Honeywell

Application Manual

HVAC400x

Variable Frequency Drives for Variable Torque Applications

EN2B-0417GE51 R0719

PREFACE

Date:	April 25, 2019
Software version:	FW0078V019_RC2

About this Manual

In this manual, you can read about the functions of the HVAC400x drive and how to use the drive. The manual has the same structure as the menu of the drive (chapters 1 and 4-8).

Chapter 1, Quick Startup Guide

- How to start working with the control panel.

Chapter 2, Wizards

- Setting up an application quickly.

Chapter 3, User Interfaces

- The display types and how to use the control panel.
- The functions of the fieldbus.

Chapter 4, Monitoring menu

- Data on the monitoring values.

Chapter 5, Parameter menu

- A list of all the parameters of the drive.

Chapter 6, Diagnostics menu

Chapter 7, I/O and Hardware menu

Chapter 8, User settings, favorites and user level menus

Chapter 9, Monitoring value descriptions

Chapitre10, Parameter descriptions

- How to use the parameters.
- Digital and analog input programming.
- Application-specific functions.

Chapter 11, Fault tracing

- Faults and their causes.
- Resetting the faults.

This manual includes a large number of parameter tables. These instructions tell you how to read the tables (see Fig. 1. Parameter table).

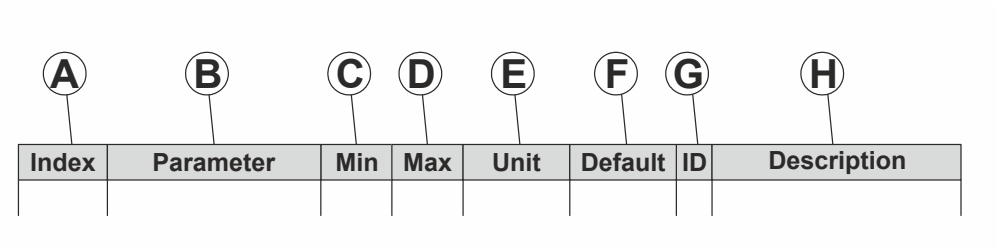


Fig. 1. Parameter table

Legend

A.	The location of the parameter in the menu, that is, the parameter number.
B.	The name of the parameter.
C.	The minimum value of the parameter.
D.	The maximum value of the parameter.
E.	The unit of the value of the parameter. The unit appears if it is available.
F.	The value that was set in the factory.
G.	The ID number of the parameter.
H.	A short description of the values of the parameter and/or its function.

NOTE: You can download the English and French product manuals with applicable safety, warning and caution information from http://hwll.co/inverter .

Functions of the HVAC400 Drive

- Wizards for startup, PID control, pump and fan cascade control, and fire mode to make commissioning easy.
- The Loc Rem button for an easy change between the local and the remote control place. The remote control place can be I/O or fieldbus. Using a parameter, you can select the remote control place.
- Run interlock input (Damper interlock). Drive does not start before this input is activated.
- A control page to operate and monitor of the most important values quickly.
- Different pre-heat modes to prevent condensation problems.
- A maximum output frequency of 320 Hz.
- A real-time clock and timer functions (an optional battery is necessary). It is possible to program three time channels and five intervals to get different functions on the drive.
- Two PID controllers are available. You can use them, e.g., to control a valve with the I/O of the HVAC drive.
- A sleep mode function that automatically enables and disables the operation of the drive to save energy.
- A 2-zone PID controller with two different feedback signals: minimum and maximum control.
- Two setpoint sources for the PID control. This is selected using a digital input.
- A function for PID setpoint boost.
- A feedforward function to make the response to the process changes better.
- A process value supervision.
- A pump / fan cascade control is available to control up to five motors.
- A pressure loss compensation to compensate pressure losses in the pipework, e.g., when the sensor is incorrectly placed near the pump or fan.
- Single input control where the analog signal (0-10V or 4-20 mA) can also be used to start and stop the motor without additional inputs.

- Resonance sweep wizard to very easily set up skip frequency areas to avoid resonances in the system.
- RTO - Ramp Time Optimizer to automatically adapt to the system to avoid fast accelerations and decelerations which might harm the water pipes or air ducts.
- Pump soft fill function to prevent overpressures (Liquid hammer) when filling the pipework with liquid.

Table of Contents

1 QUICK START-UP GUIDE

1.1 Control Panel and Keypad

The control panel is the interface between the HVAC drive and the user. The control panel allows you to control the speed of a motor and monitor the status of the HVAC drive. You can also set the parameters of the HVAC drive.

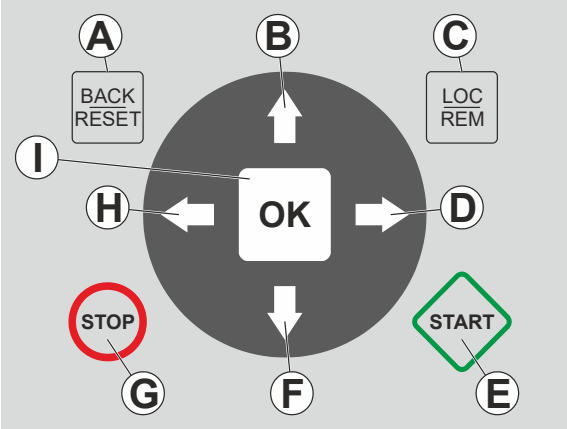


Fig. 2. Keypad buttons

Legend

A.	The BACK/RESET button. Use it to move back in the menu, exit the Edit mode, reset a fault.
B.	The UP arrow button. Use it to scroll the menu up and to increase a value.
C.	The LOC/REM button. Use it to change the rotation direction of the motor (in Keypad mode only), access the control page, and change the control place. See also Table 16. Control reference settings.
D.	The RIGHT arrow button.
E.	The START button.
F.	The DOWN arrow button. Use it to scroll the menu down and to decrease a value.
G.	The STOP button.
H.	The LEFT arrow button. Use it to move the cursor left.
I.	The OK button. Use it to go into an active level or item, or to accept a selection.

1.2 The Display

The HVAC drive features a graphical display for the Human Machine Interface (HMI).

The following data will appear in the display:

- The status of the motor and the drive.
- Faults in the motor and in the drive.
- Your location in the menu structure.
- Nine definable values.

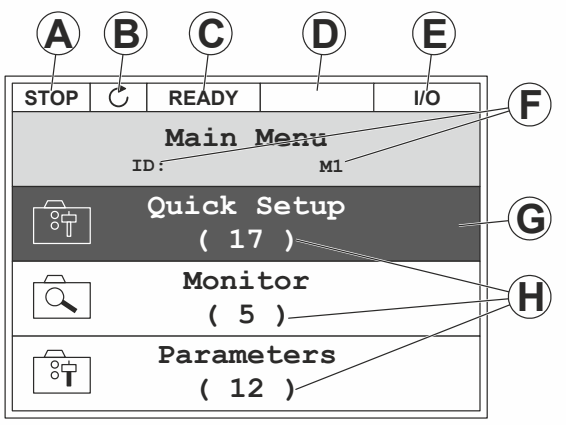


Fig. 3. The graphical display for Advanced Commissioning HMI

Legend

A.	The first status field: STOP/RUN.	**E.**	The control place field: PC / IO / KEYPAD / FIELDBUS.
B.	The rotation direction of the motor.	**F.**	The location field: the ID number of the parameter and the current location in the menu.
C.	The second status field: READY/NOT READY/FAULT.	**G.**	An activated group or item.
D.	The alarm field: ALARME/-.	**H.**	The number of items in the group in question.

1.3 First Start-Up

The Start-up wizard tells you to provide necessary data for the drive to control your procedure. In the Start-up wizard, you need these keypad buttons:

Table 1. Keypad buttons

◀ ▶	LIGHT/RIGHT arrows. Use these to easily move between digits and decimals.
▲ ▼	UP/DOWN arrows. Use these to move between options in menu and to change value.
OK	OK button. Confirm selection using this button.
BACK RESET	BACK/RESET button. With this button, you can return to the previous question in the Wizard. If you press it at the first question, the Startup Wizard is cancelled.

When you have connected power to the drive, follow these instructions to easily set up your drive.

1	Language selection.	The selection is different in all the language packages.
2	Daylight saving	Russia, US, EU, OFF
3	Temps	hh:mm:ss
4	Date	dd.mm.
5	Year	Yyyy
6	Run Startup wizard? (To set the parameter values manually, select *No* and press the OK button.)	Yes No
7	Select a process	Pump, fan

	P3.4.2	P3.4.3	P3.2.4	P3.2.5	P3.4.8	P3.4.10	P3.3.1	P3.1.2.7
Pump	5.0	5.0	1	1	False	60.0	20.0	Untouched.
Fan	See table.	See table.	1	0	True	120.0	20.0	1

Affected parameters

P3.4.2	Acceleration Time
P3.4.3	Deceleration Time
P3.2.4	Start Function
P3.2.5	Stop Function
P3.4.8	RampTimeOptimizerEnable
P3.4.10	RampTimeOptimizerMaxLimit
P3.3.1	MinFrequency
P3.1.2.7	U/F Ratio

Ramp table for fan set-up

Ramp time	400 V / 480 V	230 V
20 s	400-1P1 - 400-7P5 / C 0015 – C 0100	230-P55 - 230-4P0 / A 0007 – A 0050
30 s	400-11P - 400-22P / C 0150 – C 0300	230-5P5 - 230-11P / A 0075 – A 0150
45 s	400-30P - 400-55P / C 0400 – C 0750	230-15P - 230-30P / A 0200 – A 0400
60 s	400-75P - 400-90P / C 1000 – C 1250	230-37P - 230-45P / A 0500 – A 0750
90 s	400-110 - 400-160 / C 1500 – C 2500	230-55P / A 1000 – A 1250

8	Set a value for *Motor Nominal Speed* (so that it agrees with the nameplate).	Range: 24-19200.
9	Set a value for *Motor Nominal Current* (so that it agrees with the nameplate).	Range varies.

After these selections, the Start-up wizard is completed. To start the Start-up wizard again, you have two alternatives: Go to either parameter P6.5.1 *Restore factory defaults* or parameter P1.21 *Start-up Wizard*. Then set the value to *Activate*.

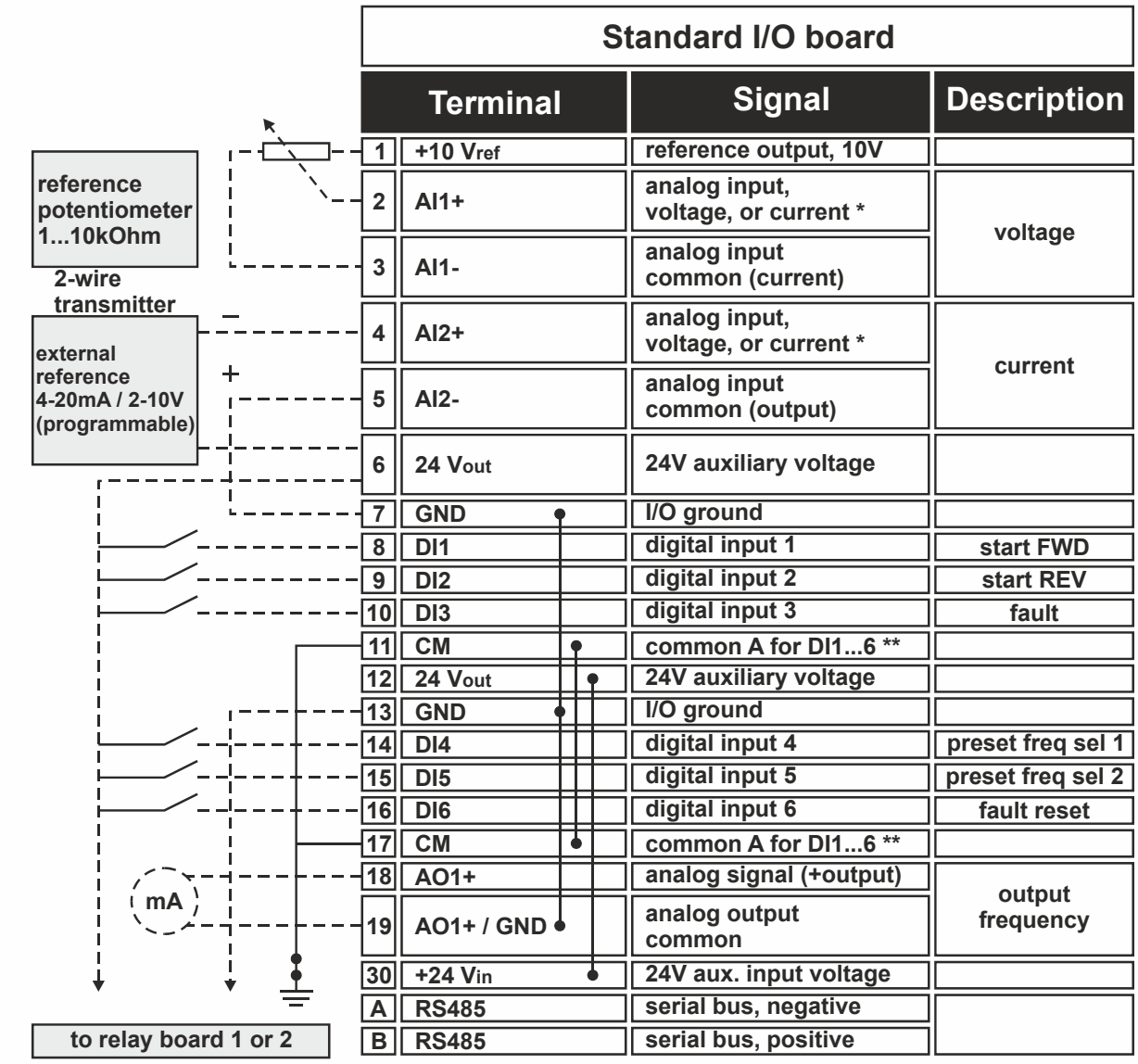
NOTE: If there is an external RUN command on the I/O, the parameters *Restore factory defaults* (par. P6.5.1) or the Startup Wizard will not work.

1.4 Description of the Applications

1.4.1 HVAC400 Applications

The HVAC drive contains a preloaded application for immediate use.

It is possible to control the drive from the keypad, the Fieldbus, your PC, or from the I/O terminal.



Standard I/O board			
Terminal		**Signal**	**Description**
1	+10 V_{ref}	reference output, 10V	
2	AI1+	analog input, voltage, or current *	voltage
3	AI1-	analog input common (current)	
4	AI2+	analog input, voltage, or current *	current
5	AI2-	analog input common (output)	
6	24 V_{out}	24V auxiliary voltage	
7	GND	I/O ground	
8	DI1	digital input 1	start FWD
9	DI2	digital input 2	start REV
10	DI3	digital input 3	fault
11	CM	common A for DI1...6 **	
12	24 V_{out}	24V auxiliary voltage	
13	GND	I/O ground	
14	DI4	digital input 4	preset freq sel 1
15	DI5	digital input 5	preset freq sel 2
16	DI6	digital input 6	fault reset
17	CM	common A for DI1...6 **	
18	AO1+	analog signal (+output)	output frequency
19	AO1+ / GND	analog output common	
30	+24 V_{in}	24V aux. input voltage	
A	RS485	serial bus, negative	
B	RS485	serial bus, positive	

Fig. 4. The control connection example for the relay board 1

* You can use the DIP switches to select these. See Installation Manual (which can be downloaded from the e-catalog).

** You can electrically isolate the digital inputs from the ground using a DIP switch.

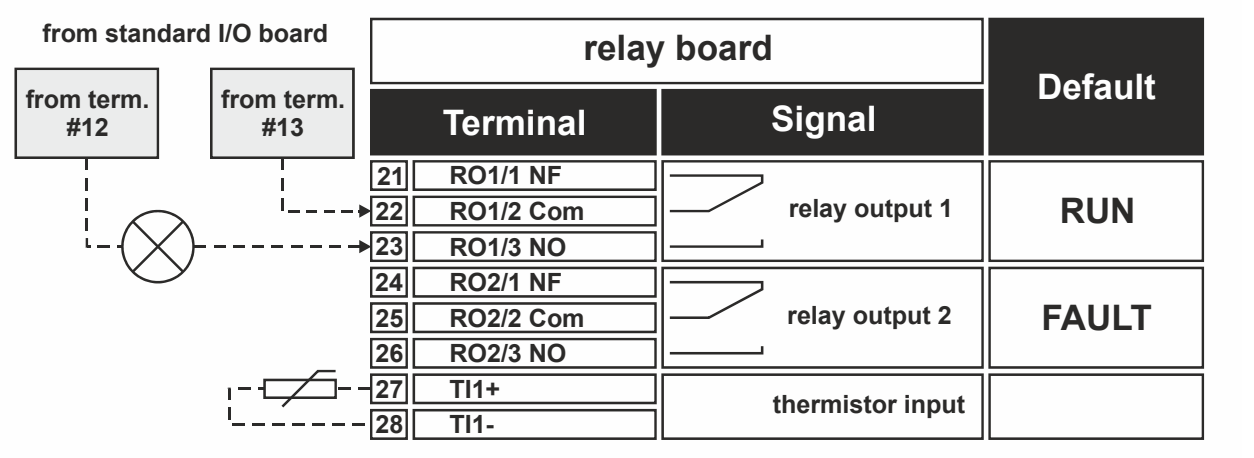


Fig. 5. The control connection example for the relay board

You can also isolate the digital inputs (terminals 8-10 and 14-16) on the standard I/O board from ground. To do this, set the dip switch on the control board to position OFF. See Fig. 6. The DIP switch to find the switches and to make applicable selections for your requirements.

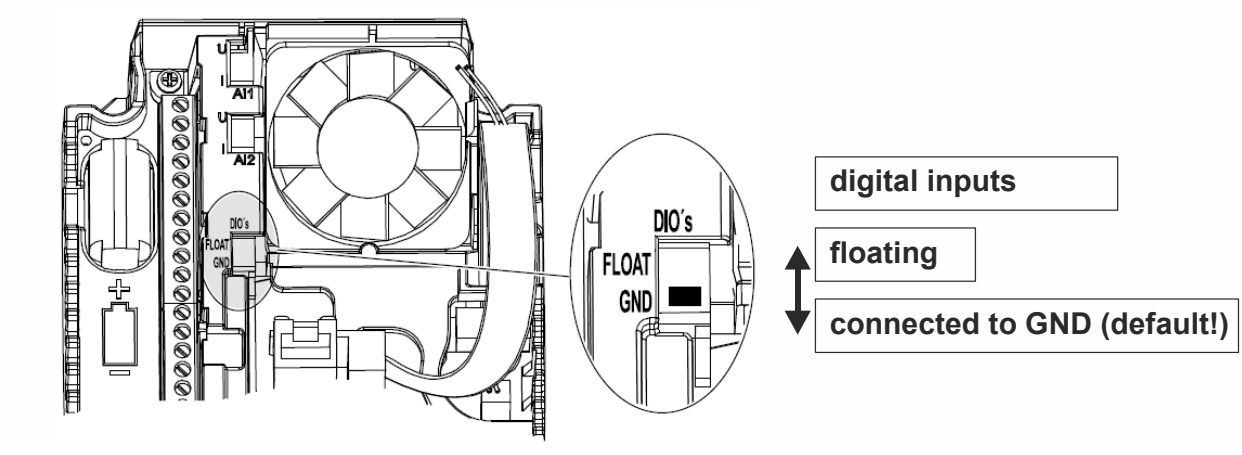


Fig. 6. The DIP switch

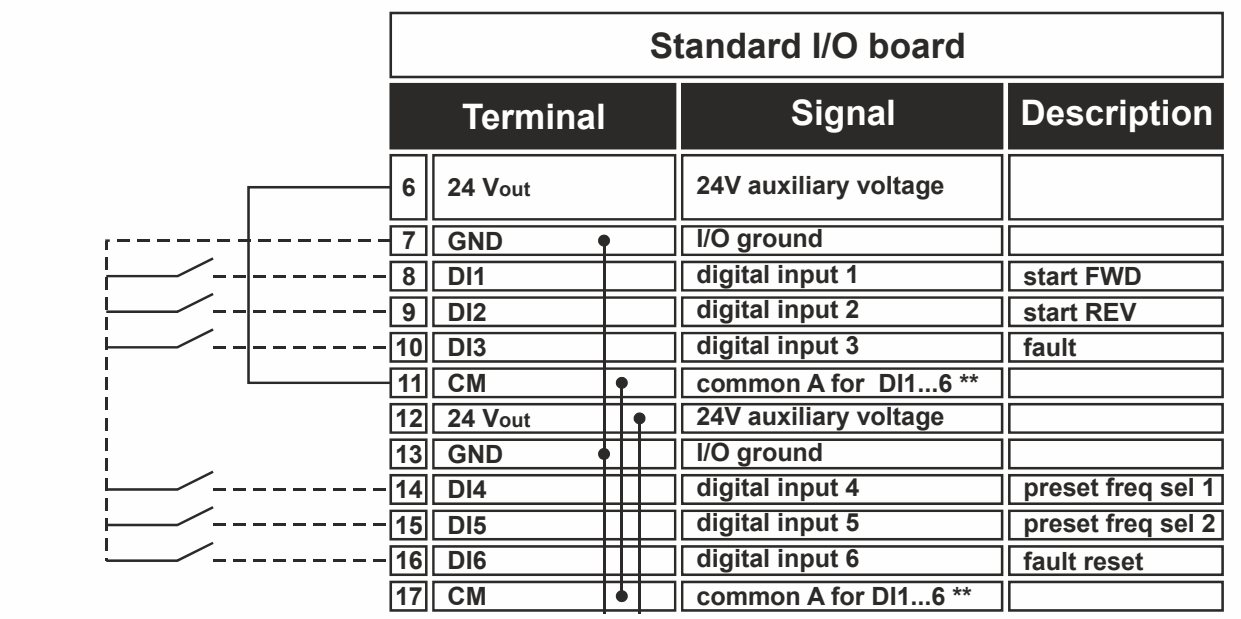


Fig. 7. The control connections example when digital inputs are isolated from ground

Table 2. Quick Setup parameter group

Index	Parameter	Min	Max	Unit	Default	ID	Description
P1.1	Motor nominal voltage	Varies	Varies	V	Varies	110	Find the value *Un* on the motor's nameplate. See P3.1.1.1.
P1.2	Motor nominal frequency	8.0	320.0	Hz	50	111	Find the value *fn* on the motor's nameplate. See P3.1.1.2.
P1.3	Motor nominal speed	24	19200	rpm	1370	112	Find the value *nn* on the motor's nameplate.
P1.4	Motor nominal current	Varies	Varies	A	Varies	113	Find the value *In* on the motor's nameplate.
P1.5	Motor Cos Phi	0.30	1.00		Varies	120	Find this value on the motor's nameplate.
P1.6	Motor nominal power	Varies	Varies	Kw	Varies	116	Find the value *nn* on the motor's nameplate.
P1.7	Motor current limit	Varies	Varies	A	Varies	107	The maximum motor current from the AC drive.
P1.8	Minimum frequency	0.00	50.00 (60.00 in N. America)	Hz	0.00	101	The minimum acceptable frequency reference.
P1.9	Maximum frequency	0.00	320.00	Hz	50.00	102	The maximum acceptable frequency reference.
P1.10	I/O Control reference A selection	1	8		6	117	The selection of the frequency reference source when the control place is I/O A. See P3.3.3 for selections.
P1.11	Preset frequency 1	0.00	50.00	Hz	10.00	105	Select with the digital input: Preset frequency selection 0 (P3.5.1.16) (Default = Digital Input 4).

Table continued: Quick Setup parameter group

Index	Parameter	Min	Max	Unit	Default	ID	Description
P1.12	Preset frequency 2	0.00	50.00	Hz	15.00	106	Select with the digital input: Preset frequency selection 1 (P3.5.1.17) (Default = Digital Input 5).
P1.13	Acceleration time 1	0.1	3000.0	s	5.0	103	Indicates the quantity of time that is necessary for the output frequency to increase from zero frequency to the maximum frequency.
P1.14	Deceleration time 1	0.1	3000.0	s	5.0	104	Indicates the quantity of time that is necessary for the output frequency to decrease from the maximum frequency to zero frequency.
P1.15	Remote control place	0	1		0	172	The selection of the remote control place (start/stop). 0 = I/O control. 1 = Fieldbus control.
P1.16	Automatic reset	0	1		0	731	0 = Disabled. 1 = Enabled.
P1.17	Motor switch	0	1		0	653	0 = Disabled. 1 = Enabled.
P1.18	PID Mini-Wizard *	0	1		0	1803	0 = Disabled. 1 = Enabled. See 2.1 PID Mini-Wizard.
P1.19	Pump and Fan Cascade Wizard*	0	1		0		0 = Disabled. 1 = Enabled. See 2.2 Pump and Fan Cascade Mini-Wizard.
P1.20	Fire Mode Wizard **	0	1		0	1672	0 = Disabled. 1 = Enabled.
P1.21	Start-Up Wizard **	0	1		0	1171	0 = Disabled. 1 = Enabled.

* = The parameter is visible only on the graphical keypad.

** = The parameter is visible only on the graphical and the text keypad.

2 WIZARDS

2.1 PID Mini-Wizard

The application wizard helps you to set the basic parameters that are related to the application.

To start the PID mini-wizard, set the value *Activate* to parameter P1.18 *PID Mini-Wizard* in the Quick Setup menu.

The default settings tell you to use the PID controller in the one feedback / one setpoint mode. The default control place is I/O A, and the default process unit is %.

1	Make selections for *Process unit* (P3.13.1.4)	More than one selection.

If your selection is other than %, you see the next questions. If you select %, the wizard goes directly to question 5.

2	Set a value for *Process Unit Min* (P3.13.1.5).	The range depends on the selection in question 1.
3	Set a value for *Process Unit Max* (P3.13.1.6).	The range depends on the selection in question 1.
4	Set a value for *Process Unit Decimals* (P3.13.1.7).	Range: 0-4.
5	Set a value for *Feedback 1 Source Selection* (P3.13.3.3).	See Table 39. Feedback settings.

If you select an analog input signal, you see the question 6. With other selections, the wizard goes to question 7.

