voltage	V	Min: 0.1 Def: 400 Max: 700	Write at Stop Only	Scalar; Vector; Sls	1	Yes
02.04	Rated Current	Motor RMS rated current	A	Min: 0.1 Def: 30 Max: 8000	Write at Stop Only	Scalar; Vector; Sls	1	Yes
02.05	Rated Speed (with slip)	Motor rated speed	rpm	Min: 1 Def: 1465 Max: 12000	Write at Stop Only	Scalar; Vector; Sls	1	Yes
02.06	Rated Freq	Motor rated frequency	Hz	Min: 10 Def: 50 Max: 400	Write at Stop Only	Scalar; Vector; Sls	1	Yes
02.07	Power Factor	Motor rated power factor	#	Min: 0.1 Def: 0.8 Max: 0.99	Read and Write	Scalar; Vector; Sls	1	Yes
02.08	Max Current Limit	Motor maximum RMS current	A	Min: 0 Def: 60 Max: 16000	Read and Write	Scalar; Vector; Sls	1	Yes
02.09	Max Speed (1 pu)	Motor absolute maximum operative speed	rpm	Min: 1 Def: 2000 Max: 12000	Write at Stop Only	Scalar; Vector; Sls	1	Yes

PREVIOUS VIEW

2 - INDUCTION MOTOR								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
02.11	L in series	Any inductance connected in series with the motor	mH	Min: 0 Def: 0 Max: 1000	Read and Write	Scalar; Vector; Sls	2	Yes
02.12	T-Model Rs	Stator phase resistance in T-equivalent circuit model (cold)	mOhm	Min: 0 Def: 0 Max: 10000	Read and Write	Scalar; Vector; Sls	3	Yes
02.13	T-Model Rr	Rotor phase resistance in T-equivalent circuit model (cold)	mOhm	Min: 0 Def: 0 Max: 10000	Read and Write	Scalar; Vector; Sls	3	Yes
02.14	T-Model Lm	Phase magnetizing inductance in T-equivalent circuit model	mH	Min: 0 Def: 0 Max: 1000	Read and Write	Scalar; Vector; Sls	3	Yes
02.15	T-Model Lls	Stator phase leakage inductance in T-equivalent circuit model	mH	Min: 0 Def: 0 Max: 1000	Read and Write	Scalar; Vector; Sls	3	Yes
02.16	T-Model Llr	Rotor phase leakage inductance in T-equivalent circuit model	mH	Min: 0 Def: 0 Max: 1000	Read and Write	Scalar; Vector; Sls	3	Yes
02.17	Sinchro Speed	Motor base/synchronous speed at rated frequency	rpm	Min: 1 Def: 1500 Max: 6000	Read Only	Scalar; Vector; Sls	2	No
02.18	Max Freq (1 pu)	Motor frequency at maximum speed	Hz	Min: 0 Def: 66 Max: 400	Read Only	Scalar; Vector; Sls	1	No
02.19	Rated Slip Freq	Motor rated slip frequency	Hz	Min: 0 Def: 1.2 Max: 40	Read Only	Scalar; Vector; Sls	2	No
02.20	Rated Torque	Motor rated torque	Nm	Min: 0 Def: 200 Max: 1000000	Read Only	Scalar; Vector; Sls	2	No
02.92	Rated Torque	Motor rated torque	lb*ft	Min: 0 Def: 147.512 Max: 737562.149	Read Only	Scalar; Vector; Sls	2	No

PREVIOUS VIEW

A-2 DRIVE

6 - Drive								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
06.01	Drive Size	Selection of the Drive size	#	Def: Undefined	Write at Stop Only	Scalar; Vector; Sls	1	Yes
06.08	Overload Class	Overload Class - 110 [110] - 150 [150]	%	Def: 110	Write at Stop Only	Scalar; Vector; Sls	1	Yes
06.20	Rated Output Current	Drive rated RMS output current	A	Min: 1 Def: 10 Max: 10000	Read Only	Scalar; Vector; Sls	1	No
06.24	AC Supply Voltage	Rated RMS AC supply voltage of Drive used to define the per-unit DC-bus voltage	V	Min: 180 Def: 400 Max: 792	Write at Stop Only	Scalar; Vector; Sls	1	Yes
06.25	Switching Freq	Output switching frequency - 1500 [1500] - 2000 [2000] - 3000 [3000] - 4000 [4000] - 6000 [6000] - 8000 [8000]	Hz	Def: 2000	Write at Stop Only	Scalar; Vector; Sls	1	Yes
06.28	Phase Reverse	Reverse the output polarity internally switching the UVW phasing to UWV - U V W [0] - U W V [1]	#	Def: U V W	Write at Stop Only	Scalar; Vector; Sls	2	Yes
06.31	Per-Unit Vdc	DC-bus per-unit voltage (sqrt(2) • AC Supply Voltage)	V	Min: 300 Def: 566 Max: 6000	Read and Write	Scalar; Vector; Sls	2	No
06.70	Expansion boards	Selection of expansion board - None [0] - Input board [1]	#	Def: None	Write at Stop Only	All	1	Yes

PREVIOUS VIEW

A-3 MOTOR ID 1

7 - MOTOR ID 1								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
07.01	Static Test ID 1	Selects the type of motor identification - Test Done [0] - Test On [1] - Use eq. Circuit data [2]	#	Def: Use eq. Circuit data	Write at Stop Only	Scalar; Vector; Sls	2	Yes
07.02	Voltage Drop Over Ls	Voltage drop across equivalent leakage inductance (IM motor) at rated motor current	pu	Min: 0.05 Def: 0.15 Max: 2	Read and Write	Scalar; Vector; Sls	2	Yes
07.03	Voltage Drop Over Rs	Voltage drop across the stator resistance at rated motor current	pu	Min: 0.001 Def: 0.01 Max: 0.9	Read and Write	Scalar; Vector; Sls	2	Yes
07.04	Dead Time Comp	Drive dead time compensation	us	Min: 0 Def: 0 Max: 20	Read and Write	Scalar; Vector; Sls	2	Yes
07.05	Stator Time Constant	Stator time constant	s	Min: 0.001 Def: 0.006 Max: 2	Read Only	Vector; Sls	2	No

PREVIOUS VIEW

A-4 INERTIA ID

10 - INERTIA ID								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
10.01	Inertia ID	Enable torque step test for system inertia identification (suitable for linear loads with constant inertia) - Test Done/Manual Set [0] - Test On [1]	#	Def: Test Done/Manual Set	Write at Stop Only	All	2	Yes
10.02	Test Start Speed	Speed to reach to trigger the inertia identification test	pu	Min: -0.5 Def: 0.1 Max: 0.5	Read and Write	All	2	Yes
10.03	Test End Speed	Speed to reach to finish the inertia identification test	pu	Min: -1 Def: 0.5 Max: 1	Read and Write	All	2	Yes
10.04	Inertia Time Constant	Acceleration time of the whole system from 0 to motor base speed with motor rated torque applied	s	Min: 0.01 Def: 0.1 Max: 999	Read and Write	All	2	Yes
10.05	Damping	Measured damping factor of motor and load (1 pu damping = Tn[N*m]/Wn[rad/s])	pu	Min: 0 Def: 0 Max: 10	Read and Write	All	2	Yes

PREVIOUS VIEW

A-5 DC-BUS

12 - DC-BUS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
12.01	DC Overvolt Mng	Reaction for DC-bus Overvoltage management - Off [0] - Brake Chopper Control [1] - OV Control [2]	#	Def: OV Control	Read and Write	Scalar; Vector; Sls	2	Yes
12.02	DC Undervolt Mng	Reaction for DC-bus Undervoltage management - Off [0] - UV Control [1]	#	Def: Off	Read and Write	Scalar; Vector; Sls	2	Yes
12.03	DC UV Trip Level	DC-bus threshold for Undervoltage protection	pu	Min: 0.7 Def: 0.7 Max: 0.85	Read and Write	Scalar; Vector; Sls	2	Yes
12.07	DC Precharge Level	Vdc threshold for the end of DC-Bus precharging	pu	Min: 0.7 Def: 0.8 Max: 1.2	Read and Write	Scalar; Vector; Sls	2	Yes
12.08	Precharge Delay	Delay before closing end-precharge contactor	ms	Min: 500 Def: 2000 Max: 10000	Read and Write	Scalar; Vector; Sls	2	Yes
12.09	Precharge Cont Delay	Precharge Contactor Closing Delay	ms	Min: 100 Def: 1000 Max: 10000	Read and Write	Scalar; Vector; Sls	2	Yes
12.15	DC UV Control Limit	DC-Bus threshold for UV Control Limit alarm	pu	Min: 0.7 Def: 0.78 Max: 0.9	Read and Write	Scalar; Vector; Sls	2	Yes
12.16	DC OV Control Limit	DC-bus threshold for OV Control Limit alarm	pu	Min: 1.01 Def: 1.3 Max: 1.5	Read and Write	Scalar; Vector; Sls	2	Yes

PREVIOUS VIEW

12 - DC-BUS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
12.30	BDrop GWait Sel	BusDrop GridWaiting Selection - Off [0] - Bus Drop [1] - Grid Waiting [2]	#	Def: Off	Write at Stop Only	Scalar; Vector; Sls	2	Yes
12.31	Vdc to shut-off	Firing pulses turn off threshold (as percentage of nominal Vdc)	pu	Min: 0 Def: 0.85 Max: 1	Read and Write	Scalar; Vector; Sls	2	Yes
12.33	UV-Off threshold	Vdc threshold for masking undervoltage trip	pu	Min: 0 Def: 0.72 Max: 1	Read and Write	Scalar; Vector; Sls	2	Yes
12.35	WaitGrid MaxTime	Maximum time for the WGTimeMax trip intervention	s	Min: 0 Def: 10 Max: 1000	Read and Write	Scalar; Vector; Sls	2	Yes
12.36	Delta on Vdc threshold	Delta on Vdc threshold	pu	Min: 0 Def: 0.05 Max: 1	Read and Write	Scalar; Vector; Sls	2	Yes

PREVIOUS VIEW

A-6 PER-UNIT BASE DATA

13 - PER-UNIT BASE DATA								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
13.01	Per-Unit DC-Bus Voltage	Base value of per-unit DC-Bus voltage	V	Min: 0 Def: 566 Max: 6000	Read Only	Scalar; Vector; Sls	1	No
13.02	Per-Unit AC Voltage	Base value of per-unit AC output voltage	V	Min: 0 Def: 400 Max: 1000	Read Only	Scalar; Vector; Sls	1	No
13.03	Per-Unit Current	Base value of per-unit current	A	Min: 0 Def: 30 Max: 8000	Read Only	Scalar; Vector; Sls	1	No
13.04	Per-Unit Frequency	Base value of per-unit frequency	Hz	Min: 0 Def: 50 Max: 3000	Read Only	Scalar; Vector; Sls	1	No
13.05	Per-Unit Power	Base value of per-unit power	kW	Min: 0 Def: 15 Max: 8000	Read Only	Scalar; Vector; Sls	1	No
13.91	Per-Unit Power	Base value of per-unit power	HP	Min: 0 Def: 20.115 Max: 10728.176	Read Only	Scalar; Vector; Sls	1	No
13.06	Per-Unit Torque	Base value of per-unit torque	Nm	Min: 0 Def: 97.8 Max: 2000000	Read Only	Scalar; Vector; Sls	1	No
13.92	Per-Unit Torque	Base value of per-unit torque	lb*ft	Min: 0 Def: 72.134 Max: 1475124.298	Read Only	Scalar; Vector; Sls	1	No
13.07	Per-Unit Speed	Base value of per-unit speed (derived from motor maximum speed parameter defined by User)	rpm	Min: 0 Def: 1500 Max: 15000	Read Only	Scalar; Vector; Sls	1	No
13.11	User Per-Unit Press. 1	Base value of per-unit pressure 1 set by User (Process PID macro only)	bar	Min: 0 Def: 0 Max: 1000	Read and Write	All	3	Yes
13.31	User Per-Unit Press. 1	Base value of per-unit pressure 1 set by User (Process PID macro only)	PSI	Min: 0 Def: 0 Max: 14503.774	Read and Write	All	3	Yes

PREVIOUS VIEW

13 - PER-UNIT BASE DATA

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
13.12	User Per-Unit Flow 1	Base value of per-unit flow 1 set by User (Process PID macro only)	m^3/h	Min: 0 Def: 0 Max: 1000	Read and Write	All	3	Yes
13.32	User Per-Unit Flow 1	Base value of per-unit flow 1 set by User (Process PID macro only)	GPM	Min: 0 Def: 0 Max: 4403.000	Read and Write	All	3	Yes
13.13	User Per-Unit Level 1	Base value of per-unit level 1 set by User (Process PID macro only)	m	Min: 0 Def: 0 Max: 1000	Read and Write	All	3	Yes
13.33	User Per-Unit Level 1	Base value of per-unit level 1 set by User (Process PID macro only)	ft	Min: 0 Def: 0 Max: 3280.840	Read and Write	All	3	Yes
13.14	User Per-Unit Temp. 1	Base value of per-unit temperature 1 set by User (Process PID macro only)	C	Min: 0 Def: 0 Max: 1000	Read and Write	All	3	Yes
13.34	User Per-Unit Temp. 1	Base value of per-unit temperature 1 set by User (Process PID macro only)	F	Min: 0 Def: 0 Max: 1832.000	Read and Write	All	3	Yes
13.21	User Per-Unit Press. 2	Base value of per-unit pressure 2 set by User (Process PID macro only)	bar	Min: 0 Def: 0 Max: 1000	Read and Write	All	3	Yes
13.41	User Per-Unit Press. 2	Base value of per-unit pressure 2 set by User (Process PID macro only)	PSI	Min: 0 Def: 0 Max: 14503.774	Read and Write	All	3	Yes
13.22	User Per-Unit Flow 2	Base value of per-unit flow 2 set by User (Process PID macro only)	m^3/h	Min: 0 Def: 0 Max: 1000	Read and Write	All	3	Yes
13.42	User Per-Unit Flow 2	Base value of per-unit flow 2 set by User (Process PID macro only)	GPM	Min: 0 Def: 0 Max: 4403.000	Read and Write	All	3	Yes
13.23	User Per-Unit Level 2	Base value of per-unit level 2 set by User (Process PID macro only)	m	Min: 0 Def: 0 Max: 1000	Read and Write	All	3	Yes

PREVIOUS VIEW

13 - PER-UNIT BASE DATA								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
13.43	User Per-Unit Level 2	Base value of per-unit level 2 set by User (Process PID macro only)	ft	Min: 0 Def: 0 Max: 3280.840	Read and Write	All	3	Yes
13.24	User Per-Unit Temp. 2	Base value of per-unit temperature 2 set by User (Process PID macro only)	C	Min: 0 Def: 0 Max: 1000	Read and Write	All	3	Yes
13.44	User Per-Unit Temp. 2	Base value of per-unit temperature 2 set by User (Process PID macro only)	F	Min: 0 Def: 0 Max: 1832.000	Read and Write	All	3	Yes

PREVIOUS VIEW

A-7 DIGITAL INPUTS

15 - DIGITAL INPUTS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
15.01	DI1 Used by	[ME26] DI1 Used by	#	Min: 0 Def: Start/Stop cmd Max: 30	Read Only	All	2	No
15.02	DI2 Used by	[ME25] DI2 Used by	#	Min: 0 Def: 0 Max: 30	Read Only	All	2	No
15.03	DI3 Used by	[ME22] DI3 Used by	#	Min: 0 Def: 0 Max: 30	Read Only	All	2	No
15.04	DI4 Used by	[ME23] DI4 Used by	#	Min: 0 Def: 0 Max: 30	Read Only	All	2	No
15.05	DI5 Used by	[ME24] DI5 Used by	#	Min: 0 Def: 0 Max: 30	Read Only	All	2	No
15.06	DI6 Used by	[ME38] DI6 Used by	#	Min: 0 Def: 0 Max: 30	Read Only	All	2	No
15.07	DI7 Used by	[ME39] DI7 Used by	#	Min: 0 Def: 0 Max: 30	Read Only	All	2	No
15.08	DI8 Used by	[ME40] DI8 Used by	#	Min: 0 Def: 0 Max: 30	Read Only	All	2	No
15.14	DI9 Used by	[ME42] DI9 Used by	#	Min: 0 Def: 0 Max: 30	Read Only	All	2	No
15.15	DI10 Used by	[ME43] DI10 Used by	#	Min: 0 Def: 0 Max: 30	Read Only	All	2	No
15.16	DI11 Used by	[ME44] DI11 Used by	#	Min: 0 Def: 0 Max: 30	Read Only	All	2	No

PREVIOUS VIEW

15 - DIGITAL INPUTS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
15.17	DI12 Used by	[ME45] DI12 Used by	#	Min: 0 Def: 0 Max: 30	Read Only	All	2	No
15.10	CW1.12 Used by	CW1.12 Used by	#	Min: 0 Def: 0 Max: 30	Read Only	All	2	No
15.11	CW1.13 Used by	CW1.13 Used by	#	Min: 0 Def: 0 Max: 30	Read Only	All	2	No
15.12	CW1.14 Used by	CW1.14 Used by	#	Min: 0 Def: 0 Max: 30	Read Only	All	2	No
15.13	CW1.15 Used by	CW1.15 Used by	#	Min: 0 Def: 0 Max: 30	Read Only	All	2	No
15.21	Invert DI1	Inversion of digital input 1 - Off [0] - On [1]	#	Def: Off	Read Only	All	2	Yes
15.22	Invert DI2	Inversion of digital input 2 - Off [0] - On [1]	#	Def: Off	Read Only	All	2	Yes
15.23	Invert DI3	Inversion of digital input 3 - Off [0] - On [1]	#	Def: Off	Read Only	All	2	Yes
15.24	Invert DI4	Inversion of digital input 4 - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
15.25	Invert DI5	Inversion of digital input 5 - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
15.26	Invert DI6	Inversion of digital input 6 - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

15 - DIGITAL INPUTS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
15.27	Invert DI7	nversion of digital input 7 - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
15.28	Invert DI8	Inversion of digital input 8 - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
15.29	Invert DI9	Inversion of digital input 9 - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
15.30	Invert DI10	Inversion of digital input 10 - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
15.31	Invert DI11	Inversion of digital input 11 - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
15.32	Invert DI12	Inversion of digital input 12 - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

A-8 DIGITAL OUTPUTS

16 - DIGITAL OUTPUTS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
16.01	DO1 Select	[ME28] DO1 selection - Off [0] - CW1.12 [510612] - CW1.13 [510613] - CW1.14 [510614] - CW1.15 [510615] - SW1.00-Ready to on [520100] - SW1.01-Ready to oper [520101] - SW1.02-Oper. enabled [520102] - SW1.03-Fault [520103] - SW1.04-No coast stop [520104] - SW1.05-No quick stop [520105] - SW1.06-Switch-On Inh [520106] - SW1.07-Warning [520107] - SW1.08-Fdb equal ref [520108] - SW1.09-Remote control [520109] - SW1.10-Ref reached [520110] - SW1.11-DE received [520111] - SW1.12-Cfg [520112] - SW1.13-Cfg [520113] - SW1.14-Cfg [520114] - SW1.15-Cfg [520115] - SW2.00-Speed limit [520200] - SW2.01-Current limit [520201] - SW2.02-Torque limit [520202] - SW2.03-Voltage limit [520203] - SW2.04-Precharged [520204] - SW2.05-Fluxed [520205] - SW2.06-CTLRM [520206] - SW2.07-Min speed [520207] - SW2.08-Zero speed [520208] - SW2.09-Fly start [520209] - SW2.10-Ramp end [520210] - SW2.11-Pulses enabled [520211] - SW2.12-Brake On [520212] - SW2.13-OV Control On [520213] - SW2.14-UV Control On [520214] - SW2.15-Flux ON [520215] - SW4.04-Aux Pump 1 [520404] - SW4.05-Aux Pump 2 [520405] - SW4.06-Aux Pump 3 [520406] - SW4.07-Aux Pump 4 [520407] - SW4.08-Aux Pump 5 [520408] - SW4.09-Aux Pump 6 [520409] - D01 from ID.bit [37]	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

16 - DIGITAL OUTPUTS

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
16.02	DO1 from ID.bit	DO1 from ID.bit	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
16.03	DO2 Select	[ME29] DO2 selection	#	Def: Off	Read and Write	All	2	Yes
16.04	DO2 from ID.bit	DO2 from ID.bit	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
16.05	DO3 Select	[ME17-18] DO3 selection	#	Def: Off	Read and Write	All	2	Yes
16.06	DO3 from ID.bit	DO3 from ID.bit	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
16.19	SW1.12 Select	Status word 1 bit 12 selection - Off [0] - CW1.12 [510612] - CW1.13 [510613] - CW1.14 [510614] - CW1.15 [510615] - SW2.00-Speed limit [520200] - SW2.01-Current limit [520201] - SW2.02-Torque limit [520202] - SW2.03-Voltage limit [520203] - SW2.04-Precharged [520204] - SW2.05-Fluxed [520205] - SW2.06-CTLRM [520206] - SW2.07-Min speed [520207] - SW2.08-Zero speed [520208] - SW2.09-Fly start [520209] - SW2.10-Ramp end [520210] - SW2.11-Pulses enabled [520211] - SW2.12-Brake On [520212] - SW2.13-OV Control On [520213] - SW2.14-UV Control On [520214] - SW2.15-Flux ON [520215] - SW1.12 from ID.bit [21]	#	Def: Off	Read and Write	All	2	Yes
16.20	SW1.12 from ID.bit	SW1.12 from ID.bit	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes

PREVIOUS VIEW

16 - DIGITAL OUTPUTS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
16.21	SW1.13 Select	Status word 1 bit 13 selection	#	Def: Off	Read and Write	All	2	Yes
16.22	SW1.13 from ID.bit	SW1.13 from ID.bit	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
16.23	SW1.14 Select	Status word 1 bit 14 selection	#	Def: Off	Read and Write	All	2	Yes
16.24	SW1.14 from ID.bit	SW1.14 from ID.bit	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
16.25	SW1.15 Select	Status word 1 bit 15 selection	#	Def: Off	Read and Write	All	2	Yes
16.26	SW1.15 from ID.bit	SW1.15 from ID.bit	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
16.27	Invert DO1	Inversion of digital output 1 - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
16.28	Invert DO2	Inversion of digital output 2 - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
16.29	Invert DO3	Inversion of digital output 3 - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
16.40	Logic function 1	Selection of Logic function 1 - Off [0] - A AND B [1] - A OR B [2] - A XOR B [3] - NOT A [4] - Positive edge on A [5]	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