6	Set the signal range of the analog input.	0 = 0-10V / 0…20mA. 1 = 2-10V / 4…20mA. See Table 19. Analog input settings.
7	Set a value for *Error Inversion* (P3.13.1.8).	0 = Normal. 1 = Inverted.
8	Set a value for *Setpoint Source Selection* (P3.13.2.4).	See Table 38. Setpoint settings.

If you select an analog input signal, you will see question 9. If you set *Keypad Setpoint 1* or *Keypad Setpoint 2* for the value, the wizard will go directly to question 10. With other selections, the wizard will go to question 11.

9	Set the signal range of the analog input.	0 = 0-10V / 0-20mA. 1 = 2-10V / 4-20mA. See Table 19. Analog input settings.
10	Set a value for *Keypad Setpoint 1* (P3.13.2.1) and *Keypad Setpoint 2* (P3.13.2.2)	Shows only if you select *Keypad Setpoint 1* or *Keypad Setpoint 2* in question 8.
11	Using the sleep function.	0 = No. 1 = Yes.

If you enter the value *Yes* for question 11, you see the next three questions. If you enter the value *No*, the wizard is completed.

12	Set a value for *Sleep Frequency Limit* (P3.13.2.7).	Range: 0.00-320.00 Hz.
13	Set a value for *Sleep Delay* (P3.13.2.8)	Range: 0-3000 s.
14	Set a value for *Wake-up Level* (P3.13.2.9).	The range depends on the set process unit.

The PID mini-wizard is completed.

2.2 Pump and Fan Cascade Mini-Wizard

The PFC mini-wizard asks the most important questions to set up a PFC system. The PFC mini-wizard is always preceded by PID mini-wizard.

15	Set a value for *Number of Motors* (P3.15.1).	1-5.
16	Set a value for *Interlock Function* (P3.15.2).	0 = Disabled. 1 = Enabled.
17	Enable *Autochange* (P3.15.4).	0 = Disabled. 1 = Enabled.

If you enable the *Autochange* function, you see the next three questions. If you do not use the *Autochange* function, the wizard goes directly to question 21.

18	Include VFD in *Autochange* (P3.15.3).	0 = Disabled. 1 = Enabled.
19	Set a value for *Autochange Interval* (P3.15.5).	0.0-3000.0 h.
20	Set a value for *Autochange: Frequency Limit* (P3.15.6).	0.00-50.00 Hz.
21	Set a value for *Bandwidth* (P3.15.8).	0-100%.
22	Set a value for *Bandwidth Delay* (P3.15.9).	0-3600 s.

After this, the keypad displays the digital input and relay output configuration performed by the application. Write these values down for future reference.

2.3 Fire Mode Wizard

To start the Fire Mode Wizard, select *Activate* for parameter P1.20 in the Quick setup menu.

CAUTION!

Before you continue, read about the password and warranty in 10.17 Fire Mode.

1	Set a value for parameter P3.17.5 *Fire Mode Frequency Source*.	More than one selection possible.

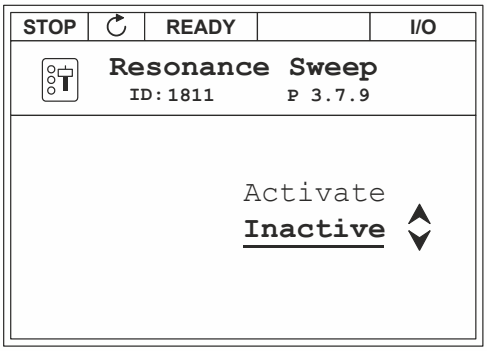
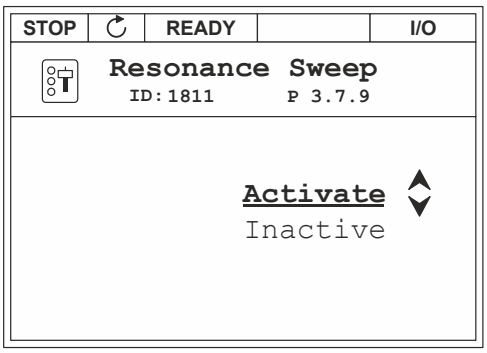
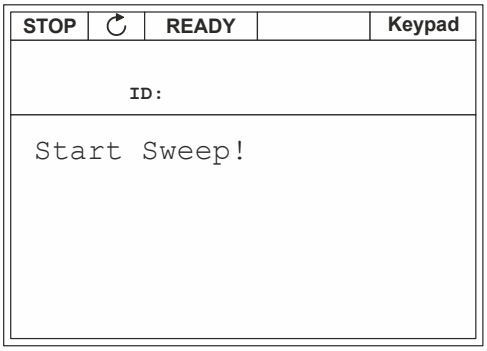
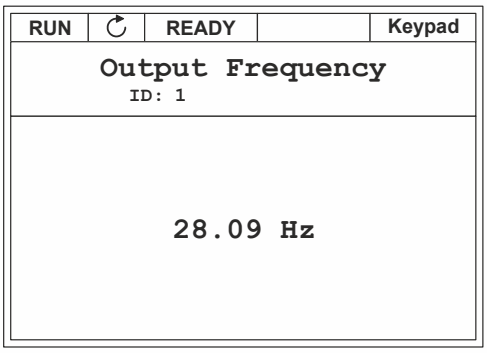
If you set a value other than Fire mode frequency, the wizard goes directly to question 3.

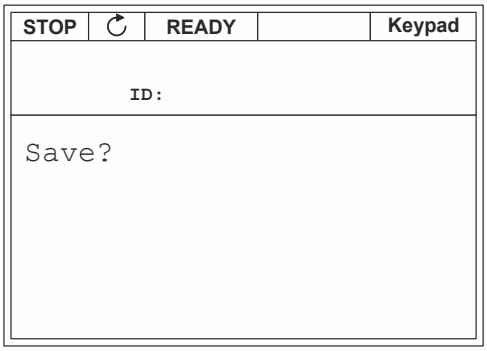
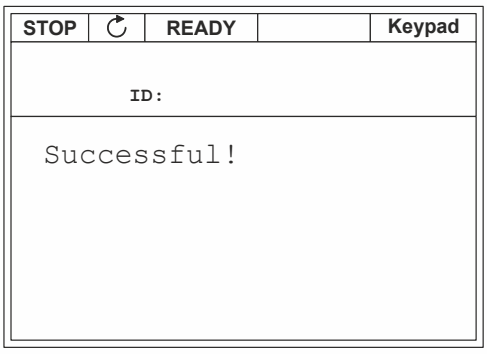
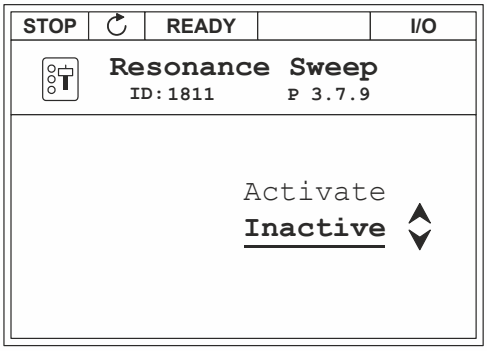
2	Set a value for parameter P3.17.4	8.00 Hz...P3.3.1.2 (MaxFreqRef).
3	Activate the signal when the contact opens or when it closes.	0 = Open contact; 1 = Closed contact.
4	Set a value for parameters P3.17.2 *Fire Mode Activation on OPEN* / P3.17.3 *Fire Mode Activation on CLOSE*.	Select a digital input to activate Fire mode. See also 10.17 Fire Mode.
5	Set a value for parameter P3.17.6 *Fire Mode Reverse*.	Select a digital input to activate the reverse direction in Fire mode.
6	Set a value for P3.17.1 *Fire Mode Password*.	Set a password to enable the Fire mode function. 1234 = Enable test mode. 1001 = Enable Fire mode.

2.4 Resonance Sweep Wizard

Use these instructions to start the resonance sweep function.

STARTING THE RESONANCE SWEEP FUNCTION

1. Find parameter P3.7.9 and press the OK button. Parameter 3.7.9 is not visible in the software – as you would normally expect – but rather only in the display.	
2. Use the UP and DOWN arrow buttons to select value 1 "Activate" and press the OK button.	
3. When the text "Start sweep" appears, press the Start button. The sweeping starts.	
4. Press the OK button each time the resonance stops to mark where the range starts and ends.	

5. When the sweeping ends, text "Save?" will appear in the display. Press the OK button if you want to save the result.	
6. When the Resonance sweeping function is saved, the text "Successful" appears in the display.	
7. Press the OK button, and the display goes back to the parameter P3.7.9 and shows value "Inactive".	

3 USER INTERFACES

3.1 Navigation on the Keypad

The data of the HVAC drive is in menus and submenus. To move between the menus, use the keypad's arrow buttons. To go into a group or an item, press the OK button. To return to the previous level, press the BACK/RESET button.

On the display, you see your current location in the menu, for example M5.5.1. You also see the name of the group or item in your current location.

Table 3. Main menu

Main menu	*Submenus*	*Main menu*	*Submenus*	*Main menu*	*Submenus*
M1 Quick set-up		**M3 Parameters**	M3.1 Motor Settings	**M5 I/O and Hardware**	M5.1 Basic I/O
M2 Monitor	M2.1 Multimonitor		M3.2 Start / Stop Set-Up		M5.2-M5.4 Slot C, D, E
	M2.2 Basic		M3.3 References		M5.5 Real-Time Clock
	M2.3 Timer Functions		M3.4 Ramps and Brakes		M5.6 Power Unit Sett.
	M2.4 PID1 Controller 1		M3.5 I/O Configuration		M5.7 Keypad
	M2.5 PID2 Controller 2		M3.6 FB Data Mapping		M5.8 RS-485
	M2.6 Multi-Pumps		M3.7 Prohibit Freq		M5.9 Ethernet
	M2.7 Maintenance counters		M3.8 Limit Supervisions		M5.13 Fieldbus General
	M2.8 Fieldbus Data		M3.9 Protections	**M6 User Settings**	M6.1 Language Selections
			M3.10 Automatic Reset		M6.2 Parameter Back-Up
			M3.11 Appl. Settings		M6.3 Parameter Compare
			M3.12 Timer Functions		M6.4 Drive Name
			M3.13 PID1 Controller 1	**M7 Favorites**	
			M3.14 PID2 Controller 2	**M8 User Levels**	M8.1 User Level
			M3.15 Pump and Fan Cascade		M8.2 Access Code
			M3.16 Maint. Counters		
			M3.17 Fire Mode		
			M3.18 kWh Pulse Object		
		M4 Diagnostics	M4.1 Active Faults		
			M4.2 Reset Faults		
			M4.3 Fault History		
			M4.4 Total Counters		
			M4.5 Trip Counters		
			M4.6 Software Info		
			M4.7 Drive Info		
			M4.8 Unit Status		

3.2 Using the HMI

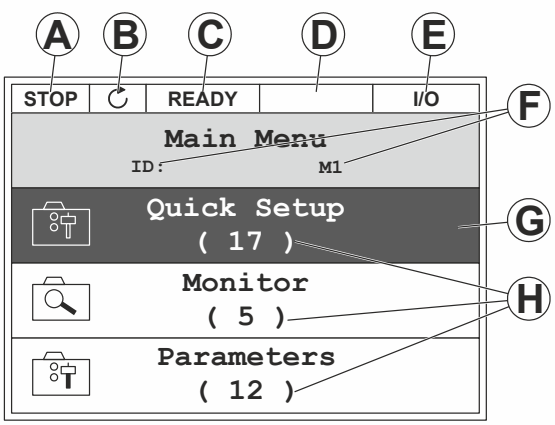


Fig. 8. The basic menu structure of the HVAC drive

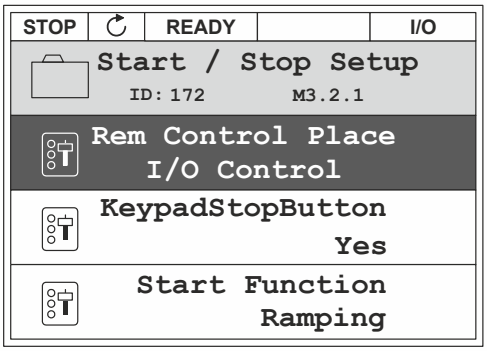
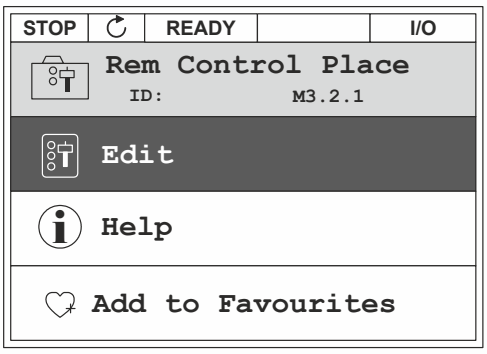
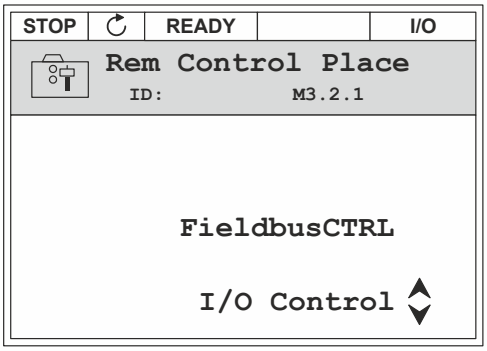
Legend

A.	The first status field: STOP/RUN.	**E.**	The control place: PC / IO / KEYPAD / FIELDBUS.
B.	The rotation direction.	**F.**	The location field: the parameter ID number and the current location in the menu.
C.	The second status field: READY / NOT READY / FAULT.	**G.**	An activated group or item: press OK to enter.
D.	The alarm field: ALARM/-.	**H.**	The number of items in the group in question.

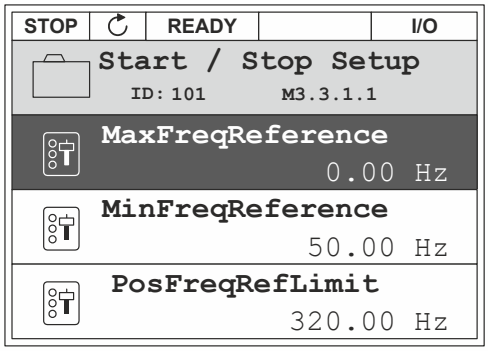
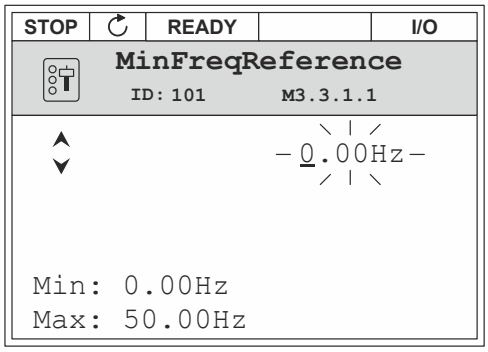
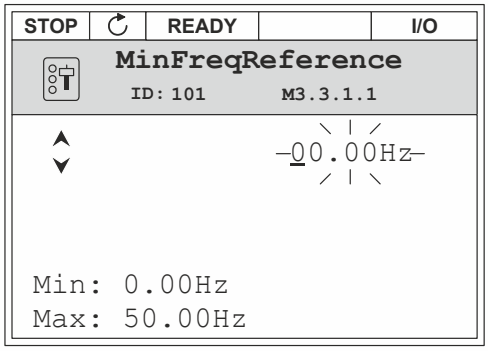
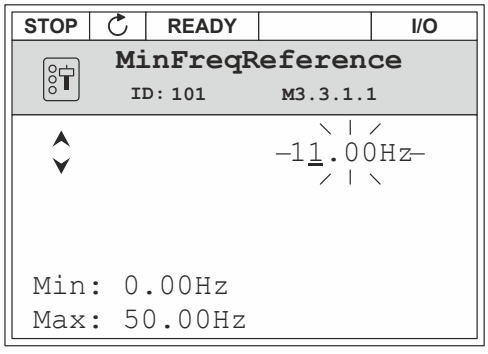
3.2.1 Editing the Values

On the graphical display, there are two different procedures to edit the value of an item. Usually, you can set only one value for a parameter. Select from a list of text values or from a range of numerical values.

CHANGING THE TEXT VALUE OF A PARAMETER

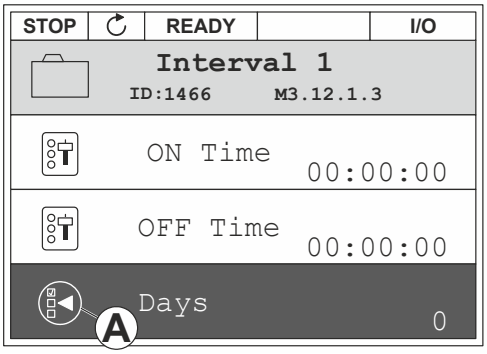
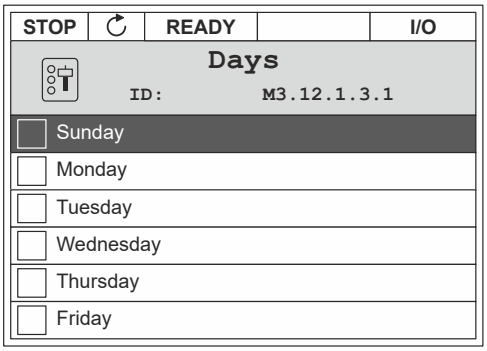
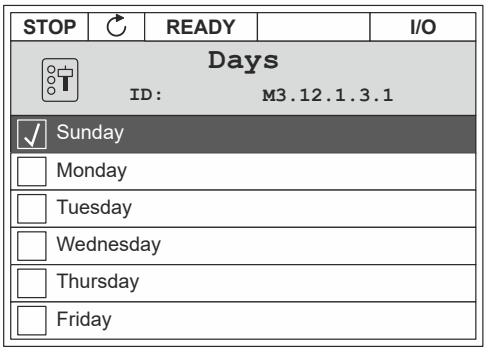
1. Find the parameter using the arrow buttons.	
2. To enter the Edit mode, press the OK button two times or press the RIGHT arrow button.	
3. To set a new value, press the UP and DOWN arrow buttons.	
4. To accept the change, press the OK button. To discard the change, use the BACK/RESET button.	

EDITING THE NUMERICAL VALUES

1. Find the parameter using the arrow buttons.	
2. Enter the Edit mode.	
3. If the value is numerical, move from digit to digit using the LEFT and RIGHT arrow buttons. Change the digits using the UP and DOWN arrow buttons.	
4. To accept the change, press the OK button. To ignore the change, use the BACK/RESET button to return to the level where you were before.	

SELECTING MORE THAN ONE VALUE

Some parameters let you to select more than one value. Select a checkbox at each necessary value.

1. Find the parameter. There is a symbol on the display when a checkbox selection is possible. (LEGEND: A = The symbol of the checkbox selection.)	
2. To move in the list of values, use the UP and DOWN arrow buttons.	
3. To add a value into your selection, select the box that is next to it using the RIGHT arrow button.	

3.2.2 Resetting a Fault

To reset a fault, you can use the Reset button or the parameter Reset Faults. See also 11.1 A Fault Comes into View.

3.2.3 The LOC/REM Button

You can use the LOC/REM button for three functions.

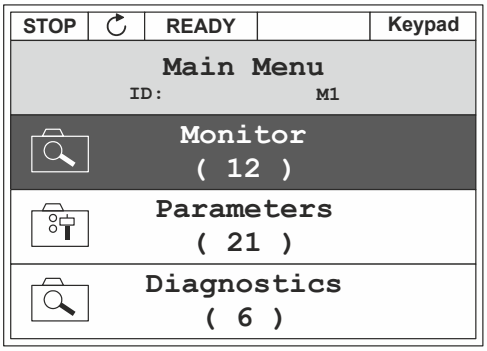
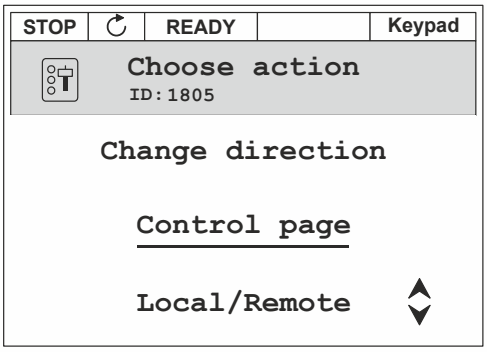
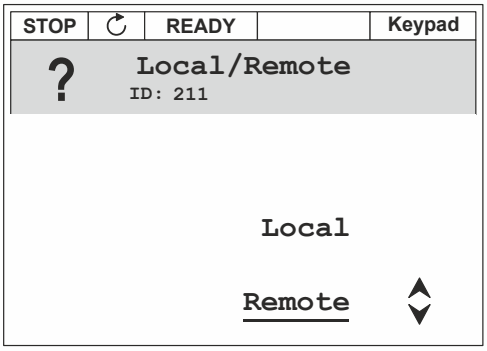
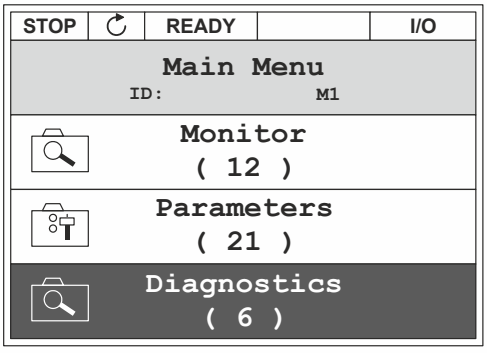
- To access the Control page.
- To easily change between the Local and Remote control places.
- To change the rotation direction (in Keypad mode, only)

The selection of the control place determines from where the HVAC drive takes the *Start* and *Stop* commands. All the control places have a parameter for the selection of the frequency reference source. The Local control place is always the keypad. The Remote control place is I/O or Fieldbus. You can see the current control place on the status bar of the display.

It is possible to use I/O A, and Fieldbus as Remote control places. I/O A and Fieldbus have the lowest priority. You can select them using P3.2.1 (Remote Control Place). I/O B can bypass the Remote control places I/O A and Fieldbus with a digital input. You can select the digital input with parameter P3.5.1.5 (I/O B Control Force).

The keypad is always used as a control place when the control place is Local. Local control has higher priority than Remote control. For example, when you are in Remote control, if parameter P3.5.1.5 bypasses the control place with a digital input, and you select Local, Keypad will become the control place. Use the LOC/REM button or P3.2.2 Local/Remote to change between the Local and Remote control.

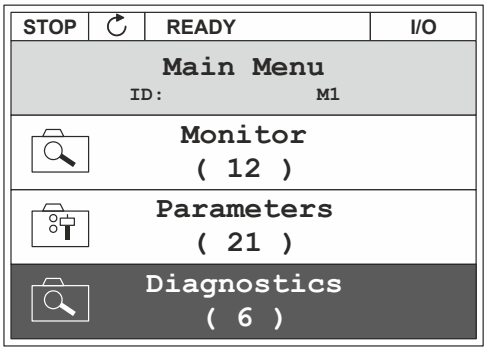
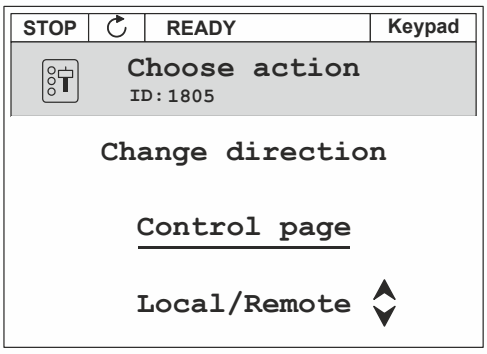
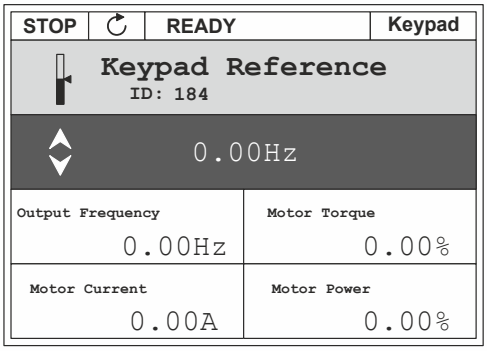
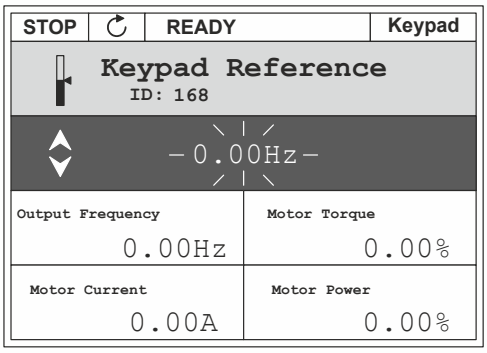
CHANGING THE CONTROL PLACE

1. Anywhere in the menu structure, press the LOC/REM button.	
2. To select Local/Remote, use the UP and DOWN arrow buttons. Press the OK button.	
3. To select either Local or Remote, use the UP and DOWN arrow buttons again. To accept the selection, press the OK button.	
4. If you changed Remote control place to Local (i.e., the keypad), provide a keypad reference.	

After the selection, the display goes back to where it was when you pressed the LOC/REM button.

ENTERING THE CONTROL PAGE

In the Control page, it is easy to monitor the most important values.

1. Anywhere in the menu structure, press the LOC/REM button.	
2. To select the Control page, press the UP and DOWN arrow buttons. Enter by pressing the OK button. The control page opens.	
3. If you use the Local control place and the keypad reference, you can set P3.3.6 Keypad Reference by pressing the OK button.	
4. To change the digits in the value, press the UP and DOWN arrow buttons. Accept the change using the OK button.	

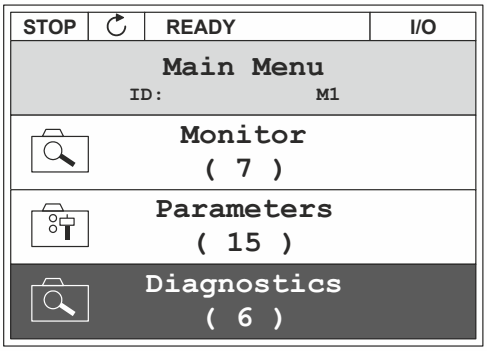
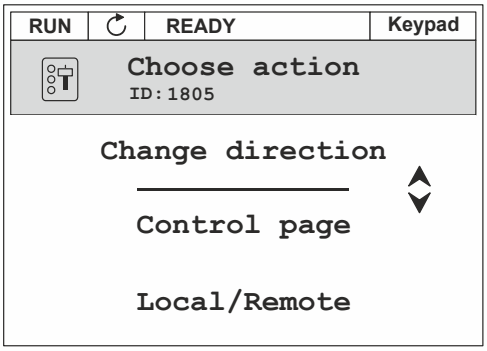
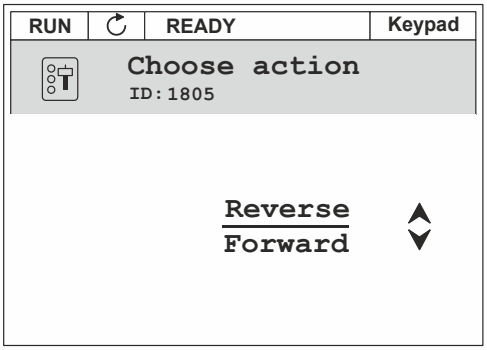
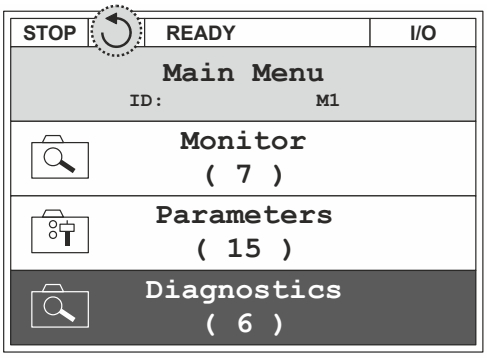
See also 5.3 Group 3.3: Control Reference Settings. If you use other control places or reference values, the display shows the frequency reference, which you cannot edit. The other values on the page are Multimonitoring values.

You can select the values that show up here (see also 4.1.1 Multimonitor).

CHANGING THE ROTATION DIRECTION

You can change the rotation direction of the motor quickly using the LOC/REM button.

NOTE: The command *Change direction* is available in the menu only if the current control place is *Keypad*.

1. Anywhere in the menu structure, press the LOC/REM button.	
2. To select *Change direction*, press the UP and DOWN arrow buttons. Press the OK button.	
3. Select a new rotation direction. The current rotation direction blinks. Press the OK button.	
4. The rotation direction changes immediately. You can see that the arrow indication in the status field of the display changes.	

3.2.4 Copying Parameters

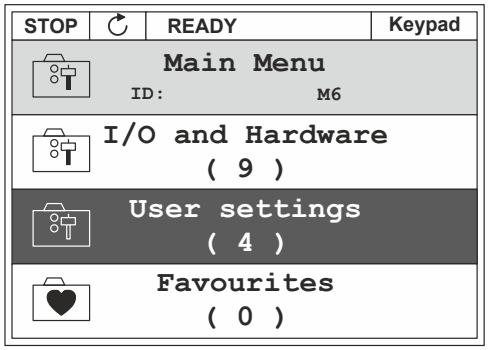
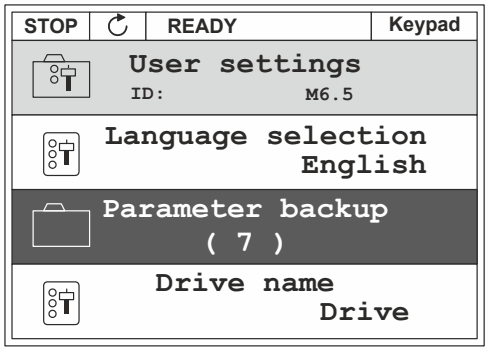
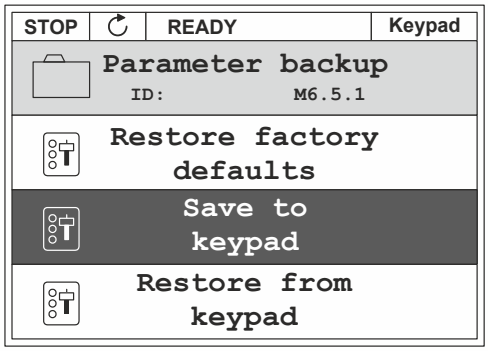
Before you can copy parameters from the control panel to the drive, you must stop the drive:

COPYING THE PARAMETERS OF AN HVAC DRIVE

You can use this function to copy parameters from a drive to another.

1. Save the parameters to the control panel.
2. Detach the control panel and connect it to another drive.
3. Download the parameters to the new drive using the command *Restore from keypad*.

SAVING THE PARAMETERS TO THE CONTROL PANEL

1. Enter the *User settings* menu.	
2. Go into the *Parameter backup* submenu.	
3. Use the UP and DOWN arrow buttons to select a function. Accept the selection using the OK button.	

The command *Restore factory defaults* brings back the parameter settings that were made at the factory. Using the command *Save to keypad*, you can copy all the parameters to the control panel. The command *Restore from keypad* copies all the parameters from the control panel to the drive.

3.2.4.1 Parameters that You Cannot Copy If the Drives Have Different Sizes

If you use the keyboard to copy parameters from one drive to another having a different size, the values of these parameters will not change.

- Motor nominal voltage (P3.1.1.1)
- Motor nominal frequency (P3.1.1.2)
- Motor nominal speed (P3.1.1.3)
- Motor nominal current (P3.1.1.4)
- Motor cos phi (P3.1.1.5)
- Motor nominal power (P3.1.1.6)
- Motor current limit (P3.1.1.7)
- Switching frequency (P3.1.2.1)
- Zero frequency voltage (P3.1.2.3)
- Motor preheat current (P3.1.2.4)
- Stator voltage adjust (P3.1.2.12)
- Maximum frequency (P3.3.2)
- Start magnetizing current (P3.4.12)
- DC brake current (P3.4.14)
- Flux braking current (P3.4.17)
- Stall current limit (P3.9.12)
- Motor thermal time constant (P3.9.9)

3.2.5 Comparing Parameters

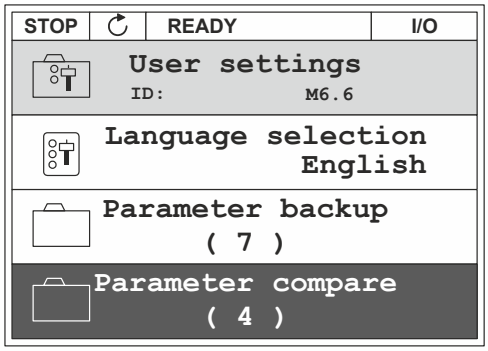
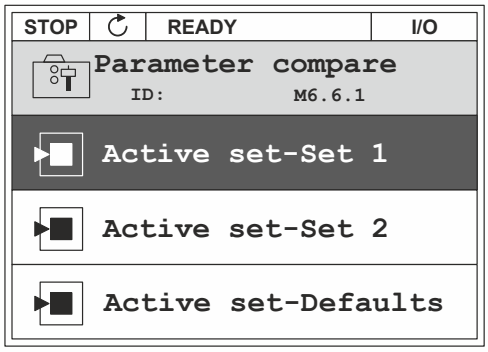
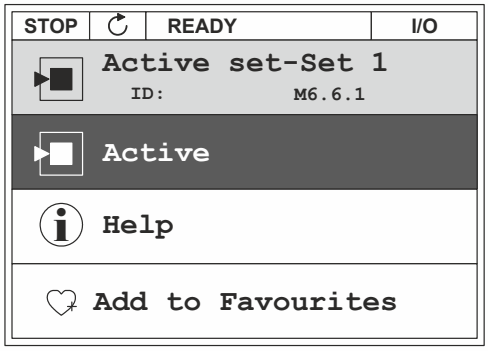
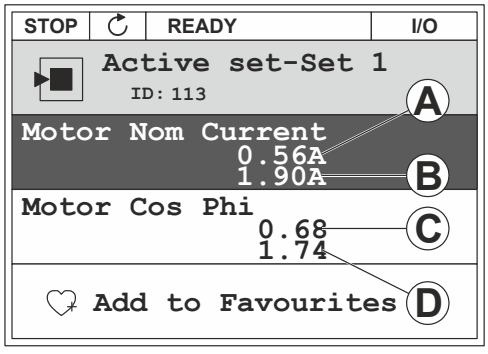
With this function, you can compare the current parameter set with one of these four sets.

- Set 1 (P6.5.4 Save to Set 1)
- Set 2 (P6.5.6 Save to Set 2)
- The defaults (P6.5.1 Restore Factory Defaults)
- The keypad set (P6.5.2 Save to Keypad)

See also Table 64. The parameter compare.

NOTE: If you have not saved the parameter set with which you want to compare the current set, the display shows the text *Comparing failed*.

USING THE FUNCTION PARAMETER COMPARE

1. Enter *Parameter Compare* in the User settings.	
2. Select the pair of sets. Press OK to accept the selection.	
3. Select *Active* and press OK.	
4. Examine the comparing between the current values and the values of the other set.	

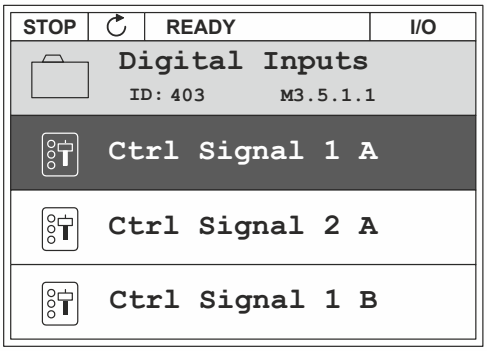
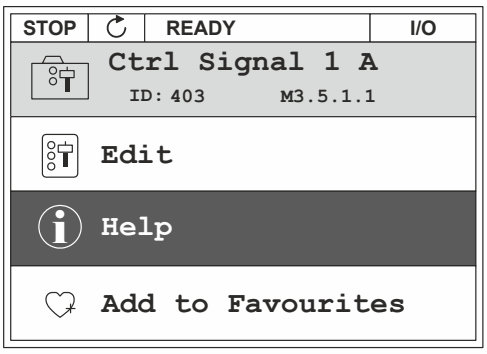
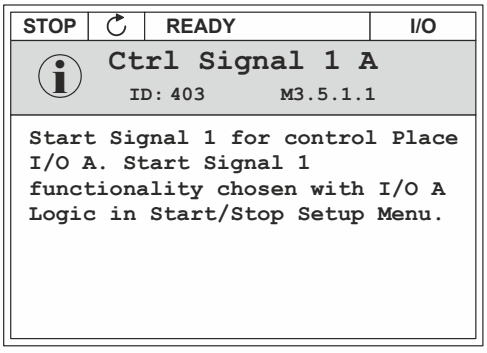
Legend

A.	The current value.	**C.**	The cosphi value.
B.	The value of the other set.	**D.**	The cosphi value of the other set.

3.2.6 Help Texts

The graphical display can show help texts on many topics. All the parameters have a help text. The help texts are also available for the faults, alarms, and the Startup wizard.

READING A HELP TEXT

1. Find the item about which you want to read.	
2. Use the UP and DOWN arrow buttons to select HELP.	
3. To open the HELP text, press the OK button.	

NOTE: The help texts are always in English.

3.2.7 Using the FAVORITES Menu

If you use the same items frequently, you can add them into Favorites. You can collect a set of parameters or monitoring signals from all the keypad menus.

See also 8.2 Favorites.

3.3 Menu Structure

Table 4. Menu structure

Menu	Function
Quick set-up	See 1.4.1 HVAC400 Applications.
Affichage	Multi-monitor
	Basic
	Timer functions
	PID controller 1
	PID controller 2
	Multi-pump
	Maintenance counters
	Fieldbus data
	Temperature inputs **
Parameters	See 5 Parameters MENU.
Diagnostics	Active faults
	Reset faults
	Fault history
	Counters without reset
	Counters with reset
	Software info
I/O and hardware	Basic I/O
	Slot C
	Slot D
	Slot E
	Real-time clock
	Power unit settings
	Keypad
	RS-485
	Ethernet
	Fieldbus General
User settings	Language selections
	Parameter back-up
	Parameter compare
	Drive name
Favorites	See 8.2 Favorites.
User levels	See 8.3 User Levels.

** = The function is available only when the OPTBH option board is connected to the HVAC drive.

3.3.1 Quick Set-Up

The Quick Setup Menu includes the minimum set of the most commonly used parameters during installation and commissioning of the HVAC400 application.

They are collected in the first parameter group so that they are fast and easy to find. You can also find and edit them in their actual parameter groups. When you change a parameter value in the Quick setup group, the value of this parameter in its actual group also changes.

See also 1.3 First Start-Up and 2 Wizards.

3.3.2 Monitor

MULTIMONITOR

Using the Multimonitor function, you can collect 4-9 items to monitor. See 4.1.1 Multimonitor.

BASIC

The basic monitoring values can include statuses, measurements, and the actual values of parameters and signals. See 4.1.2 Basic.

TIMER FUNCTIONS

With this function, you can monitor the timer functions and the Real-Time Clock. See 4.1.3 Timer Functions Monitoring.

PID CONTROLLER 1

With this function, you can monitor the PID controller values. See 4.1.4 PID1 Controller Monitoring.

PID CONTROLLER 2

With this function, you can monitor the PID controller values. See 4.1.5 PID2 Controller Monitoring.

MULTI-PUMP

You can use this function to monitor the values that are related to the operation of more than one drive.

See 4.1.6 Multipump Monitoring.

MAINTENANCE COUNTERS

With this function, you can monitor the Maintenance counter values. See 4.1.7 Maintenance Counters.

FIELDBUS DATA

With this function, you see the fieldbus data as monitor values. You can use this function, e.g., for monitoring during the fieldbus commissioning. See 4.1.8 Fieldbus Process Data Monitoring.

4 MONITORING MENU

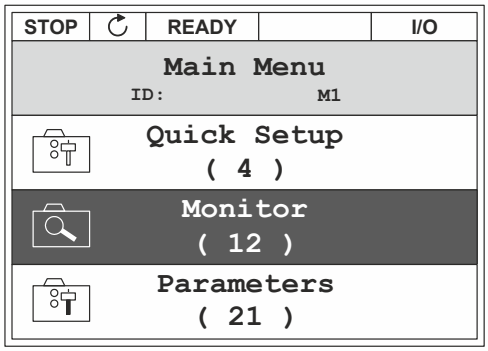
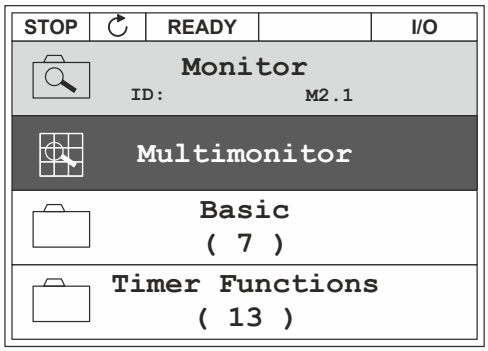
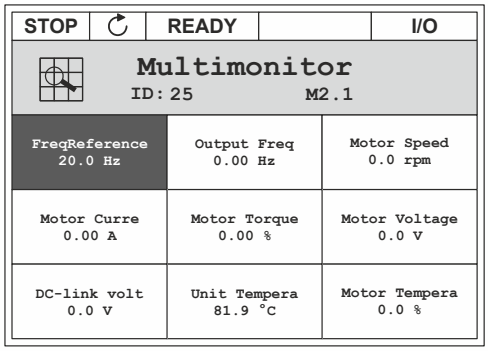
4.1 Monitor Group

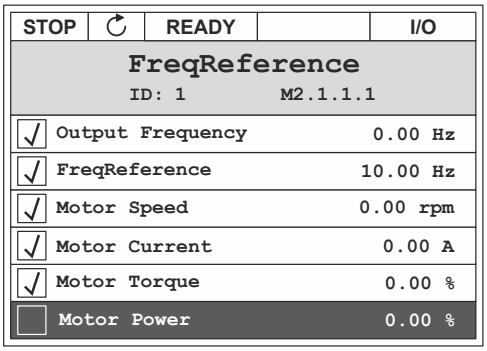
You can monitor the actual values of the parameters and signals. You can also monitor the statuses and measurements. You can customize some of the values that you can monitor.

4.1.1 Multimonitor

On the Multimonitor page, you can collect nine items to monitor.

CHANGING THE ITEMS TO MONITOR

1. Enter the Monitor menu using the OK button.	
2. Enter the MULTIMONITOR.	
3. To replace an old item, activate it. Use the UP and DOWN arrow buttons.	

4. To select a new item in the list, press OK.	

4.1.2 Basic

The basic monitoring values are the actual values of selected parameters, signals, statuses and measurements. The different applications may have different number of monitoring values.

You can see the basic monitoring values and their related data in the next table.

NOTE: Only the standard I/O board statuses are available in the Monitor menu. You can find the statuses of all the I/O board signals as raw data in the I/O and Hardware system menu.

Check the statuses of the expander I/O board in the I/O and Hardware system menu when the system asks you to do it.

Table 5. Items in the monitoring menu

Index	Monitoring value	Unit	ID	Description
V2.2.1	Output frequency	Hz	1	
V2.2.2	Frequency reference	Hz	25	
V2.2.3	Motor speed	rpm	2	
V2.2.4	Motor current	A	3	
V2.2.5	Motor torque	%	4	
V2.2.7	Motor shaft power	%	5	
V2.2.8	Motor shaft power	KW	73	
V2.2.9	Motor voltage	V	6	
V2.2.10	DC link voltage	V	7	
V2.2.11	Unit temperature	°C/ °F	8	
V2.2.12	Motor temperature	%	9	
V2.2.13	Analog input 1	%	59	
V2.2.14	Analog input 2	%	60	
V2.2.15	Analog output 1	%	81	
V2.2.16	Motor preheat		1228	0 = Disabled. 1 = Heating (feeding DC-current).
V2.2.17	Heating (feeding DC-current)		43	B1 =Ready. B2 = Run. B3 = Fault. B6 =RunEnable. B7 = AlarmActive. B10 = DC Current in stop. B12 = RunRequest. B13 = MotorRegulatorActive.
V2.2.18	LastActiveFaultCode		37	
V2.2.19	Fire mode status		1597	0 = Disabled. 1 = Enabled. 2 = Activated. 3 = Test mode.
V2.2.20	Appl.StatusWord 1		89	B0 = Interlock 1. B1 = Interlock 2. B5 = E/S Control Act. B6 = I/O B Control Act. B7 = Fieldbus Control Act. B8 = Local Control Act. B9 = PC Control Act. B10 = Preset Frequencies Act. B12 = FireMode Act. B13 = PreHeat Act.

continued: Items in the monitoring menu

Index	Monitoring value	Unit	ID	Description
V2.2.21	Appl.StatusWord 2		90	B0 = Acc./Dec. Prohibited. B1 = MotorSwitch Act.
V2.2.22	DIN Status Word 1		56	
V2.2.23	DIN Status Word 2		57	
V2.2.24	Motor current with one decimal		45	
V2.2.25	kWhTripCounter Low		1054	
V2.2.26	kWhTripCounter High		1067	
V2.2.27	LastActiveFault ID		95	
V2.2.28	LastActiveAlarmCode		74	
V2.2.29	LastActiveAlarm ID		94	
V2.2.30	U Phase Current	A	39	
V2.2.31	V Phase Current	A	40	
V2.2.32	W Phase Current	A	41	
V2.2.33	Motor regulation status		77	B0: Max. current motor B1: Max. current generator B2: Max. torque motor B3: Max. torque generator B4: Overvoltage monitoring B5: Undervoltage monitoring B6: Max. power motor B7: Max. power generator

4.1.3 Timer Functions Monitoring

Monitor the values of Timer functions and the Real-Time Clock.

Table 6. Monitoring of the timer functions

Index	Monitoring value	Unit	ID	Description
V2.3.1	TC 1, TC 2, TC 3		1441	It is possible to use three timers (TC).
V2.3.2	Interval 1		1442	State of the timer.
V2.3.3	Interval 2		1443	State of the timer.
V2.3.4	Interval 3		1444	State of the timer.
V2.3.5	Interval 4		1445	State of the timer.
V2.3.6	Interval 5		1446	State of the timer.
V2.3.7	Timer 1	s	1447	Remaining time.
V2.3.8	Timer 2	s	1448	Remaining time.
V2.3.9	Timer 3	s	1449	Remaining time.
V2.3.10	Real-time clock	xx:xx:xx	1450	Shows the real time from the drive.

4.1.4 PID1 Controller Monitoring

Table 7. Monitoring of the values of the PID1 controller

Index	Monitoring value	Unit	ID	Description
V2.4.1	PID1 setpoint	Varies	20	Displayed in units selected for the PID process.
V2.4.2	PID1 feedback	Varies	21	Displayed in units selected for the PID process.
V2.4.3	PID1 error value	Varies	22	Displayed in units selected for the PID process.
V2.4.4	PID1 ouptut	%	23	PID output is the process reference (AO).
V2.4.5	PID1 status		24	0 = Stopped 1 = Running 3 = Sleep mode 4 = In dead band (see 5.13 Group 3.13: PID Controller 1 Settings.)

4.1.5 PID2 Controller Monitoring

Table 8. Monitoring of the values of the PID2 controller

Index	Monitoring value	Unit	ID	Description
V2.5.1	PID2 setpoint	Varies	83	Displayed in units selected for the PID process.
V2.5.2	PID2 feedback	Varies	84	Displayed in units selected for the PID process.
V2.5.3	PID2 error value	Varies	85	Displayed in units selected for the PID process.
V2.5.4	PID2 output	%	86	PID output is the process reference (AO).
V2.5.5	PID2 status	Varies	87	0 = Stopped 1 = Running 3 = Sleep mode 4 = In dead band (see 5.14 Group 3.14: PID Controller 2.)

4.1.6 Multipump Monitoring

Table 9. Multipump monitoring

Index	Monitoring value	Unit	ID	Description
V2.6.1	Motors running		30	Max. number of running motors during pump permutation.
V2.6.2	Autochange		1114	Indicates if a permutation is due.

4.1.7 Maintenance Counters

Table 10. Monitoring of the values of the Maintenance Counters

Index	Monitoring value	Unit	ID	Description
V2.7.1	Maintenance Counter 1		1101	State of the counter in (rpm/h*1000 or in hours).
V2.7.2	Maintenance Counter 2		1102	State of the counter in (rpm/h*1000 or in hours).
V2.7.3	Maintenance Counter 3		1103	State of the counter in (rpm/h*1000 or in hours).

4.1.8 Fieldbus Process Data Monitoring

Table 11. Fieldbus data monitoring

Index	Monitoring value	Unit	ID	Description
V2.8.1	FB Control Word		874	Fieldbus control word used in mode/format bypass. Depending on the type and the profile of the bus, values can be set before being sent to the application. These values can be changed without affecting the reference setpoint.
V2.8.2	FB Speed Reference		875	Speed reference in scaled in from 0…100% between the min and max frequency set by the time it was set to the application.
V2.8.3	FB data in 1		876	Gross value assigned in a 32-bit format.
V2.8.4	FB data in 2		877	Gross value assigned in a 32-bit format.
V2.8.5	FB data in 3		878	Gross value assigned in a 32-bit format.
V2.8.6	FB data in 4		879	Gross value assigned in a 32-bit format.
V2.8.7	FB data in 5		880	Gross value assigned in a 32-bit format.
V2.8.8	FB data in 6		881	Gross value assigned in a 32-bit format.
V2.8.9	FB data in 7		882	Gross value assigned in a 32-bit format.
V2.8.10	FB data in 8		883	Gross value assigned in a 32-bit format.
V2.8.11	FB Status Word		864	Fieldbus status word used in mode/format bypass. Depending on the type and the profile of the bus, values can be set before being sent to the application. These values can be changed without affecting the reference setpoint.
V2.8.12	FB Speed Actual		865	Speed feedback value in scaled in from 0…100% between the min and max frequency set by the time it was set to the application.
V2.8.13	FB data out 1		866	Gross value assigned in a 32-bit format.
V2.8.14	FB data out 2		867	Gross value assigned in a 32-bit format.
V2.8.15	FB data out 3		868	Gross value assigned in a 32-bit format.
V2.8.16	FB data out 4		869	Gross value assigned in a 32-bit format.
V2.8.17	FB data out 5		870	Gross value assigned in a 32-bit format.
V2.8.18	FB data out 6		871	Gross value assigned in a 32-bit format.
V2.8.19	FB data out 7		872	Gross value assigned in a 32-bit format.
V2.8.20	FB data out 8		873	Gross value assigned in a 32-bit format.

5 PARAMETERS MENU

Table 12. Menu and Parameter group description

Menu and Parameter group	Description
Group 3.1: Motor settings	Basic and advanced motor settings.
Group 3.2: Start/Stop setup	Start and stop functions.
Group 3.3: Control reference settings	Frequency reference setup.
Group 3.4: Ramp & Brakes Setup	Acceleration/Deceleration setup.
Group 3.5: I/O Configuration	I/O programming.
Group 3.6: Fieldbus Data Mapping	Fieldbus data out parameters.
Group 3.7: Prohibit Frequencies	Prohibit frequencies programming.
Group 3.8: Limit supervisions	Programmable limit controllers.
Group 3.9: Protections	Protections configuration.
Group 3.10: Automatic reset	Auto reset after fault configuration.
Group 3.11 Application Settings	Settings of the process units, keypad, and passwords.
Group 3.12: Timer functions	Configuration of three timers based on Real-Time Clock.
Group 3.13: PID controller 1	Parameters for PID Controller 1. Motor control or external usage.
Group 3.14: PID controller 2	Parameters for PID Controller 2. External usage.
Group 3.15: Pump and Fan Cascade	Parameters for PFC system.
Group 3.16 Maintenance counters	Parameters for Maintenance counters.
Group 3.17: Fire mode	Parameters for Fire Mode.
Group 3.18 kWh Pulse Output	Parameters to configure a digital output giving pulses that agree with the kWh counter.