16 - DIGITAL OUTPUTS

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
16.41	Logic function 2	Selection of Logic function 2 - Off [0] - C AND D [1] - C OR D [2] - C XOR D [3] - NOT C [4] - Positive edge on C [5]	#	Def: Off	Read and Write	All	2	Yes
16.42	Logic function 3	Selection of Logic function 3 - Off [0] - E AND F [1] - E OR F [2] - E XOR F [3] - NOT E [4] - Positive edge on E [5]	#	Def: Off	Read and Write	All	2	Yes
16.45	Signal A from ID.bit	Signal A from ID.bit	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
16.46	Invert signal A	Inversion of signal A - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
16.47	Signal B from ID.bit	Signal B from ID.bit	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
16.48	Invert signal B	Inversion of signal B - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
16.49	Signal C from ID.bit	Signal C from ID.bit	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
16.50	Invert signal C	Inversion of signal C - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

16 - DIGITAL OUTPUTS

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
16.51	Signal D from ID.bit	Signal D from ID.bit	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
16.52	Invert signal D	Inversion of signal D - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
16.53	Signal E from ID.bit	Signal E from ID.bit	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
16.54	Invert signal E	Inversion of signal E - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
16.55	Signal F from ID.bit	Signal F from ID.bit	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
16.56	Invert signal F	Inversion of signal F - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
16.60	Logic function alarm	Selection of logic function to set alarm bit - None [0] - Logic function 1 [1] - Logic function 2 [2] - Logic function 3 [3]	#	Def: None	Read and Write	All	2	Yes

PREVIOUS VIEW

A-9 ANALOG INPUTS

17 - ANALOG INPUTS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
17.05	AI1 Value for 1 pu	AI1 Percentage for 1 per-unit (100% to get 1 pu at 10V/20mA)	%	Min: -2000 Def: 100 Max: 2000	Read and Write	All	2	Yes
17.06	AI2 Value for 1 pu	AI2 Percentage for 1 per-unit (100% to get 1 pu at 10V/20mA)	%	Min: -2000 Def: 100 Max: 2000	Read and Write	All	2	Yes
17.07	AI3 Value for 1 pu	AI3 Percentage for 1 per-unit (100% to get 1 pu at 10V/20mA)	%	Min: -2000 Def: 100 Max: 2000	Read and Write	All	2	Yes
17.08	AI4 Value for 1 pu	AI4 Percentage for 1 per-unit (100% to get 1 pu at 10V/20mA)	%	Min: -2000 Def: 100 Max: 2000	Read and Write	All	2	Yes
17.09	AI1 Value for 0 pu	AI1 Percentage for 0 per-unit (20% to get 0 pu at 2V/4mA)	%	Min: -2000 Def: 0 Max: 2000	Read and Write	All	2	Yes
17.10	AI2 Value for 0 pu	AI2 Percentage for 0 per-unit (20% to get 0 pu at 2V/4mA)	%	Min: -2000 Def: 0 Max: 2000	Read and Write	All	2	Yes
17.11	AI3 Value for 0 pu	AI3 Percentage for 0 per-unit (20% to get 0 pu at 2V/4mA)	%	Min: -2000 Def: 0 Max: 2000	Read and Write	All	2	Yes
17.12	AI4 Value for 0 pu	AI4 Percentage for 0 per-unit (20% to get 0 pu at 2V/4mA)	%	Min: -2000 Def: 0 Max: 2000	Read and Write	All	2	Yes
17.13	AI1 Neg Range En	AI1 Option to use negative input values - Off [0] - On [1]	#	Def: On	Read and Write	All	2	Yes
17.14	AI2 Neg Range En	AI2 Option to use negative input values	#	Def: On	Read and Write	All	2	Yes

PREVIOUS VIEW

17 - ANALOG INPUTS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
17.15	AI3 Neg Range En	AI3 Option to use negative input values - Off [0] - On [1]	#	Def: On	Read and Write	All	2	Yes
17.16	AI4 Neg Range En	AI4 Option to use negative input values - Off [0] - On [1]	#	Def: On	Read and Write	All	2	Yes
17.17	AI1 Abs En	AI1 Option to use absolute value of input - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
17.18	AI2 Abs En	AI2 Option to use absolute value of input	#	Def: Off	Read and Write	All	2	Yes
17.19	AI3 Abs En	AI3 Option to use absolute value of input - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
17.20	AI4 Abs En	AI4 Option to use absolute value of input - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
17.21	AI1 Filter Time Const	AI1 Time constant of low-pass filter	s	Min: 0 Def: 0 Max: 100	Read and Write	All	2	Yes
17.22	AI2 Filter Time Const	AI2 Time constant of low-pass filter	s	Min: 0 Def: 0 Max: 100	Read and Write	All	2	Yes
17.23	AI3 Filter Time Const	AI3 Time constant of low-pass filter	s	Min: 0 Def: 0 Max: 100	Read and Write	All	2	Yes
17.24	AI4 Filter Time Const	AI4 Time constant of low-pass filter	s	Min: 0 Def: 0 Max: 100	Read and Write	All	2	Yes
17.25	AI1 Type	Input signal type corresponding to DIP switch setting - Volt [0] - mA [1]	#	Def: Volt	Read and Write	All	2	Yes

PREVIOUS VIEW

17 - ANALOG INPUTS

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
17.26	AI2 Type	Input signal type corresponding to DIP switch setting - Volt [0] - mA [1]	#	Def: Volt	Read and Write	All	2	Yes
17.29	Monitor 1 AI Sel	Analog input selection for Monitor 1 - Off [0] - AI1 [2] - AI2 (Int. Pull-Up) [3] - AI3 (Option) [4] - AI4 (Option) [5]	#	Def: Off	Read and Write	All	2	Yes
17.30	Monitor 2 AI Sel	Analog Input selection for Monitor 2 - Off [0] - AI1 [2] - AI2 (Int. Pull-Up) [3] - AI3 (Option) [8] - AI4 (Option) [9]	#	Def: Off	Read and Write	All	2	Yes
17.31	Monitor Level 1	First monitor threshold for the analog input used	#	Min: -4 Def: 0 Max: 4	Read and Write	All	2	Yes
17.32	Monitor Level 2	First monitor threshold for the analog input used	#	Min: -4 Def: 0 Max: 4	Read and Write	All	2	Yes
17.33	Monitor 1 Alarm En	Enables Monitor 1 and selects how to force the Monitor 1 Alarm - Off [0] - AI > Level 1 [1] - AI < Level 1 [2] - AI > Level 2 [3] - AI < Level 2 [4] - |AI| > Level 1 [5] - |AI| > Level 2 [6] - (AI<Lvl1)OR(AI>Lvl2) [7]	#	Def: Off	Read and Write	All	2	Yes
17.34	Monitor 2 Alarm En	Enables Monitor 2 and selects how to force the Monitor 2 Alarm - Off [0] - AI > Level 1 [1] - AI < Level 1 [2] - AI > Level 2 [3] - AI < Level 2 [4] - |AI| > Level 1 [5] - |AI| > Level 2 [6] - (AI<Lvl1)OR(AI>Lvl2) [7]	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

17 - ANALOG INPUTS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
17.43	AI1 Loss	Option to manage a loss of AI connection - No Action [0] - Freeze To Last Val [1] - Freeze To Preset Val [2] - Prs PID Disable [3]	#	Def: No Action	Read and Write	All	2	Yes
17.44	AI2 Loss	Option to manage a loss of AI connection - No Action [0] - Freeze To Last Val [1] - Freeze To Preset Val [2] - Prs PID Disable [3]	#	Def: No Action	Read and Write	All	2	Yes
17.45	AI3 Loss	Option to manage a loss of AI connection - No Action [0] - Freeze To Last Val [1] - Freeze To Preset Val [2] - Prs PID Disable [3]	#	Def: No Action	Read and Write	All	2	Yes
17.46	AI4 Loss	Option to manage a loss of AI connection - No Action [0] - Freeze To Last Val [1] - Freeze To Preset Val [2] - Prs PID Disable [3]	#	Def: No Action	Read and Write	All	2	Yes
17.51	AI1 Loss Threshold	AI1 Percentage for the threshold of AI loss management	%	Min: -100 Def: 0 Max: 100	Read and Write	All	2	Yes
17.52	AI2 Loss Threshold	AI2 Percentage for the threshold of AI loss management	%	Min: -100 Def: 0 Max: 100	Read and Write	All	2	Yes
17.53	AI3 Loss Threshold	AI3 Percentage for the threshold of AI loss management	%	Min: -100 Def: 0 Max: 100	Read and Write	All	2	Yes

PREVIOUS VIEW

17 - ANALOG INPUTS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
17.54	AI4 Loss Threshold	AI4 Percentage for the threshold of AI loss management	%	Min: -100 Def: 0 Max: 100	Read and Write	All	2	Yes
17.59	AI1 Preset Value	AI1 Percentage for the AI loss preset value	%	Min: -100 Def: 0 Max: 100	Read and Write	All	2	Yes
17.60	AI2 Preset Value	AI2 Percentage for the AI loss preset value	%	Min: -100 Def: 0 Max: 100	Read and Write	All	2	Yes
17.61	AI3 Preset Value	AI3 Percentage for the AI loss preset value	%	Min: -100 Def: 0 Max: 100	Read and Write	All	2	Yes
17.62	AI4 Preset Value	AI4 Percentage for the AI loss preset value	%	Min: -100 Def: 0 Max: 100	Read and Write	All	2	Yes

PREVIOUS VIEW

A-10 ANALOG OUTPUTS

18 - ANALOG OUTPUTS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
18.01	AO1 Sel	[ME13] AO1 Signal selection	#	Min: 0 Def: 1 Max: 200	Read and Write	All	2	Yes
18.02	AO2 Sel	[ME14] AO2 Signal selection	#	Min: 0 Def: 2 Max: 200	Read and Write	All	2	Yes
18.05	AO1 Value for 1 pu	AO1 Percentage at 1 per-unit (100% to get 10V/ 20mA at 1 pu)	%	Min: -2000 Def: 100 Max: 2000	Read and Write	All	2	Yes
18.06	AO2 Value for 1 pu	AO2 Percentage at 1 per-unit (100% to get 10V/ 20mA at 1 pu)	%	Min: -2000 Def: 100 Max: 2000	Read and Write	All	2	Yes
18.09	AO1 Value for 0 pu	AO1 Percentage at 0 per-unit (20% to get 2V/ 4mA at 0 pu)	%	Min: -2000 Def: 0 Max: 2000	Read and Write	All	2	Yes
18.10	AO2 Value for 0 pu	AO2 Percentage at 0 per-unit (20% to get 2V/ 4mA at 0 pu)	%	Min: -2000 Def: 0 Max: 2000	Read and Write	All	2	Yes
18.13	AO1 Neg Range En	AO1 Option to use negative output values - Off [0] - On [1]	#	Def: On	Read and Write	All	2	Yes
18.14	AO2 Neg Range En	AO2 Option to use negative output values	#	Def: On	Read and Write	All	2	Yes

PREVIOUS VIEW

18 - ANALOG OUTPUTS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
18.17	AO1 Abs En	AO1 Option to use only absolute value of signal - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
18.18	AO2 Abs En	AO2 Option to use only absolute value of signal	#	Def: Off	Read and Write	All	2	Yes
18.21	AO1 Type	Output signal type corresponding to jumper setting - Volt [0] - mA [1]	#	Def: Volt	Read and Write	All	2	Yes
18.22	AO2 Type	Output signal type corresponding to jumper setting - Volt [0] - mA [1]	#	Def: Volt	Read and Write	All	2	Yes

PREVIOUS VIEW

A-11 SPEED CONTROL

21 - SPEED CONTROL								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
21.01	Speed Ctrl Autotune	Enable internal controller autotuning for desired bandwidth using the inertia time constant - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
21.02	Speed Ctrl Bandwidth	Desired speed control bandwidth	Hz	Min: 1 Def: 3 Max: 50	Read and Write	All	2	Yes
21.03	Cmd 1 Gain Set Sel	Command 1 for gain set selection - Off [0] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17] - CW1.12 [9] - CW1.13 [10] - CW1.14 [11] - CW1.15 [12] - CW2.10 [13]	#	Def: Off	Read and Write	All	2	Yes
21.04	Cmd 2 Gain Set Sel	Command 2 for gain set selection	#	Def: Off	Read and Write	All	2	Yes
21.05	Proportional Gain 1	User speed control proportional gain 1	pu	Min: 0 Def: 3 Max: 100	Read and Write	All	2	Yes
21.06	Integral Time 1	User speed control integral time 1	s	Min: 0 Def: 0.3 Max: 60	Read and Write	All	2	Yes

PREVIOUS VIEW

21 - SPEED CONTROL								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
21.07	Proportional Gain 2	User speed control proportional gain 2	pu	Min: 0 Def: 0 Max: 100	Read and Write	All	2	Yes
21.08	Integral Time 2	User speed control integral time 2	s	Min: 0 Def: 0 Max: 60	Read and Write	All	2	Yes
21.09	Proportional Gain 3	User speed control proportional gain 3	pu	Min: 0 Def: 0 Max: 100	Read and Write	All	2	Yes
21.10	Integral Time 3	User speed control integral time 3	s	Min: 0 Def: 0 Max: 60	Read and Write	All	2	Yes
21.11	Proportional Gain 4	User speed control proportional gain 4	pu	Min: 0 Def: 0 Max: 100	Read and Write	All	2	Yes
21.12	Integral Time 4	User speed control integral time 4	s	Min: 0 Def: 0 Max: 60	Read and Write	All	2	Yes
21.13	Speed Fdb Filter Time	Time constant of the low-pass filter for the speed feedback	s	Min: 0 Def: 0 Max: 0.1	Read and Write	All	2	Yes

PREVIOUS VIEW

A-12 TORQUE CONTROL

22 - TORQUE CONTROL								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
22.01	Pos Torque Limit 1	Fixed positive torque limit 1	pu	Min: 0 Def: 1 Max: 4	Read and Write	All	2	Yes
22.02	Neg Torque Limit 1	Fixed negative torque limit 1	pu	Min: -4 Def: -1 Max: 0	Read and Write	All	2	Yes
22.03	Pos Torque Limit 2	Fixed positive torque limit 2	pu	Min: 0 Def: 1 Max: 4	Read and Write	All	2	Yes
22.04	Neg Torque Limit 2	Fixed negative torque limit 2	pu	Min: -4 Def: -1 Max: 0	Read and Write	All	2	Yes
22.22	Pos Torque Limit 3	Fixed positive torque limit 3	pu	Min: 0 Def: 1 Max: 4	Read and Write	All	2	Yes
22.23	Neg Torque Limit 3	Fixed negative torque limit 3	pu	Min: -4 Def: -1 Max: 0	Read and Write	All	2	Yes
22.24	Pos Torque Limit 4	Fixed positive torque limit 4	pu	Min: 0 Def: 1 Max: 4	Read and Write	All	2	Yes
22.25	Neg Torque Limit 4	Fixed negative torque limit 4	pu	Min: -4 Def: -1 Max: 0	Read and Write	All	2	Yes

PREVIOUS VIEW

22 - TORQUE CONTROL								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
22.05	Cmd 1 Torque Limit Set	Command 1 for selection of fixed torque limit set - Off [0] - On [1] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17] - CW1.12 [9] - CW1.13 [10] - CW1.14 [11] - CW1.15 [12] - CW2:07 [13]	#	Def: Off	Read and Write	All	2	Yes
22.26	Cmd 2 Torque Limit Set	Command 2 for selection of fixed torque limit set - Off [0] - On [1] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17] - CW1.12 [9] - CW1.13 [10] - CW1.14 [11] - CW1.15 [12] - CW4:08 [13]	#	Def: Off	Read and Write	All	2	Yes
22.06	Torque Limit Type	Internal type of use for the Pos and Neg torque limiters - Pos/Neg [0] - Motor/Gen [1]	#	Def: Pos/Neg	Read and Write	All	2	Yes

PREVIOUS VIEW

22 - TORQUE CONTROL								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
22.08	Ext Pos Torque Lim Sel	Source selection for the external positive signal to limit the speed controller output - Off [0] - AI1 [2] - Profibus [6] - Modbus [7]	#	Def: Off	Read and Write	All	2	Yes
22.09	Ext Neg Torque Lim Sel	Source selection for the external negative signal to limit the speed controller output - Off [0] - AI2 [3] - Profibus [6] - Modbus [7]	#	Def: Off	Read and Write	All	2	Yes
22.10	Torque Ffw Sel	Torque feedforward reference source selection - Off [0] - AI1 [2] - AI2 [3] - AI3 (Option) [4] - AI4 (Option) [5] - Profibus [6] - Modbus [7]	#	Def: Off	Read and Write	All	2	Yes
22.11	Torque Ffw En Cmd	Torque feedforward command enable - Operation Enabled [0] - Always On [1] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17] - CW1.12 [9] - CW1.13 [10] - CW1.14 [11] - CW1.15 [12] - CW2:01 [13]	#	Def: Operation Enabled	Read and Write	All	2	Yes

PREVIOUS VIEW

22 - TORQUE CONTROL								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
22.12	Torque Ramp-Up Time	Time for the reference to increase from zero to nominal motor torque	s	Min: 0 Def: 0 Max: 1	Read and Write	All	2	Yes
22.13	Torque Ramp-Down Time	Time for the reference to decrease from nominal motor torque to zero	s	Min: 0 Def: 0 Max: 1	Read and Write	All	2	Yes
22.14	Torque Ramp Band	Defines the torque reference band above and below zero where the torque ramp is active	pu	Min: 0 Def: 0.1 Max: 4	Read and Write	All	2	Yes

PREVIOUS VIEW

A-13 V/F CONTROL

24 - V/f CONTROL								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
24.01	Base Voltage	Maximum output voltage	pu	Min: 0.5 Def: 1 Max: 1.5	Read and Write	Scalar	1	Yes
24.02	Base Freq / Rated Freq	Ratio to modify the initial frequency of field-weakening	pu	Min: 0.5 Def: 1 Max: 2	Read and Write	Scalar	2	Yes
24.03	Boost Gain	Gain to modify the Rs voltage drop compensation for initial boost	%	Min: 20 Def: 100 Max: 400	Read and Write	Scalar	1	Yes
24.04	Slip Compensation	Gain to modify the rated frequency slip compensation under load conditions	%	Min: 0 Def: 100 Max: 200	Read and Write	Scalar	2	Yes
24.05	FlyStart En	Activates the Flying Start feature under V/f control mode - Off [0] - On [1]	#	Def: Off	Read and Write	Scalar	2	Yes
24.06	FlyStart Current Error	Maximum current error required to terminate the motor frequency search	pu	Min: 0 Def: 0.15 Max: 0.5	Read and Write	Scalar	2	Yes
24.07	Scalar V/f En	Disables the speed/torque control loop and enable the scalar V/f control - Off [0] - On [1]	#	Def: On	Read and Write	Scalar	2	Yes
24.08	Current Damping	Activates the damping of current oscillations for scalar control (to switch off in case of LC output filter) - Off [0] - On [1]	#	Def: On	Read and Write	Scalar	1	Yes
24.09	V/f Ratio 1/3 Point	V/f Ratio 1/3 Point	pu	Min: 0 Def: 0.333 Max: 1	Read and Write	Scalar	2	Yes
24.10	V/f Ratio 2/3 Point	V/f Ratio 2/3 Point	pu	Min: 0 Def: 0.667 Max: 1	Read and Write	Scalar	2	Yes

PREVIOUS VIEW

A-14 SYSTEM CTRL INPUTS

31 - SYSTEM CTRL INPUTS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
31.01	Cmd Wd 1 Sel	Source selection for the main command word - Terminal Board [0] - Profibus [1] - Modbus [2]	#	Def: Terminal Board	Write at Stop Only	All	1	Yes
31.02	Run Interlock En	Enable HW run interlock - Off [0] - On [1]	#	Def: Off	Write at Stop Only	All	2	Yes
31.03	Special Cmd Wd En	Enable bits 4, 5, 6 of main command word - Off [0] - On [1]	#	Def: Off	Write at Stop Only	All	2	Yes
31.04	Cmd Wd 2 Sel	Command Word 2 source selection - Off [0] - Profibus [1] - Modbus [2]	#	Def: Off	Write at Stop Only	All	2	Yes
31.06	Cmd Wd 4 Sel	Command Word 4 source selection - Off [0] - Profibus [1] - Modbus [2]	#	Def: Off	Write at Stop Only	All	2	Yes
31.10	DI Run/Fw/Rv Connect.	DI Run/Forward/Reverse connections - DI1:Run [0] - DI1:Run - DI2:Fw/Rv [1] - DI1:RunFw - DI2:RunRv [2]	#	Def: DI1:Run	Write at Stop Only	All	1	Yes
31.11	DI Quick Stop Sel	DI Quick Stop (OFF3) selection - Off [0] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17]	#	Def: Off	Write at Stop Only	All	2	Yes

PREVIOUS VIEW

31 - SYSTEM CTRL INPUTS

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
31.12	DI Fault Ack Sel	DI Fault acknowledge selection - Off [0] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17]	#	Def: Off	Write at Stop Only	All	2	Yes
31.13	DI Coast Stop Sel	DI Coast Stop (OFF2) selection - Off [0] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17]	#	Def: Off	Write at Stop Only	All	2	Yes

PREVIOUS VIEW

A-15 SPEED REFERENCE

32 - SPEED REFERENCE								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
32.01	Main Speed Ref Sel	Selection of main speed command source - Off [0] - Fixed [1] - AI1 [2] - AI2 [3] - AI3 (Option) [4] - AI4 (Option) [5] - Profibus [6] - Modbus [7] - Digital Pot [9] - Prs PID [10] - Keypad [11]	#	Def: Off	Write at Stop Only	All	1	Yes
32.02	Aux Speed Ref Sel	Selection of auxiliary speed command source - Off [0] - Fixed [1] - AI1 [2] - AI2 [3] - AI3 (Option) [4] - AI4 (Option) [5] - Profibus [6] - Modbus [7] - Digital Pot [9] - Prs PID [10] - Keypad [11]	#	Def: Off	Write at Stop Only	All	2	Yes

PREVIOUS VIEW

32 - SPEED REFERENCE

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
32.03	Aux Speed Ref Cmd	Source selection for switch command from Main to Aux speed reference - Off [0] - On [1] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17] - CW1.12 [9] - CW1.13 [10] - CW1.14 [11] - CW1.15 [12] - CW4.05 [13]	#	Def: Off	Write at Stop Only	All	2	Yes
32.04	Add Speed Ref Sel	Selection of additional speed command source - Off [0] - Fixed [1] - AI1 [2] - AI2 [3] - AI3 (Option) [4] - AI4 (Option) [5] - Profibus [6] - Modbus [7]	#	Def: Off	Write at Stop Only	All	2	Yes
32.05	Speed Feedforward Sel	Selection of feedforward speed command source - Off [0] - Fixed [1] - AI1 [2] - AI2 [3] - AI3 (Option) [4] - AI4 (Option) [5] - Profibus [6] - Modbus [7]	#	Def: Off	Write at Stop Only	All	2	Yes
32.06	Fixed Speed Ref 1	Fixed speed command 1	pu	Min: -2 Def: 0 Max: 2	Read and Write	All	1	Yes