5.1 Group 3.1: Motor Settings

NOTE: If drive is in the run state, these parameters are locked.

Table 13. Basic settings

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.1.1.1	Motor nominal voltage	Varies	Varies	V	Varies	110	
P3.1.1.2	Motor nominal frequency	8.00	320.00	Hz	50 (60 in N. America)	111	
P3.1.1.3	Motor nominal speed	24	19200	rpm	1370 (1750 in N. America)	112	
P3.1.1.4	Motor nominal current	Varies	Varies	A	Varies	113	
P3.1.1.5	Motor Cos Phi	0.30	1.00		Varies	120	
P3.1.1.6	Motor Nominal Power	Varies	Varies	Kw/hp	Varies	116	
P3.1.1.7	Motor current limit	Varies	Varies	A	Varies	107	
P3.1.1.8	Motor type	0	1		0	650	0 = asynchronous induction motor. 1 = PM synchronous motor.

Table 14. Motor control

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.1.2.1	Switching Frequency	1.5	Varies	kHz	Varies	601	
P3.1.2.2	Motor switch	0	1		0	653	0 = Disabled. 1 = Enabled.
P3.1.2.3	Zero Frequency Voltage	0.00	40.00	%	Varies	606	
P3.1.2.4	Motor preheat function	0	4		0	1225	0 = Disabled 1 = Stop state 2 = DIN control 3 = Temp limit (heatsink) 4 = Motor temperature
P3.1.2.5	Motor preheat temperature limit	-20	100	°C	0	1226	
P3.1.2.6	Motor preheat current	0	0.5*IL	A	Varies	1227	
P3.1.2.7	U/f Ratio selection	0	2		Varies	108	0 = Linear 1 = Squared 2 = programmable.
P3.1.2.8	Overvoltage Control	0	1		1	607	0 = Disabled. 1 = Enabled.
P3.1.2.9	Undervoltage Control	0	1		1	608	0 = Disabled. 1 = Enabled.
P3.1.2.10	Energy Optimization	0	1		0	666	0 = Disabled. 1 = Enabled.
P3.1.2.11	Flying Start Options	0	65			1590	B0 = Disable reverse direction search. B6 = Flux build with current control.
P3.1.2.12	Stator Voltage Adjust	50.0	150.0	%	100.0	659	
P3.1.2.13	I/f Start	0	1		0	534	0 = Disabled. 1 = Enabled.
P3.1.2.14	/f Start Frequency	5.0	25	Hz	0.2 P3.1.1.2	535	
P3.1.2.15	I/f Start Current	0	100	%	80	536	
P3.1.2.16	Identification	0	2	--	0	631	0 = No action. 1 = ID no run. 2 = ID with run.
P3.1.2.17	U/f Mid Frequency	0.0	P3.1.1.2	Hz	P.3.1.1.2	604	
P3.1.2.18	U/f Mid Voltage	0.0	200.0	%	100	605	
3.1.2.19	Motor preheat	0	6	--	0	1045	0 = Not used. 1 = Temperature signal 1. 2 = Temperature signal 2. 3 = Temperature signal 3.

5.2 Group 3.2: Start / Stop Set-Up

Table 15. Start / stop menu

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.2.1	Remote Control Place	0	1		0	172	0 = I/O control. 1 = Fieldbus control.
P3.2.2	Local/Distance	0	1		0	211	0 = Remote. 1 = Local.
P3.2.3	Touche stop	0	1		1	1806	0 = Disabled. 1 = Enabled.
P3.2.4	Function Start	0	1		Varies	505	0 = Ramping. 1 = Flying start.
P3.2.5	Function Stop	0	1		0	506	0 = Coasting. 1 = Ramping.
P3.2.6	I/O A Start / Stop Logic	0	5		0	300	Logic = 0. Ctrl signal 1 = Forward. Ctrl signal 2 = Backward. Logic = 1. Ctrl signal 1 = Forward (edge). Ctrl signal 2 = Inverted Stop. Logic = 2. Ctrl signal 1 = Forward (edge). Ctrl signal 2 = Backward (front). Logic = 3. Ctrl signal 1 = Start. Ctrl signal 2 = Inverted. Logic = 4. Ctrl signal 1 = Start (front). Ctrl signal 2 = Backward. Logic = 5. Ctrl signal 1 = AI1 threshold. Ctrl signal 2 = AI1 threshold.
P3.2.7	I/O B Start / Stop Logic	0	5		0	363	See above.
P3.2.8	AI1 Start Threshold	3.00	100.00		10.00	185	
P3.2.9	Fieldbus Start Logic	0	1		0	889	A rising edge is necessary. 1 = State.
P3.2.10	Keypad Stop Button	No	Yes		No	114	No (Always enabled). Yes = Start enabled only if P3.2.2 is set to local.
P3.2.11	Start Delay	0.00	60.00	s	0.00	524	

5.3 Group 3.3: Control Reference Settings

Table 16. Control reference settings

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.3.1	Min. Frequency	0.00	P3.3.2	Hz	0.00	101	
P3.3.2	Max. Frequency	P3.3.1	320.00	Hz	0.00	102	
P3.3.3	I/O Control Reference A Selection	1	11		6	117	1 = Preset Frequency 0. 2 = Keypad reference. 3 = Fieldbus. 4 = AI1. 5 = AI2. 6 = AI1+AI2. 7 = PID 1 reference. 8 = Motor potentiometer. 9 = Average (AI1, AI2). 10 = Min (AI1, AI2). 11 = Max (AI1, AI2).
P3.3.4	I/O Control Reference B Selection	1	11		4	131	See above.
P3.3.5	Keypad Ctrl Reference Selection	1	8		2	121	1 = Preset Frequency 0. 2 = Keypad. 3 = Fieldbus. 4 = AI1. 5 = AI2. 6 = AI1+AI2. 7 = PID 1 reference. 8 = Motor potentiometer.
P3.3.6	Keypad Reference	P3.3.1	P3.3.2	Hz	0.00	184	
P3.3.7	Keypad Direction	0	1		0	123	0 = Forward. 1 = Reverse.
P3.3.8	Keypad reference copy	0	2		1	181	0 = Copy reference. 1 = Copy ref & Run state. 2 = No copying.
P3.3.9	Fieldbus Control Reference Selection	1	8		3	122	1 = Preset frequency 0. 2 = Keypad. 3 = Fieldbus. 4 = AI1. 5 = AI2. 6 = AI1+AI2. 7 = PID 1 reference. 8 = Motor potentiometer.
P3.3.10	Preset Frequency Mode	0	1		0	182	0 = Binary coded. 1 = Number of inputs.

continued: Parameters de références

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.3.11	Preset frequency 0	P3.3.1	P3.3.2	Hz	5.00	180	
P3.3.12	Preset frequency 1	P3.3.1	P3.3.1	Hz	10.00	105	
P3.3.13	Preset frequency 2	P3.3.1	P3.3.1	Hz	15.00	106	
P3.3.14	Preset frequency 3	P3.3.1	P3.3.1	Hz	20.00	126	
P3.3.15	Preset frequency 4	P3.3.1	P3.3.1	Hz	25.00	127	
P3.3.16	Preset frequency 5	P3.3.1	P3.3.1	Hz	30.00	128	
P3.3.17	Preset frequency 6	P3.3.1	P3.3.1	Hz	40.00	129	
P3.3.18	Preset frequency 7	P3.3.1	P3.3.1	Hz	50.00	130	
P3.3.19	Preset alarm frequency	P3.3.1	P3.3.2	Hz	25.00	183	
P3.3.20	Motor Potentiometer Ramp Time	0.1	500.0	Hz/s	10.0	331	
P3.3.21	Motor Potentiometer Reset	0	2		1	367	0 = No reset. 1 = Reset if stopped. 2 = Reset if powered down.
P3.3.22	Reverse direction	0	1		0	15530	0 = Reverse allowed. 1 = Reverse prevented.

5.4 Group 3.4: Ramp and Brakes Set-Up

Table 17. Ramp and brakes set-up

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.4.1	Ramp 1 Shape	0.0	10.0	s	0.0	500	
P3.4.2	Acceleration Time 1	0.1	3000.0	s	5.0	103	
P3.4.3	Deceleration Time 1	0.1	3000.0	s	5.0	104	
P3.4.4	Ramp 2 Threshold	0.00	50.00	Hz	0.00	526	
P3.4.5	Ramp 2 Shape	0.0	10.0	s	0.0	501	
P3.4.6	Acceleration Time 2	0.1	3000.0	s	20.0	502	
P3.4.7	Deceleration Time 2	0.1	3000.0	s	20.0	503	
P3.4.8	Ramp Time Optimizer	0	1		0	1808	0 = Disabled. 1 = Enabled.
P3.4.9	Ramp Time Optimizer % Step	0.00	50.0		10.0	1809	I.e., 10% of 60s ramp time = a 6-second correction.
P3.4.10	Ramp Optimizer Max. Time	0.1	3000.0		40.0	1810	
P3.4.11	Start Magnetizing Time	0.00	600.00	s	0.00	516	
P3.4.12	Start Magnetizing Current	Varies	Varies	A	Varies	517	
P3.4.13	DC Braking Time at Stop	0.00	600.00	s	0.00	508	
P3.4.14	DC Brake Current	Varies	Varies	A	Varies	507	0 = Disabled.
P3.4.15	Frequency to Start DC Braking at Ramp Stop	0.10	10.00	Hz	1.50	515	
P3.4.16	Flux Braking	0	1		0	520	0 = Disabled. 1 = Enabled.
P3.4.17	Flux Braking Current	0	Varies	A	Varies	519	

5.5 Group 3.5: I/O Configuration

For more information, see 10.5.1.1 Programming Digital Inputs.

Table 18. Digital input settings

Index	Parameter	Min	Max	Unit
P3.5.1.1	Control signal 1 A	DigIN SlotA.1	403	
P3.5.1.2	Control signal 2 A	DigIN SlotA.2	404	
P3.5.1.3	Control signal 1 B	DigIN Slot0.1	423	
P3.5.1.4	Control signal 2 B	DigIN Slot0.1	424	
P3.5.1.5	I/O B Control Force	DigIN Slot0.1	425	
P3.5.1.6	I/O B Reference Force	DigIN Slot0.1	343	
P3.5.1.7	External Fault Close	DigIN SlotA.3	405	OPEN = OK. CLOSED = External fault.
P3.5.1.8	External Fault Open	DigIN Slot0.2	406	OPEN = External fault. CLOSED = OK.
P3.5.1.9	Fault Reset Close	DigIN SlotA.6	414	
P3.5.1.10	Run Enable	DigIN Slot0.2	407	
P3.5.1.11	Interlock 1	DigIN Slot0.2	1041	
P3.5.1.12	Interlock 2	DigIN Slot0.2	1042	
P3.5.1.13	Acceleration / Deceleration Time Set	DigIN Slot0.1	408	OPEN = Ramp 1 Shape, Acceleration Time 1 and Deceleration Time 1. CLOSED = Ramp 2 Shape, Acceleration Time 2 and Deceleration Time 2.
P3.5.1.14	Motor Preheat ON	DigIN Slot0.1	1044	OPEN = No action. CLOSED = Uses the DC current of the motor preheat in Stop state. Used when the value of P3.1.2.5 is 2.
P3.5.1.15	Fire Mode Activation OPEN	DigIN Slot0.2	1596	OPEN = Active. CLOSED = Inactive.
P3.5.1.16	Preset Frequency Selection 0	DigIN SlotA.4	419	
P3.5.1.17	Preset Frequency Selection 1	DigIN SlotA.5	420	
P3.5.1.18	Preset Frequency Selection 2	DigIN Slot0.1	421	
P3.5.1.19	Timer 1	DigIN Slot0.1	447	
P3.5.1.20	Timer 2	DigIN Slot0.1	448	
P3.5.1.21	Timer 3	DigIN Slot0.1	449	
P3.5.1.22	PID1 Setpoint Boost	DigIN Slot0.1	1046	OPEN = No boost. CLOSED = Boost.

continued: Digital input settings

Index	Parameter	Min	Max	Unit
P3.5.1.23	PID1 Select Setpoint	DigIN Slot0.1	1047	OPEN = Setpoint 1. CLOSED = Setpoint 2.
P3.5.1.24	PID2 Start Signal	DigIN Slot0.2	1049	OPEN = PID2 in stop mode. CLOSED = PID2 regulating.
P3.5.1.25	PID2 Select Setpoint	DigIN Slot0.1	1048	OPEN = Setpoint 1. CLOSED = Setpoint 2.
P3.5.1.26	Motor 1 Interlock	DigIN Slot0.2	426	OPEN = Not active. CLOSED = Active.
P3.5.1.27	Motor 2 Interlock	DigIN Slot0.1	427	OPEN = Not active. CLOSED = Active.
P3.5.1.28	Motor 3 Interlock	DigIN Slot0.1	428	OPEN = Not active. CLOSED = Active.
P3.5.1.29	Motor 4 Interlock	DigIN Slot0.1	429	OPEN = Not active. CLOSED = Active.
P3.5.1.30	Motor 5 Interlock	DigIN Slot0.1	430	OPEN = Not active. CLOSED = Active.
P3.5.1.31	Maintenance Counter 1 reset	DigIN Slot0.1	490	
P3.5.1.32	Maintenance Counter 2 reset	DigIN Slot0.1	491	
P3.5.1.33	Maintenance Counter 3 reset	DigIN Slot0.1	492	
P3.5.1.36	Motor Potentiometer UP	DigIN Slot0.1	418	OPEN = Not active. CLOSED = Active. The motor potentiometer reference INCREASES until the contact is open.
P3.5.1.37	Motor Potentiometer DOWN	DigIN Slot0.1	417	OPEN = Not active. CLOSED = Active. The motor potentiometer reference DECREASES until the contact is open.
P3.5.1.38	Fire mode preset frequency selection 0	DigIN Slot0.1	15531	
P3.5.1.39	Fire mode preset frequency selection 1	DigIN Slot0.1	15532	
P3.5.1.40	Fire Mode Activation CLOSED	DigIN Slot0.1	1619	OPEN = Not active. CLOSED = Active.
P3.5.1.41	Fire Mode Reverse	DigIN Slot0.1	1618	
P3.5.1.42	Fieldbus control force	DigIN Slot0.1	411	OPEN = Forced bus control.
P3.5.1.43	Keypad CTRL	DigIN Slot0.1	410	
P3.5.1.44	Reset kWh Trip Counter	DigIN Slot0.1	1053	
P3.5.1.45	Param. Set 1/2 Selection	DigIN Slot0.1	496	OPEN = Parameter Set 1. CLOSED = Parameter Set 2.
P3.5.1.46	Fault Reset OPEN	DigIN Slot0.1	213	
P3.5.1.47	Disable Timer Function	DigIN Slot0.1	1499	OPEN = Enables the Timer functions. CLOSED = Disables the Timer functions and resets timers.

Table 19. Analog input settings

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.5.2.1	AI1 Signal Selection				AnINSlot.1	377	
P3.5.2.2	AI1 Filter Time	0.0	300.0	s	1.0	378	
P3.5.2.3	AI1 Signal Range	0	1		0	379	0 = 0–10V / 0–20mA. 1 = 2–10V / 4–20mA.
P3.5.2.4	AI1 Custom. Min	-160.00	160.00	%	0.00	380	
P3.5.2.5	AI1 Custom. Max	-160.00	160.00	%	100.00	381	
P3.5.2.6	AI1 Signal Inversion	0	1		0	387	0 = Normal. 1 = Signal inverted.
P3.5.2.7	AI2 Signal Selection				AnINSlot.2	388	See P3.5.2.1.
P3.5.2.8	AI2 Filter Time	0.0	300.0	s	1.0	389	See P3.5.2.2.
P3.5.2.9	AI2 Signal Range	0	1		1	390	See P3.5.2.3.
P3.5.2.10	AI2 Custom. Min	-160.00	160.00	%	0.00	391	See P3.5.2.4.
P3.5.2.11	AI2 Custom. Max	-160.00	160.00	%	100.00	392	See P3.5.2.5.
P3.5.2.12	AI2 Signal Inversion	0	1		0	398	See P3.5.2.6.
P3.5.2.13	AI3 Signal Selection				AnINSlot0.1	141	See P3.5.2.1.
P3.5.2.14	AI3 Filter Time	0.0	300.0	s	1.0	142	See P3.5.2.2.
P3.5.2.15	AI3 Signal Range	0	1		1	143	See P3.5.2.3.
P3.5.2.16	AI3 Custom. Min	-160.00	160.00	%	0.00	144	See P3.5.2.4.
P3.5.2.17	AI3 Custom. Max	-160.00	160.00	%	100.00	145	See P3.5.2.5.
P3.5.2.18	AI3 Signal Inversion	0	1		0	151	See P3.5.2.6.
P3.5.2.19	AI4 Signal Selection				AnINSlot0.1	152	See P3.5.2.1.
P3.5.2.20	AI4 Filter Time	0.0	300.0	s	1.0	153	See P3.5.2.2.
P3.5.2.21	AI4 Signal Range	0	1		1	154	See P3.5.2.3.
P3.5.2.22	AI4 Custom. Min	-160.00	160.00	%	0.00	155	See P3.5.2.4.
P3.5.2.23	AI4 Custom. Max	-160.00	160.00	%	100.00	156	See P3.5.2.5.
P3.5.2.24	AI4 Signal Inversion	0	1		0	162	See P3.5.2.6.
P3.5.2.25	AI5 Signal Selection				AnINSlot0.1	188	See P3.5.2.1.
P3.5.2.26	AI5 Filter Time	0.0	300.0	s	1.0	189	See P3.5.2.2.
P3.5.2.27	AI5 Signal Range	0	1		1	190	See P3.5.2.3.
P3.5.2.28	AI5 Custom. Min	-160.00	160.00	%	0.00	191	See P3.5.2.4.
P3.5.2.29	AI5 Custom. Max	-160.00	160.00	%	100.00	192	See P3.5.2.5.
P3.5.2.30	AI5 Signal Inversion	0	1		0	198	See P3.5.2.6.
P3.5.2.31	AI6 Signal Selection				AnINSlot0.1	199	See P3.5.2.1.
P3.5.2.32	AI6 Filter Time	0.0	300.0	s	1.0	200	See P3.5.2.2.
P3.5.2.33	AI6 Signal Range	0	1		1	201	See P3.5.2.3.
P3.5.2.34	AI6 Custom. Min	-160.00	160.00	%	0.00	203	See P3.5.2.4.
P3.5.2.35	AI6 Custom. Max	-160.00	160.00	%	100.00	204	See P3.5.2.5.
P3.5.2.36	AI6 Signal Inversion	0	1		0	209	See P3.5.2.6.

Table 20. Digital output settings on standard I/O board

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.5.3.2.1	Basic R01 Function	0	41		2	11001	The function selection for Basic R01. 0 = None. 1 = Ready. 2 = Run. 3 = Fault. 4 = FaultInvert. 5 = Alarm. 6 = Reverse. 7 = At speed. 8 = Motor regulator active. 9 = Preset speed. 10 = Keypad control. 11 = I/O B control. 12= Limit supervision 1. 13 = Limit supervision 2. 14 = Start signal. 15 = Reserved. 16 = Fire mode activation. 17 = RTC time channel 1 control. 18 = RTC time channel 2 control. 19 = RTC time channel 3 control. 20 = FB ControlWord B13. 21 = FB ControlWord B14. 22 = FB ControlWord B15. 23 = PID 1 in Sleep mode. 24 = Reserved. 25 = PID1 supervision limits. 26 = PID2 supervision limits. 27 = Motor 1 control. 28 = Motor 2 control. 29 = Motor 3 control. 30 = Motor 4 control. 31 = Motor 5 control. 32 = Reserved. 33 = Reserved. 34 = Maintenance alarm. 35 = Maintenance fault. 36 = Thermistor fault. 37 = Motor switch. 38 = PreHeat. 39 = kWh pulse output. 40 = Run Indication. 41 = Selected Param. Set.

continued: Digital output settings on standard I/O board

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.5.3.2.2	Basic R01 ON Delay	0.00	320.00	s	0.00	11002	
P3.5.3.2.3	Basic R01 OFF Delay	0.00	320.00	s	0.00	11003	
P3.5.3.2.4	Basic R02 Function	0	41		3	11004	See P3.5.3.2.1.
P3.5.3.2.5	Basic R02 ON Delay	0.00	320.00	s	0.00	11005	See P3.5.3.2.2.
P3.5.3.2.6	Basic R02 OFF Delay	0.00	320.00	s	0.00	11006	See P3.5.3.2.3.

The Digital Outputs of the Expander Slots C, D, and E

Shows only the parameters for the outputs on option boards in slots C, D and E. Make the selections as in Basic RO1 Function (P3.5.3.2.1).

If there are no digital outputs in slots C, D, or E, this group or these parameters are not visible.

Table 21. Standard I/O board analog output settings

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.5.4.1.1	AO1 function	0	20		2	10050	0 = TEST 0% (Not used). 1 = TEST 100%. 2 = Output freq (0 - fmax). 3 = Freq reference (0 - fmax). 4 = Motor speed (0 - Motor nominal speed). 5 = Output current (0 - InMotor). 6 = Motor torque (0 - TnMotor). 7 = Motor power (0 - PnMotor). 8 = Motor voltage (0 - UnMotor). 9 = DC link voltage (0 - 1000V). 10 = PID1 output (0-100%). 11 = PID2 output (0-100%). 12 = ProcessDataIn1 (0-100%). 13 = ProcessDataIn2 (0-100%). 14 = ProcessDataIn3 (0-100%). 15 = ProcessDataIn4 (0-100%). 16 = ProcessDataIn5 (0-100%). 17 = ProcessDataIn6 (0-100%). 18 = ProcessDataIn7 (0-100%). 19 = ProcessDataIn8 (0-100%). 20 = PID Feedback (0-100%).
P3.5.4.1.2	AO1 filter time	0.0	300.0	s	1.0	10051	0 = No filtering.
P3.5.4.1.3	AO1 minimum signal	0	1		0	10052	0 = 0 mA / 0V. 1 = 4 mA / 2V.
P3.5.4.1.4	AO1 minimum scale	Varies	Varies	Varies	0.0	10053	
P3.5.4.1.5	AO1 maximum scale	Varies	Varies	Varies	0.0	10054	

Slot C, D, and E Analog Outputs

Shows only parameters for existing outputs in slot C/D/E. The selections are the same as in Basic A01 (see P3.5.4.1.1). If there are no digital outputs in slots C, D, or E, this group or these parameters are not visible.

5.6 Group 3.6: Fieldbus Data Mapping

Table 22. Fieldbus data mapping

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.6.1	Fieldbus Data Out 1 Selection	0	35000		1	852	
P3.6.2	Fieldbus Data Out 2 Selection	0	35000		2	853	
P3.6.3	Fieldbus Data Out 3 Selection	0	35000		45	854	
P3.6.4	Fieldbus Data Out 4 Selection	0	35000		4	855	
P3.6.5	Fieldbus Data Out 5 Selection	0	35000		5	856	
P3.6.6	Fieldbus Data Out 6 Selection	0	35000		6	857	
P3.6.7	Fieldbus Data Out 7 Selection	0	35000		7	858	
P3.6.8	Fieldbus Data Out 8 Selection	0	35000		37	859	

Table 23. The default values for Process Data Out in fieldbus

Data	Default values	Scale
Process Data Out 1	Output frequency	0.01 Hz.
Process Data Out 2	Motor speed	1 t/min.
Process Data Out 3	Motor current	0.1 A.
Process Data Out 4	Motor torque	0.1%.
Process Data Out 5	Motor power	0.1%.
Process Data Out 6	Motor voltage	0.1 V.
Process Data Out 7	DC link voltage	1 V.
Process Data Out 8	Last active fault code	1.

For example, the value 2500 for Output frequency agrees with 25.00 Hz because the scale is 0.01. All the monitoring values listed in 4.1 Monitor Group are given the scale value.

5.7 Group 3.7: Prohibit Frequencies

Table 24. Prohibit frequencies

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.7.1	Prohibit Frequency Range 1 Low Limit	-1.00	320.00	Hz	0.00	509	0 = Not used.
P3.7.2	Prohibit Frequency Range 1 High Limit	0.00	320.00	Hz	0.00	510	0 = Not used.
P3.7.3	Prohibit Frequency Range 2 Low Limit	0.00	320.00	Hz	0.00	511	0 = Not used.
P3.7.4	Prohibit Frequency Range 2 High Limit	0.00	320.00	Hz	0.00	512	0 = Not used.
P3.7.5	Prohibit Frequency Range 3 Low Limit	0.00	320.00	Hz	0.00	513	0 = Not used.
P3.7.6	Prohibit Frequency Range 3 High Limit	0.00	320.00	Hz	0.00	514	0 = Not used.
P3.7.7	Ramp Time Factor	0.1	10.0	Times	1.0	518	
P3.7.8	Resonance Sweep Ramp	0.1	3000.0	s	60.0	1812	
P3.7.9	Resonance Sweep	0	1		0	1811	0 = Disabled. 1 = Enabled.

5.8 Group 3.8: Limit Supervisions

Table 25. Limits supervision settings

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.8.1	Supervision #1 Item Selection	0	7		0	1431	0 = Output frequency. 1 = Frequency reference. 2 = Motor current. 3 = Motor torque. 4 = Motor power. 5 = DC-link voltage. 6 = Analog input 1. 7 = Analog input 2.
P3.8.2	Supervision #1 Mode	0	2		0	1432	0 = Not used. 1 = Low limit supervision (output active under limit). 2 = High limit supervision (output active over limit).
P3.8.3	Supervision #1 Limit	Varies	Varies	Varies	25.00	1433	
P3.8.4	Supervision #1 Limit Hysteresis	Varies	Varies	Varies	5.00	1434	
P3.8.5	Supervision #2 Item Selection	0	7		1	1435	See P3.8.1.
P3.8.6	Supervision #2 Mode	0	2		0	1436	See P3.8.2.
P3.8.7	Supervision #2 Limit	Varies	Varies	Varies	40.00	1437	See P3.8.3.
P3.8.8	Supervision #2 Limit Hysteresis	Varies	Varies	Varies	5.00	1438	See P3.8.4.