PREVIOUS VIEW

32 - SPEED REFERENCE

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
32.07	Fixed Speed Ref 2	Fixed speed command 2	pu	Min: -2 Def: 0 Max: 2	Read and Write	All	2	Yes
32.08	Fixed Speed Ref 3	Fixed speed command 3	pu	Min: -2 Def: 0 Max: 2	Read and Write	All	2	Yes
32.09	Fixed Speed Ref 4	Fixed speed command 4	pu	Min: -2 Def: 0 Max: 2	Read and Write	All	2	Yes
32.10	Cmd 1 Sel Fix Speed Ref	Command 1 for selection of fixed command reference - Off [0] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17] - CW1.12 [9] - CW1.13 [10] - CW1.14 [11] - CW1.15 [12] - CW4.03 [13]	#	Def: Off	Read and Write	All	2	Yes
32.11	Cmd 2 Sel Fix Speed Ref	Command 2 for selection of fixed command reference	#	Def: Off	Read and Write	All	2	Yes
32.12	Ramp Acc Time 1	Maximum acceleration ramp time 1 from 0 to 100% speed	s	Min: 0 Def: 10 Max: 600	Read and Write	All	1	Yes
32.13	Ramp Dec Time 1	Maximum deceleration ramp time 1 from 0 to 100% speed	s	Min: 0 Def: 10 Max: 600	Read and Write	All	1	Yes

PREVIOUS VIEW

32 - SPEED REFERENCE

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
32.14	Ramp Acc Time 2	Maximum acceleration ramp time 2 from 0 to 100% speed	s	Min: 0 Def: 20 Max: 600	Read and Write	All	1	Yes
32.15	Ramp Dec Time 2	Maximum deceleration ramp time 2 from 0 to 100% speed	s	Min: 0 Def: 20 Max: 600	Read and Write	All	1	Yes
32.16	Ramp Rate Sel	Selection of ramp rate - Set 1 [0] - Set 2 [1] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17] - CW1.12 [9] - CW1.13 [10] - CW1.14 [11] - CW1.15 [12] - CW2.08 [13]	#	Def: Set 1	Read and Write	All	1	Yes
32.18	Overspeed Threshold	Absolute threshold of speed feedback to set the Overspeed alarm	pu	Min: 0 Def: 1.2 Max: 2	Read and Write	All	1	Yes
32.19	Min Speed	Absolute value of minimum speed feedback to set the Min-Speed status bit	pu	Min: 0 Def: 0.03 Max: 0.5	Read and Write	All	2	Yes
32.20	Min Speed Hysteresis	Size of hysteresis band above and below the Min-Speed threshold	pu	Min: 0 Def: 0.01 Max: 0.2	Read and Write	All	2	Yes

PREVIOUS VIEW

32 - SPEED REFERENCE

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
32.21	Zero Speed	Size of band above and below the zero speed to detect the standstill condition	pu	Min: 0 Def: 0.01 Max: 0.5	Read and Write	All	2	Yes
32.22	Max Pos Ref	Maximum allowable positive speed command before and after ramp	pu	Min: 0 Def: 1 Max: 1	Read and Write	All	2	Yes
32.23	Max Neg Ref	Maximum allowable negative speed command before and after ramp	pu	Min: -1 Def: -1 Max: 0	Read and Write	All	2	Yes
32.24	Speed Deviation Error	Absolute speed error tolerance before causing the Speed Deviation alarm	pu	Min: 0.01 Def: 0.2 Max: 0.5	Read and Write	All	2	Yes
32.25	Speed Deviation Time	Maximum amount of time the speed error tolerance can be exceeded without generating alarm	s	Min: 0.1 Def: 2 Max: 60	Read and Write	All	2	Yes
32.26	Settling Time	Minimum time with the speed error inside the band to set the Freq-Equal-Setpoint status bit	s	Min: 0.01 Def: 0.01 Max: 60	Read and Write	All	2	Yes
32.27	Settling Band	Size of band above and below the command speed to set the Freq-Equal-Setpoint status bit	pu	Min: 0 Def: 0.02 Max: 4	Read and Write	All	2	Yes
32.28	Skip Speed Band 1	Size of hysteresis band above and below the speed to skip	pu	Min: 0 Def: 0 Max: 0.1	Read and Write	All	2	Yes
32.29	Skip Speed 1	Speed reference to skip	pu	Min: -1 Def: 0 Max: 1	Read and Write	All	2	Yes
32.30	Skip Speed Band 2	Size of hysteresis band above and below the speed to skip	pu	Min: 0 Def: 0 Max: 0.1	Read and Write	All	2	Yes
32.31	Skip Speed 2	Speed reference to skip	pu	Min: -1 Def: 0 Max: 1	Read and Write	All	2	Yes

PREVIOUS VIEW

32 - SPEED REFERENCE

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
32.32	Enable Add Speed Cmd	Selection of digital input to enable the additional speed reference - Off [0] - On [1] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17] - CW1.12 [9] - CW1.13 [10] - CW1.14 [11] - CW1.15 [12] - CW4.06 [13]	#	Def: On	Read and Write	All	2	Yes
32.33	Enable Ffw Speed Cmd	Selection of digital input to enable the speed feedforward reference - Off [0] - On [1] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17] - CW1.12 [9] - CW1.13 [10] - CW1.14 [11] - CW1.15 [12] - CW4.07 [13]	#	Def: On	Read and Write	All	2	Yes

PREVIOUS VIEW

32 - SPEED REFERENCE								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
32.34	Jerk Rate Time	Jerk rate time	s	Min: 0 Def: 0 Max: 100	Read and Write	All	2	Yes
32.38	Speed Ffw Gain	Speed Feedforward Gain	pu	Min: -2 Def: 1 Max: 2	Read and Write	All	3	Yes
32.39	Speed Ffw Offset	Speed Feedforward Offset	pu	Min: -2 Def: 0 Max: 2	Read and Write	All	3	Yes
32.41	TB Ramp Acc Time 1	Thrust Bearing Ramp Acceleration Time from 0% to 100% speed Set 1	s	Min: 0 Def: 5 Max: 100	Read and Write	All	2	Yes
32.42	TB Ramp Dec Time 1	Thrust Bearing Ramp Deceleration Time from 100% to 0% speed Set 1	s	Min: 0 Def: 5 Max: 100	Read and Write	All	2	Yes
32.43	TB Thresh Speed 1	Thrust Bearing Threshold Speed Set 1 (=0 disable)	pu	Min: 0 Def: 0 Max: 1	Read and Write	All	2	Yes
32.44	TB Ramp Acc Time 2	Thrust Bearing Ramp Acceleration Time from 0% to 100% speed Set 2	s	Min: 0 Def: 5 Max: 100	Read and Write	All	2	Yes
32.45	TB Ramp Dec Time 2	Thrust Bearing Ramp Deceleration Time from 100% to 0% speed Set 2	s	Min: 0 Def: 5 Max: 100	Read and Write	All	2	Yes
32.46	TB Thresh Speed 2	Thrust Bearing Threshold Speed Set 2 (=0 disable)	pu	Min: 0 Def: 0 Max: 1	Read and Write	All	2	Yes

PREVIOUS VIEW

A-16 START/STOP MODE

33 - START/STOP MODE								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
33.01	Start Mode	Drive start mode - Auto [0] - Flux-Up Time [1]	#	Def: Auto	Read and Write	All	1	Yes
33.02	Flux-up Time	Constant amount of time to flux-up the induction motor after the Run command	s	Min: 0 Def: 1 Max: 60	Read and Write	All	2	Yes
33.03	Flux-up Timeout	Maximum time allowed to complete the induction motor fluxing without Flux-Up Timeout alarm	s	Min: 0.03 Def: 4 Max: 60	Read and Write	Scalar; Vector; Sls	2	Yes
33.04	Flux Cmd Sel	Selection for Flux command (for hand-tuning, pre-magnetizing, or DC-braking) - Off [0] - On [1] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17] - CW1.12 [9] - CW1.13 [10] - CW1.14 [11] - CW1.15 [12] - CW2.00 [13] - After OFF1 or Jog [20]	#	Def: Off	Read and Write	Scalar; Vector; Sls	2	Yes
33.05	Flux Cmd Current	Current step applied to the Id reference when the Flux command is active	pu	Min: 0 Def: 0.4 Max: 1	Read and Write	Scalar; Vector; Sls	2	Yes
33.06	DC Brake	Flux command or constant time flux-up applies a DC current to brake the motor or maintain it at standstill - Off [0] - On (Flux Cmd Current) [1] - On (Idn) [2]	#	Def: Off	Read and Write	Scalar; Vector; Sls	1	Yes

PREVIOUS VIEW

33 - START/STOP MODE

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
33.10	Ramp Stop Time	Deceleration time for OFF1 (0 gives coast stop)	s	Min: 0 Def: 15 Max: 600	Read and Write	All	1	Yes
33.11	Quick Stop Time	Deceleration time for OFF3 (0 gives coast stop)	s	Min: 0 Def: 5 Max: 600	Read and Write	All	1	Yes
33.12	HOA Start/Stop type	HOA Start/Stop type - Edge Start/Stop [0] - Level Start/Stop [1] - Pulsed Start/Stop [2]	#	Def: Edge Start/Stop	Write at Stop Only	All	2	Yes
33.13	HOA Man/Auto OnFly Cmd	HOA Manual/Automatic OnFly Command Selection - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
33.16	HOA Man Ref Src Sel	HOA Manual Reference Source Selection - Off [0] - Fixed [1] - AI1 [2] - AI2 [3] - AI3 (Option) [4] - AI4 (Option) [5] - Keypad [11]	#	Def: Keypad	Write at Stop Only	All	2	Yes
33.17	HOA Man/Auto Cmd Sel	HOA Manual/Automatic Command Selection - Keypad Auto/Man [0] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17] - Man disabled [20]	#	Def: Keypad Auto/Man	Write at Stop Only	All	2	Yes

PREVIOUS VIEW

33 - START/STOP MODE								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
33.18	HOA Man Start Cmd Sel	HOA Manual Start Command Selection - Keypad Start [0] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17]	#	Def: Keypad Start	Write at Stop Only	All	2	Yes
33.19	HOA Man P Stop Cmd Sel	HOA Manual Pulsed Stop Command Selection - Keypad Stop [0] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17]	#	Def: Keypad Stop	Write at Stop Only	All	2	Yes
33.20	HOA Auto P Stop Cmd Sel	HOA Auto Pulsed Stop Command Selection - Off [0] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17] - CW1.12 [9] - CW1.13 [10] - CW1.14 [11] - CW1.15 [12]	#	Def: Off	Write at Stop Only	All	2	Yes

PREVIOUS VIEW

33 - START/STOP MODE

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
33.21	Auto OnOff Enable	Auto On/Off Enable - Off [0] - On [1]	#	Def: Off	Write at Stop Only	All	2	Yes
33.22	Auto OnOff Stop Thresh	Auto On/Off Stop Threshold	pu	Min: -1 Def: -1 Max: 1	Read and Write	All	2	Yes
33.23	Auto OnOff Start Thresh	Auto On/Off Start Threshold	pu	Min: -1 Def: 1 Max: 1	Read and Write	All	2	Yes
33.24	Auto OnOff Stop Delay	Auto On/Off Stop Delay	s	Min: 0 Def: 1 Max: 300	Read and Write	All	2	Yes
33.25	Auto OnOff Start Delay	Auto On/Off Start Delay	s	Min: 0 Def: 1 Max: 300	Read and Write	All	2	Yes
33.30	Frost Prot. Enable	Frost Protection Enable - Off [0] - AI1 [1] - AI2 [2] - AI3 (Option) [3] - AI4 (Option) [4]	#	Def: Off	Write at Stop Only	All	3	Yes
33.31	Frost Prot. Low Temp.	Frost Protection Low Temperature	%	Min: -100 Def: 20 Max: 100	Read and Write	All	3	Yes
33.32	Frost Prot. High Temp.	Frost Protection High Temperature	%	Min: -100 Def: 80 Max: 100	Read and Write	All	3	Yes

PREVIOUS VIEW

33 - START/STOP MODE

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
33.33	Frost Prot. Speed Ref	Frost Protection Speed Reference	pu	Min: -1 Def: 0.1 Max: 1	Read and Write	All	3	Yes
33.40	Low City Press. Enable	Low City Pressure Enable - Off [0] - On [1]	#	Def: Off	Write at Stop Only	All	3	Yes
33.41	Low City Press. Cmd Sel	Low City Pressure Command Selection - Off [0] - On [1] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17]	#	Def: Off	Read and Write	All	3	Yes
33.42	Low City Press. Timeout	Low City Pressure Timeout	s	Min: 0 Def: 5 Max: 100	Read and Write	All	3	Yes
33.50	Motor Switch Enable	Motor Switch Enable - Off [0] - On [1]	#	Def: Off	Write at Stop Only	All	2	Yes
33.51	Motor Switch Cmd Sel	Motor Switch Cmd Sel - Off [0] - On [1] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17]	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

33 - START/STOP MODE

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
33.60	AntiBlocking Enable	AntiBlocking Enable - Off [0] - On [1]	#	Def: Off	Write at Stop Only	All	3	Yes
33.61	AntiBlocking Interval	AntiBlocking Interval	s	Min: 0 Def: 5 Max: 100	Read and Write	All	3	Yes
33.62	AntiBlocking Runtime	AntiBlocking Runtime	s	Min: 0 Def: 5 Max: 100	Read and Write	All	3	Yes
33.63	AntiBlocking Speed Ref	AntiBlocking Speed Reference	pu	Min: -1 Def: 0.1 Max: 1	Read and Write	All	3	Yes
33.70	AutoClean Enable	AutoCleaning Enable - Off [0] - Digital Input [1] - Current Threshold [2] - Time Interval [3] - Start Command [4]	#	Def: Off	Write at Stop Only	All	3	Yes
33.71	AutoClean Cmd Sel	AutoCleaning Cmd Sel - Off [0] - On [1] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17]	#	Def: Off	Read and Write	All	3	Yes
33.72	AutoClean Curr Thres	AutoCleaning Current Threshold	%	Min: 0 Def: 10 Max: 100	Read and Write	All	3	Yes
33.73	AutoClean Curr Delay	AutoCleaning Current Threshold Delay	s	Min: 0 Def: 5 Max: 100	Read and Write	All	3	Yes

PREVIOUS VIEW

33 - START/STOP MODE

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
33.74	AutoClean Time Interval	AutoCleaning Time Interval - Delta functioning	min	Min: 0 Def: 1 Max: 43200	Read and Write	All	3	Yes
33.75	AutoClean Cycles Number	AutoCleaning Cycles Number	#	Min: 1 Def: 1 Max: 100	Read and Write	All	3	Yes
33.76	AutoClean Forward Speed	AutoCleaning Forward Speed	pu	Min: 0 Def: 0.1 Max: 1	Read and Write	All	3	Yes
33.77	AutoClean Forward Time	AutoCleaning Forward Time	s	Min: 0 Def: 5 Max: 100	Read and Write	All	3	Yes
33.78	AutoClean Reverse Speed	AutoCleaning Reverse Speed	pu	Min: 0 Def: 0.1 Max: 1	Read and Write	All	3	Yes
33.79	AutoClean Reverse Time	AutoCleaning Reverse Time	s	Min: 0 Def: 5 Max: 100	Read and Write	All	3	Yes
33.80	AutoClean Ramp Acc Time	AutoCleaning Ramp Acceleration Time from 0% to 100% speed	s	Min: 0 Def: 5 Max: 100	Read and Write	All	3	Yes
33.81	AutoClean Ramp Dec Time	AutoCleaning Ramp Deceleration Time from 100% to 0% speed	s	Min: 0 Def: 5 Max: 100	Read and Write	All	3	Yes
33.82	AutoClean OffDelay Time	AutoCleaning Off Delay Time	s	Min: 0 Def: 5 Max: 100	Read and Write	All	3	Yes

PREVIOUS VIEW

A-17 AUTORESET

34 - AUTORESET								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
34.01	Auto Reset Enable	Auto Reset Enable - Off [0] - On [1]	#	Def: Off	Write at Stop Only	All	2	Yes
34.02	Auto Reset Time	Auto Reset Time	s	Min: 0.1	Read and Write	All	2	Yes
34.03	Auto Reset Attempt	Auto Reset Attempt	#	Def: 10	Read and Write	All	2	Yes
34.04	Reset Memory Time	Reset Memory Time	s	Max: 300	Read and Write	All	2	Yes
34.05	Reset Desaturation	Reset Desaturation Enable - Off [0] - On [1]	#	Min: 1	Read and Write	All	2	Yes
34.06	Reset IOC	Reset IOC Enable - Off [0] - On [1]	#	Def: 2	Read and Write	All	2	Yes
34.07	Reset Overvoltage	Reset Overvoltage Enable - Off [0] - On [1]	#	Max: 100	Read and Write	All	2	Yes
34.08	Reset Undervoltage	Reset Undervoltage Enable - Off [0] - On [1]	#	Min: 0.1	Read and Write	All	2	Yes
34.09	Reset Therm. Ovld.	Reset Therm. Ovld. Enable - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

A-18 MOTOR UNDER/OVERLOAD

35 - MOTOR UNDER/OVERLOAD								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
35.01	Overload Mng	Select Drive response to motor overload - Off [0] - Fault/Alarm [1] - Flt/Alm & Reduce Curr [2]	#	Def: Off	Write at Stop Only	Scalar; Vector; Sls	2	Yes
35.02	Overload Level	Defines motor overload current limit relative to rated motor current	%	Min: 105 Def: 110 Max: 250	Write at Stop Only	Scalar; Vector; Sls	2	Yes
35.03	Overload Time	Motor overload maximum time before reaction	s	Min: 1 Def: 600 Max: 18000	Write at Stop Only	Scalar; Vector; Sls	2	Yes
35.04	Zero Speed Icont	Continuos current at zero speed	%	Min: 25 Def: 100 Max: 100	Write at Stop Only	Scalar; Vector	2	Yes
35.10	Underload Enable	Motor Underload Enable - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
35.11	Underload Level	Motor Underload Level	%	Min: 0 Def: 10 Max: 100	Read and Write	All	2	Yes
35.12	Underload Time	Motor Underload Time	s	Min: 0 Def: 10 Max: 1000	Read and Write	All	2	Yes

PREVIOUS VIEW

A-19 ALARM SETTINGS

36 - ALARM SETTINGS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
36.01	Watchdog	AW1.00 - Watchdog	#	Def: Coast Stop	Read Only	All	2	No
36.02	AC Line Supply	AW1.01 - AC line supply	#	Def: Coast Stop	Read Only	All	2	No
36.03	Vdc OV	AW1.02 - DC link Overvoltage	#	Def: Coast Stop	Read Only	All	2	No
36.04	IGBT Desat	AW1.03 - IGBT desaturation	#	Def: Coast Stop	Read Only	All	2	No
36.05	Overheat	AW1.04 - Overheat	#	Def: Coast Stop	Read Only	All	2	No
36.06	Earth	AW1.05 - Earth	#	Def: Coast Stop	Read Only	All	2	No
36.07	OverCur	AW1.06 - Overcurrent	#	Def: Coast Stop	Read Only	All	2	No
36.08	Prc Timeout	AW1.07 - Precharge timeout	#	Def: Coast Stop	Read Only	All	2	No
36.09	External Fault	AW1.08 - External fault (DI3 = FALSE)	#	Def: Off	Read and Write	All	2	Yes
36.11	Vdc UV	AW1.10 - DC link undervoltage	#	Def: Coast Stop	Read Only	All	2	No
36.12	Vmin Supply	AW1.11 - Minimun supply voltage at power card	#	Def: Coast Stop	Read Only	All	2	No
36.13	Power Card Fail	AW1.12 - Generic failure at power cards	#	Def: Coast Stop	Read Only	All	2	No
36.16	AC Line Phase	AW1.15 - AC line phase	#	Def: Coast Stop	Read Only	All	2	No
36.17	Motor Overload	AW2.00 - Motor overload	#	Def: Coast Stop	Read and Write	All	2	Yes
36.18	Drive Overload	AW2.01 - Drive overload	#	Def: Coast Stop	Read and Write	All	2	Yes
36.19	AW2.02	AW2.02	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

36 - ALARM SETTINGS

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
36.20	AW2.03	AW2.03	#	Def: Off	Read and Write	All	2	Yes
36.21	Underload	AW2.04 - Underload	#	Def: Warning	Read and Write	All	2	Yes
36.22	Fluxup Timeout	AW2.05 - Fluxup timeout	#	Def: Warning	Read and Write	All	2	Yes
36.23	Max Current Limit	AW2.06 - Load current exceeded the maximum limit	#	Def: Off	Read and Write	All	2	Yes
36.24	Speed Deviation	AW2.07 - Speed deviation	#	Def: Warning	Read and Write	All	2	Yes
36.25	Overspeed	AW2.08 - Overspeed	#	Def: Coast Stop	Read and Write	All	2	Yes
36.27	DSP Init Error	AW2.10 - DSP initialization error	#	Def: Coast Stop	Read Only	All	2	Yes
36.28	DSP Par Error	AW2.11 - DSP parameters change error	#	Def: Warning	Read and Write	All	2	Yes
36.29	DC UV Control Limit	AW2.12 - DC link undervoltage control limit	#	Def: Off	Read and Write	All	2	Yes
36.30	DC OV Control Limit	AW2.13 - DC link overvoltage control limit	#	Def: Warning	Read and Write	All	2	Yes
36.31	AW2.14	AW2.14	#	Def: Off	Read and Write	All	2	Yes
36.32	ADC AutoCal	AW2.15 - ADC auto-calibration failed	#	Def: Coast Stop	Read and Write	All	2	Yes
36.33	FlyStart Error	AW3.00 - FlyStart search failed or AC line synchro-nization	#	Def: Coast Stop	Read and Write	All	2	Yes
36.35	AW3.02	AW3.02	#	Def: Off	Read and Write	All	2	Yes
36.36	AW3.03	AW3.03	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

36 - ALARM SETTINGS

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
36.37	AW3.04	AW3.04	#	Def: Off	Read and Write	All	2	Yes
36.38	AW3.05	AW3.05	#	Def: Off	Read and Write	All	2	Yes
36.39	AI Monitor 1 Alarm	AW3.06 - Alarm generated by AI Monitor 1	#	Def: Off	Read and Write	All	2	Yes
36.40	AI Monitor 2 Alarm	AW3.07 - Alarm generated by AI Monitor 2	#	Def: Off	Read and Write	All	2	Yes
36.41	AI Loss	AW3.08 - AI Loss	#	Def: Warning	Read and Write	All	2	Yes
36.42	Logic Alarm	AW3.09 - Alarm generated by logic function	#	Def: Off	Read and Write	All	2	Yes
36.43	GWMaxTime	AW3.10 - Grid Waiting Maximum Time	#	Def: Coast Stop	Read and Write	All	2	Yes
36.46	Prs PID Fdb Loss	AW3.13 - Process PID Feedback Loss	#	Def: Warning	Read and Write	All	2	Yes
36.47	Soft Fill Timeout	AW3.14 - Soft Fill Timeout	#	Def: Warning	Read and Write	All	2	Yes
36.49	Profibus Error	AW4.00 - Profibus error	#	Def: Coast Stop	Read and Write	All	2	Yes
36.50	Modbus Slave Error	AW4.01 - Modbus slave error	#	Def: Coast Stop	Read and Write	All	2	Yes
36.51	Bad Par	AW4.02 - Bad parameter	#	Def: Off	Read and Write	All	2	Yes
36.52	MCU - DSP Timeout	AW4.03 - MCU-->DSP timeout	#	Def: Coast Stop	Read and Write	All	2	Yes
36.53	MCU - DSP Sync Error	AW4.04 - MCU-->DSP sync error	#	Def: Warning	Read and Write	All	2	Yes
36.54	Frost Protection	AW4.05 - Frost Protection	#	Def: Warning	Read and Write	All	2	Yes

PREVIOUS VIEW

36 - ALARM SETTINGS

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
36.55	WDD Sleep Mode	AW4.06 - Well Draw Down Sleep Mode	#	Def: Warning	Read and Write	All	2	Yes
36.56	Low City Pressure	AW4.07 - Low City Pressure	#	Def: Warning	Read and Write	All	2	Yes
36.57	Motor Switch	AW4.08 - Motor Switch	#	Def: Warning	Read and Write	All	2	Yes
36.58	Fdb Monitor	AW4.09 - Feedback Supervision	#	Def: Warning	Read and Write	All	2	Yes
36.59	In Press Monitor Thres1	AW4.10 - Input Pressure Supervision Threshold 1	#	Def: Warning	Read and Write	All	2	Yes
36.60	In Press Monitor Thres2	AW4.11 - Input Pressure Supervision Threshold 2	#	Def: Warning	Read and Write	All	2	Yes
36.61	AutoClean Curr Thres	AW4.12 - Auto-Cleaning Current Threshold	#	Def: Warning	Read and Write	All	2	Yes
36.62	AW4.13	AW4.13	#	Def: Off	Read and Write	All	2	Yes
36.63	AW4.14	AW4.14	#	Def: Off	Read and Write	All	2	Yes
36.64	AW4.15	AW4.15	#	Def: Off	Read and Write	All	2	Yes
36.65	Power Off if HW Fault	Forces a new precharge sequence after any HW trip (Alarm Word 1) - Off [0] - On [1]	#	Def: Off	Read and Write	All	1	Yes
36.66	AutoReset VminSupply	Enables the automatic reset of VminSupply fault at Drive power-on - Off [0] - On [1]	#	Def: On	Write at Stop Only	All	2	Yes
36.67	AutoReset VdcUV/ACSup	Enables the automatic reset of VdcUV or AC-Supply faults at Drive power-on - Off [0] - On [1]	#	Def: Off	Write at Stop Only	All	2	Yes

PREVIOUS VIEW

A-20 JOG/FLUSHING

41 - JOG/FLUSHING								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
41.01	Jog En	Enable use of Jog macro - Off [0] - On [1	#	Def: Off	Read and Write	All	2	Yes
41.02	Jog 1 Speed Ref	Jog 1 setpoint	pu	Min: -0.5 Def: 0.05 Max: 0.5	Read and Write	All	2	Yes
41.03	Jog 2 Speed Ref	Jog 2 setpoint	pu	Min: -0.5 Def: 0.02 Max: 0.5	Read and Write	All	2	Yes
41.04	Jog Time 1	Jog 1 ramp time	s	Min: 0 Def: 2 Max: 60	Read and Write	All	2	Yes
41.05	Jog Time 2	Jog 2 ramp time	s	Min: 0 Def: 2 Max: 60	Read and Write	All	2	Yes
41.06	Jog 1 Cmd Sel	Jog 1 command selection - Off [0] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17] - CW1.08 [13]	#	Def: Off	Read and Write	All	2	Yes
41.07	Jog 2 Cmd Sel	Jog 2 command selection	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

A-21 DIGIT. POTENTIOMETER

42 - DIGIT. POTENTIOMETER								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
42.01	DigPot Enable	Digital Potentiometer Enable - Off [0] - On [1]	#	Def: Off	Write at Stop Only	All	2	Yes
42.02	DigPot Neg Range En	Digital Potentiometer Negative Range Enable - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
42.03	DigPot Step Up	Digital Potentiometer Step Up	pu	Min: 0.001 Def: 0.01 Max: 1	Read and Write	All	2	Yes
42.04	DigPot Step Down	Digital Potentiometer Step Down	pu	Min: 0.001 Def: 0.01 Max: 1	Read and Write	All	2	Yes
42.05	DigPot Pos Lim	Digital Potentiometer Positive Limit - Off [0] - On [1]	pu	Min: 0 Def: 2 Max: 2	Read and Write	All	2	Yes
42.06	DigPot Neg Lim	Digital Potentiometer Negative Limit	pu	Min: -2 Def: -2 Max: 0	Read and Write	All	2	Yes

PREVIOUS VIEW

42 - DIGIT. POTENTIOMETER

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
42.07	DigPot Up Cmd Sel	Digital Potentiometer Up Command Selection - Off [0] - On [1] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17] - CW1.12 [9] - CW1.13 [10] - CW1.14 [11] - CW1.15 [12] - CW4.00 [13]	#	Def: Off	Read and Write	All	2	Yes
42.08	DigPot Down Cmd Sel	Digital Potentiometer Down Command Selection - Off [0] - On [1] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17] - CW1.12 [9] - CW1.13 [10] - CW1.14 [11] - CW1.15 [12] - CW4.01 [13]	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

42 - DIGIT. POTENTIOMETER								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
42.09	DigPot Cmd Delay	Digital Potentiometer Command Delay	s	Min: 1 Def: 1 Max: 10	Read and Write	All	2	Yes
42.10	DigPot Up/Dw Ramp Time	Digital Potentiometer Up/Down Ramp Time	s	Min: 0 Def: 1 Max: 100	Read and Write	All	2	Yes
42.11	DigPot Clear Cmd Sel	Digital Potentiometer Clear Command Selection - Off [0] - On [1] - ME25:DI-02 [2] - ME22:DI-03 [3] - ME23:DI-04 [4] - ME24:DI-05 [5] - ME38:DI-06 (Option) [6] - ME39:DI-07 (Option) [7] - ME40:DI-08 (Option) [8] - ME42:DI-09 (Option) [14] - ME43:DI-10 (Option) [15] - ME44:DI-11 (Option) [16] - ME45:DI-12 (Option) [17] - CW1.12 [9] - CW1.13 [10] - CW1.14 [11] - CW1.15 [12] - CW4.02 [13]	#	Def: Off	Read and Write	All	2	Yes
42.12	DigPot Aux-Main Track	Digital Potentiometer Auxilary-Main Reference Tracking - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
42.13	DigPot Mem Ref En	Digital Potentiometer Memorized Reference Enable	#	Def: Off	Read and Write	All	2	Yes
42.14	DigPot Mem Ref Value	Digital Potentiometer Memorized Reference Value	pu	Min: -2 Def: 0 Max: 2	Read Only	All	2	No

PREVIOUS VIEW

A-22 PROCESS PID

45 - PROCESS PID								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
45.01	PID Enable	Enables/disables PID regulator - Off [0] - On [1]	#	Def: Off	Write at Stop Only	All	3	Yes
45.02	PID Proportional Gain	PID regulator proportional gain	#	Min: 0 Def: 1 Max: 100	Read and Write	All	3	Yes
45.03	PID Integral Time	PID regulator integral time (Ti=0s, disable)	s	Min: 0 Def: 0.1 Max: 100	Read and Write	All	3	Yes
45.04	PID Derivative Time	PID regulator derivative time	s	Min: 0 Def: 0 Max: 100	Read and Write	All	3	Yes
45.05	PID Upper Limit	PID regulator output upper limit	pu	Min: 0 Def: 1 Max: 1	Read and Write	All	3	Yes
45.06	PID Lower Limit	PID regulator output lower limit	pu	Min: -1 Def: -1 Max: 0	Read and Write	All	3	Yes
45.07	PID Hysteresis Upper	PID Upper threshold for automatic start/stop command	pu	Min: -1 Def: 1 Max: 1	Read and Write	All	3	Yes
45.08	PID Hysteresis Lower	PID Lower threshold for automatic start/stop command	pu	Min: -1 Def: -1 Max: 1	Read and Write	All	3	Yes
45.09	PID Pump Type Sel 1	PID Error Calculation Selection 1 (Main) - Lift [0] - Force [1]	#	Def: Lift	Read and Write	All	3	Yes
45.10	PID Fixed Ref 1	PID Fixed Reference 1 (Main)	pu	Min: -1 Def: 0 Max: 1	Read and Write	All	3	Yes

PREVIOUS VIEW

45 - PROCESS PID								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
45.11	PID Ref Src Sel 1	PID Reference Source Selection 1 (Main) - Off [0] - Fixed [1] - AI1 [2] - AI2 [3] - AI3 (Option) [4] - AI4 (Option) [5] - Profibus [6] - Modbus [7]	#	Def: Off	Read and Write	All	3	Yes
45.12	PID Fdb Src Sel 1	PID Feedback Source Selection 1 (Main) - Off [0] - AI1 [2] - AI2 [3] - AI3 (Option) [4] - AI4 (Option) [5] - Profibus [6] - Modbus [7]	#	Def: Off	Read and Write	All	3	Yes
45.13	PID Pump Type Sel 2	PID Error Calculation Selection 2 (Aux) - Lift [0] - Force [1]	#	Def: Lift	Read and Write	All	3	Yes
45.14	PID Fixed Ref 2	PID Fixed Reference 2 (Aux)	pu	Min: -1 Def: 0 Max: 1	Read and Write	All	3	Yes
45.15	PID Ref Src Sel 2	PID Reference Source Selection 2 (Aux) - Off [0] - Fixed [1] - AI1 [2] - AI2 [3] - AI3 (Option) [4] - AI4 (Option) [5] - Profibus [6] - Modbus [7]	#	Def: Off	Read and Write	All	3	Yes
45.16	PID Fdb Src Sel 2	PID Feedback Source Selection 2 (Aux) - Off [0] - AI1 [2] - AI2 [3] - AI3 (Option) [4] - AI4 (Option) [5] - Profibus [6] - Modbus [7]	#	Def: Off	Read and Write	All	3	Yes

PREVIOUS VIEW

45 - PROCESS PID								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
45.17	PID Mode Sel	PID function mode selection - Continuous [0] - On/Off [1] - Both [2]	#	Def: Continuous	Read and Write	All	3	Yes
45.20	Motor Pause Enable	Motor Pause Enable - Off [0] - On [1]	#	Def: Off	Write at Stop Only	All	3	Yes
45.21	Motor Pause Curr Limit	Motor Pause Current Limit	%	Min: 0 Def: 10 Max: 100	Read and Write	All	3	Yes
45.22	Motor Pause Time Limit	Motor Pause Time Limit	s	Min: 0 Def: 10 Max: 1000	Read and Write	All	3	Yes
45.23	Motor Pause Fdb Thres	Motor Pause Feedback Threshold	pu	Min: -1 Def: 0 Max: 1	Read and Write	All	3	Yes
45.30	Aux Pumps Enable	Auxiliary Pumps Enable - Off [0] - On [1]	#	Def: Off	Read and Write	All	3	Yes
45.31	Aux Pumps Off Thres	Auxiliary Pumps switch-off threshold	pu	Min: 0 Def: 0.1 Max: 1	Read and Write	All	3	Yes
45.32	Aux Pumps On Thres	Auxiliary Pumps switch-on threshold	pu	Min: 0 Def: 0.1 Max: 1	Read and Write	All	3	Yes
45.33	Aux Pumps Off Wait	Auxiliary Pumps Waiting time for next pump off	s	Min: 1 Def: 5 Max: 300	Read and Write	All	3	Yes
45.34	Aux Pumps On Wait	Auxiliary Pumps Waiting time for next pump on	s	Min: 1 Def: 5 Max: 300	Read and Write	All	3	Yes
45.35	Aux Pumps Number	Auxiliary Pumps Number	#	Min: 1 Def: 1 Max: 6	Read and Write	All	3	Yes

PREVIOUS VIEW

45 - PROCESS PID								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
45.40	Soft Fill Mode	Soft Fill Mode - Off [0] - Horizontal mode [1] - Vertical simple mode [2] - Vertical complex mode [3]	#	Def: Off	Write at Stop Only	All	3	Yes
45.41	Soft Fill Timeout	Soft Fill Timeout	s	Min: 0 Def: 5 Max: 100	Read and Write	All	3	Yes
45.42	Soft Fill Threshold	Soft Fill Threshold (Pressure, Flow, Level)	pu	Min: -2 Def: 0 Max: 2	Read and Write	All	3	Yes
45.43	Soft Fill Band	Soft Fill Band	pu	Min: 0 Def: 0.05 Max: 2	Read and Write	All	3	Yes
45.44	Soft Fill Ramp Time	Soft Fill Ramp Time	s	Min: 0 Def: 1 Max: 100	Read and Write	All	3	Yes
45.50	WDD Enable	Well Draw Down Enable - Off [0] - On [1]	#	Def: Off	Write at Stop Only	All	3	Yes
45.51	WDD Threshold 1	Well Draw Down Threshold 1	pu	Min: 0 Def: 0 Max: 2	Read and Write	All	3	Yes
45.52	WDD Timeout 1	Well Draw Down Timeout 1	s	Min: 0 Def: 5 Max: 100	Read and Write	All	3	Yes
45.53	WDD Threshold 2	Well Draw Down Threshold 2	pu	Min: 0 Def: 0 Max: 2	Read and Write	All	3	Yes
45.54	WDD Timeout 2	Well Draw Down Timeout 2	s	Min: 0 Def: 5 Max: 100	Read and Write	All	3	Yes
45.55	WDD Threshold 3	Well Draw Down Threshold 3	pu	Min: 0 Def: 0 Max: 2	Read and Write	All	3	Yes

PREVIOUS VIEW

45 - PROCESS PID								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
45.56	WDD Timeout 3	Well Draw Down Timeout 3	s	Min: 0 Def: 5 Max: 100	Read and Write	All	3	Yes
45.60	Fdb Mon Enable	Feedback Supervision Enable - Off [0] - On [1]	#	Def: Off	Write at Stop Only	All	3	Yes
45.61	Fdb Mon Low Lim	Feedback Supervision Lower Limit (Delta between Prs PID Ref and threshold)	pu	Min: 0 Def: 0.05 Max: 2	Read and Write	All	3	Yes
45.62	Fdb Mon Up Lim	Feedback Supervision Upper Limit (Delta between Prs PID Ref and threshold)	pu	Min: 0 Def: 0.05 Max: 2	Read and Write	All	3	Yes
45.63	Fdb Mon Timeout	Feedback Supervision Timeout	s	Min: 0 Def: 5 Max: 300	Read and Write	All	3	Yes
45.70	In Press Mon Enable	Input Pressure Supervision Enable - Off [0] - On [1]	#	Def: Off	Write at Stop Only	All	3	Yes
45.71	In Press Mon Alm Thres	Input Pressure Supervision Alarm Threshold	pu	Min: 0 Def: 0 Max: 2	Read and Write	All	3	Yes
45.72	In Press Mon Trip Thres	Input Pressure Supervision Trip Threshold	pu	Min: 0 Def: 0 Max: 2	Read and Write	All	3	Yes
45.73	In Press Mon Ref Delta	Input Pressure Supervision Reference Delta	pu	Min: 0 Def: 0 Max: 2	Read and Write	All	3	Yes

PREVIOUS VIEW

45 - PROCESS PID								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
45.80	Dead Band Enable	Dead Band Enable - Off [0] - On [1]	#	Def: Off	Write at Stop Only	All	3	Yes
45.81	Dead Band Low Lim	Dead Band Lower Limit (Delta between Prs PID Fdb and threshold)	pu	Min: 0 Def: 0.05 Max: 2	Read and Write	All	3	Yes
45.82	Dead Band Up Lim	Dead Band Upper Limit (Delta between Prs PID Fdb and threshold)	pu	Min: 0 Def: 0.05 Max: 2	Read and Write	All	3	Yes
45.83	Dead Band Time Delay	Dead Band Time Delay	s	Min: 0 Def: 5 Max: 300	Read and Write	All	3	Yes

PREVIOUS VIEW

A-23 FAULT HISTORY

59 - FAULT HISTORY								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
59.65	Clear Fault Log	Clear Fault Log - Off [0] - Clear log [1]	#	Def: Off	Read and Write	All	1	No

PREVIOUS VIEW

A-24 TRACE SETTINGS

66 - TRACE SETTINGS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
66.01	Trace Enable	Enables the trace - Off [0] - On - Trigger A [1] - On - Trigger B [2] - On - Trig A OR Trig B [3]	#		Read and Write	All	1	Yes
66.02	Trace Restart	Selection of command for restarting the trace - Alarm Reset [510607] - CW1.12 [510612] - CW1.13 [510613] - CW1.14 [510614] - CW1.15 [510615]	#		Read and Write	All	1	Yes
66.03	Trigger Position	Trigger position in the buffer	%		Read and Write	All	1	Yes
66.04	Sampling Time	Time interval between two samples - 1 [1] - 2 [2] - 5 [5] - 10 [10] - 20 [20] - 50 [50] - 100 [100] - 200 [200] - 500 [500] - 1000 [1000] - 2000 [2000] - 5000 [5000]	ms		Read and Write	All	1	Yes
66.05	Trigger A - Type	Selection of the trigger A type - Fault [0] - Level 1 - Rising [1] - Level 1 - Falling [2] - Out of band [3] - Bit-Mask (0->1) [4] - Bit-Mask (1->0) [5] - Forced [6]	#		Read and Write	All	1	Yes
66.06	Trigger A - Variable	ID of the variable linked to the trigger A	#		Read and Write	All	1	Yes
66.07	Trigger A - Level 1	Trigger A level 1	#		Read and Write	All	1	Yes

PREVIOUS VIEW

66 - TRACE SETTINGS

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
66.08	Trigger A - Level 2	Trigger A level 2	#		Read and Write	All	1	Yes
66.09	Trigger A - Mask	Mask applied to trigger A variable to build the signal trigger	#		Read and Write	All	1	Yes
66.10	Samples Number	Number of samples to be recorded	#		Read and Write	All	1	Yes
66.11	Trigger B - Type	Selection of the trigger B type - Fault [0] - Level 1 - Rising [1] - Level 1 - Falling [2] - Out of band [3] - Bit-Mask (0->1) [4] - Bit-Mask (1->0) [5] - Forced [6]	#		Read and Write	All	1	Yes
66.12	Trigger B - Variable	ID of the variable linked to the trigger B	#		Read and Write	All	1	Yes
66.13	Trigger B - Level 1	Trigger B level 1	#		Read and Write	All	1	Yes
66.14	Trigger B - Level 2	Trigger B level 2	#		Read and Write	All	1	Yes
66.15	Trigger B - Mask	Mask applied to trigger B variable to build the signal trigger	#		Read and Write	All	1	Yes
66.20	Trace Signal 0	ID of the sampling variable in channel 0	#		Read and Write	All	1	Yes
66.21	Trace Signal 1	ID of the sampling variable in channel 1	#		Read and Write	All	1	Yes
66.22	Trace Signal 2	ID of the sampling variable in channel 2	#		Read and Write	All	1	Yes
66.23	Trace Signal 3	ID of the sampling variable in channel 3	#		Read and Write	All	1	Yes

PREVIOUS VIEW

66 - TRACE SETTINGS

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
66.24	Trace Signal 4	ID of the sampling variable in channel 4	#		Read and Write	All	1	Yes
66.25	Trace Signal 5	ID of the sampling variable in channel 5	#		Read and Write	All	1	Yes
66.26	Trace Signal 6	ID of the sampling variable in channel 6	#		Read and Write	All	1	Yes
66.27	Trace Signal 7	ID of the sampling variable in channel 7	#		Read and Write	All	1	Yes
66.28	Trace Signal 8	ID of the sampling variable in channel 8	#		Read and Write	All	1	Yes
66.29	Trace Signal 9	ID of the sampling variable in channel 9	#		Read and Write	All	1	Yes
66.51	Trace status	Trace Status - Trace disabled/undef [0] - Running & wait trig. [1] - Defined & wait start [2] - Trace stopped [3] - Trace parameter error [4] - Trace wait post trig [5] - Trigger reached [64] - Trace completed [128]	#		Read Only	All	1	No
66.52	Trigger Time Stamp	Time Stamp of the trigger signal	#		Read Only	All	1	No

PREVIOUS VIEW

A-25 PROFIBUS

81 - PROFIBUS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
81.01	Profibus En	Profibus Enable - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
81.02	Slave Address	Slave address	#	Min: 3 Def: 3 Max: 127	Read and Write	All	2	Yes
81.03	Timeout	Timeout	s	Min: 0.01 Def: 0.01 Max: 10	Read and Write	All	2	Yes
81.04	Freeze En	Enable freeze of Speed Ref/Cmd Wd - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
81.05	Delay Com Restore	Delay for communication restore	s	Min: 0 Def: 0 Max: 10	Read and Write	All	2	Yes
81.20	PPO Type	Selection of PPO type - PPO1 [1] - PPO2 [2] - PPO3 [3] - PPO4 [4] - PPO5 [5]	#	Def: PPO5	Read and Write	All	2	Yes
81.21	IPZ03 Sel	IPZ03 selection - Off [0] - Aux Speed Ref [1] - Add Speed Ref [2] - Speed Feedforward [3] - Cmd Wd 2 [4] - Cmd Wd 3 [5] - Cmd Wd 4 [6] - Torque Lim Ref Pos [7] - Torque Lim Ref Neg [8] - Torque Ref [9] - Torque FeedForward [21] - 1 Analog Output [12] - 2 Analog Output [13] - PrsPIDRef1 [65] - PrsPIDFdb1 [66] - PrsPIDRef2 [67] - PrsPIDFdb2 [68]	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

81 - PROFIBUS

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
81.22	IPZ04 Sel	IPZ04 selection	#	Def: Off	Read and Write	All	2	Yes
81.23	IPZ05 Sel	IPZ05 selection	#	Def: Off	Read and Write	All	2	Yes
81.24	IPZ06 Sel	IPZ06 selection	#	Def: Off	Read and Write	All	2	Yes
81.25	IPZ07 Sel	IPZ07 selection	#	Def: Off	Read and Write	All	2	Yes
81.26	IPZ08 Sel	IPZ08 selection	#	Def: Off	Read and Write	All	2	Yes
81.27	IPZ09 Sel	IPZ09 selection	#	Def: Off	Read and Write	All	2	Yes
81.28	IPZ10 Sel	IPZ10 selection	#	Def: Off	Read and Write	All	2	Yes
81.31	OPZ03 Sel	OPZ03 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
81.32	OPZ04 Sel	OPZ04 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
81.33	OPZ05 Sel	OPZ05 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
81.34	OPZ06 Sel	OPZ06 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
81.35	OPZ07 Sel	OPZ07 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes

PREVIOUS VIEW

81 - PROFIBUS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
81.36	OPZ08 Sel	OPZ08 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
81.37	OPZ09 Sel	OPZ09 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
81.38	OPZ10 Sel	OPZ10 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes

PREVIOUS VIEW

A-26 MODBUS

82 - MODBUS								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
82.01	Modbus En	Modbus enable - Off [0] - RTU [1] - TCP/IP [2] - RTU & TCP/IP [3]	#		Read and Write	All	2	Yes
82.02	Slave Address	Slave address	#		Read and Write	All	2	Yes
82.03	RTU Baud Rate	Baud rate - 300 [300] - 600 [600] - 1200 [1200] - 2400 [2400] - 4800 [4800] - 9600 [9600] - 19200 [19200] - 28800 [28800] - 38400 [38400] - 57600 [57600] - 115200 [115200]	#		Read and Write	All	2	Yes
82.04	RTU Parity Type	Parity type - None + 1 Stop bit [0] - None + 2 Stop bit [1] - Even [2] - Odd [3]	#		Read and Write	All	2	Yes
82.05	RTU Timeout	Timeout for alarm 53 (0 = disabled)	s		Read and Write	All	2	Yes
82.06	Min Slave Reaction Time	Minimum slave reaction time	ms		Read and Write	All	2	Yes
82.07	Mod Exchange Area In	Selection of input auxiliary exchange area (from Modbus to Drive) - Off [0] - 1 Data Exchange Area [1] - 2 Data Exchange Area [2]	#		Read and Write	All	2	Yes

PREVIOUS VIEW

A-27 EXCH AREA 1/2 CONFIG

87 - EXCH AREA 1/2 CONFIG								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
87.01	En Exch Area 1/2 Config	Enables the configuration of exchange area 1 and 2 - Off [0] - En Area 1 In [1] - En Area 2 Out [2] - En Area 1 In & 2 Out [3]	#	Def: Off	Read and Write	All	2	Yes
87.04	Area 1 Input Wd 01 Sel	Area 1 Input Word 01 selection - Off [0] - Main Speed Ref [98] - Aux Speed Ref [1] - Add Speed Ref [2] - Speed Feedforward [3] - Cmd Wd 1 [99] - Cmd Wd 2 [4] - Cmd Wd 3 [5] - Cmd Wd 4 [6] - Torque Lim Ref Pos [7] - Torque Lim Ref Neg [8] - Torque Ref [9] - Torque FeedForward [21] - 1 Analog Output [12] - 2 Analog Output [13] - PrsPIDRef1 [65] - PrsPIDFdb1 [66] - PrsPIDRef2 [67] - PrsPIDFdb2 [68]	#	Def: Off	Read and Write	All	2	Yes
87.05	Area 1 Input Wd 02 Sel	Area 1 Input Word 02 selection - Off [0] - Main Speed Ref [98] - Aux Speed Ref [1] - Add Speed Ref [2] - Speed Feedforward [3] - Cmd Wd 1 [99] - Cmd Wd 2 [4] - Cmd Wd 3 [5] - Cmd Wd 4 [6] - Torque Lim Ref Pos [7] - Torque Lim Ref Neg [8] - Torque Ref [9] - Torque FeedForward [21] - 1 Analog Output [12] - 2 Analog Output [13] - PrsPIDRef1 [65] - PrsPIDFdb1 [66] - PrsPIDRef2 [67] - PrsPIDFdb2 [68]	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

87 - EXCH AREA 1/2 CONFIG

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
87.06	Area 1 Input Wd 03 Sel	Area 1 Input Word 03 selection - Off [0] - Main Speed Ref [98] - Aux Speed Ref [1] - Add Speed Ref [2] - Speed Feedforward [3] - Cmd Wd 1 [99] - Cmd Wd 2 [4] - Cmd Wd 3 [5] - Cmd Wd 4 [6] - Torque Lim Ref Pos [7] - Torque Lim Ref Neg [8] - Torque Ref [9] - Torque FeedForward [21] - 1 Analog Output [12] - 2 Analog Output [13] - PrsPIDRef1 [65] - PrsPIDFdb1 [66] - PrsPIDRef2 [67] - PrsPIDFdb2 [68]	#	Def: Off	Read and Write	All	2	Yes
87.07	Area 1 Input Wd 04 Sel	Area 1 Input Word 04 selection - Off [0] - Main Speed Ref [98] - Aux Speed Ref [1] - Add Speed Ref [2] - Speed Feedforward [3] - Cmd Wd 1 [99] - Cmd Wd 2 [4] - Cmd Wd 3 [5] - Cmd Wd 4 [6] - Torque Lim Ref Pos [7] - Torque Lim Ref Neg [8] - Torque Ref [9] - Torque FeedForward [21] - 1 Analog Output [12] - 2 Analog Output [13] - PrsPIDRef1 [65] - PrsPIDFdb1 [66] - PrsPIDRef2 [67] - PrsPIDFdb2 [68]	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

87 - EXCH AREA 1/2 CONFIG

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
87.08	Area 1 Input Wd 05 Sel	Area 1 Input Word 05 selection - Off [0] - Main Speed Ref [98] - Aux Speed Ref [1] - Add Speed Ref [2] - Speed Feedforward [3] - Cmd Wd 1 [99] - Cmd Wd 2 [4] - Cmd Wd 3 [5] - Cmd Wd 4 [6] - Torque Lim Ref Pos [7] - Torque Lim Ref Neg [8] - Torque Ref [9] - Torque FeedForward [21] - 1 Analog Output [12] - 2 Analog Output [13] - PrsPIDRef1 [65] - PrsPIDFdb1 [66] - PrsPIDRef2 [67] - PrsPIDFdb2 [68]	#	Def: Off	Read and Write	All	2	Yes
87.09	Area 1 Input Wd 06 Sel	Area 1 Input Word 06 selection - Off [0] - Main Speed Ref [98] - Aux Speed Ref [1] - Add Speed Ref [2] - Speed Feedforward [3] - Cmd Wd 1 [99] - Cmd Wd 2 [4] - Cmd Wd 3 [5] - Cmd Wd 4 [6] - Torque Lim Ref Pos [7] - Torque Lim Ref Neg [8] - Torque Ref [9] - Torque FeedForward [21] - 1 Analog Output [12] - 2 Analog Output [13] - PrsPIDRef1 [65] - PrsPIDFdb1 [66] - PrsPIDRef2 [67] - PrsPIDFdb2 [68]	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

87 - EXCH AREA 1/2 CONFIG

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
87.10	Area 1 Input Wd 07 Sel	Area 1 Input Word 07 selection - Off [0] - Main Speed Ref [98] - Aux Speed Ref [1] - Add Speed Ref [2] - Speed Feedforward [3] - Cmd Wd 1 [99] - Cmd Wd 2 [4] - Cmd Wd 3 [5] - Cmd Wd 4 [6] - Torque Lim Ref Pos [7] - Torque Lim Ref Neg [8] - Torque Ref [9] - Torque FeedForward [21] - 1 Analog Output [12] - 2 Analog Output [13] - PrsPIDRef1 [65] - PrsPIDFdb1 [66] - PrsPIDRef2 [67] - PrsPIDFdb2 [68]	#	Def: Off	Read and Write	All	2	Yes
87.11	Area 1 Input Wd 08 Sel	Area 1 Input Word 08 selection - Off [0] - Main Speed Ref [98] - Aux Speed Ref [1] - Add Speed Ref [2] - Speed Feedforward [3] - Cmd Wd 1 [99] - Cmd Wd 2 [4] - Cmd Wd 3 [5] - Cmd Wd 4 [6] - Torque Lim Ref Pos [7] - Torque Lim Ref Neg [8] - Torque Ref [9] - Torque FeedForward [21] - 1 Analog Output [12] - 2 Analog Output [13] - PrsPIDRef1 [65] - PrsPIDFdb1 [66] - PrsPIDRef2 [67] - PrsPIDFdb2 [68]	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

87 - EXCH AREA 1/2 CONFIG

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
87.12	Area 1 Input Wd 09 Sel	Area 1 Input Word 09 selection - Off [0] - Main Speed Ref [98] - Aux Speed Ref [1] - Add Speed Ref [2] - Speed Feedforward [3] - Cmd Wd 1 [99] - Cmd Wd 2 [4] - Cmd Wd 3 [5] - Cmd Wd 4 [6] - Torque Lim Ref Pos [7] - Torque Lim Ref Neg [8] - Torque Ref [9] - Torque FeedForward [21] - 1 Analog Output [12] - 2 Analog Output [13] - PrsPIDRef1 [65] - PrsPIDFdb1 [66] - PrsPIDRef2 [67] - PrsPIDFdb2 [68]	#	Def: Off	Read and Write	All	2	Yes
87.13	Area 1 Input Wd 10 Sel	Area 1 Input Word 10 selection - Off [0] - Main Speed Ref [98] - Aux Speed Ref [1] - Add Speed Ref [2] - Speed Feedforward [3] - Cmd Wd 1 [99] - Cmd Wd 2 [4] - Cmd Wd 3 [5] - Cmd Wd 4 [6] - Torque Lim Ref Pos [7] - Torque Lim Ref Neg [8] - Torque Ref [9] - Torque FeedForward [21] - 1 Analog Output [12] - 2 Analog Output [13] - PrsPIDRef1 [65] - PrsPIDFdb1 [66] - PrsPIDRef2 [67] - PrsPIDFdb2 [68]	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

87 - EXCH AREA 1/2 CONFIG

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
87.14	Area 1 Input Wd 11 Sel	Area 1 Input Word 11 selection - Off [0] - Main Speed Ref [98] - Aux Speed Ref [1] - Add Speed Ref [2] - Speed Feedforward [3] - Cmd Wd 1 [99] - Cmd Wd 2 [4] - Cmd Wd 3 [5] - Cmd Wd 4 [6] - Torque Lim Ref Pos [7] - Torque Lim Ref Neg [8] - Torque Ref [9] - Torque FeedForward [21] - 1 Analog Output [12] - 2 Analog Output [13] - PrsPIDRef1 [65] - PrsPIDFdb1 [66] - PrsPIDRef2 [67] - PrsPIDFdb2 [68]	#	Def: Off	Read and Write	All	2	Yes
87.15	Area 1 Input Wd 12 Sel	Area 1 Input Word 12 selection - Off [0] - Main Speed Ref [98] - Aux Speed Ref [1] - Add Speed Ref [2] - Speed Feedforward [3] - Cmd Wd 1 [99] - Cmd Wd 2 [4] - Cmd Wd 3 [5] - Cmd Wd 4 [6] - Torque Lim Ref Pos [7] - Torque Lim Ref Neg [8] - Torque Ref [9] - Torque FeedForward [21] - 1 Analog Output [12] - 2 Analog Output [13] - PrsPIDRef1 [65] - PrsPIDFdb1 [66] - PrsPIDRef2 [67] - PrsPIDFdb2 [68]	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

87 - EXCH AREA 1/2 CONFIG

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
87.16	Area 1 Input Wd 13 Sel	Area 1 Input Word 13 selection - Off [0] - Main Speed Ref [98] - Aux Speed Ref [1] - Add Speed Ref [2] - Speed Feedforward [3] - Cmd Wd 1 [99] - Cmd Wd 2 [4] - Cmd Wd 3 [5] - Cmd Wd 4 [6] - Torque Lim Ref Pos [7] - Torque Lim Ref Neg [8] - Torque Ref [9] - Torque FeedForward [21] - 1 Analog Output [12] - 2 Analog Output [13] - PrsPIDRef1 [65] - PrsPIDFdb1 [66] - PrsPIDRef2 [67] - PrsPIDFdb2 [68]	#	Def: Off	Read and Write	All	2	Yes
87.17	Area 1 Input Wd 14 Sel	Area 1 Input Word 14 selection - Off [0] - Main Speed Ref [98] - Aux Speed Ref [1] - Add Speed Ref [2] - Speed Feedforward [3] - Cmd Wd 1 [99] - Cmd Wd 2 [4] - Cmd Wd 3 [5] - Cmd Wd 4 [6] - Torque Lim Ref Pos [7] - Torque Lim Ref Neg [8] - Torque Ref [9] - Torque FeedForward [21] - 1 Analog Output [12] - 2 Analog Output [13] - PrsPIDRef1 [65] - PrsPIDFdb1 [66] - PrsPIDRef2 [67] - PrsPIDFdb2 [68]	#	Def: Off	Read and Write	All	2	Yes

PREVIOUS VIEW

87 - EXCH AREA 1/2 CONFIG

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
87.18	Area 1 Input Wd 15 Sel	Area 1 Input Word 15 selection - Off [0] - Main Speed Ref [98] - Aux Speed Ref [1] - Add Speed Ref [2] - Speed Feedforward [3] - Cmd Wd 1 [99] - Cmd Wd 2 [4] - Cmd Wd 3 [5] - Cmd Wd 4 [6] - Torque Lim Ref Pos [7] - Torque Lim Ref Neg [8] - Torque Ref [9] - Torque FeedForward [21] - 1 Analog Output [12] - 2 Analog Output [13] - PrsPIDRef1 [65] - PrsPIDFdb1 [66] - PrsPIDRef2 [67] - PrsPIDFdb2 [68]	#	Def: Off	Read and Write	All	2	Yes
87.19	Area 1 Input Wd 16 Sel	Area 1 Input Word 16 selection - Off [0] - Main Speed Ref [98] - Aux Speed Ref [1] - Add Speed Ref [2] - Speed Feedforward [3] - Cmd Wd 1 [99] - Cmd Wd 2 [4] - Cmd Wd 3 [5] - Cmd Wd 4 [6] - Torque Lim Ref Pos [7] - Torque Lim Ref Neg [8] - Torque Ref [9] - Torque FeedForward [21] - 1 Analog Output [12] - 2 Analog Output [13] - PrsPIDRef1 [65] - PrsPIDFdb1 [66] - PrsPIDRef2 [67] - PrsPIDFdb2 [68]	#	Def: Off	Read and Write	All	2	Yes
87.52	Area 2 Output Wd 01 Sel	Area 2 Output Word 01 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes

PREVIOUS VIEW

87 - EXCH AREA 1/2 CONFIG

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
87.53	Area 2 Output Wd 02 Sel	Area 2 Output Word 02 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
87.54	Area 2 Output Wd 03 Sel	Area 2 Output Word 03 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
87.55	Area 2 Output Wd 04 Sel	Area 2 Output Word 04 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
87.56	Area 2 Output Wd 05 Sel	Area 2 Output Word 05 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
87.57	Area 2 Output Wd 06 Sel	Area 2 Output Word 06 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
87.58	Area 2 Output Wd 07 Sel	Area 2 Output Word 07 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
87.59	Area 2 Output Wd 08 Sel	Area 2 Output Word 08 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
87.60	Area 2 Output Wd 09 Sel	Area 2 Output Word 09 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
87.61	Area 2 Output Wd 10 Sel	Area 2 Output Word 10 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
87.62	Area 2 Output Wd 11 Sel	Area 2 Output Word 11 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes

PREVIOUS VIEW

87 - EXCH AREA 1/2 CONFIG

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
87.63	Area 2 Output Wd 12 Sel	Area 2 Output Word 12 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
87.64	Area 2 Output Wd 13 Sel	Area 2 Output Word 13 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
87.65	Area 2 Output Wd 14 Sel	Area 2 Output Word 14 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
87.66	Area 2 Output Wd 15 Sel	Area 2 Output Word 15 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
87.67	Area 2 Output Wd 16 Sel	Area 2 Output Word 16 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes

PREVIOUS VIEW

A-28 ETHERNET - TCP/IP

88 - ETHERNET - TCP/IP								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
88.01	IP Address	IP address	#	Min: 0 Def: 192.168.1.1 Max: 20	Write at Stop Only	All	1	Yes
88.02	Subnet Mask	Subnet mask	#	Min: 0 Def: 255.255.255.0 Max: 20	Write at Stop Only	All	1	Yes
88.03	Default Gateway	Default Gateway	#	Min: 0 Def: 0.0.0.0 Max: 20	Write at Stop Only	All	2	Yes
88.11	IP Address-Octet1	IP address - Octet 1	#	Min: 0 Def: 192 Max: 255	Write at Stop Only	All	2	Yes
88.12	IP Address-Octet2	IP address - Octet 2	#	Min: 0 Def: 168 Max: 255	Write at Stop Only	All	2	Yes
88.13	IP Address-Octet3	IP address - Octet 3	#	Min: 0 Def: 1 Max: 255	Write at Stop Only	All	2	Yes
88.14	IP Address-Octet4	IP address - Octet 4	#	Min: 0 Def: 1 Max: 255	Write at Stop Only	All	2	Yes

PREVIOUS VIEW

88 - ETHERNET - TCP/IP

Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
88.15	Subnet mask-Octet1	Subnet mask - Octet 1	#	Min: 0 Def: 255 Max: 255	Write at Stop Only	All	2	Yes
88.16	Subnet mask-Octet2	Subnet mask - Octet 2	#	Min: 0 Def: 255 Max: 255	Write at Stop Only	All	2	Yes
88.17	Subnet mask-Octet3	Subnet mask - Octet 3	#	Min: 0 Def: 255 Max: 255	Write at Stop Only	All	2	Yes
88.18	Subnet mask-Octet4	Subnet mask - Octet 4	#	Min: 0 Def: 0 Max: 255	Write at Stop Only	All	2	Yes
88.20	Host Name	Host Name	#	Min: 0 Def: Drive Max: 16	Read and Write	All	2	Yes
88.21	Default Gateway-Octet1	Default Gateway - Octet 1	#	Min: 0 Def: 0 Max: 255	Write at Stop Only	All	2	Yes
88.22	Default Gateway-Octet2	Default Gateway - Octet 2	#	Min: 0 Def: 0 Max: 255	Write at Stop Only	All	2	Yes
88.23	Default Gateway-Octet3	Default Gateway - Octet 3	#	Min: 0 Def: 0 Max: 255	Write at Stop Only	All	2	Yes
88.24	Default Gateway-Octet4	Default Gateway - Octet 4	#	Min: 0 Def: 0 Max: 255	Write at Stop Only	All	2	Yes
99.17	MAC Address	MAC address	#	Min: 0 Def: 0 Max: 17	Read Only	All	2	No

PREVIOUS VIEW

A-29 INFO

99 - INFO								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
99.30	Product Version	Product Version	#	Min: 0 Def: 0 Max: 48	Read Only	All	1	No
99.11	Info Firmware	Info firmware	#	Min: 0 Def: 0 Max: 65535	Read Only	All	1	No
99.02	SW Version	Parameter set and software package version	#	Min: 0 Def: 1G1504B1 Max: 16	Read Only	All	1	Yes
99.16	Serial Number	Serial number	#	Min: 0 Def: 0 Max: 20	Read Only	All	2	No
99.17	MAC Address	MAC address	#	Min: 0 Def: 0 Max: 17	Read Only	All	2	No
99.70	ETH-Profi FW Version	ETH-Profi FW Version	#	Min: 0 Def: 0 Max: 65535	Read Only	All	2	No
99.88	Parameter Security	Blocks the modification of parameters from keypad - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	No
99.89	Security Code	Security code input to unlock the parameters	#	Min: -32768 Def: 0 Max: 32767	Read and Write	All	2	No
99.90	Reset All	Reset all parameters to default - Reset All [0] - Off [1]	#	Def: Reset All	Write at Stop Only	All	2	No

PREVIOUS VIEW

ANNEX B SWITCHING FREQUENCIES

CURRENT DERATING BASED ON SWITCHING FREQUENCY

The default switching frequency is 2kHz. Table B.1 reports the Drive output current derating coefficient based on the selected switching frequency.
The switching frequency value is selected with parameter **Switching Freq [06.25]**. After modifying parameter **Switching Freq [06.25]** (range 1.5kHz ÷ 8kHz) a confirmation is requested through the dialog window.

The possible selections are:
1.5 kHz 2 kHz 3 kHz 4 kHz 6 kHz 8 kHz

Table B.1 - Current downgrading based on switching frequency

AD1000	CLASS 1							CLASS 2						
	1,5KHz	2 kHz	3 kHz	4 kHz	6 kHz	8 kHz		1,5KHz	2 kHz	3 kHz	4 kHz	6 kHz	8 kHz	
AD1A0P3F		**100%**	100%	100%	100%	80%			**100%**	100%	100%	100%	80%	
AD1A0P4F		**100%**	100%	100%	100%	80%			**100%**	100%	100%	100%	80%	
AD1A0P6F		**100%**	100%	100%	100%	80%			**100%**	100%	100%	100%	80%	
AD1A008F		**100%**	100%	100%	100%	80%			**100%**	100%	100%	100%	80%	
AD1A011F		**100%**	100%	100%	100%	80%			**100%**	100%	100%	100%	80%	
AD1A015F		**100%**	100%	100%	100%	80%			**100%**	100%	100%	100%	80%	
AD1A018F		**100%**	100%	100%	100%	80%			**100%**	100%	100%	100%	80%	
AD1A022F		**100%**	100%	100%	100%	80%			**100%**	100%	100%	100%	80%	
AD1A028F		**100%**	100%	100%	100%	80%			**100%**	100%	100%	100%	80%	
AD1A030F		**100%**	100%	100%	92%	84%			**100%**	100%	100%	100%	84%	
AD1A036F		**100%**	100%	100%	90%	80%			**100%**	100%	100%	90%	80%	
AD1A045F		**100%**	100%	100%	100%	90%			**100%**	100%	100%	100%	90%	
AD1A053F		**100%**	100%	100%	90%	80%			**100%**	100%	100%	90%	80%	

PREVIOUS VIEW

AD1000	CLASS 1							CLASS 2						
	1,5KHz	2 kHz	3 kHz	4 kHz	6 kHz	8 kHz		1,5KHz	2 kHz	3 kHz	4 kHz	6 kHz	8 kHz	
AD1A066F		**100%**	100%	100%	85%	70%			**100%**	100%	100%	80%	70%	
AD1A086F		**100%**	100%	100%					**100%**	100%	100%			
AD1A108F		**100%**	100%	85%					**100%**	100%	80%			
AD1A125F		**100%**	100%	85%					**100%**	100%	85%			
AD1A150F		**100%**	100%	85%					**100%**	100%	85%			
AD1A166F		**100%**	90%	80%					**100%**	90%	80%			
AD1A210F	**100%**	**100%**	80%	65%				**100%**	**100%**	80%	65%			
AD1A260F	**100%**	**100%**	80%	65%				**100%**	**100%**	80%	65%			
AD1A290F	**100%**	**100%**	80%	65%				**100%**	**100%**	80%	65%			
AD1A350F	**100%**	**100%**	80%					**100%**	**100%**	80%				
AD1A370F	**100%**	**100%**	80%					**100%**	**100%**	80%				
AD1A440F	**100%**	**100%**	80%					**100%**	**100%**	80%				
AD1A480F	**100%**	**100%**	80%					**100%**	**100%**	80%				
AD1A520F	**100%**	**100%**	80%					**100%**	**100%**	80%				

The full current switching frequency is highlighted in bold.