5.9 Group 3.9: Protections

Table 26. Protections settings

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.9.1	Response to Analog input low fault	0	4		0	700	0 = No action. 1 = Alarm. 2 = Alarm and preset frequency according to value in P3.3.19. 3 = Alarm and keep at previous frequency. 4 = Fault (Stop according to stop mode). 5 = Fault and coast.
P3.9.2	Response to external fault	0	3		2	701	0 = No action. 1 = Alarm. 2 = Fault (Stop according to stop mode). 3 = Fault (Stop by coasting).
P3.9.3	Response to Input phase fault	0	1		0	730	0 = 3 Phase Support. 1 = 1 Phase Support.
P3.9.4	Undervoltage Fault	0	1		0	727	0 = Fault stored in history. 1 = Fault not stored in history.
P3.9.5	Response to Output Phase Fault	0	3		2	702	See P3.9.2.
P3.9.6	Motor Thermal Protection	0	3		2	704	See P3.9.2.
P3.9.7	Motor ambient temperature factor	-20.0 °C -4 °F	100.0 °C 212 °F	°C °F	40.0 °C 104 °F	705	Ambient temperature, in °C.
P3.9.8	Motor thermal zero speed cooling	5.0	150.0	%	Varies	706	
P3.9.9	Motor Thermal Time Constant	1	200	Min	Varies	707	
P3.9.10	Motor Thermal Loadability	0	150	%	100	708	
P3.9.11	Motor Stall Fault	0	3		0	709	See P3.9.2.
P3.9.12	Stall Current	0.00	2*IH	A	IH	710	
P3.9.13	Stall Time Limit	1.00	120.00	s	15.00	711	
P3.9.14	Stall Frequency Limit	1.00	P3.3.2	Hz	25.00	712	

continued: Protections settings

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.9.15	Underload Fault (broken belt/dry pump)	0	3		0	713	See P3.9.2.
P3.9.16	Underload Protection: Field Weakening Area Load	10.0	150.0	%	50.0	714	
P3.9.17	Underload Protection: Zero Frequency Load	5.0	150.0	%	10.0	715	
P3.9.18	Underload Protection: Time Limit	2.00	600.00	s	20.00	716	
P3.9.19	Response to Fieldbus Communication Fault	0	4		3	733	See P3.9.1.
P3.9.20	Slot Communication Fault	0	3		2	734	See P3.9.2.
P3.9.21	Thermistor Fault	0	3		0	732	See P3.9.2.
P3.9.22	SoftFill Timeout	0	3		2	748	See P3.9.2.
P3.9.23	Response to PID1 Supervision Fault	0	3		2	749	See P3.9.2.
P3.9.24	Response to PID2 Supervision Fault	0	3		2	757	See P3.9.2.
P3.9.25	TempFault Signal	0	6		0	739	0 = Not Used. 1 = Temp. Input 1. 2 = Temp. Input 2. 3 = Temp. Input 3. 4 = Temp. Inputs 1-2. 5 = Temp. Inputs 2-3. 6 = Temp. Inputs 1-3.
P3.9.26	TempAlarm Limit	-30.0 °C -22 °F	200 °C 392 °F	°C °F	130.0 °C 266 °F	741	
P3.9.27	TempFault Limit	-30.0 °C -22 °F	200 °C 392 °F	°C °F	155.0 °C 311 °F	742	
P3.9.28	TempFault Response	0	3		2	740	0 = No response. 1 = Alarm. 2 = Fault (Stop according to stop mode). 3 = Fault (Stop by coasting).

5.10 Group 3.10: Automatic reset

Table 27. Autoreset settings

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.10.1	Automatic reset	0	1		1	731	0 = Disabled. 1 = Enabled.
P3.10.2	Restart Function	0	1		1	719	0 = Flying start. 1 = According to P3.2.4.
P3.10.3	Wait Time	0.10	10000.00	s	0.50	717	
P3.10.4	Trial Time	0.00	10000.00	s	60.00	718	
P3.10.5	Number of Trials	1	10		4	759	
P3.10.6	Autoreset: Undervoltage	0	1		1	720	0 = No. 1 = Yes.
P3.10.7	Autoreset: Overvoltage	0	1		1	721	0 = No. 1 = Yes.
P3.10.8	Autoreset: Overcurrent	0	1		1	722	0 = No. 1 = Yes.
P3.10.9	Autoreset: AI Low	0	1		1	723	0 = No. 1 = Yes.
P3.10.10	Autoreset: Unit Overtemperature	0	1		1	724	0 = No. 1 = Yes.
P3.10.11	Autoreset: Motor Overtemperature	0	1		1	725	0 = No. 1 = Yes.
P3.10.12	Autoreset: External Fault	0	1		0	726	0 = No. 1 = Yes.
P3.10.13	Autoreset: Underload Fault	0	1		0	738	0 = No. 1 = Yes.
P3.10.14	PID Supervision	0	1		0	15538	0 = No. 1 = Yes.

5.11 Group 3.11: Application Settings

Table 28. Settings

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.11.1	C /°F selection	0	1		0	1197	
P3.11.2	kW/HP selection	0	1		0	1198	
P3.11.3	LOC/REMButtonConfig	0	7		7	1195	
P3.11.4	Password	0	9999		0	1900	

5.12 Group 3.12: Timer Functions

Table 29. 3.12.1 Interval 1

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.12.1.1	ON Time	00:00:00	23:59:59	hh:mm:ss	00:00:00	1464	
P3.12.1.2	OFF Time	00:00:00	23:59:59	hh:mm:ss	00:00:00	1465	
P3.12.1.3	From day	0	6		0	1466	0 = Sunday. 1 = Monday. 2 = Tuesday. 3 = Wednesday. 4 = Thursday. 5 = Friday. 6 = Saturday.
P3.12.1.4	To day	0	6		0	1467	0 = Sunday. 1 = Monday. 2 = Tuesday. 3 = Wednesday. 4 = Thursday. 5 = Friday. 6 = Saturday.
P3.12.1.5	Assign to Channel	0	3		0	1468	0 = Not used. 1 = Time channel 1. 2 = Time channel 2. 3 = Time channel 3.

Table 30. 3.12.2 Interval 2

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.12.2.1	ON Time	00:00:00	23:59:59	hh:mm:ss	00:00:00	1469	See Interval 1.
P3.12.2.2	OFF Time	00:00:00	23:59:59	hh:mm:ss	00:00:00	1470	See Interval 1.
P3.12.2.3	From day	0	6		0	1471	See Interval 1.
P3.12.2.4	To day	0	6		0	1472	See Interval 1.
P3.12.2.5	Assign to Channel	0	3		0	1473	See Interval 1.

Table 31. 3.12.3 Interval 3

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.12.3.1	ON Time	00:00:00	23:59:59	hh:mm:ss	00:00:00	1474	See Interval 1.
P3.12.3.2	OFF Time	00:00:00	23:59:59	hh:mm:ss	00:00:00	1475	See Interval 1.
P3.12.3.3	From day	0	6		0	1476	See Interval 1.
P3.12.3.4	To day	0	6		0	1477	See Interval 1.
P3.12.3.5	Assign to Channel	0	3		0	1478	See Interval 1.

Table 32. 3.12.4 Interval 4

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.12.4.1	ON Time	00:00:00	23:59:59	hh:mm:ss	00:00:00	1479	See Interval 1.
P3.12.4.2	OFF Time	00:00:00	23:59:59	hh:mm:ss	00:00:00	1480	See Interval 1.
P3.12.4.3	From day	0	6		0	1481	See Interval 1.
P3.12.4.4	To day	0	6		0	1482	See Interval 1.
P3.12.4.5	Assign to Channel	0	3		0	1483	See Interval 1.

Table 33. 3.12.5 Interval 5

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.12.5.1	ON Time	00:00:00	23:59:59	hh:mm:ss	00:00:00	1484	See Interval 1.
P3.12.5.2	OFF Time	00:00:00	23:59:59	hh:mm:ss	00:00:00	1485	See Interval 1.
P3.12.5.3	From day	0	6		0	1486	See Interval 1.
P3.12.5.4	To day	0	6		0	1487	See Interval 1.
P3.12.5.5	Assign to Channel	0	3		0	1488	See Interval 1.

Table 34. 3.12.6 Timer 1

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.12.6.1	Duration	0	72000	s	0	1489	
P3.12.6.2	Assign to Channel	0	3		0	1490	0 = Not used. 1 = Time channel 1. 2 = Time channel 2. 3 = Time channel 3.
P3.12.6.3	Mode	TOFF	TON		TOFF	15527	

Table 35. 3.12.7 Timer 2

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.12.7.1	Duration	0	72000	s	0	1491	See Timer 1.
P3.12.7.2	Assign to Channel	0	3		0	1492	See Timer 1.
P3.12.7.3	Mode	TOFF	TON		TOFF	15528	See Timer 1.

Table 36. 3.12.8 Timer 3

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.12.8.1	Duration	0	72000	s	0	1493	See Timer 1.
P3.12.8.2	Assign to Channel	0	3		0	1494	See Timer 1.
P3.12.8.3	Mode	TOFF	TON		TOFF	15529	See Timer 1.

5.13 Group 3.13: PID Controller 1 Settings

Table 37. PID controller 1 basic settings

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.13.1.1	PID Gain	0.00	1000.00	%	100.00	118	
P3.13.1.2	PID Integration Time	0.00	600.00	s	1.00	119	
P3.13.1.3	PID Derivation Time	0.00	100.00	s	0.00	132	
P3.13.1.4	Process Unit Selection	1	40		1	1036	
P3.13.1.5	Process Unit Min	Varies	Varies	Varies	0	1033	
P3.13.1.6	Process Unit Max	Varies	Varies	Varies	100	1034	
P3.13.1.7	Process Unit Decimals	0	4		2	1035	
P3.13.1.8	Error Inversion	0	1		0	340	0 = Normal (signal increase speed decrease and vice-versa). 1 =Inverted (signal increase speed increase and vice-versa).
P3.13.1.9	Dead Band hysteresis	Varies	Varies	Varies	0	1056	Zone around the non-action around the setpoint.
P3.13.1.10	Dead Band Delay	0.00	320.00	s	0.00	1057	

Table 38. Setpoint settings

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.13.2.1	Keypad setpoint 1	Varies	Varies	Varies	0	167	
P3.13.2.2	Keypad setpoint 2	Varies	Varies	Varies	0	168	
P3.13.2.3	Setpoint ramp time	0.00	300.0	s	0.00	1068	
P3.13.2.4	Setpoint source 1 selection	0	19		1	332	0 = Not used. 1 = Keypad setpoint 1. 2 = Keypad setpoint 2. 3 = AI1. 4 = AI2. 5 = AI3. 6 = AI4. 7 = AI5. 8 = AI6. 9 = ProcessDataIn1. 10 = ProcessDataIn2. 11 = ProcessDataIn3. 12 = ProcessDataIn4. 13 = ProcessDataIn5. 14 = ProcessDataIn6. 15 = ProcessDataIn7. 16 = ProcessDataIn8. 17 = Temp. Input 1. 18 = Temp. Input 2. 19 = Temp. Input 3.

continued: Parameters des consignes

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.13.2.5	Setpoint 1 minimum	-200.00	200.00	%	0.00	1069	
P3.13.2.6	Setpoint 1 maximum	-200.00	200.00	%	100.00	1070	
P3.13.2.7	Sleep Frequency limit 1	0.00	320.00	Hz	0.00	1016	
P3.13.2.8	Sleep Delay 1	0	3000	s	0	1017	
P3.13.2.9	Wake-up Level 1	-214748.36	214748.36	Varies	0	1018	
P3.13.2.10	Setpoint 1 boost	-2.0	2.0	x	1.0	1071	
P3.13.2.11	Setpoint source 2 selection	0	16		2	431	See P3.13.2.4.
P3.13.2.12	Setpoint 2 minimum	-200.00	200.00	%	0.00	1073	See P3.13.2.5.
P3.13.2.13	Setpoint 2 maximum	-200.00	200.00	%	100.00	1074	See P3.13.2.6.
P3.13.2.14	Sleep Frequency limit 2	0.00	320.00	Hz	0.00	1075	See P3.13.2.7.
P3.13.2.15	Sleep Delay 2	0	3000	s	0	1076	See P3.13.2.8.
P3.13.2.16	Wake-up Level 2	-214748.36	214748.36	Varies	0.0000	1077	See P3.13.2.8.
P3.13.2.17	Setpoint 2 boost	-2.0	2.0	x	1.0	1078	See P3.13.2.10.
P3.13.2.18	Setpoint 1 Wake-up	0	1		0	15539	0 = Absolute level. 1 = Relative setpoint.
P3.13.2.19	Setpoint 2 Wake-up	0	1		0	15540	0 = Absolute level. 1 = Relative setpoint.

Table 39. Feedback settings

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.13.3.1	Feedback Function	1	9		1	333	1 = Only Source1 in use. 2 = SQRT(Source1); (Flow=Constant x SQRT(Pressure)). 3 = SQRT(Source1- Source 2). 4 = SQRT(Source 1) + SQRT (Source 2). 5 = Source 1 + Source 2. 6 = Source 1 - Source 2. 7 = MIN (Source 1, Source 2). 8 = MAX (Source 1, Source 2). 9 = MEAN (Source 1, Source 2).
P3.13.3.2	Feedback Function Gain	-1000.0	1000.0	%	100.0	1058	
P3.13.3.3	Feedback 1 Source Selection	0	14		2	334	0 = Not used. 1 = AI1. 2 = AI2. 3 = AI3. 4 = AI4. 5 = AI5. 6 = AI6. 7 = ProcessDataIn1. 8 = ProcessDataIn2. 9 = ProcessDataIn3. 10 = ProcessDataIn4. 11 = ProcessDataIn5. 12 = ProcessDataIn6. 13 = ProcessDataIn7. 14 = ProcessDataIn8. 15 = Temp Input 1. 16 = Temp Input 2. 17 = Temp Input 3.
P3.13.3.4	Feedback 1 Minimum	-200.00	200.00	%	0.00	336	
P3.13.3.5	Feedback 1 Maximum	-200.00	200.00	%	100.00	337	
P3.13.3.6	Feedback 2 Source Selection	0	14		0	335	See P3.13.3.3.
P3.13.3.7	Feedback 2 Minimum	-200.00	200.00	%	0.00	338	See P3.13.3.4.
P3.13.3.8	Feedback 2 Maximum	-200.00	200.00	%	100.00	339	See P3.13.3.5.

Table 40. Feedforward settings

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.13.4.1	Feedforward Function	1	9		1	1059	See P3.13.3.1.
P3.13.4.2	Feedforward Function	-1000	1000	%	100.0	1060	See P3.13.3.2.
P3.13.4.3	Feedforward 1 Source Selection	0	14		0	1061	See P3.13.3.3.
P3.13.4.4	Feedforward 1 Minimum	-200.00	200.00	%	0.00	1062	See P3.13.3.4.
P3.13.4.5	Feedforward 1 Maximum	-200.00	200.00	%	100.00	1063	See P3.13.3.5.
P3.13.4.6	Feedforward 2 Source Selection	0	14		0	1064	See P3.13.3.6.
P3.13.4.7	Feedforward 2 Minimum	-200.00	200.00	%	0.00	1065	See P3.13.3.7.
P3.13.4.8	Feedforward 2 Maximum	-200.00	200.00	%	100.00	1066	See P3.13.3.8.

Table 41. Process supervision parameters

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.13.5.1	Enable Process Supervision	0	1		0	735	0 = Disabled. 1 = Enabled.
P3.13.5.2	Upper Limit	-214748.36	214748.36	Varies	0.00	736	
P3.13.5.3	Lower Limit	-214748.36	214748.36	Varies	0.00	758	
P3.13.5.4	Delay	0	30000	s	0	737	

Table 42. Parameters de la compensation pertes de pression

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.13.6.1	Enable Setpoint 1	0	1		0	1189	0 = Disabled. 1 = Enabled.
P3.13.6.2	Setpoint 1 Max Compensation	-214748.36	214748.36	Varies	0.0	1190	
P3.13.6.3	Enable Setpoint 2	0	1		0	1191	See P3.13.6.1.
P3.13.6.4	Setpoint 2 Max Compensation	-214748.36	214748.36	Varies	0.0	1192	See P3.13.6.2.

Table 43. Soft Fill parameters

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.13.7.1	Enable SoftFill	0	1		0	1094	0 = Disabled. 1 = Enabled.
P3.13.7.2	SoftFill Freq	0.00	50.00	Hz	20.0	1055	Frequency during the filling process.
P3.13.7.3	SoftFill Level	-214748.36	214748.36	%	0.00	1095	Transition level from SF frequency to ref. frequency.
P3.13.7.4	SoftFill Timeout	0	30000	s	0	1096	

5.14 Group 3.14: PID Controller 2

Table 44. Basic settings

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.143.1.1	Enable PID	0.00	1000.00	%	100.00	1630	0 = Disabled. 1 = Enabled.
P3.14.1.2	Output in Stop	0.00	600.00	s	1.00	1100	
P3.14.1.3	PID Gain	0.00	100.00	s	0.00	1631	See P3.13.1.1.
P3.14.1.4	PID Integration Time	1	40		1	1632	See P3.13.1.2.
P3.14.1.5	PID Derivation Time	Varies	Varies	Varies	0	1633	See P3.13.1.3.
P3.14.1.6	Process Unit Selection	Varies	Varies	Varies	100	1635	See P3.13.1.4.
P3.14.1.7	Process Unit Min.	0	4		2	1664	See P3.13.1.5.
P3.14.1.8	Process Unit Max.	0	1		0	1665	See P3.13.1.6.
P3.14.1.9	Process Unit Decimals	Varies	Varies	Varies	0	1666	See P3.13.1.7.
P3.14.1.10	Error Inversion	0.00	320.00	s	0.00	1636	0 = Normal. 1 = Inverted. See P3.13.1.8.
P3.14.1.11	Dead Band hysteresis	0.00	1000.00	%	100.00	1637	See P3.13.1.9.
P3.14.1.12	Dead Band Delay	0.00	600.00	s	1.00	1638	See P3.13.1.10.

Table 45. Setpoints

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.14.2.1	Keypad Setpoint 1	Varies	Varies	Varies	0	1640	
P3.14.2.2	Keypad Setpoint 2	Varies	Varies	Varies	0	1641	
P3.14.2.3	Setpoint Ramp Time	0.00	300.0	s	0.00	1642	
P3.14.2.4	Setpoint Source 1 Selection	0	19		1	1643	0 = Not Used. 1 = Keypad Setpoint 1. 2 = Keypad Setpoint 2. 3 = AI1. 4 = AI2. 5 = AI3. 6 = AI4. 7 = AI5. 8 = AI6. 9 =ProcessDataIn1. 10 =ProcessDataIn2. 11 =ProcessDataIn3. 12 =ProcessDataIn4. 13 =ProcessDataIn5. 14 =ProcessDataIn6. 15 =ProcessDataIn7. 16 =ProcessDataIn8. 17 = Temp Input 1. 18 = Temp Input 2. 19 = Temp Input 3.
P3.14.2.5	Setpoint 1 min.	-200.00	200.00	%	0.00	1644	
P3.14.2.6	Setpoint 1 max.	-200.00	200.00	%	100.00	1645	
P3.14.2.7	Setpoint source 2 selection	0.00	320.00	Hz	0.00	1646	See P3.14.2.4.
P3.14.2.8	Setpoint 2 min.	0	3000	s	0	1647	
P3.14.2.9	Setpoint 2 max.	-214748.36	214748.36	Varies	0	1648	

Table 46. Feedbacks

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.14.3.1	Feedback Function	1	9		1	1650	See P3.13.3.1.
P3.14.3.2	Feedback Function Gain	-1000.0	1000.0	%	100.0	1651	See P3.13.3.2.
P3.14.3.3	Feedback 1 Source Selection	0	14		1	1652	See P3.13.3.3.
P3.14.3.4	Feedback 1 min.	-200.00	200.00	%	0.00	1653	
P3.14.3.5	Feedback 1 max.	-200.00	200.00	%	100.00	1654	
P3.14.3.6	Feedback 2 Source Selection	0	14		2	1655	See P3.13.3.6.
P3.14.3.7	Feedback 2 min.	-200.00	200.00	%	0.00	1656	
P3.14.3.8	Feedback 2 max.	-200.00	200.00	%	100.00	1657	

Table 47. Process supervision

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.14.4.1	Enable Supervision	0	1		0	1659	0 = Disabled. 1 = Enabled.
P3.14.4.2	Upper Limit	Varies	Varies	Varies	Varies	1660	See P3.13.5.2.
P3.14.4.3	Lower Limit	Varies	Varies	Varies	Varies	1661	See P3.13.5.3.
P3.14.4.4	Delay	0	30000	s	0	1662	

5.15 Group 3.15: Pump and Fan Cascade

Table 48. Pump and fan cascade parameters

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.15.1	Number of Motors	1	5	--	1	1001	
P3.15.2	Interlock Function	0	1	--	1	1032	0 = Disabled. 1 = Enabled.
P3.15.3	Include FC	0	1	--	1	1028	0 = Disabled. 1 = Enabled.
P3.15.4	Autochange	0	1	--	1	1027	0 = Disabled. 1 = Enabled.
P3.15.5	Autochange Interval	0.0	3000.0	h	48.0	1029	Interval between two autochanges.
P3.15.6	Autochange: Frequency Limit	0.00	50.00	Hz	25.00	1031	Frequency limit of the drive output to allow autochange.
P.3.15.7	Autochange Motor Limit	0	5	--	1	1030	Max. of running motors during the autochange.
P3.15.8	Bandwidth	0	100	%	10	1097	Bandwidth around the setpoint where no aux. motor can be switched on / off.
P3.15.9	Bandwidth Delay	0	3600	s	10	1098	Min. delay before an aux. motor can be switched on / off.

5.16 Group 3.16: Maintenance Counters

Table 49. Maintenance counter parameters

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.16.1	Counter 1 Mode	0	2		0	1104	0 = Not used. 1 = Hours. 2 = Revolutions *1000.
P3.16.2	Counter 1 Alarm Limit	0	2147483647	Varies	0	1105	
P3.16.3	Counter 1 Fault Limit	0	2147483647	Varies	0	1106	
P3.16.4	Counter 1 Reset	0	1		0	1107	0 = Disabled. 1 = Enabled.
P3.16.5	Counter 2 Mode	0	2		0	1108	See P3.16.1.
P3.16.6	Counter 2 Alarm Limit	0	2147483647	Varies	0	1109	See P3.16.2.
P3.16.7	Counter 2 Fault Limit	0	2147483647	Varies	0	1110	See P3.16.3.
P3.16.8	Counter 2 Reset	0	1		0	1111	See P3.16.4.
P3.16.9	Counter 3 Mode	0	2		0	1163	See P3.16.1.
P3.16.10	Counter 3 Alarm Limit	0	2147483647	Varies	0	1164	See P3.16.2.
P3.16.11	Counter 3 Fault Limit	0	2147483647	Varies	0	1165	See P3.16.3.
P3.16.12	Counter 3 Reset	0	1		0	1166	See P3.16.4.

5.17 Group 3.17: Fire Mode

Table 50. Fire mode parameters

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.17.1	Fire Mode Password	0	9999		0	1599	1002 = Enabled. 1234 = Test mode.
P3.17.2	Fire Mode Activ. Open				DigINSlot0.2	1596	Open = Fire Mode active. closed = No action.
P3.17.3	Fire Mode active closed				DigINSlot0.1	1619	Open = No action. Closed = Fire Mode active.
P3.17.4	Fire Mode Frequency	8.00	P3.3.2	Hz	50.00	1598	
P3.17.5	Fire Mode Frequency Source	0	8		0	1617	0 = Fire Mode frequency. 1 = Preset speeds. 2 = Keypad. 3 = Fieldbus. 4 = AI1. 5 = AI2. 6 = AI1 + AI2. 7 = PID1. 8 = Motor potentiometer.
P3.17.6	Fire Mode Reverse				DigINSlot0.1	1618	Open = Forward. Closed = Reverse.
P3.17.7	Fire Mode preset freq. 1	0	50		10	15535	
P3.17.8	Fire Mode preset freq. 2	0	50	Hz	20	15536	
P3.17.9	Fire Mode preset freq. 3	0	50		30	15537	
V3.17.10	Fire Mode Status	0	3		0	1597	A 0 = Disabled. 1 = Enabled. 2 = Activated (Enabled + DI Open). 3 = Test Mode.
V3.17.11	Fire Mode Counter				0	1679	
P3.17.12	Fire Mode Run Indication Current	0.0	100.0	%	10.0	15580	

5.18 Group 3.18: kWh Pulse Output Settings

Table 51. kWh pulse output settings

Index	Parameter	Min	Max	Unit	Default	ID	Description
P3.18.1	kWh pulse length	50	200	ms	50	15534	
P3.18.2	kWh pulse resolution	1	100	KWh	1	15533	

6 DIAGNOSTICS MENU

6.1 Active Faults

When there is a fault or many faults, the display shows the name of the fault and blinks. Press OK to go back to the Diagnostics menu. The submenu Active faults shows the number of faults. To see the fault-time data, select a fault and then press OK.

The fault stays active until you reset it. There are four ways to reset a fault.

- Press the Reset button for 2 s.
- Go into the submenu Reset faults and use the parameter Reset Faults.
- Give a reset signal in the I/O terminal.
- Give a reset signal with the fieldbus.

The Active faults submenu can store a maximum of ten faults. The submenu shows the faults in the sequence in which they occurred.

6.2 Reset Faults

In this menu, you can reset faults. See 11.1 A Fault Comes into View.

CAUTION!

Before you reset the fault, remove the external Control signal to prevent that you restart the drive accidentally.

6.3 Fault History

You can see 40 faults in the Fault history.

To see the details of a fault, go into Fault history, find the fault, and press OK.

6.4 Total Counters

Table 52. The total counter parameters in the diagnostics menu

Index	Parameter	Min	Max	Unit	Default	ID	Description
V4.4.1	Energy Counter			Varies		2291	The quantity of energy taken from the supply network. You cannot reset the counter. In the text display: the highest energy unit that the display shows is MW. If the counted energy exceeds 999.9 MW, no unit will appear in the display.
V4.4.3	Operating Time			a d hh:min		2298	The operating time of the control unit.
V4.4.7	Run Time			a d hh:min		2293	The motor run time.
V4.4.11	Power On Time			a d hh:min		2294	The quantity of time that the power unit has been powered on. You cannot reset the counter.
V4.4.15	Start Command Counter					2295	The number of times that the power unit has been started.

6.5 Trip Counters

Table 53. The trip counter parameters in the diagnostics menu

Index	Parameter	Min	Max	Unit	Default	ID	Description
P4.5.1	Energy Trip Counter			Varies		2296	You can reset this counter. In the text display: the highest energy unit that the display shows is MW. If the counted energy exceeds 999.9 MW, no unit will appear in the display. Resetting the counter: Press OK. A Reset counter page shows. Press OK again
P4.5.3	Operating Time			a d hh:min		2299	You can reset this counter. See instructions in P4.5.1 above.

6.6 Software Info

Table 54. The software info parameters in the diagnostics menu

Index	Parameter	Min	Max	Unit	Default	ID	Description
V4.6.1	Software Package					2524	The code for the software identification.
V4.6.4	System Load	0	100	%		2300	The load on the control unit CPU.
V4.6.5	Application Name					2525	The name of the application.
V4.6.6	Application ID					837	The code of the application.
V4.6.7	Application Version					838	
V4.6.8	Language selection						Selected language package in software loading.
V4.7.1	Power size						Size of the power unit.

7 I/O AND HARDWARE MENU

In this menu, there are different settings that are related to the options.

7.1 Basic I/O

In the Basic I/O menu, you can monitor the statuses of the inputs and the outputs.

Table 55. The basic I/O parameters in the I/O and Hardware menu

Index	Parameter	Min	Max	Unit	Default	ID	Description
V5.1.1	Digital Input 1	0	1		0	2502	Status of the digital input signal.
V5.1.2	Digital Input 2	0	1		0	2503	Status of the digital input signal.
V5.1.3	Digital Input 3	0	1		0	2504	Status of the digital input signal.
V5.1.4	Digital Input 4	0	1		0	2505	Status of the digital input signal.
V5.1.5	Digital Input 5	0	1		0	2506	Status of the digital input signal.
V5.1.6	Digital Input 6	0	1		0	2507	Status of the digital input signal.
V5.1.7	Analog input 1 Mode	1	3		3	2508	Shows the mode that is set for the analog input signal. The selection is made using a DIP switch on the control board. 1 = 0...20mA 3 = 0...10V
V5.1.8	Analog input 1	0	100	%	0.00	2509	Status of the analog input signal 1
V5.1.9	Analog input 2 Mode	1	3		3	2510	Shows the mode that is set for the analog input signal. The selection is made using a DIP switch on the control board. 1 = 0...20mA 3 = 0...10V
V5.1.10	Analog input 2	0	100	%	0.00	2511	Status of the analog input signal 2
V5.1.11	Analog output 1 Mode	1	3		1	2512	Shows the mode that is set for the analog input signal. The selection is made using a DIP switch on the control board. 1 = 0...20mA 3 = 0...10V
V5.1.12	Analog output 1	0	100	%	0.00	2513	Status of analog output signal 1.
V5.1.13	Relay Output 1	0	1		0	2514	Status of relay output signal 1.
V5.1.14	Relay Output 2	0	1		0	2515	Status of relay output signal.
V5.1.16	Thermistor	0	1		0	2516	Status of the thermistor.

7.2 Option Board Slots

The parameters in this menu are different for all the option boards. You see the parameters of the option board that you installed. If there is no option board in the slots C, D or E, you do not see parameters. See more about the location of the slots in 10.5 I/O Configuration.

When you remove an option board, the fault code 39 and the fault name *Device removed* show on the display. See 11.3 Fault Codes.

Table 56. Option board related parameters

Menu	Function	Description
Slot C	Settings	The settings that are related to the option board.
	Monitoring	Monitor the data that is related to the option board.
Slot D	Settings	The settings that are related to the option board.
	Monitoring	Monitor the data that is related to the option board.
Slot E	Settings	The settings that are related to the option board.
	Monitoring	Monitor the data that is related to the option board.

7.3 Real-Time Clock

Table 57. The real-time clock parameters in the I/O and Hardware menu

Index	Parameter	Min	Max	Unit	Default	ID	Description
V5.5.1	Battery State	1	3			2205	Status of the battery: 1 = Not installed. 2 = Installed. 3 = Replace the battery.
P5.5.2	Time			hh:mm:ss		2201	The current time of day.
P5.5.3	Date			dd.mm.		2202	The current date.
P5.5.4	Year			yyyy		2203	The current year.
P5.5.5	Daylight Savings Time	1	4		1	2204	The daylight savings time rule: 1 = Off. 2 = EU: starts on the last Sunday in March, ends on the last Sunday in October. 3 = US: starts on the 2nd Sunday in March, ends on the 1st Sunday in November. 4 = Russia (permanent).

7.4 Power Unit Settings

In this menu, you can change the settings of the fan and the sine filter.

The fan operates in the optimized or the always on mode. In the optimized mode, the internal logic of the drive receives data about the temperature and controls the fan speed. After the drive goes in the Ready state, the fan stops in 5 minutes. In the always on mode, the fan operates in full speed, and does not stop.

The Sine filter keeps the overmodulation depth in limits and does not let the thermal management functions decrease the switching frequency.

Table 58. Power unit settings, fan

Index	Parameter	Min	Max	Unit	Default	ID	Description
P5.6.1.1	Fan Control Mode	0	1		1	2377	0 = Always on. 1 = Optimized.
V5.6.1.5	Fan lifetime	N/A	N/A	h		849	Fan lifetime.
P5.6.1.6	Fan lifetime alarm limit	0	200 000	h	50 000	824	Fan lifetime alarm limit.
P5.6.1.7	Fan lifetime reset	N/A	N/A		0	823	Fan lifetime reset.

Table 59. Power unit settings, sine filter

Index	Parameter	Min	Max	Unit	Default	ID	Description
P5.6.4.1	Sine Filter	0	1		0	2527	0 = Disabled. 1 = Enabled.

Table 60. Power unit settings, harmonic filter

Index	Parameter	Min	Max	Unit	Default	ID	Description
P5.6.5.1	Harmonic Filter	0	1		0	2497	0 = Disabled. 1 = Enabled.

7.5 Keypad

Table 61. The keypad parameters in the I/O and Hardware menu

Index	Parameter	Min	Max	Unit	Default	ID	Description
P5.7.1	Timeout Time	0	60	Min	0	804	The time after which the display goes back to the page that is set with parameter P5.7.2. 0 = Not used.
P5.7.2	Default Page	0	4		0	2318	0 = Not used. 1 = Enter menu index. 2 = Main menu. 3 = Control page. 4 = Multimonitor.
P5.7.3	Menu Index					2499	Set a page to be the menu index. (The selection 1 in P5.7.2.)
P5.7.4	Contrast	30	70	%	50	830	Set the contrast of the display.
P5.7.5	Backlight Time	0	60	Min	5	818	Set the time after which the backlight of the display turns off. If the value is set to 0, the backlight is always on.

7.6 Fieldbus

In the I/O and Hardware menu, there are the parameters that are related to different fieldbus boards. You can find the instructions on how to use these parameters in the related fieldbus manual.

8 USER SETTINGS, FAVORITES, AND USER LEVEL MENUS

8.1 User Settings

Table 62. General settings in the user settings menu

Index	Parameter	Min	Max	Unit	Default	ID	Description
P6.1	Language selections	Varies	Varies		Varies	802	Select the desired language.
M6.5	Parameter back-up						See Table 63. The parameter back-up parameters in the user settings menu.
M6.6	Parameter compare						
P6.7	Drive name						Give a name to the drive if you think that it is necessary.

8.1.1 Parameter Back-Up

Table 63. The parameter back-up parameters in the user settings menu

Index	Parameter	Min	Max	Unit	Default	ID	Description
P6.5.1	Restore Factory Defaults					831	Restores the default parameter values and starts the Startup wizard.
P6.5.2	Save to Keypad					2487	Saves the parameter values to the control panel, e.g., to copy them to another drive.
P6.5.3	Restore from Keypad					2488	Loads the parameter values from the control panel to the drive.
P6.5.4	Save to Set 1					2489	Keeps the parameter values to parameter set 1.
P6.5.5	Restore from Set 1					2490	Loads the parameter values from parameters set 1 to the drive.
P6.5.6	Save to Set 2					2491	Keeps the parameter values to parameter set 2.
P6.5.7	Restore from Set 2					2492	Loads the parameter values from parameter set 2 to the drive.

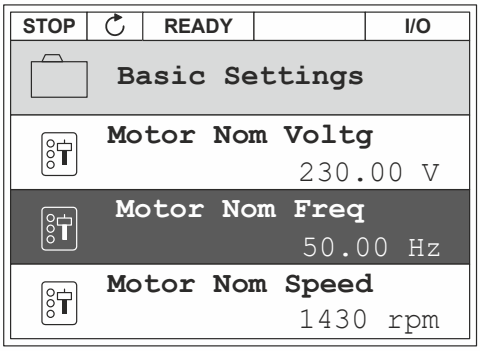
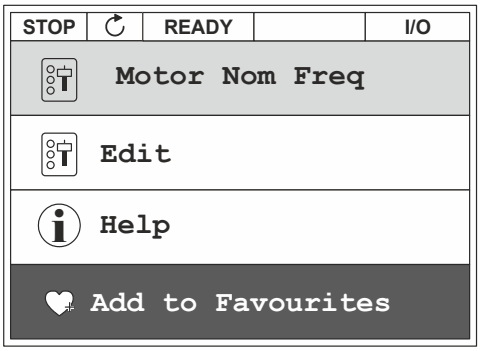
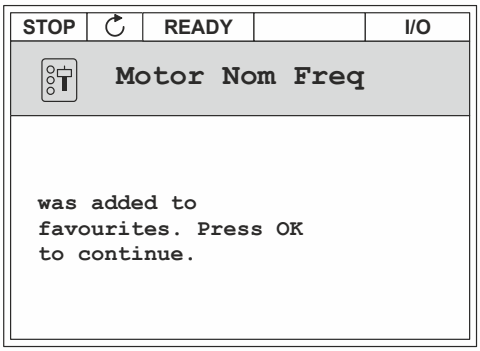
Table 64. The parameter compare

Index	Parameter	Min	Max	Unit	Default	ID	Description
P6.6.1	Active set-Set 1					2493	Starts to compare parameters to the selected set.
P6.6.2	Active set-Set 2					2494	Starts to compare parameters to the selected set.
P6.6.3	Active set-Defaults					2495	Starts to compare parameters to the selected set.
P6.6.4	Active set-Keypad					2496	Starts to compare parameters to the selected set.

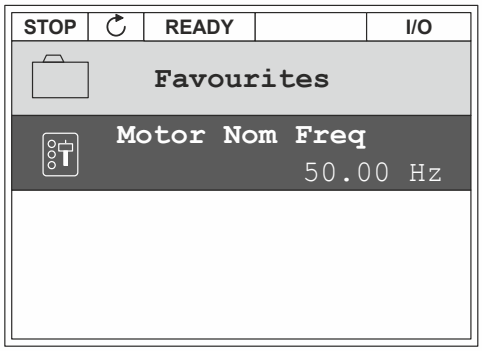
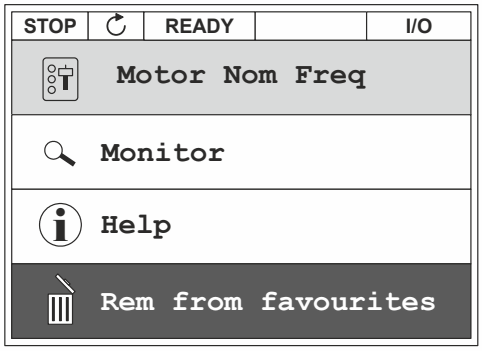
8.2 Favorites

If you use the same items frequently, you can add them into Favorites. You can collect a set of parameters or monitoring signals from all the keypad menus. It is not necessary to find them in the menu structure one by one. As an alternative, add them into the Favorites folder where it is easy to find them.

ADDING AN ITEM TO THE FAVORITES

1. Find the item that you want to add to *Favorites*.	
2. Select *Add to favorites* and press the OK button.	
3. The steps are now completed. To continue, read the instructions on the display.	

REMOVING AN ITEM FROM THE FAVORITES

1. Go to *Favorites*.	
2. Find the item that you want to remove. Press the OK button.	
3. Select *Rem from favorites*.	
4. To remove the item, press the OK button again.	

8.3 User Levels

Use the User level parameters to keep the personnel who are not approved from making changes in the parameters. You can also prevent accidental changes in the parameters.

When you select a user level, the user cannot see all the parameters on the display of the control panel.

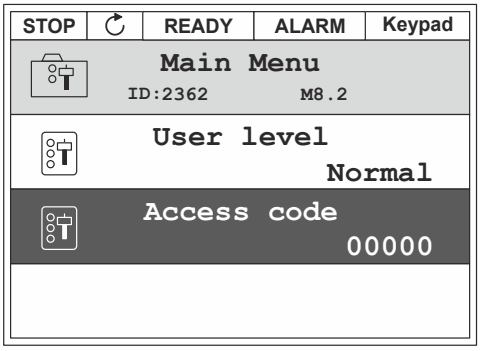
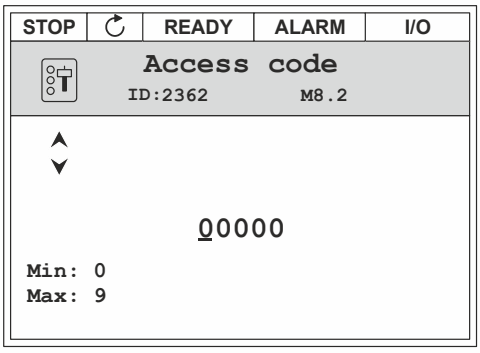
Table 65. The user level parameters

Index	Parameter	Min	Max	Unit	Default	ID	Description
P8.1	User Level	1	2		1	1194	1 = Normal. 2 = Monitoring.
P8.2	Access Code	0	9		0	2362	If the option Monitoring has been selected in P8.1, then you must allocate a pass number; then, only monitoring values will appear in the display.

CAUTION!

Do not lose the access code. If the access code is lost, contact your nearest service center or partner.

CHANGING THE ACCESS CODE OF THE USER LEVELS

1. Go to the User levels.	
2. Go to the item *Access code*, press the RIGHT arrow button, and confirm by pressing the OK button.	
3. To change the digits of the access code, use the arrow buttons.	
4. Accept the change by pressing the OK button.	

9 MONITORING VALUE DESCRIPTIONS

This chapter gives you the basic descriptions of all monitoring values.

9.1 Basic

V2.2.1 OUTPUT FREQUENCY (ID 1)

This monitoring value indicates the actual output frequency to the motor.

V2.2.2 FREQUENCY REFERENCE (ID 25)

This monitoring value indicates the actual frequency reference to the motor control. The value is updated at 10 ms intervals.

V2.2.3 MOTOR SPEED (ID 2)

This monitoring value indicates the actual speed of the motor in rpm (calculated value).

V2.2.4 MOTOR CURRENT (ID 3)

This monitoring value indicates the measured current of the motor. The scaling of the value is different for different drive sizes.

V2.2.5 MOTOR TORQUE (ID 4)

This monitoring value indicates the actual torque of the motor (calculated value).

V2.2.7 MOTOR SHAFT POWER (ID 5)

This monitoring value indicates the actual shaft power of the motor (calculated value) as a percentage of the motor nominal power.

V2.2.8 MOTOR SHAFT POWER (ID 73)

This monitoring value indicates the actual shaft power of the motor (calculated value). The unit of measurement is kW or hp, depending on the 'kW/hp Selection' parameter value.

V2.2.9 MOTOR VOLTAGE (ID 6)

This monitoring value indicates the actual output voltage to the motor.

V2.2.10 DC LINK VOLTAGE (ID 7)

This monitoring value indicates the measured voltage in the DC-link of the drive.

V2.2.11 UNIT TEMPERATURE (ID 8)

This monitoring value indicates the measured heatsink temperature of the drive. The unit of the monitoring value is degrees Celsius degrees or degrees Fahrenheit, depending on the parameter value *C/F Selection*.

V2.2.12 MOTOR TEMPERATURE (ID 9)

This monitoring value indicates the calculated motor temperature in percentage of the nominal working temperature. When the value rises above 105%, motor thermal protection fault occurs.

V2.2.13 Analog INPUT 1 (ID 59)

This monitoring value indicates the value of the analog input signal as a percentage of the used range.

V2.2.14 Analog INPUT 1 (ID 60)

This monitoring value indicates the value of the analog input signal as a percentage of the used range.

V2.2.15 Analog OUTPUT 1 (ID 81)

This monitoring value indicates the value of the analog output as a percentage of the used range.

V2.2.16 MOTOR PREHEAT (ID 1228)

This monitoring value indicates the status of the motor preheat function.

V2.2.17 DRIVE STATUS WORD (ID 43)

This monitoring value indicates the bit-coded status of drive.

V2.2.18 LAST ACTIVE FAULT CODE (ID 37)

This monitoring value indicates the fault code of latest activated fault that is not reset.

V2.2.19 FIRE MODE STATUS (ID 1597)

This monitoring value indicates the status of the Fire mode function.

V2.2.20 APPL. STATUS WORD 1 (ID 89)

This monitoring value indicates the bit coded statuses of the application.

V2.2.21 APPL. STATUS WORD 2 (ID 90)

This monitoring value indicates the bit-coded statuses of the application.

V2.2.22 DIN STATUS WORD 1 (ID 56)

This monitoring value indicates the bit-coded status of the digital input signals. A 16-bit word, where each bit indicates the status of one digital input. Six digital inputs from each slot are read. Word 1 starts from the input 1 in slot A (bit0) and ends with input 4 in slot C (bit15).

V2.2.23 DIN STATUS WORD 2 (ID 57)

This monitoring value indicates the bit-coded status of the digital input signals. A 16-bit word, where each bit indicates the status of one digital input. Six digital inputs from each slot are read. Word 2 starts from the input 5 in slot C (bit0) and ends with input 6 in slot E (bit13).

V2.2.24 MOTOR CURRENT WITH ONE DECIMAL (ID 45)

This monitoring value indicates the measured current of the motor with the fixed number of decimals and that is less filtered.

V2.2.25 KWH TRIP COUNTER LOW (ID 1054)

This monitoring value indicates the actual value of the kWh counter (energy counter).

V2.2.26 KWH TRIP COUNTER HIGH (ID 1067)

This monitoring value indicates how many times the kWh counter (energy counter) has spun around.

V2.2.27 LAST ACTIVE FAULT ID (ID 95)

This monitoring value indicates the fault ID of latest activated fault that is not reset.

V2.2.28 LAST ACTIVE ALARM CODE (ID 74)

This monitoring value indicates the alarm code of latest activated alarm that is not reset.

V2.2.29 LAST ACTIVE ALARM ID (ID 94)

This monitoring value indicates the alarm ID of latest activated alarm that is not reset.

V2.2.30 U PHASE CURRENT (ID 39)

This monitoring value indicates the measured phase current of the motor (1s filtering).

V2.2.31 V PHASE CURRENT (ID 40)

This monitoring value indicates the measured phase current of the motor (1s filtering).

V2.2.32 W PHASE CURRENT (ID 41)

This monitoring value indicates the measured phase current of the motor (1s filtering).

V2.2.33 MOTOR REGULAT. STATUS (ID 77)

This monitoring value indicates the bit-coded status of the motor limit controllers.

9.2 Timer Functions

V2.3.1 TC 1, TC 2, TC3 (ID 1441)

This monitoring value indicates the status of the time channels 1, 2, and 3.

V2.3.2 INTERVAL 1 (ID 1442)

This monitoring value indicates the status of the interval function.

V2.3.3 INTERVAL 2 (ID 1443)

This monitoring value indicates the status of the interval function.

V2.3.4 INTERVAL 3 (ID 1444)

This monitoring value indicates the status of the interval function.

V2.3.5 INTERVAL 4 (ID 1445)

This monitoring value indicates the status of the interval function.

V2.3.6 INTERVAL 5 (ID 1446)

This monitoring value indicates the status of the interval function.

V2.3.7 TIMER 1 (ID 1447)

If the timer is active, the monitoring value indicates the remaining time on the timer.

V2.3.8 TIMER 2 (ID 1448)

If the timer is active, the monitoring value indicates the remaining time on the timer.

V2.3.9 TIMER 3 (ID 1449)

If the timer is active, the monitoring value indicates the remaining time on the timer.

V2.3.10 REAL TIME CLOCK (ID 1450)

This monitoring value indicates the actual time of the real-time clock in a format of hh:mm:ss.

9.3 PID1 Controller

V2.4.1 PID1 SETPOINT (ID 20)

This monitoring value indicates the value of the PID setpoint signal in process units. You can use the parameter P3.13.1.4 to select the process unit (See 10.13.1 Basic Settings).

V2.4.2 PID1 FEEDBACK (ID 21)

This monitoring value indicates the value of the PID feedback signal in process units. You can use the parameter P3.13.1.4 to select the process unit (See 10.13.1 Basic Settings).

V2.4.3 PID1 ERROR VALUE (ID 22)

This monitoring value indicates the error value of the PID controller. It is the deviation of PID feedback from the PID setpoint in process unit.

V2.4.4 PID1 OUTPUT (ID 23)

This monitoring value indicates the output of the PID controller as a percentage (0-100%).

V2.4.5 PID1 STATUS (ID 24)

This monitoring value indicates the state of the PID controller.

9.4 PID2 Controller

V2.5.1 PID2 SETPOINT (ID 83)

This monitoring value indicates the value of the PID setpoint signal in process units. You can use the parameter P3.14.1.6 to select the process unit (See 10.13.1 Basic Settings).

V2.5.2 PID2 FEEDBACK (ID 84)

This monitoring value indicates the value of the PID feedback signal in process units. You can use the parameter P3.14.1.6 to select the process unit (See 10.13.1 Basic Settings).

V2.4.3 PID2 ERROR VALUE (ID 85)

This monitoring value indicates the error value of the PID controller. The error value is the deviation of PID feedback from the PID setpoint in process unit. You can use the parameter P3.14.1.6 to select the process unit.

V2.5.4 PID2 OUTPUT (ID 86)

This monitoring value indicates the output of the PID controller as a percentage (0-100%). You can give this value to, e.g., the analog output.

V2.5.5 PID2 STATUS (ID 87)

This monitoring value indicates the state of the PID controller.

9.5 Multi-Pump

V2.6.1 MOTORS RUNNING (ID 30)

This monitoring value indicates the actual number of motors that operate in the Multi-pump system.

V2.6.2 AUTOCHANGE (ID 1114)

This monitoring value indicates the status of the autochange requested.

9.6 Maintenance Counters

V2.7.1 MAINTENANCE COUNTER 1 (ID 1101)

This monitoring value indicates the status of the maintenance counter.

V2.7.1 MAINTENANCE COUNTER 2 (ID 1102)

This monitoring value indicates the status of the maintenance counter.

V2.7.3 MAINTENANCE COUNTER 1 (ID 1103)

This monitoring value indicates the status of the maintenance counter.

9.7 Fieldbus Data

V2.8.1 FB CONTROL WORD (ID 874)

This monitoring value indicates the status of the fieldbus control word that the application uses in bypass mode.

Depending on the fieldbus type or profile, the data that is received from the fieldbus can be modified before it is sent to the application.

V2.8.2 FB SPEED REFERENCE (ID 875)

This monitoring value indicates the fieldbus frequency reference as a percentage of minimum frequency to maximum frequency. The speed reference information is scaled between the minimum and the maximum frequency at the moment when the application received it. You can change the minimum and the maximum frequencies after the application received the reference without an effect on the reference.

V2.8.3 FB DATA IN 1 (ID 876)

This monitoring value indicates the raw value of process data in a 32-bit signed format.

V2.8.4 FB DATA IN 2 (ID 877)

This monitoring value indicates the raw value of process data in a 32-bit signed format.

V2.8.5 FB DATA IN 3 (ID 878)

This monitoring value indicates the raw value of process data in a 32-bit signed format.

V2.8.6 FB DATA IN 4 (ID 879)

This monitoring value indicates the raw value of process data in a 32-bit signed format.

V2.8.7 FB DATA IN 5 (ID 880)

This monitoring value indicates the raw value of process data in a 32-bit signed format.

V2.8.8 FB DATA IN 6 (ID 881)

This monitoring value indicates the raw value of process data in a 32-bit signed format.

V2.8.9 FB DATA IN 7 (ID 882)

This monitoring value indicates the raw value of process data in a 32-bit signed format.

V2.8.10 FB DATA IN 8 (ID 883)

This monitoring value indicates the raw value of process data in a 32-bit signed format.

V2.8.11 FB STATUS WORD (ID 864)

This monitoring value indicates the status of the fieldbus status word that the application uses in bypass mode. Depending on the fieldbus type or profile, the data can be modified before it is sent to the fieldbus.

V2.8.12 FB SPEED ACTUAL (ID 865)

This monitoring value indicates the actual speed of the drive as a percentage of minimum frequency and maximum frequency. The value 0% indicates the minimum frequency and the value 100% indicates the maximum frequency. This monitoring value is continuously updated depending on the momentary min and max frequencies and the output frequency.

V2.8.13 FB DATA OUT 1 (ID 866)

This monitoring value indicates the raw value of process data in a 32-bit signed format.

V2.8.14 FB DATA OUT 2 (ID 867)

This monitoring value indicates the raw value of process data in a 32-bit signed format.

V2.8.15 FB DATA OUT 3 (ID 868)

This monitoring value indicates the raw value of process data in a 32-bit signed format.

V2.8.16 FB DATA OUT 4 (ID 869)

This monitoring value indicates the raw value of process data in a 32-bit signed format.

V2.8.17 FB DATA OUT 5 (ID 870)

This monitoring value indicates the raw value of process data in a 32-bit signed format.

V2.8.18 FB DATA OUT 6 (ID 871)

This monitoring value indicates the raw value of process data in a 32-bit signed format.