PREVIOUS VIEW

ANNEX C DATA PROCESS REFRESH TIME

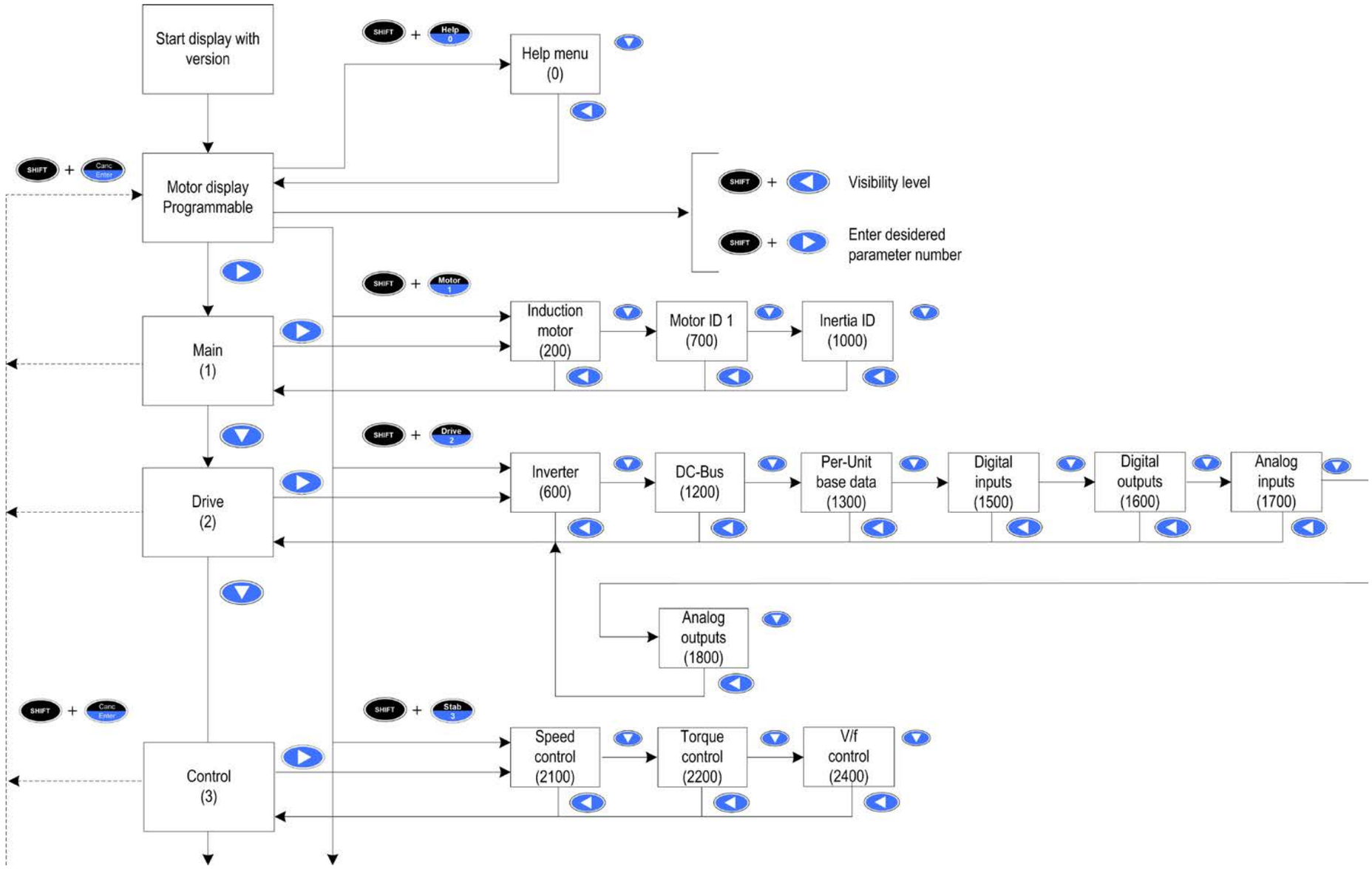
Table C.1 - Refresh times

Data type	Variable refresh time [ms]
Digital output	1 ms
Analog output	Switching frequency for switching frequencies over 4kHz Twice of switching frequency for switching frequencies less than or equal to 4kHz
Fieldbus	1 ms minimum

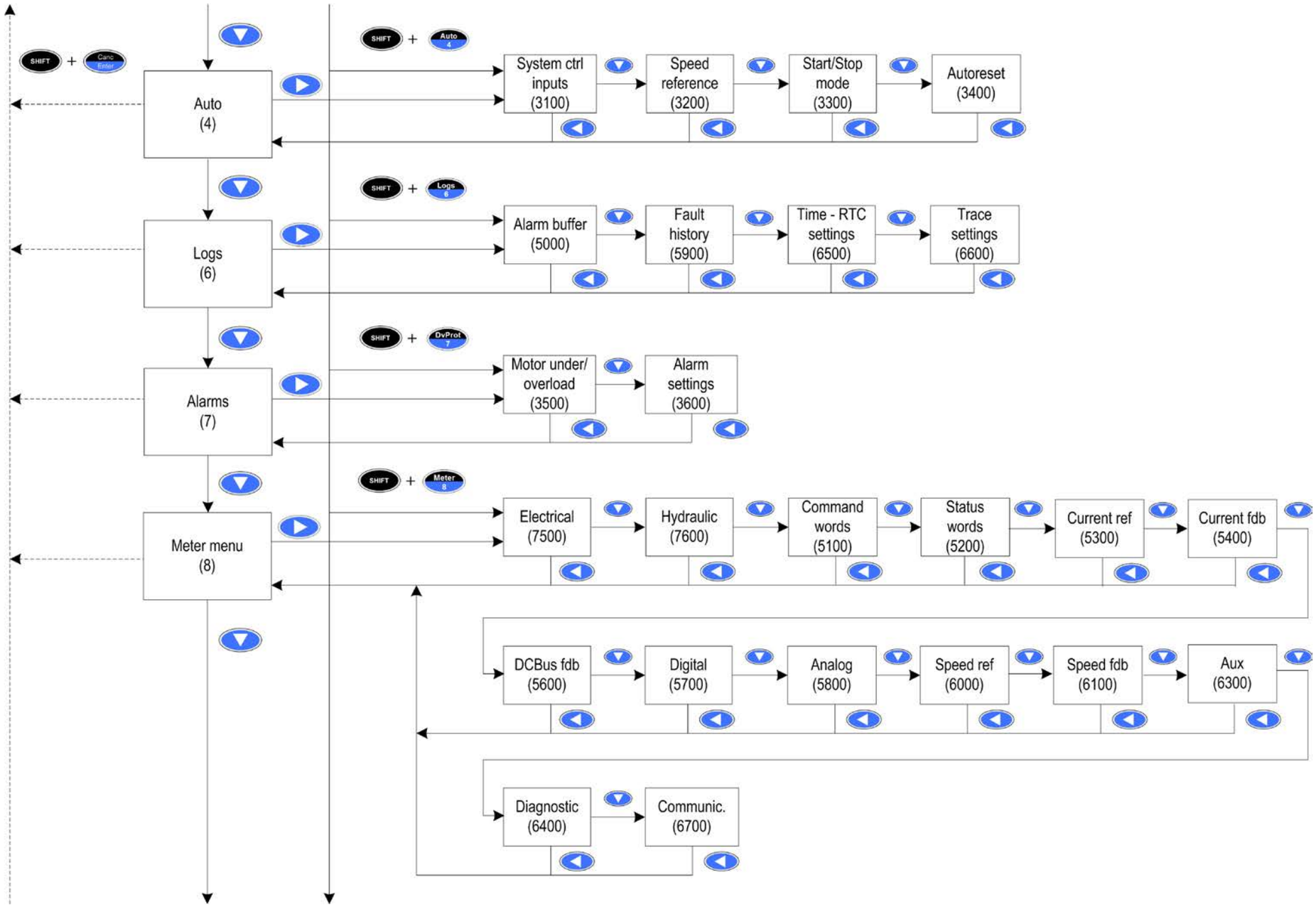
PREVIOUS VIEW

ANNEX D FLOW CHART MENU

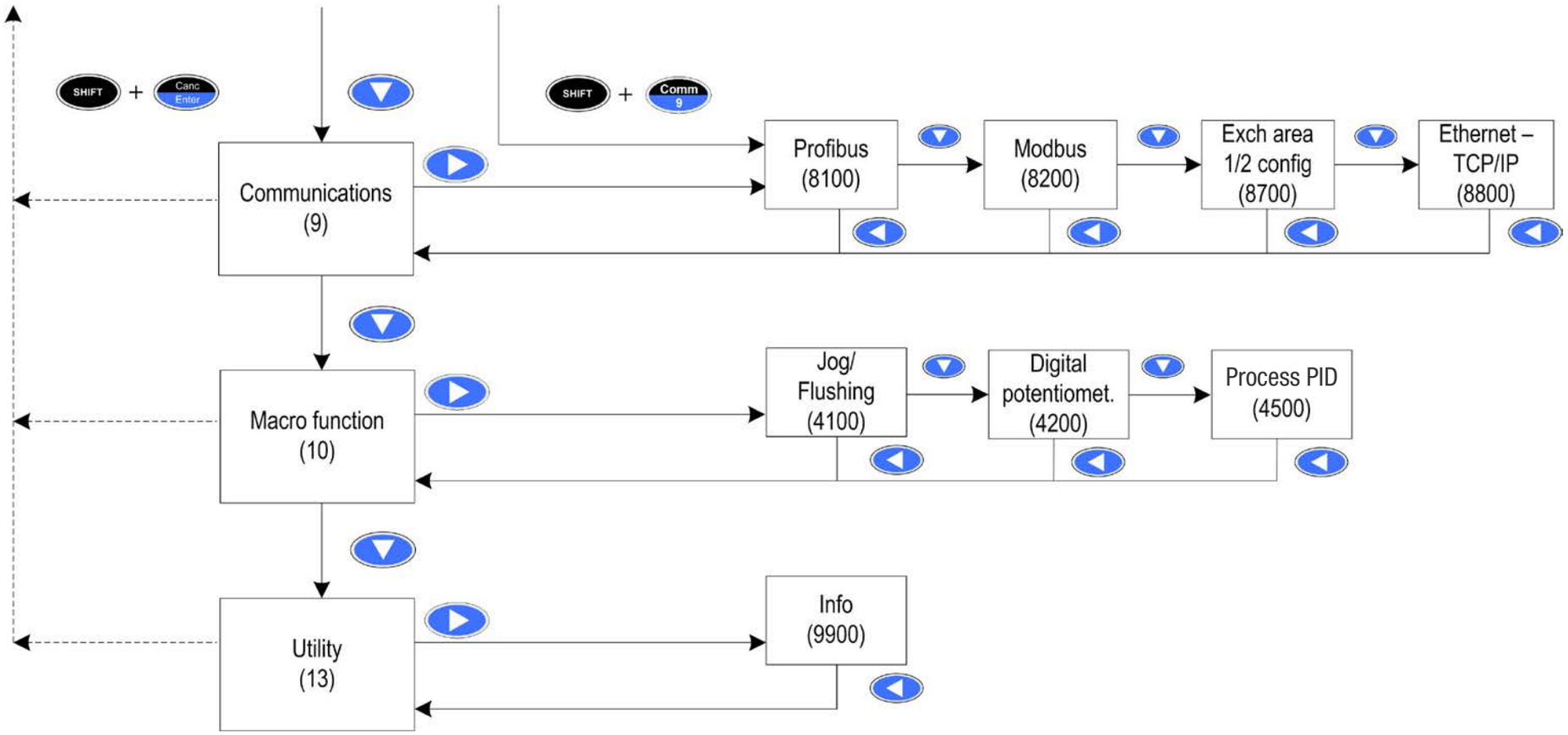
Drive configuration depends on the parameters in the structure called "System Menu". The System Menu allows the operator to navigate over menus, submenus and parameters.
The Flowchart shows all families available at levels 1, 2.