V2.8.19 FB DATA OUT 7 (ID 872)

This monitoring value indicates the raw value of process data in a 32-bit signed format.

V2.8.20 FB DATA OUT 8 (ID 873)

This monitoring value indicates the raw value of process data in a 32-bit signed format.

10 PARAMETER DESCRIPTIONS

In this chapter, you can find information on all the parameters of your HVAC400 application. If other information is necessary, see 5 Parameters MENU or contact your nearest distributor.

10.1 Motor Settings

10.1.1 Motor Nameplate Parameters

P3.1.1.1 MOTOR NOMINAL VOLTAGE (ID 110)

Find the value *Un* on the motor's nameplate. Find out whether the motor connection is Delta or Star.

P3.1.1.2 MOTOR NOMINAL FREQUENCY (ID 111)

Find the value *fn* on the motor's nameplate.

P3.1.1.3 MOTOR NOMINAL SPEED (ID 112)

Find the value *nn* on the motor's nameplate.

P3.1.1.4 MOTOR NOMINAL CURRENT (ID 113)

Find the value *In* on the motor's nameplate.

P3.1.1.5 MOTOR COS PHI (ID 120)

Find the value *cos phi* on the motor's nameplate.

P3.1.1.6 MOTOR NOMINAL POWER (ID 116)

Find the value *Pn* on the motor's nameplate.

P3.1.1.7 MOTOR CURRENT LIMIT (ID 107)

You can use this parameter to set the maximum motor current from the HVAC drive. The range of values for the parameter is different for each enclosure size of the drive. When the current limit is active, the drive output frequency is decreases.

NOTE: The Motor Current Limit is not an overcurrent trip limit.

P3.1.1.8 MOTOR TYPE (ID 650)

You can use this parameter to set the type of motor in your process. Select the type of the motor. You can select for example, asynchronous induction motor (IM) or synchronous permanent magnet motor (PM).

10.1.2 Motor Control Parameters

P3.1.2.1 SWITCHING FREQUENCY (ID 601)

You can use this parameter to set the switching frequency of the HVAC drive.

If you increase the switching frequency, the capacity of the HVAC drive reduces. To reduce capacitive currents in the motor cable, when the cable is long, we recommend that you use a low switching frequency. To reduce the motor noise, use a high switching frequency.

P3.1.2.2 MOTOR SWITCH (ID 653)

You can use this parameter to enable the Motor Switch function.

If the cable that connects the motor and the drive has a motor switch, you can use the Motor Switch function. The operation of the motor switch makes sure that the motor is isolated from the voltage source and does not start during the servicing.

To activate the function, set the parameter P3.1.2.2 to the value *Enabled*. The drive stops automatically when the motor switch is opened, and the drive starts automatically when the motor switch is closed. The drive does not trip when you use the Motor switch function.

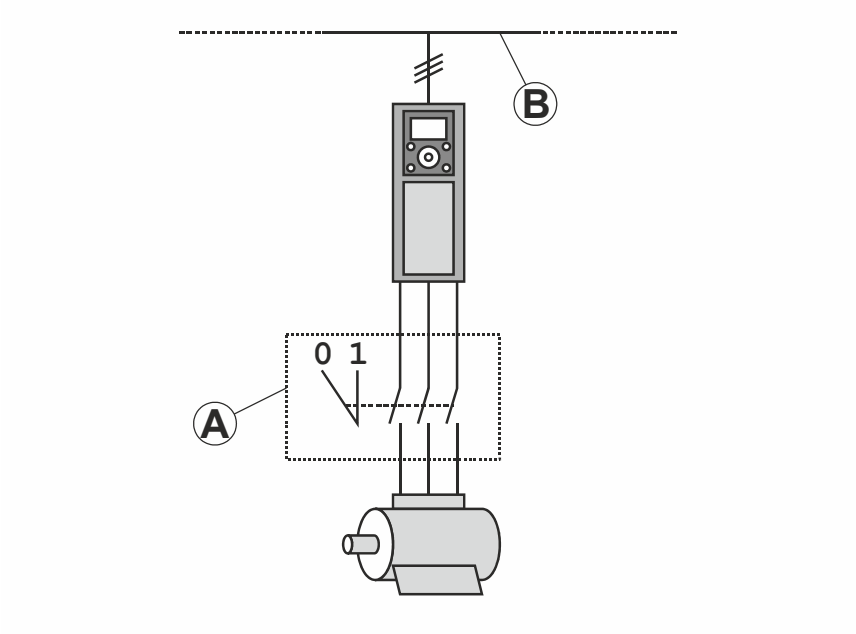


Fig. 9. The motor switch between the drive and the motor

Legend

A.	motor switch.	**B.**	Mains.

P3.1.2.3 ZERO FREQUENCY VOLTAGE (ID 606)

You can use this parameter to set the zero frequency voltage of the U/f curve. The default value for the parameter is different for each unit size.

P3.1.2.4 MOTOR PREHEAT FUNCTION (ID 1225)

You can use this parameter to enable or disable the Motor Preheat function. The motor preheat function keeps the drive and the motor warm during the stop status by giving the motor a DC current.

P3.1.2.5 MOTOR PREHEAT FUNCTION (ID 1226)

You can use this parameter to set the temperature limit of the Motor Preheat function. When the heatsink temperature or the measured motor temperature goes below this level, motor preheat becomes active.

P3.1.2.6 MOTOR PREHEAT CURRENT (ID 1227)

You can use this parameter to set the DC current of the Motor Preheat function.

P3.1.2.7 U/F RATIO SELECTION (ID 108)

You can use this parameter to set the type of the U/f curve between zero frequency and the field weakening point.

P3.1.2.7 U/F RATIO (ID 108)

Selection number	Selection name	Description
0	Linear	The voltage of the motor changes linearly as a function of the output frequency. The voltage changes from the value of P3.1.2.3 (Zero Frequency Voltage) to the value of Voltage at Field Weakening Point at a frequency set in Field Weakening Point Frequency. If a different setting is not necessary, use this default setting.
1	Squared	The voltage of the motor changes from the value of P3.1.2.3 (Zero Frequency Voltage) to the value of Field Weakening Point Frequency at a squared curve. The motor operates undermagnetized below the field weakening point and produces less torque. You can use the squared U/f ratio in applications where the torque demand is in relation to the square of the speed, for example in centrifugal fans and pumps.
2	Programmable	It is possible to program the U/f by using 2 points of reference: voltage at zero frequency (P1) and U/f mid frequency (P2). The field weakening point (P3) is then set automatically. This function is used to boost torque at start. After having set the parameter to programmable, activate ID run to tune the settings.

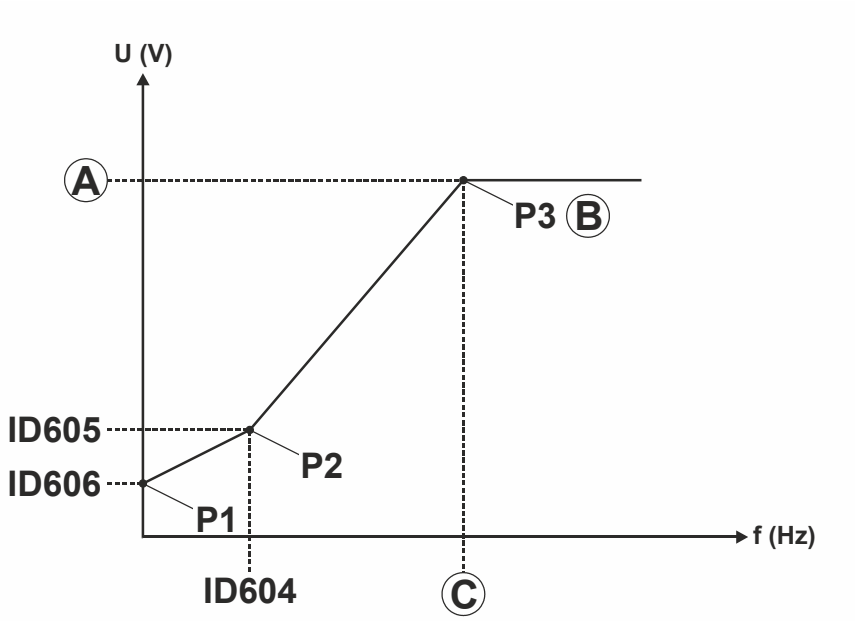


Fig. 10. Programmable U/f curve

Legend

A.	Nominal voltage of the motor.	**C.**	Nominal frequency of the motor.
B.	Linear Squared Field weakening point.		

When the parameter Motor Type is set to PMM then the U/f curve is automatically set to *linear*.

P3.1.2.8 OVERVOLTAGE CONTROL (ID 607)

You can use this parameter to set the overvoltage controller out of operation. See the description in P3.1.2.9 Undervoltage Control.

P3.1.2.9 UNDERVOLTAGE CONTROLLER (ID 608)

You can use this parameter to set the undervoltage controller out of operation. When you enable P3.1.2.8 or P3.1.2.9, the controllers start to monitor the changes in the supply voltage. The controllers change the output frequency if it becomes too high or too low. To stop the operation of the undervoltage and the overvoltage controllers, disable these two parameters. This is useful if the supply voltage changes more than -15% to +10%, and if the application does not tolerate the operation of the controllers.

P3.1.2.10 ENERGY OPTIMIZATION (ID 666)

You can use this parameter to enable the Energy Optimization function. To save energy and to lower the motor noise, the drive searches for the minimum motor current. You can use this function for example in fan and pump processes. Do not use the function with fast PID controlled processes.

P3.1.2.11 FLYING START OPTIONS (ID 1590)

You can use this parameter to set the flying start options. The parameter Flying Start Options has a checkbox selection of values. The bits can receive these values.

- Disable reverse direction search
- Flux build with current control

The bit B0 controls the search direction. When you set the bit to 0, the shaft frequency is searched in two directions, the positive and the negative. When you set the bit to 1, the shaft frequency is searched only in the frequency reference direction. This prevents the shaft movements for the other direction.

Bits 64 and 65 provide an enhanced procedure to magnetize an induction motor. It can help, e.g., with high power motors.

P3.1.2.12 STATOR VOLTAGE ADJUST (ID 659)

You can use this parameter to adjust the stator voltage in permanent magnet motors. It is possible to use this parameter only when the parameter P3.1.1.8 Motor Type has the value *PM motor*. If you set induction motor as the motor type, the value is automatically set to 100%, and you cannot change the value.

When you change the value of P3.1.1.8 (Motor type) to *PM Motor*, the U/f curve will increase automatically to be equal with output voltage of the drive. The set U/f ratio does not change.

This is done to prevent the operation of the PM motor in the field weakening area. The nominal voltage of the PM motor is much lower than the full output voltage of the drive.

The nominal voltage of the PM motor agrees to the back-EMF voltage of the motor at nominal frequency. But in a different motor manufacturer, it can be equal to, e.g., the stator voltage at nominal load.

Stator Voltage Adjust helps you to adjust the U/f curve of the drive near the back-EMF curve. It is not necessary to change the values of many U/f curve parameters.

The parameter P3.1.2.12 gives the drive's output voltage as a percentage of the motor's nominal voltage at the motor's nominal frequency. Adjust the U/f curve of the drive above the back-EMF curve of the motor. The motor current increases the more the U/f curve is different from the back-EMF curve.

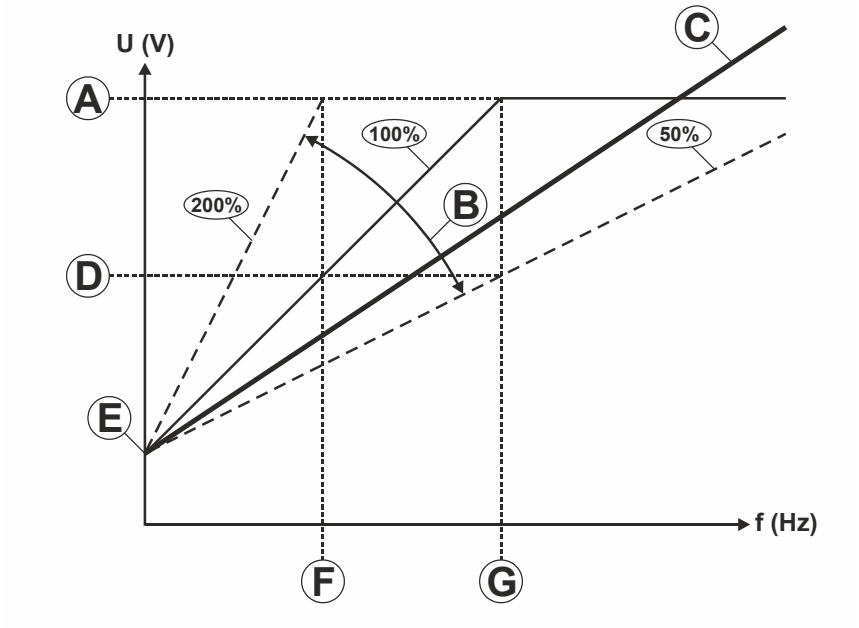


Fig. 11. Adjusting the stator voltage

Legend

A.	Field weakening point voltage.	**E.**	Zero frequency voltage.
B.	Zero frequency voltage (50…200%).	**F.**	Motor nominal frequency.
C.	Back EMF.	**G.**	Field Weakening Point.
D.	Motor nominal voltage.		

P3.1.2.13 I/F START (ID 534)

You can use this parameter to enable the I/f Start function.

This function starts the motor with constant current control. It provides a sufficient torque for the motor at startup. You can use this function for example with PM-motors.

P3.1.2.14 I/F START FREQUENCY (ID 535)

You can use this parameter to set the output frequency limit below which the set I/f start current is fed to motor.

When the output frequency of the drive is below the limit of this parameter, I/f Start function activates. When the output frequency is more than the limit, the drive operation mode changes back to the normal U/f control mode.

P3.1.2.15 I/F START CURRENT (ID 536)

You can use this parameter to set the current that is used when the I/f Start function is enabled.

P3.1.2.16 IDENTIFICATION (ID 631)

Used to automatically optimize the U/f curve.

Identification run calculates, measures, and automatically tunes parameters, thus ensuring good motor operation.

Identification run is a tool used to align parameters from the drive to the connected motor and ensure optimized operation.

NOTE: Before running the identification process, information from the motor nameplate must be set in the drive.

Selection number	Selection name	Description
0	No action	Identification will not be performed.
1	ID no run	The identification process performs without running the motor. The motor is supplied with voltage and current but always at frequency zero.
2	ID with run	The identification process performs and the motor will run. The U/f ratio and magnetization are identified. To obtain precise results, use this function with no load connected to the motor.

To perform this function, go to P3.1.2.16 and give a *Start* command within 20 seconds. If the *Start* command is not given on time, the P3.1.2.16 identification will not be performed, the values will not be tuned, settings will remain unchanged, and an alarm will be triggered.

To interrupt the identification process, press the stop button. The process will be aborted, settings changes will not be considered, and an alarm will be triggered

NOTE: When the identification process has ended, a *Start* command is needed to run the motor.

P3.1.2.17 MID FREQUENCY U/f (ID 604)

You can use this parameter to set the U/f for the power supplied to the motor.

NOTE: In order to be able to set the mid frequency, the U/f ratio P3.1.2.7 must be programmable.

P3.1.2.17 MID VOLTAGE U/f (ID 605)

You can use this parameter to set the midpoint voltage of the U/f curve.

NOTE: In order to be able to set the mid frequency; the U/f ratio P3.1.2.7 must be programmable.

P3.1.2.19 MOTOR PREHEAT (ID 1045)

You can use this parameter to control the motor temperature before the start.

10.2 Start/Stop Parameters

P3.2.1 REMOTE CONTROL PLACE (ID 172)

You can use this parameter to select the remote control place (start/stop).

You can use this parameter to change back to remote control from PC, for example if the control panel is broken.

P3.2.2 LOCAL/REMOTE (ID 211)

You can use this parameter to switch between the local and remote control places.

Local control place is always keypad control. The remote control place can be I/O or Fieldbus, depending on the parameter value *Remote Control Place*.

P3.2.3 KEYPAD MASTER-STOP (ID 1806)

You can use this parameter to enable the Keypad Master-stop function.

When this parameter is enabled, you can force the drive to the stop state from the keypad stop button even if it is controlled from another control place (Remote). If you stop the drive with this function, the drive goes to the lock state. To restart the drive in Remote mode, you need to first press the BACK/RESET button and then press the Start button.

You can also change the control to Local and start there but when you go back to the Remote mode, you still need to press the Start button. This also applies after a power-down as the state of this function is retained in memory.

P3.2.4 START FUNCTION (ID 505)

You can use this parameter to select the type of the start function.

P3.2.4 START FUNCTION (ID 505)

Selection number	Selection name	Description
0	Ramp	The drive accelerates from 0 frequency to frequency reference.
1	Flying start	The drive detects the actual speed of the motor and accelerates from that speed to frequency reference.

P3.2.5 STOP FUNCTION (ID 506)

You can use this parameter to select the type of the stop function.

P3.2.5 STOP FUNCTION (ID 506)

Selection number	Selection name	Description
0	Coasting	The motor stops on its inertia. When the *Stop* command is given, the control by the drive stops and the current from the drive goes to 0.
1	Ramp	After the *Stop* command, the speed of the motor is decreased to zero speed according to the deceleration parameters.

NOTE: Ramp stop cannot be guaranteed in all situations. If ramp stop is selected and the net voltage changes by more than 20%, the voltage estimation fails. In such case, ramp stop is not possible.

P3.2.6 I/O START/STOP LOGIC (ID 300)

You can use this parameter to control the start and stop of the drive with the digital signals.

The selections can include the word 'edge' to help you prevent an accidental start.

An accidental start can occur, e.g., in the following conditions:

- When you connect the power.
- When the power is connected again after a power cut.
- After you reset a fault.
- After Run Enable stops the drive.
- When you change the control place to I/O control.

Before you can start the motor, you must open the Start/Stop contact.

In all the examples of the next pages, the stop mode is coasting, CS = Control signal.

P3.2.6 I/O START/STOP LOGIC 0 (ID 300)

Selection number	Selection name	Description
0	Forw-BACK	The functions activate when the contacts are CLOSED. CS 1 = Start/stop forward. CS 2 = Start/stop backwards.

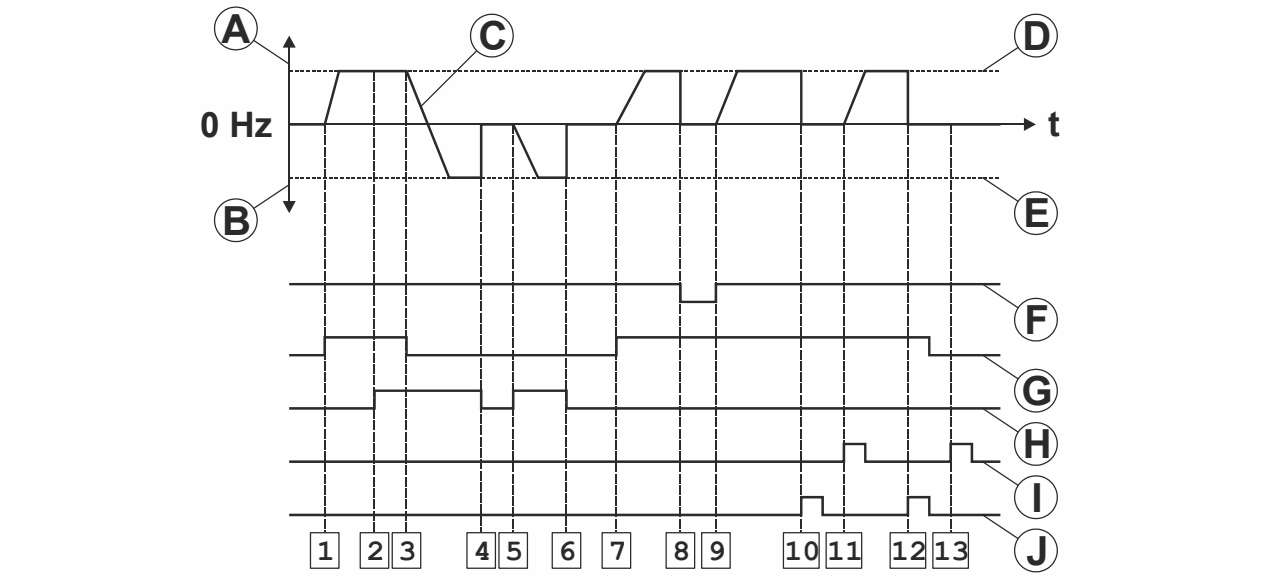


Fig. 12. E/S A Start/stop logic = 0

Legend

1.	Control signal (CS) 1 activates and causes the output frequency to increase. The motor operates forward.	**7.**	CS1 activates and the motor accelerates (FWD) to the set frequency.
2.	CS2 activates, but it does not have an effect on the output frequency because the direction that is set first has the highest priority.	**8.**	The Run enable signal is set to OPEN, which causes the frequency to go to 0. Configure the Run enable signal with parameter P3.5.1.10.
3.	CS1 becomes inactive and causes the direction to start to change (FWD to REV) because CS2 is still active.	**9.**	The Run enable signal is set to CLOSED, causing the frequency to increase to the set frequency because CS1 is still active.
4.	CS2 becomes inactive and the frequency that is fed to the motor goes to 0.	**10.**	The STOP button on the keypad is pushed, and the frequency that is fed to the motor goes to 0. (This signal works only if P3.2.3 Keypad Master Stop is Enabled.)
5.	CS2 activates again and causes the motor to accelerate (REV) to the set frequency.	**11.**	The drive starts because the BACK/RESET and START buttons on the keypad were pushed.
6.	CS2 becomes inactive and the frequency fed to the motor drops to 0.	**12.**	The STOP button on the keypad is pushed again to stop the drive.
		13.	The attempt to start the drive using the START button is unsuccessful because CS1 is inactive.
A.	FWD.	**F.**	Run enable.
B.	REV.	**G.**	Ctrl signal 1.
C.	Output frequency.	**H.**	Ctrl signal 2.
D.	Set frequency.	**I.**	Keypad start button.
E.	Set frequency REV.	**J.**	Keypad stop button.

Suite: I/O START/STOP LOGIC 1

Selection number	Selection name	Description
1	Forw-BACK	CS1 = Start impulse forward edge if CS2 is CLOSED. CS2 = Stop impulse.

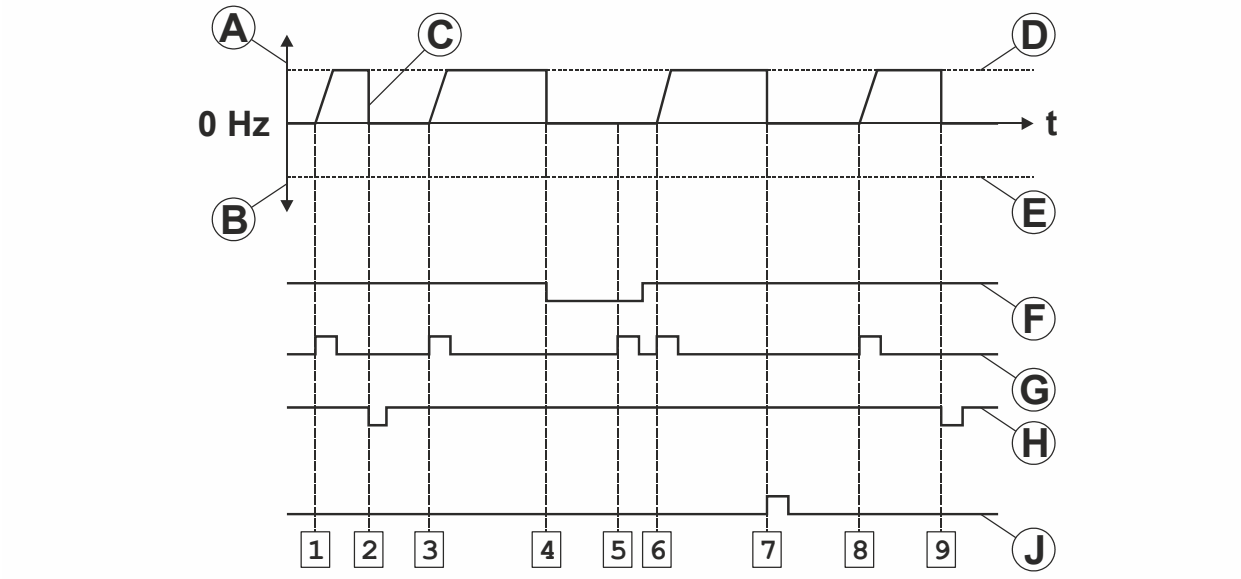


Fig. 13. I/O A Start/stop logic = 1

Legend

1.	Control signal (CS) 1 activates and causes the output frequency to increase. The motor operates forward.	**6.**	CS1 activates and the motor accelerates (FWD) to the set frequency because the Run enable signal was set to CLOSED.
2.	CS2 becomes inactive and causes the frequency to go to 0.	**7.**	The STOP button on the keypad is pushed, and the frequency that is fed to the motor goes to 0. (This signal only works if the value of P3.2.10 Keypad Stop Button is *Yes* or P3.2.3 Keypad Master Stop is *Enabled*.).
3.	CS1 activates and causes the output frequency to increase again. The motor operates forward.	**8.**	CS1 activates and causes the output frequency to increase again. The motor operates forward.
4.	The Run enable signal is set to OPEN, which causes the frequency to go to 0. Configure the Run enable signal with parameter P3.5.1.10.	**9.**	CS2 becomes inactive and causes the frequency to go to 0.
5.	The start attempt with CS1 is not successful because the Run enable signal is still OPEN.		
A.	FWD.	**F.**	Run enable.
B.	REV.	**G.**	Ctrl signal 1.
C.	Output frequency.	**H.**	Ctrl signal 2.
D.	Set frequency.	**I.**	--
E.	Set frequency REV.	**J.**	Keypad stop button.