PREVIOUS VIEW



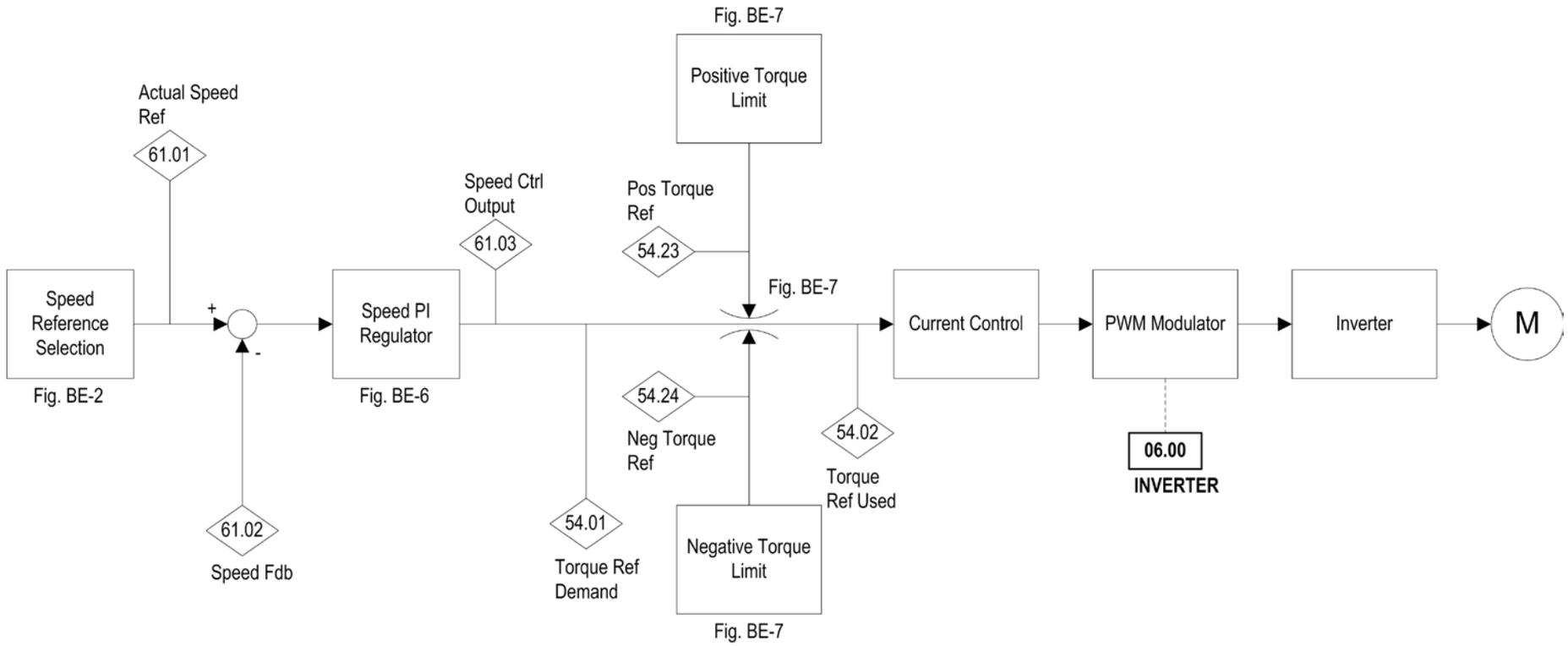
PREVIOUS VIEW



PREVIOUS VIEW

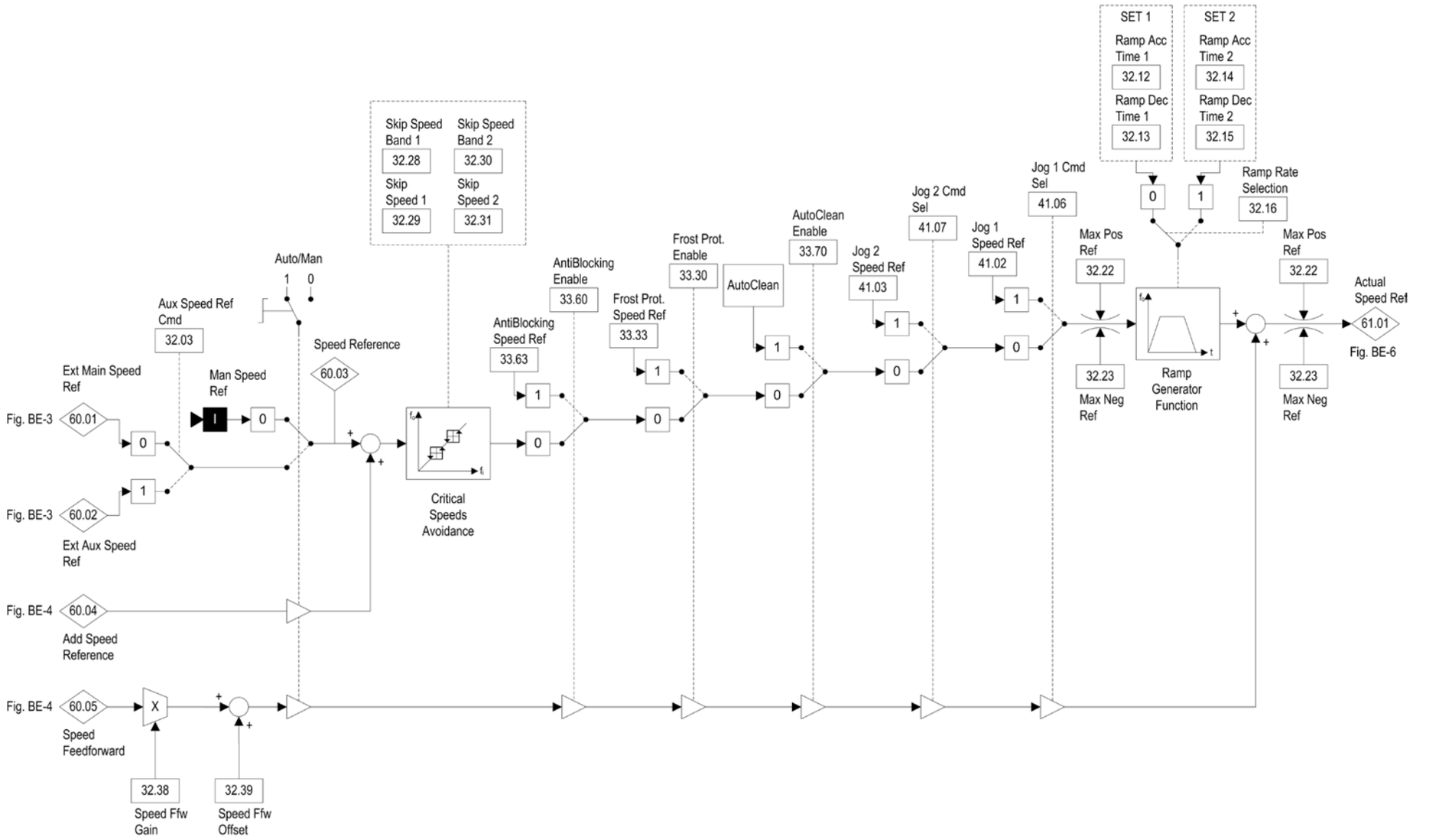
ANNEX E CONTROL SCHEMES

Figure E.1 - General scheme of control



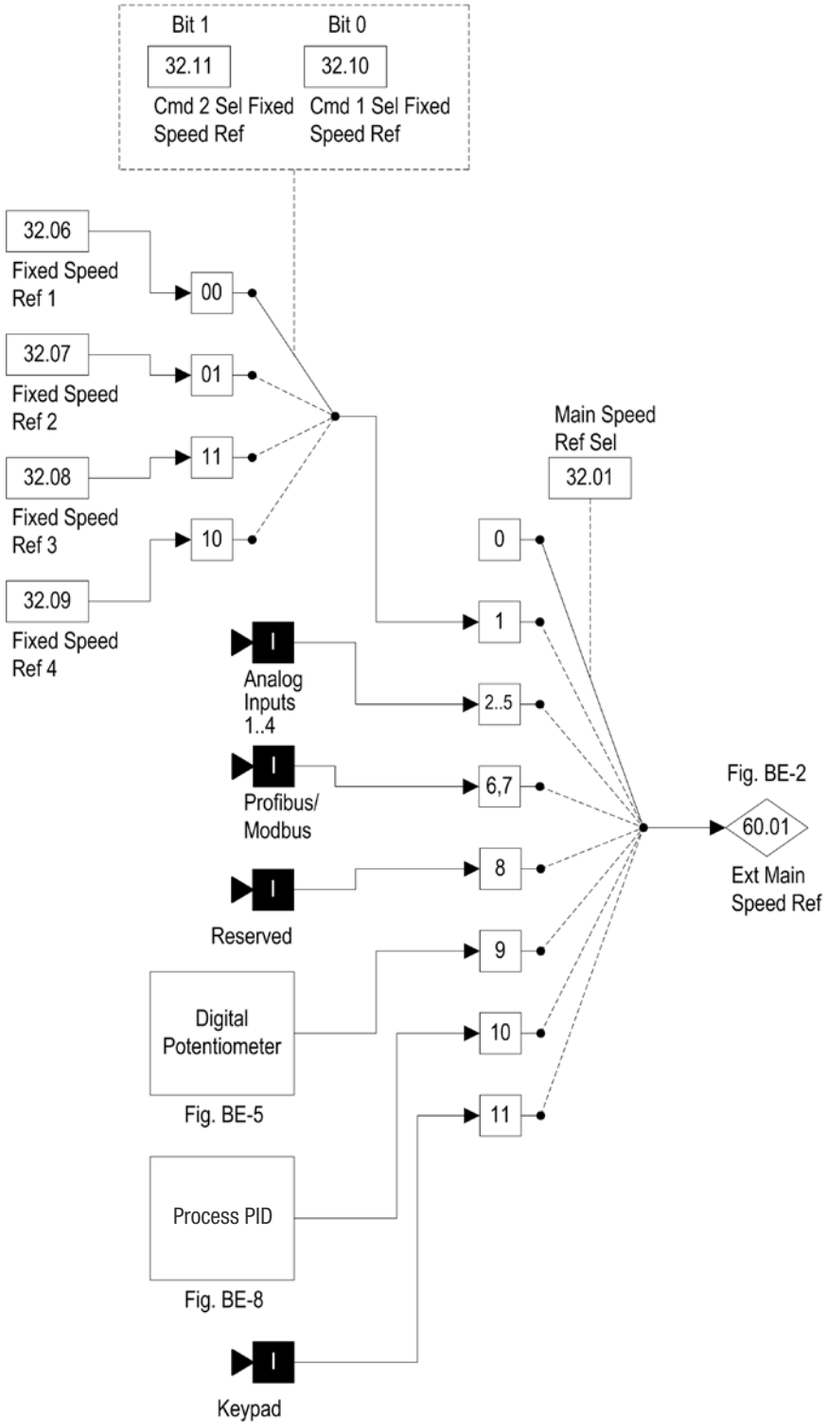
PREVIOUS VIEW

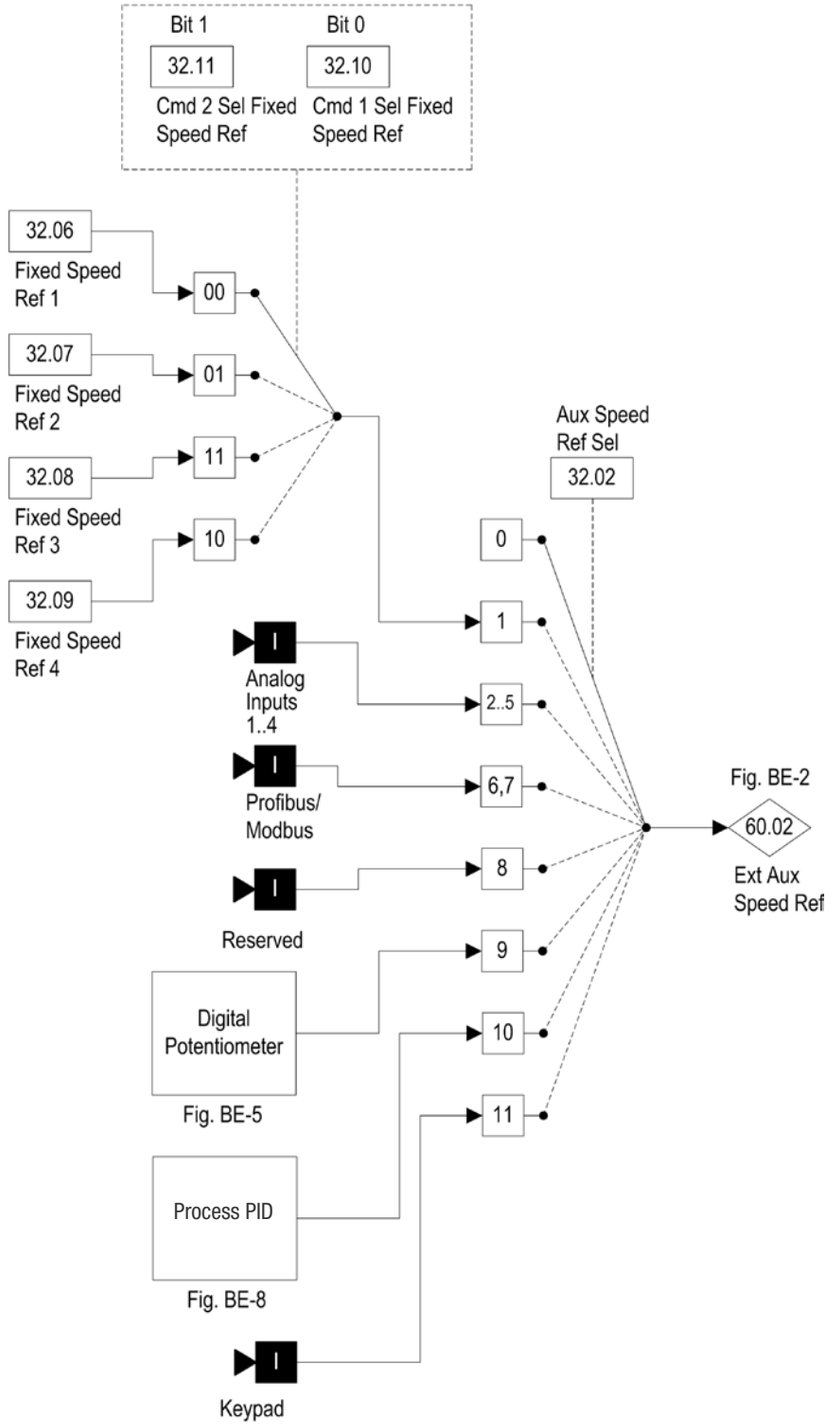
Figure E.2 - Speed Demand scheme



PREVIOUS VIEW

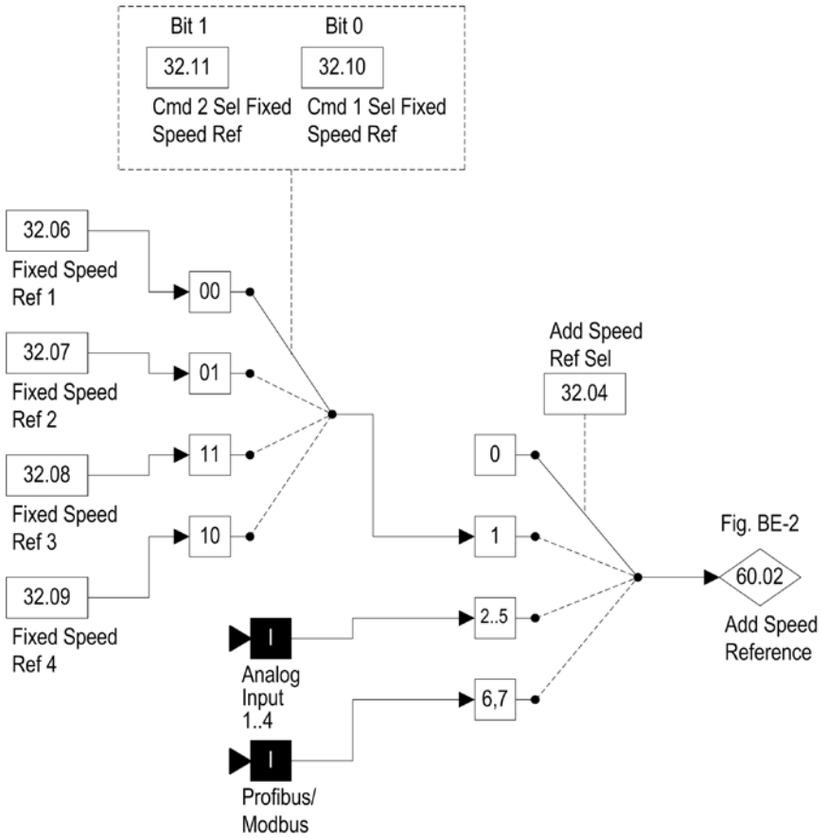
Figure E.3 - Speed reference source selection (Main and auxiliary)

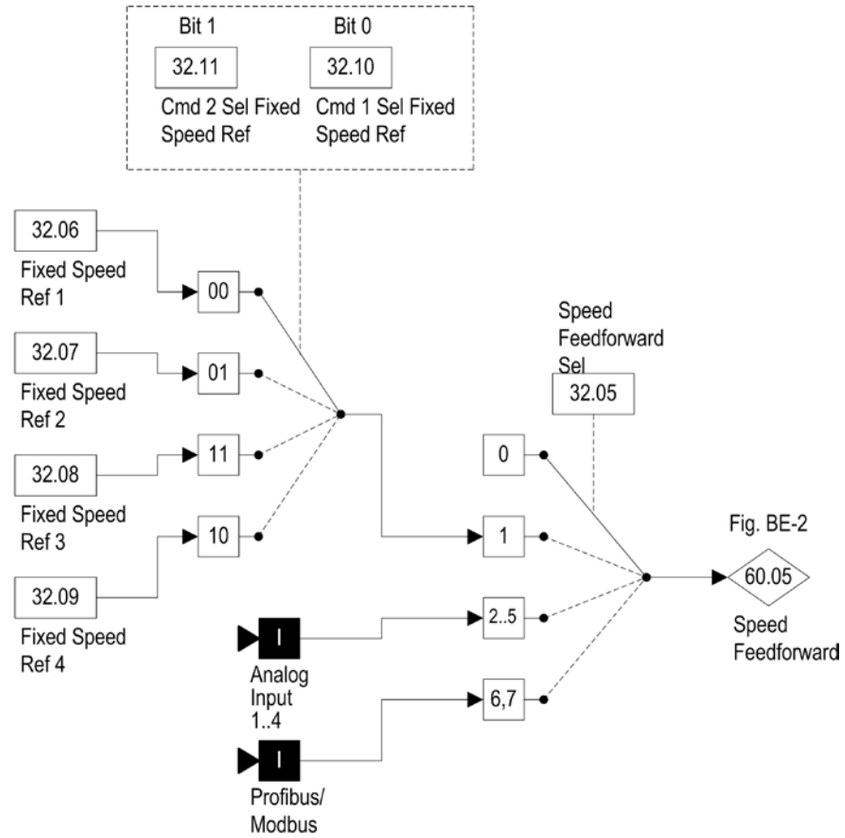




PREVIOUS VIEW

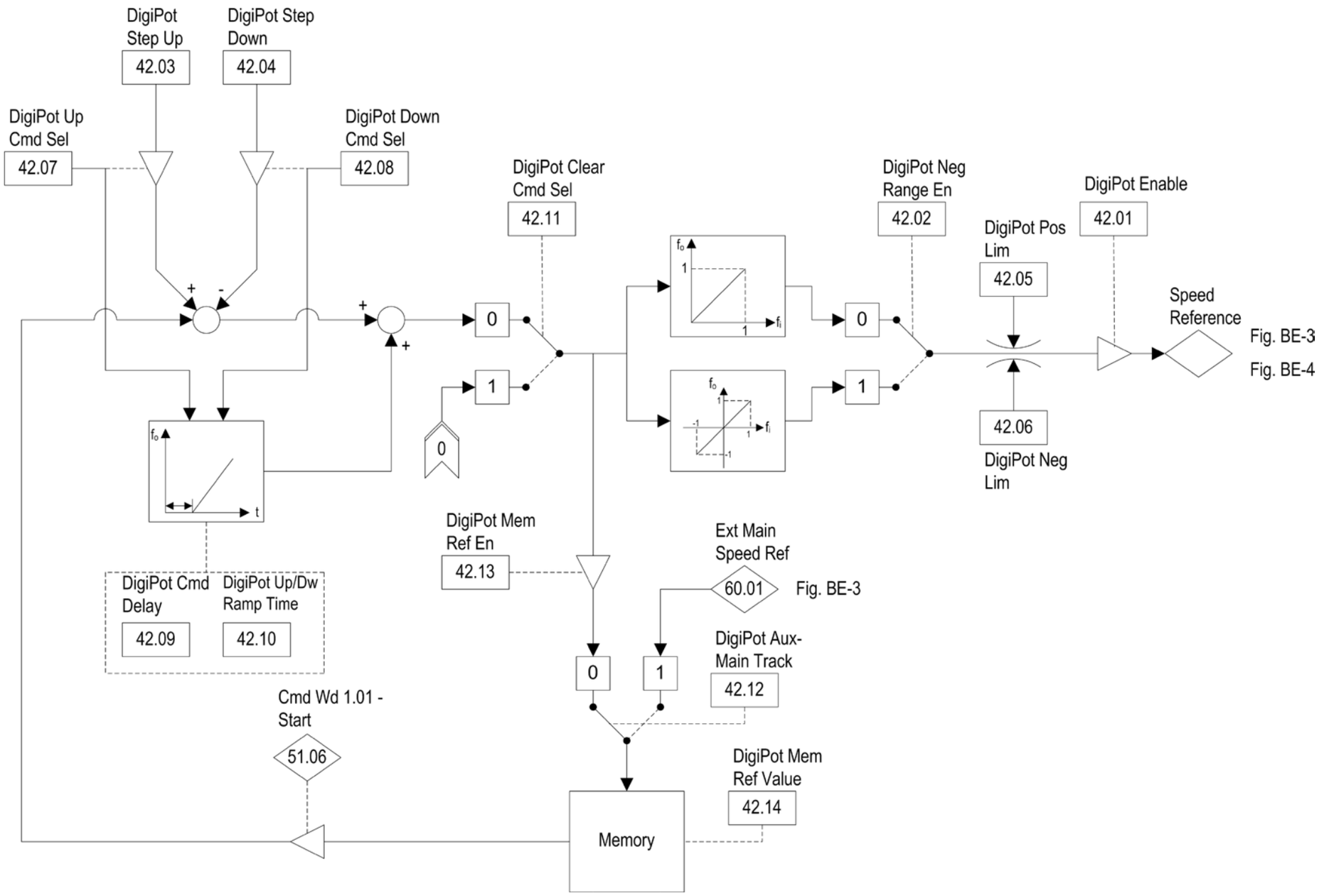
Figure E.4 - Speed reference source selection (Additional and Feedforward)





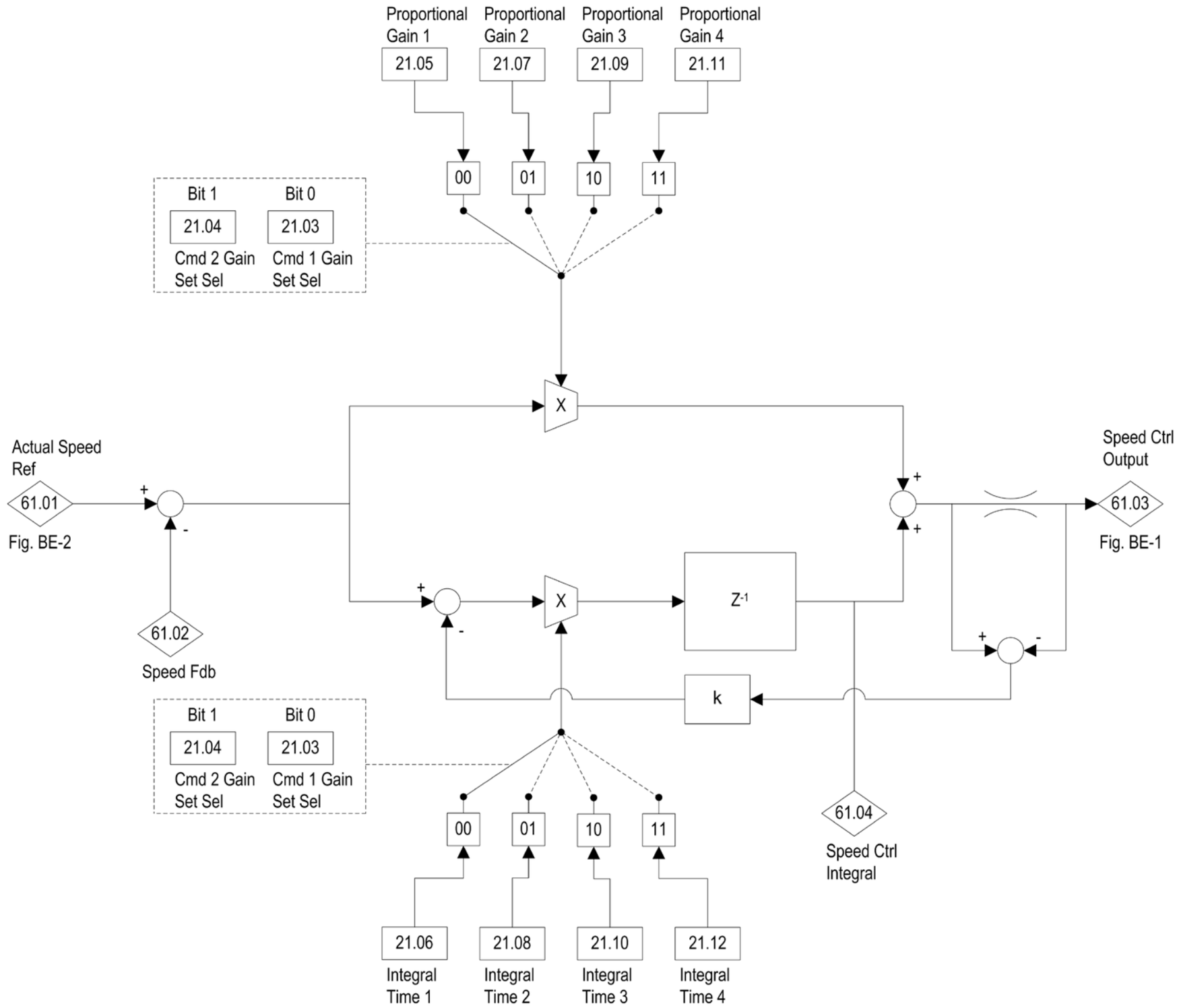
PREVIOUS VIEW

Figure E.5 - Digital Potentiometer



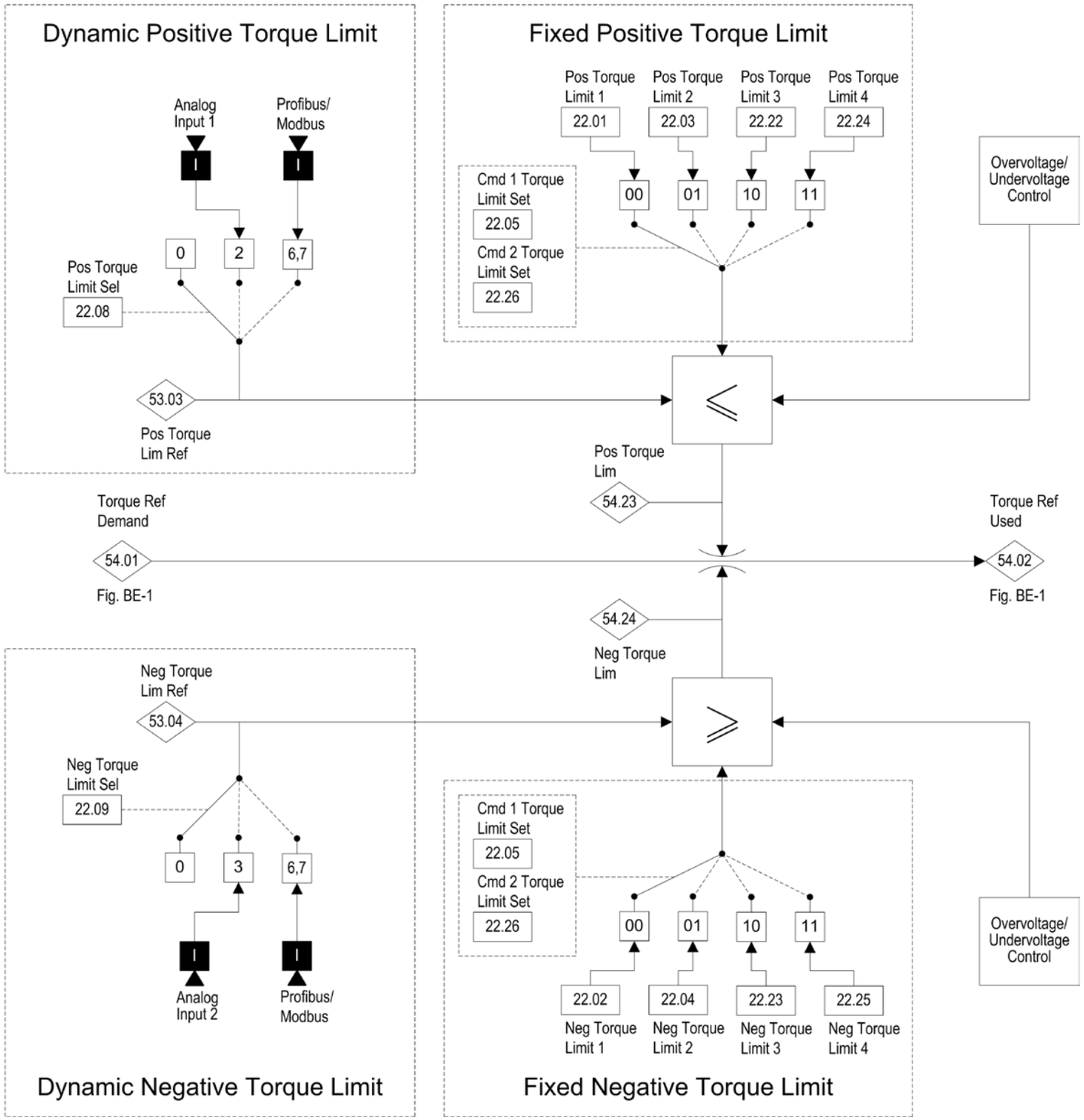
PREVIOUS VIEW

Figure E.6 - Speed PI Regulator



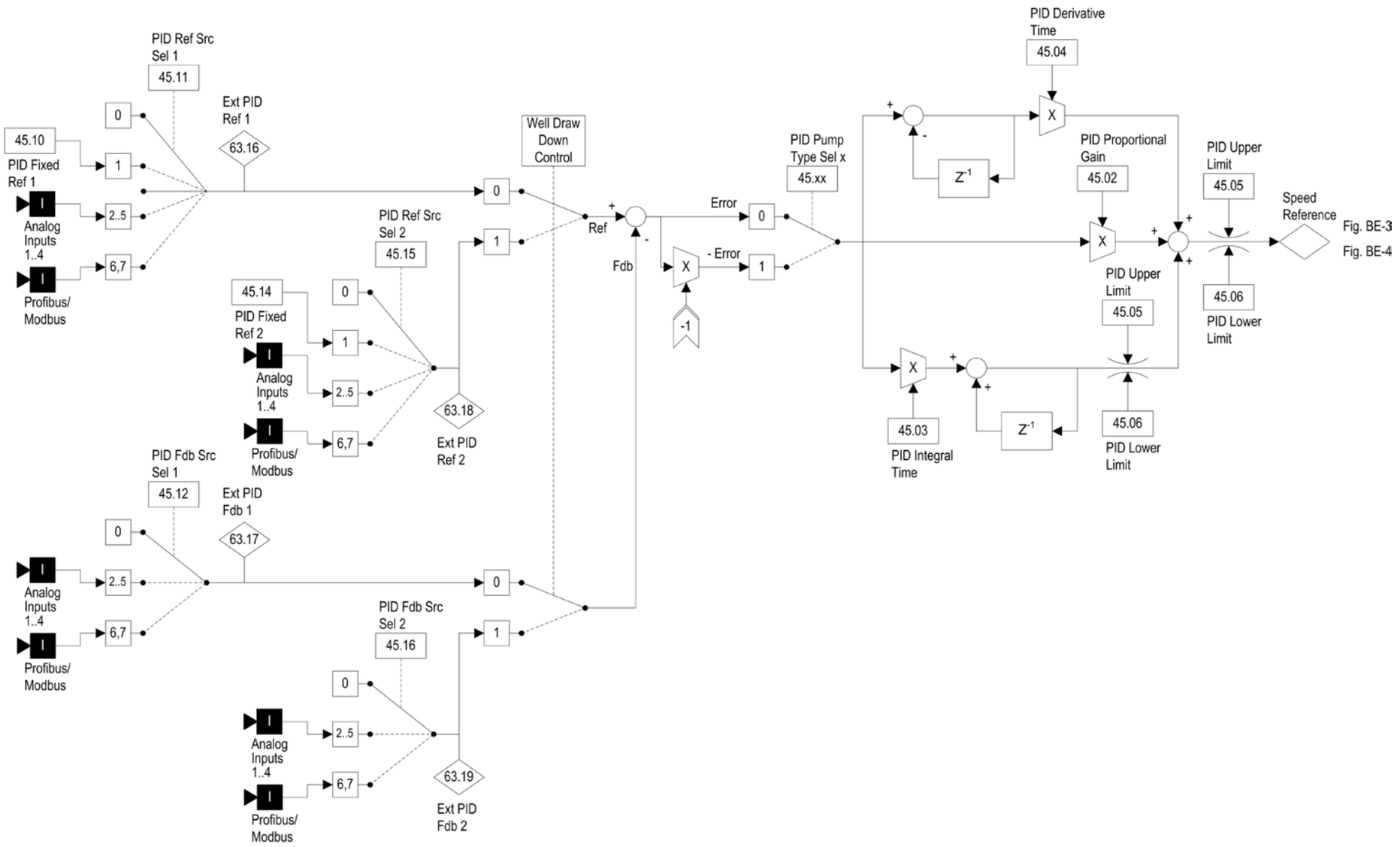
PREVIOUS VIEW

Figure E.7 - Torque reference limitation



PREVIOUS VIEW

Figure E.8 - Process PID



PREVIOUS VIEW

Figure E.9 - Legend

SYMBOL	DESCRIPTION
00.00 Parameter Description	Parameter
00.00 Data Process Description	Process Data
00.00 FAMILY DESCRIPTION	Family parameters
00.00 FAMILY DESCRIPTION	Data Process Description
	Group objects
+ +	Adding element
X	Multiplying element
< >	Minimum and maximum functions

SYMBOL	DESCRIPTION
f	Function Block
G	Buffer (Output = 0 if Gate = 0)
	Limiter
I O	Input / Output
0 1	Selector (Pick List)
0 1	Selector Switch
M	Motor
k	Constant

PREVIOUS VIEW

ANNEX F SETTING UP THE FIRMWARE OF THE DRIVE

Drives of AD1000 Basis family allow you to perform a complete Drive Firmware update using a Serial line connection.

You need:
- A connection to the **AD1000** using the Serial Line.
- A firmware file (file extension is .fmw) used to update the Drive.

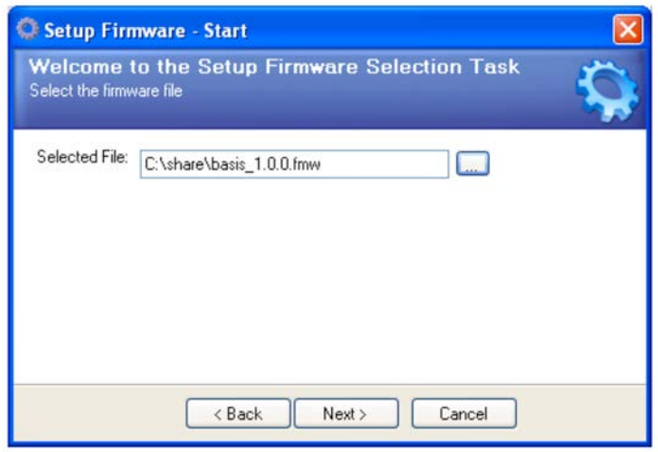
WARNING

Please pay attention to this operation because you could erroneously operate with a wrong Drive.
Carefully check if the Drive selected is the Drive you want to work with.
The update will erase the previous firmware and the values of the parameters of the control card.

CHOOSING THE FIRMWARE FILE

You need to select the proper firmware setup file. It has a .fmw extension.
When selected click on the finish button. A new window will appear.

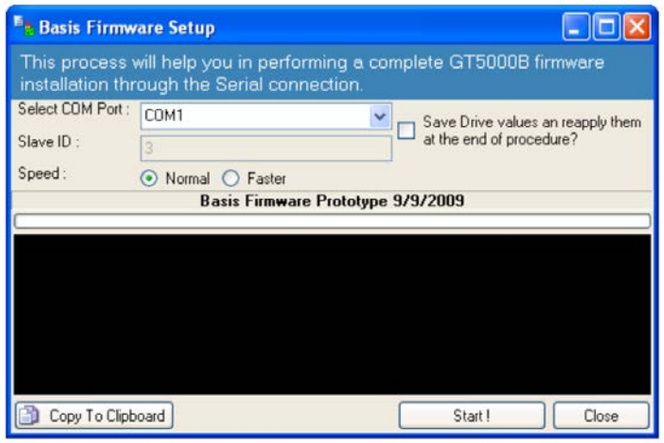
Figure F.1 – Choosing the firmware file



When the page is displayed you can read a description of the firmware you have chosen ("Basis Firmware Prototype 9/9/2009" in the sample on the right).

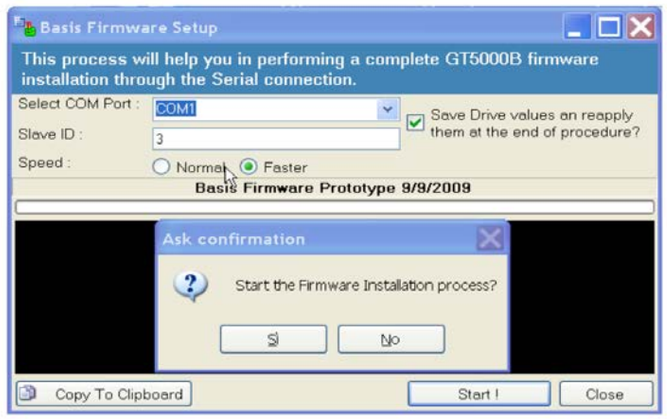
The Firmware installation page allows you to select:
- The Serial COM port target
- The firmware installation speed
- If you want to save the old parameter values and then reapply them at the end of the firmware installation process (optional but slower)

Figure F.2 – Firmware setup options



Click on the **Start !** button to install the new firmware.
The steps it will perform are:

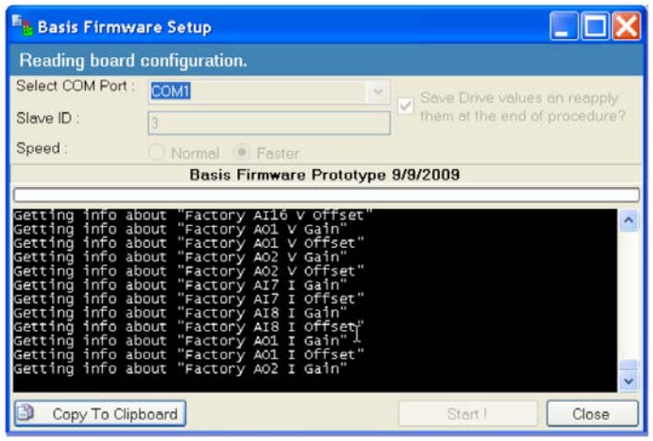
Figure F.3 – Start firmware installation



PREVIOUS VIEW

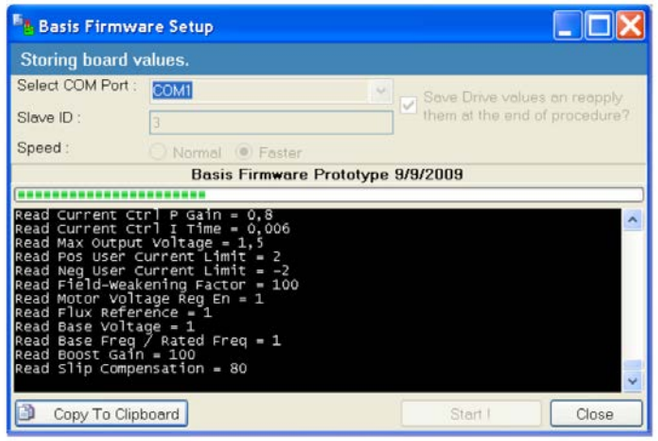
- Read of the whole current Drive configuration

Figure F.4 – Reading the configuration



- Read of the current Drive values

Figure F.5 – Reading the Drive values

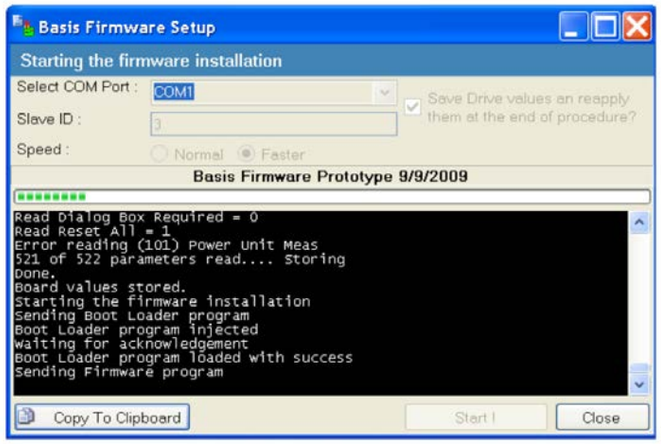


At end of Drive Data read a warning is displayed.
You have to manually close the Jumper P34 and reset the board in order to put the Board in "firmware installation mode"

Figure F.6 – Close the jumper

After click on the OK button the firmware installation starts.

Figure F.7 – Download Firmware. Started



Firmware installation ended

Figure F.8 – Download Firmware. Installation succeeded

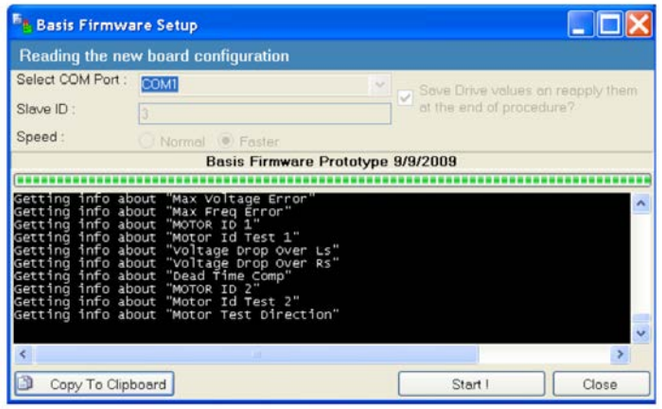
PREVIOUS VIEW

You will have to manually open the Jumper P34 and then reset the board in order to proceed.

Figure F.9 – Download Firmware. Open the jumper

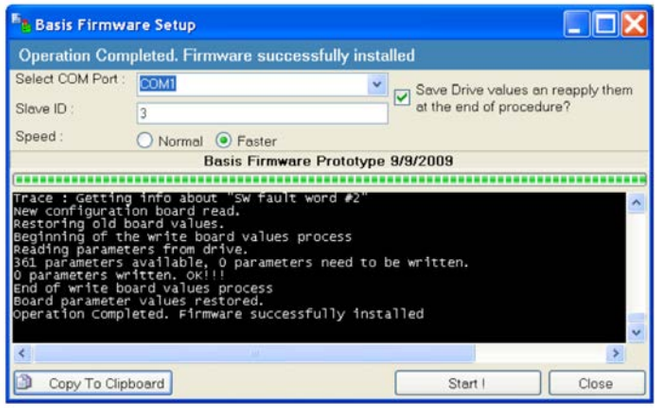
Now follows another 2 steps where the new configuration will be read and the old data values will be applied.

Figure F.10 – Download Firmware. Reading the new configuration



Operation completed. Firmware installed.

Figure F.11 – Download Firmware. Firmware installed



PREVIOUS VIEW

ANNEX G PUMP APPLICATION EXAMPLES

EXAMPLE N. 1 – WATER PRESSURE REGULATION WITH PROCESS PID

The following example shows how to configure AD1000 drive in order to perform a process variable regulation in a typical hydraulic system; in this case the process variable is the water pressure at the outlet of the pump. See Figure 1 for a scheme of the hydraulic system.

ASSUMPTION

The output of the Pressure Transducer (PT) is a current signal in the range (4÷20) mA connected to AI1 (analog input) of AD1000. The full scale of PT is 10 bar.

HARDWARE CONFIGURATION

Set the jumper P6 in position 1-2 on Basis board in order to configure the analog input AI1 as current input.

STEPS TO CONFIGURE AD1000 DRIVE

Set the motor parameters with the right data, using the parameters available in the family **INDUCTION MOTOR [02.00]**.
Set the drive parameters with the right data, in particular the size (**Drive Size [16.01]**), using the parameters available in the family **INVERTER [06.00]**.
Set AI1 parameters, using the parameters available in the family **ANALOG INPUTS [17.00]**:

[17.05] AI1 Value for 1 pu	100.00 %
[17.09] AI1 Value for 0 pu	20.00 %
[17.13] AI1 Neg Range En	Off
[17.25] AI1 Type	mA

Set the full scale of the sensor, using the parameters available in the family **PER-UNIT BASE DATA [13.00]**:

[13.11] User Per-Unit Press. 1	10.000 bar

Set the speed reference for the motor, using the parameters available in the family **SPEED REFERENCE [32.00]**:

[32.01] Main Speed Ref Sel	Prs PID

Set the parameters for PID regulator (e.g. the desired reference is 2 bar, fixed), using the parameters available in the family **PROCESS PID [45.00]**:

[45.01] PID Enable	On
[45.02] PID Proportional Gain	0.500
[45.03] PID Integral Time	0.800 s
[45.10] PID Fixed Ref 1	0.200 pu
[45.11] PID Ref Src Sel 1	Fixed
[45.12] PID Fdb Src Sel 1	AI1
[45.17] PID Mode Sel	Continuous

Note: [45.10] = desired reference / [13.11] = 2 [bar] / 10 [bar] = 0.200 [pu]

PREVIOUS VIEW

EXAMPLE N. 2 – WATER FLOW REGULATION WITH PROCESS PID

The following example shows how to configure AD1000 drive in order to perform a process variable regulation in a typical hydraulic system; in this case the process variable is the water flow at the outlet of the pump. See Figure 1 for a scheme of the hydraulic system.

ASSUMPTION

The output of the Flow Transducer (FT) is a voltage signal in the range (0÷10) V connected to AI2 (analog input) of AD1000. The full scale of FT is 30 m^3/h.

HARDWARE CONFIGURATION

Set the jumper P7 in position 2-3 on Basis board in order to configure the analog input AI2 as voltage input.

STEPS TO CONFIGURE AD1000 DRIVE

Set the motor parameters with the right data, using the parameters available in the family **INDUCTION MOTOR [02.00]**.
Set the drive parameters with the right data, in particular the size (**Drive Size [16.01]**), using the parameters available in the family **INVERTER [06.00]**.
Set the AI1 parameters, using the parameters available in the family **ANALOG INPUTS [17.00]**:

[17.06] AI2 Value for 1 pu	100.00 %
[17.10] AI2 Value for 0 pu	0.00 %
[17.14] AI2 Neg Range En	Off
[17.26] AI2 Type	Volt

Set the full scale of the sensor, using the parameters available in the family **PER-UNIT BASE DATA [13.00]**:

[13.12] User Per-Unit Flow 1	30.000 m^3/h

Set the Speed Reference for the motor, using the parameters available in the family **SPEED REFERENCE [32.00]**:

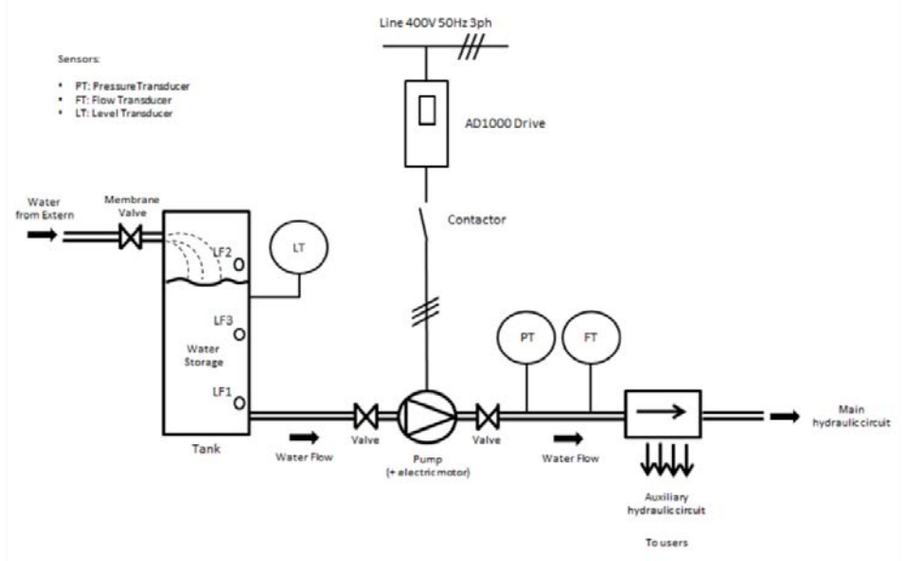
[32.01] Main Speed Ref Sel	Prs PID

Set the parameters for PID regulator (e.g. the desired reference is 15 m^3/h, fixed), using the parameters available in the family **PROCESS PID [45.00]**:

[45.01] PID Enable	On
[45.02] PID Proportional Gain	0.500
[45.03] PID Integral Time	0.800 s
[45.10] PID Fixed Ref 1	0.500 pu
[45.11] PID Ref Src Sel 1	Fixed
[45.12] PID Fdb Src Sel 1	AI2
[45.17] PID Mode Sel	Continuous

Note: [45.10] = desired reference / [13.12] = 15 [m^3/h] / 30 [m^3/h] = 0.500 [pu]

Figure 1 – Scheme of the hydraulic system (Examples N. 1 and N. 2).



PREVIOUS VIEW

EXAMPLE N. 3 – WATER PRESSURE REGULATION WITH PROCESS PID AND INPUT PRESSURE SUPERVISION

The following example shows how to configure AD1000 drive in order to perform a pressure regulation at the outlet of the pump with an input pressure supervision (at the inlet of the pump). See Figure 2 for a scheme of the hydraulic system.

ASSUMPTION

The outputs of the Pressure Transducers (PT1 and PT2) are current signals in the range (4÷20) mA connected to AI1 and AI2 (analog inputs) of AD1000. PT1 is connected to AI1 and PT2 is connected to AI2. The full scale of PT1 and PT2 is 10 bar.

HARDWARE CONFIGURATION

Set the jumpers P6 and P7 in position 1-2 on Basis board in order to configure the analog inputs AI1 and AI2 as current inputs.

STEPS TO CONFIGURE AD1000 DRIVE

Set the motor parameters with the right data, using the parameters available in the family **INDUCTION MOTOR [02.00]**.
Set the drive parameters with the right data, in particular the size (Drive Size [16.01]), using the parameters available in the family **INVERTER [06.00]**.
Set the AI1 parameters, using the parameters available in the family **ANALOG INPUTS [17.00]**:

[17.05] AI1 Value for 1 pu	100.00 %
[17.06] AI2 Value for 1 pu	100.00 %
[17.09] AI1 Value for 0 pu	20.00 %
[17.10] AI2 Value for 0 pu	20.00 %
[17.13] AI1 Neg Range En	Off
[17.14] AI2 Neg Range En	Off
[17.25] AI1 Type	mA
[17.26] AI2 Type	mA

Set the full scale of the sensors, using the parameters available in the family **PER-UNIT BASE DATA [13.00]**:

[13.11] User Per-Unit Press. 1	10.000 bar
[13.21] User Per-Unit Press. 2	10.000 bar

Set the Speed Reference for the motor, using the parameters available in the family **SPEED REFERENCE [32.00]**:

[32.01] Main Speed Ref Sel	Prs PID

Set the parameters for PID regulator (e.g. the desired reference is 5 bar, fixed), using the parameters available in the family **PROCESS PID [45.00]**:

[45.01] PID Enable	On
[45.02] PID Proportional Gain	0.500
[45.03] PID Integral Time	0.800 s
[45.10] PID Fixed Ref 1	0.500 pu
[45.11] PID Ref Src Sel 1	Fixed
[45.12] PID Fdb Src Sel 1	AI1
[45.16] PID Fdb Src Sel 2	AI2
[45.17] PID Mode Sel	Continuous

Note: [45.10] = desired reference / [13.11] = 5 [bar] / 10 [bar] = 0.500 [pu]

Set the parameters for Input Pressure Supervision function (e.g. the alarm threshold is 3 bar and the trip threshold is 1.5 bar), using the parameters available in the family **PROCESS PID [45.00]**:

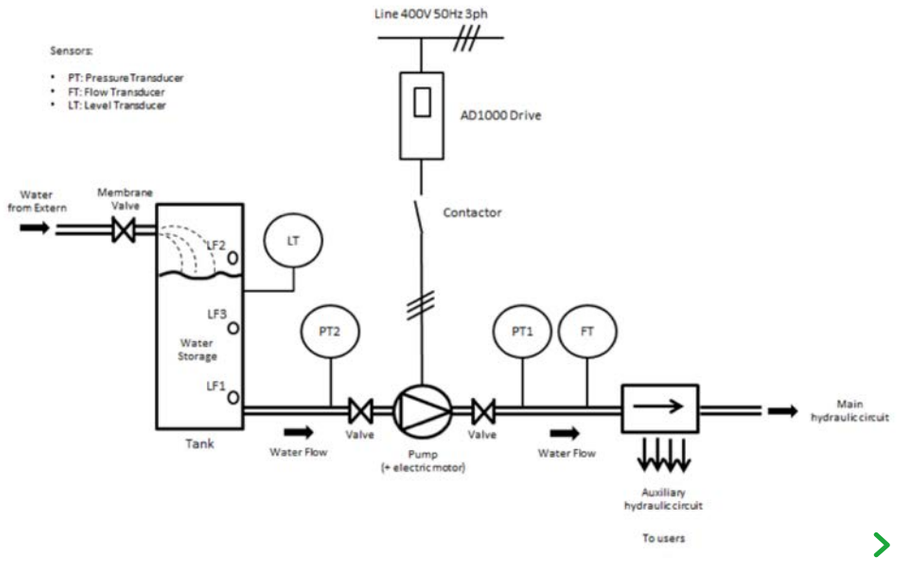
[45.70] In Press Mon Enable	On
[45.71] In Press Mon Alm Thres	0.30 pu
[45.72] In Press Mon Trip Thres	0.15 pu
[45.73] In Press Mon Ref Delta	0.01 pu

Note: [45.71] = alarm threshold / [13.21] = 3 [bar] / 10 [bar] = 0.30 [pu]
Note: [45.72] = trip threshold / [13.21] = 1.5 [bar] / 10 [bar] = 0.15 [pu]

Set the behavior of the drive when Input Pressure Supervision alarms are released, using the parameters available in the family **ALARM SETTINGS [36.00]**:

[36.59] In Press Monitor Thres 1	Warning
[36.60] In Press Monitor Thres 2	Coast Stop

Figure 2 – Scheme of the hydraulic system (Example N. 3).



Nidec

All for dreams