Suite: I/O START/STOP LOGIC 2

Selection number	Selection name	Description
2	Forw-STOP (edge)	You can use this function to prevent an accidental start. Before you can start the motor again, you must open the start/stop contact. CS1 = Start/stop forward (edge) CS2 = Start/stop backwards (edge)

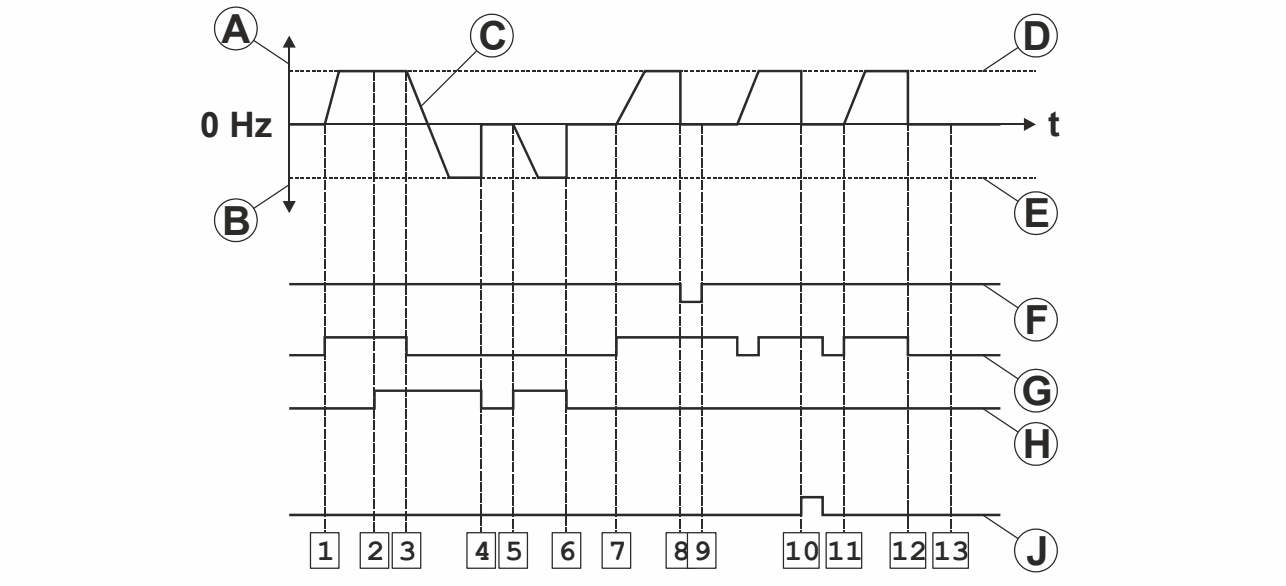


Fig. 14. E/S A Start/stop logic = 2

Legend

1.	Control signal (CS) 1 activates and causes the output frequency to increase. The motor operates forward.	**7.**	CS1 activates and the motor accelerates (FWD) to the set frequency.
2.	CS2 activates, but it does not have an effect on the output frequency because the direction that is set first has the highest priority.	**8.**	The Run enable signal is set to OPEN, which causes the frequency to go to 0. Configure the Run enable signal with parameter P3.1.1.10.
3.	CS1 is becomes inactive and causes the direction to start to change (FWD to REV) because CS2 is still active.	**9.**	The Run enable signal is set to CLOSED, which does not have an effect because a rising edge is necessary for the start, even if CS1 is active.
4.	CS2 becomes inactive and causes the frequency to go to 0.	**10.**	The STOP button on the keypad is pushed and the frequency that is fed to the motor goes to 0. (This signal works only if P3.2.3 Keypad Master Stop is Enabled.).
5.	CS2 activates again and causes the motor to accelerate (REV) to the set frequency.	**11.**	CS1 is opened and closed again, which causes the motor to start.
6.	CS2 becomes inactive and causes the frequency to go to 0.	**12.**	CS1 becomes inactive and the frequency that is fed to the motor goes to 0.
A.	FWD.	**F.**	Run enable.
B.	REV.	**G.**	Ctrl signal 1.
C.	Output frequency.	**H.**	Ctrl signal 2.
D.	Set frequency.	**I.**	--
E.	Set frequency REV.	**J.**	Keypad stop button.

Suite: I/O START/STOP LOGIC 3

Selection number	Selection name	Description
3	Forw-BACK (edge)	CS1 = Start/stop forward. CS2 = Start backwards if CS1 = CLOSED.

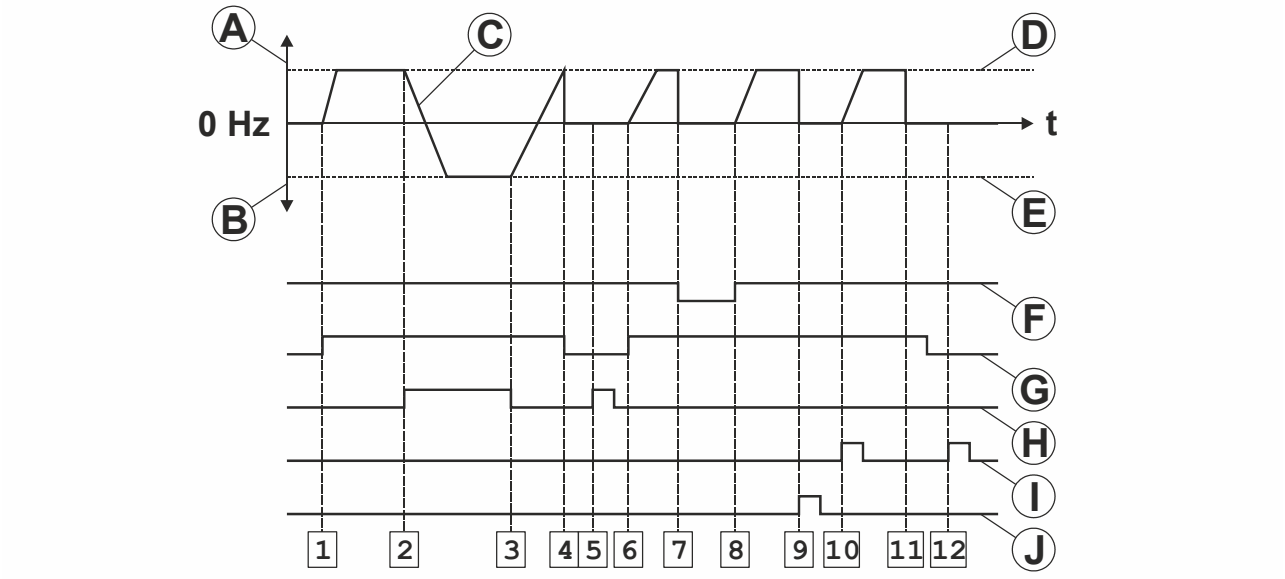


Fig. 15. E/S A Start/stop logic = 3

Legend

1.	Control signal (CS) 1 activates and causes the output frequency to increase. The motor operates forward.	**7.**	The Run enable signal is set to OPEN, which causes the frequency to go to 0. Configure the Run enable signal with parameter P3.5.1.10.
2.	CS2 activates and causes the direction to start to change (FWD to REV).	**8.**	The Run enable signal is set to CLOSED, which causes the frequency to increase to the set frequency because CS1 is still active.
3.	CS2 becomes inactive, which causes the direction to start to change (REV to FWD) because CS1 is still active.	**9.**	The STOP button on the keypad is pushed and the frequency that is fed to the motor goes to 0. (This signal works only if P3.2.3 Keypad Master Stop is Enabled.).
4.	CS1 becomes inactive and the frequency goes to 0.	**10.**	The drive starts because the BACK/ RESET and START buttons on the keypad were pushed.
5.	CS2 activates, but the motor does not start because CS1 is inactive.	**11.**	The drive is stopped again using the STOP button on the keypad.
6.	CS1 activates and causes the output frequency to increase again. The motor operates forward because CS2 is inactive.	**12.**	The attempt to start the drive using the START button is unsuccessful because CS1 is inactive.
A.	FWD.	**F.**	Run enable.
B.	REV.	**G.**	Ctrl signal 1.
C.	Output frequency.	**H.**	Ctrl signal 2.
D.	Set frequency.	**I.**	Keypad start button.
E.	Set frequency REV	**J.**	Keypad stop button

Suite: I/O START/STOP LOGIC 4

Selection number	Selection name	Description
4	Start-REV	You can use this function to prevent an accidental start. Before you can start the motor again, you will have to open the start/stop contact. CS1 = Start/stop forward. CS2 = Start backwards if CS1 = CLOSED.

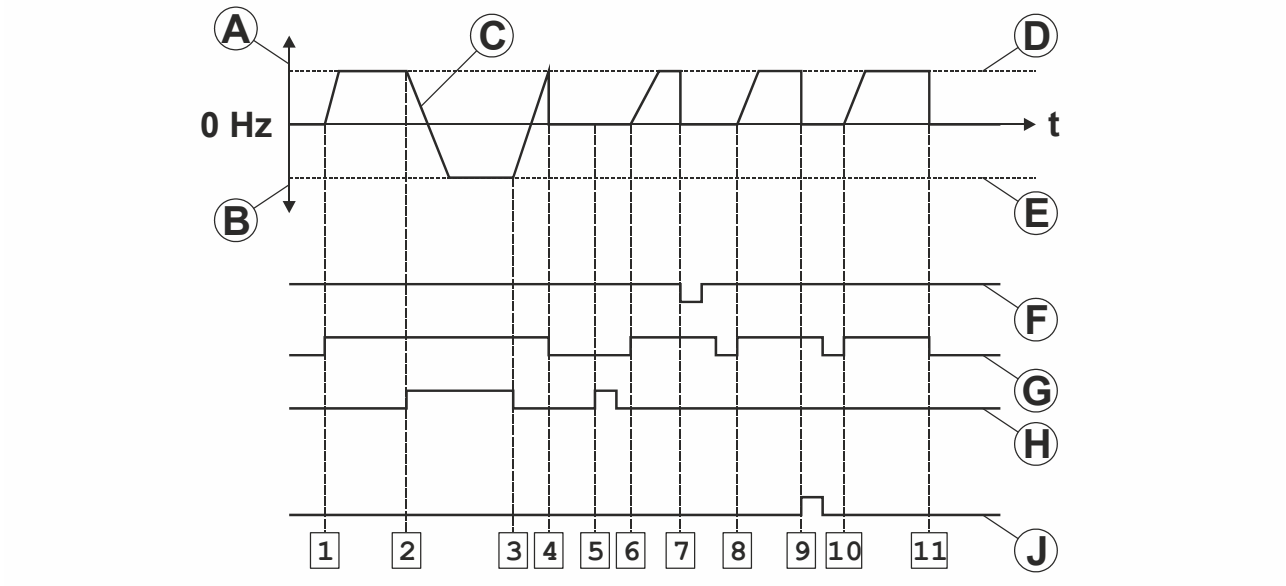


Fig. 16. I/O A Start/stop logic = 4

Legend

1.	Control signal (CS) 1 activates and causes the output frequency to increase. The motor operates forward. because CS2 is inactive.	**7.**	The Run enable signal is set to OPEN, which causes the frequency to go to 0. Configure the Run enable signal with parameter P3.5.1.10.
2.	CS2 activates and causes the direction to start to change (FWD to REV).	**8.**	Before the drive can start, you must open and close CS1 again.
3.	CS2 becomes inactive, which causes the direction to start to change (REV to FWD) because CS1 is still active.	**9.**	The STOP button on the keypad is pushed and the frequency that is fed to the motor goes to 0. (This signal only works if P3.2.3 Keypad Master Stop is Enabled.).
4.	CS1 becomes inactive and the frequency goes to 0.	**10.**	Before the drive can start, you must open and close CS1 again.
5.	CS2 activates, but the motor does not start because CS1 is inactive.	**11.**	CS1 becomes inactive and the frequency goes to 0.
6.	CS1 activates and causes the output frequency to increase again. The motor operates forward because CS2 is inactive.		
A.	FWD.	**F.**	Run enable.
B.	REV.	**G.**	Ctrl signal 1.
C.	Output frequency.	**H.**	Ctrl signal 2.
D.	Set frequency.	**I.**	--
E.	Set frequency REV.	**J.**	Keypad stop button.

Suite: I/O START/STOP LOGIC

Selection number	Selection name	Description
6	AI1 Start Threshold	Special start mode where no separate start signal is needed. Increasing the value of AI1 will act as a *Start* command. AI1 threshold (P3.2.8) described in the figure below creates a safety margin to prevent unintentional starts. Consequently, the drive will start only after the value of AI1 exceeds the threshold. Control signal 2 can be used for changing the rotation direction.

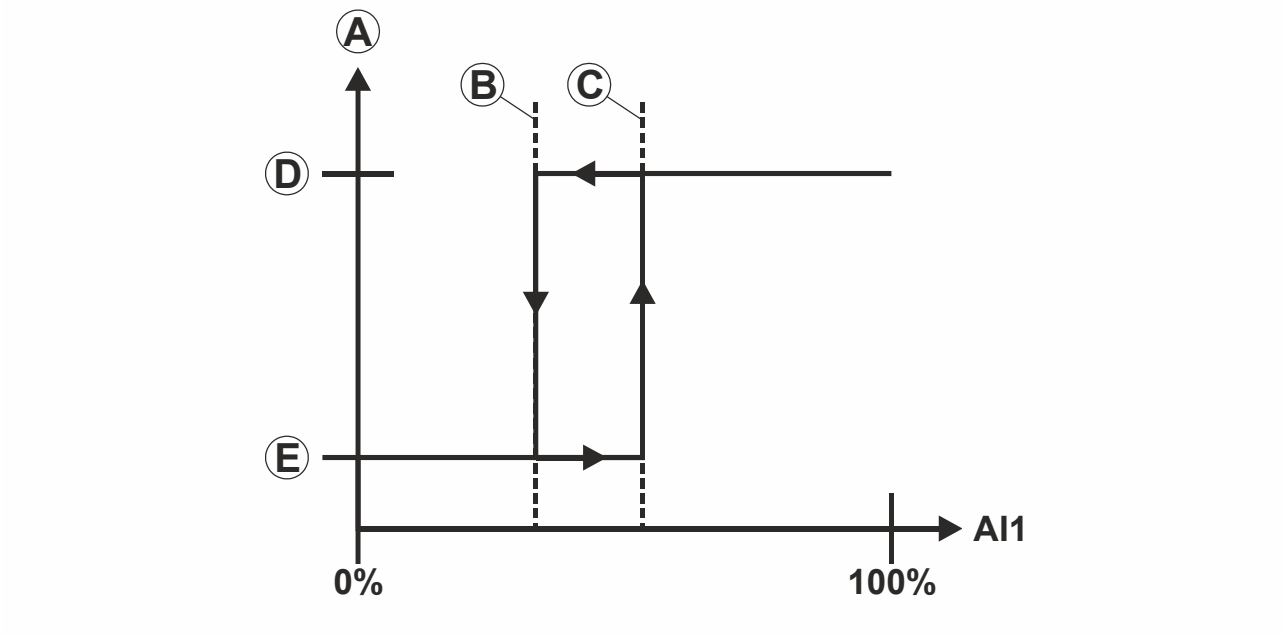


Fig. 17. AI1 start threshold

Legend

A.	Start command.	**D.**	1 = Enabled.
B.	AI1 threshold -2%.	**E.**	0 = Disabled.
C.	AI1 threshold.		

P3.2.7 I/O B START/STOP LOGIC (ID 363)

You can use this parameter to control the start and stop of the drive with the digital signals. The selections can include the word 'edge' to help you prevent an accidental start. See P3.2.6 for more information.

P3.2.8 AI1 START THRESHOLD (ID 185)

You can use this parameter to set the threshold level to start the HVAC drive from Analog Input 1 when the Start/Stop Logic is set to AI1. If P3.2.6 (I/O Start/Stop Logic) is set to value *5* (AI1 threshold) the motor starts at the level set with this parameter and stops at the same value -2%. AI1 can also be used as a frequency reference at the same time.

P3.2.9 FIELDBUS START LOGIC (ID 889)

You can use this parameter to set the fieldbus start logic. The selections can include the word 'edge' to help you prevent an accidental start.

RESTART MODE

Selection number	Selection name	Description
0	A rising edge is necessary	Restart after power-off disabled.
1	State	Restart after power-off enabled.

P3.2.10 KEYPAD STOP BUTTON (ID 114)

You can use this parameter to enable the keypad stop button. When this function is enabled, a press of keypad stop button always stops the drive (regardless of the control place). When this function is disabled, a press of keypad stop button stops the drive in local control only.

DISABLING THE START BUTTON

Selection number	Selection name	Description
0	Keypad Stop button Yes	The keypad Stop button is always enabled.
1	Keypad Stop button No	Limited function of the keypad Stop button.

P3.2.11 START DELAY (ID 524)

You can use this parameter to set the delay between the *Start* command and the actual start of the HVAC drive.

10.3 References

10.3.1 Frequency Reference

P3.3.1 MINIMUM FREQUENCY REFERENCE (ID 101)

You can use this parameter to set the minimum frequency reference.

P3.3.2 MAXIMUM FREQUENCY (ID 102)

You can use this parameter to set the maximum frequency reference.

P3.3.3 I/O CONTROL REFERENCE A SELECTION (ID 117)

You can use this parameter to select the reference source when the control place is I/O A.

P3.3.4 I/O CONTROL REFERENCE B SELECTION (ID 131)

You can use this parameter to select the reference source when the control place is I/O B. You can force the I/O B control place to be active only with a digital input (P3.5.1.6).

P3.3.5 KEYPAD CONTROL REFERENCE SELECTION (ID 121)

You can use this parameter to select the reference source when the control place is keypad.

P3.3.6 KEYPAD REFERENCE (ID 184)

You can use this parameter to adjust the frequency reference on the keypad. This parameter gives the frequency reference of the drive when the frequency reference source is 'Keypad Reference'.

P3.3.7 KEYPAD DIRECTION (ID 123)

You can use this parameter to set the rotation direction of the motor when the control place is keypad.

P3.3.8 KEYPAD REFERENCE COPY (ID 181)

You can use this parameter to set the selection of copy settings when you go from Remote to Local (keypad) control.

P3.3.9 FIELDBUS CONTROL REFERENCE SELECTION (ID 122)

You can use this parameter to select the reference source when the control place is Fieldbus.

10.3.2 Preset Frequencies

You can use the Preset frequencies function in processes where more than one fixed frequency reference is necessary. Eight preset frequency references are available. You can select a preset frequency reference using the digital input signals P3.5.1.16, P3.5.1.17, and P3.5.1.18.

P3.3.10 PRESET FREQUENCY MODE (ID 182)

You can use this parameter to set the logic of the digital input preset frequencies. With this parameter, you can set the logic which one of the preset frequencies is selected into use. There is a selection of two different logics.

CODING METHOD OF PRESET FREQUENCIES

Selection number	Selection name	Description
0	Binary coded	The mix of the inputs is binary coded. The different sets of active digital inputs determine the preset frequency. See more data in Table 66. SELECTING PRESET FREQUENCIES WHEN P3.3.10 = Binary coded.
1	Number (of inputs used)	Number (of inputs used) The number of active inputs tells which preset frequency is used: 1, 2, or 3.

P3.3.11 PRESET FREQUENCY 0 (ID 180)

You can use this parameter to set the preset frequency reference when the preset frequencies function is used. Select the preset frequencies with the digital input signals.

P3.3.12 PRESET FREQUENCY 1 (ID 105)

You can use this parameter to set the preset frequency reference when the preset frequencies function is used. Select the preset frequencies with the digital input signals.

P3.3.13 PRESET FREQUENCY 2 (ID 106)

You can use this parameter to set the preset frequency reference when the preset frequencies function is used. Select the preset frequencies with the digital input signals.

P3.3.14 PRESET FREQUENCY 3 (ID 126)

You can use this parameter to set the preset frequency reference when the preset frequencies function is used. Select the preset frequencies with the digital input signals.

P3.3.15 PRESET FREQUENCY 4 (ID 127)

You can use this parameter to set the preset frequency reference when the preset frequencies function is used. Select the preset frequencies with the digital input signals.

P3.3.16 PRESET FREQUENCY 5 (ID 128)

You can use this parameter to set the preset frequency reference when the preset frequencies function is used. Select the preset frequencies with the digital input signals.

P3.3.17 PRESET FREQUENCY 6 (ID 129)

You can use this parameter to set the preset frequency reference when the preset frequencies function is used. Select the preset frequencies with the digital input signals.

P3.3.18 PRESET FREQUENCY 7 (ID 130)

You can use this parameter to set the preset frequency reference when the preset frequencies function is used. Select the preset frequencies with the digital input signals. To select a preset frequency between 0 and 7, give digital inputs to P3.5.1.16 (Preset Frequency Selection 0), P3.5.1.17 (Preset Frequency Selection 1), and/or P3.5.1.18 (Preset Frequency Selection 2). The different sets of active digital inputs determine the preset frequency. You can find more data in the table below. The values of the preset frequencies stay automatically between the minimum and maximum frequencies (P3.3.1 and P3.3.2).

SELECTING PRESET FREQUENCIES

Necessary step	Activated frequency
Select the place of reference of I/O in P3.3.3.	Preset frequency 0

Table 66. SELECTING PRESET FREQUENCIES WHEN P3.3.10 = Binary coded

Activated digital input signal			Activated frequency reference
B2	B1	B0	
			Preset frequency 0
		*	Preset frequency 1
	*		Preset frequency 2
	*	*	Preset frequency 3
*			Preset frequency 4
*		*	Preset frequency 5
*	*		Preset frequency 6
*	*	*	Preset frequency 7

* = The input is activated.

P3.3.19 PRESET ALARM FREQUENCY (ID 183)

When the reference signal is cut-off and the alarm action in P3.9.19 is set to 'alarm + preset frequency', then the drive will run at this alarm preset frequency.

10.3.3 Motor Potentiometer Parameters

Reference P3.3.3 must be set to motor potentiometer and digital inputs P3.5.1.36 and 3.5.1.37 must be selected.

P3.3.20 MOTOR POTENTIOMETER RAMP TIME (ID 331)

You can use this parameter to set the rate of change in the motor potentiometer reference when it is increased or decreased. The parameter value is entered as Hz/second.

P3.3.21 MOTOR POTENTIOMETER RESET (ID 367)

You can use this parameter to set the logic for the resetting of the frequency reference of the motor potentiometer. This parameter defines when the reference of the motor potentiometer is set to 0. There are three selections in the reset function: no reset, reset when the drive stops, or reset when the drive is powered down.

RESETTING THE POTENTIOMETER

Selection number	Selection name	Description
0	No reset	The last motor potentiometer frequency reference is kept through the stop state and kept in memory if a power-down occurs.
1	Stop state	The motor potentiometer frequency reference is set to 0 when the drive goes to the stop state, or when the drive is powered down.
2	Powered down	The motor potentiometer frequency reference is set to 0 only when a power-down occurs.

P3.3.22 REVERSE DIRECTION (ID 15530)

You can use this parameter to permit running in reverse direction.

10.4 Ramps and Brakes Set-Up

P3.4.1 FORME DE LA RAMPE 1 (ID 500)

You can use this parameter to make the start and the end of the acceleration and deceleration ramps smoother.

Using the parameter *Ramp 1 Shape*, you can smooth the start and the end of the acceleration and deceleration ramps. If you set the value to *0*, you get a linear ramp shape. The acceleration and deceleration act immediately to the changes in the reference signal.

When you set the value between 0.1 and 10 s, you get an S-shaped acceleration or deceleration ramp. You can use this function to reduce mechanical erosion of the parts and current spikes when the reference changes. You can modify the acceleration time with parameters P3.4.2 (Acceleration Time 1) and P3.4.3 (Deceleration Time 1).

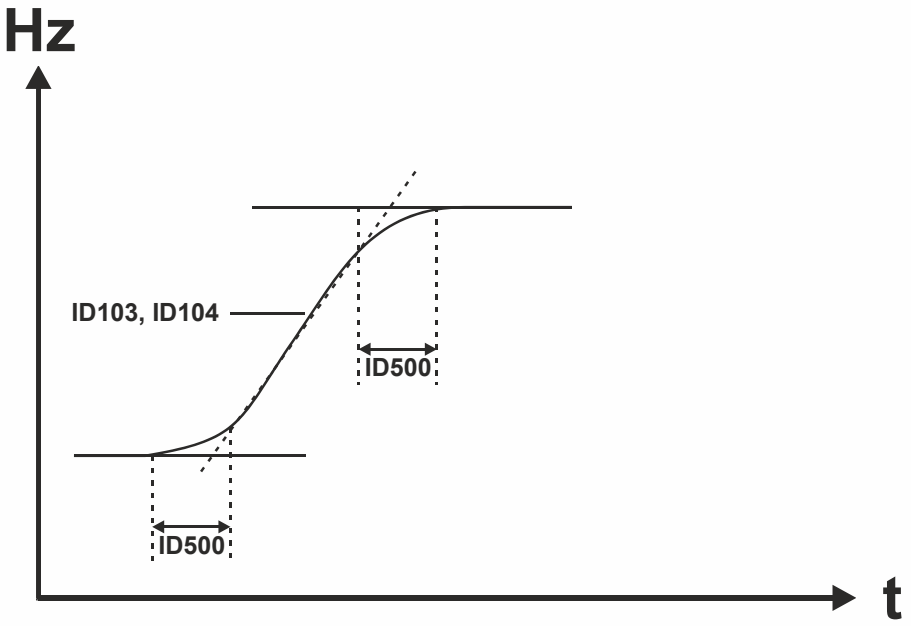


Fig. 18. The acceleration/deceleration curve (S-shaped)

P3.4.2 ACCELERATION TIME 1 (ID 103)

You can use this parameter to set the time that is necessary for the output frequency to increase from zero frequency to maximum frequency.

P3.4.3 DECELERATION TIME 1 (ID 104)

You can use this parameter to set the time that is necessary for the output frequency to decrease from maximum frequency to zero frequency.

P3.4.4 RAMP 2 THRESHOLD (ID 526)

You can use this parameter to set the output frequency limit above which the Ramp 2 is used.

Use the function, e.g., in applications for deep well pumps, where faster ramp times are necessary when the pump starts or stops (operates below the minimum frequency). Second ramp times are activated when the output frequency of the drive goes above the limit specified by this parameter. To disable the function, set the value of the parameter to *0*.

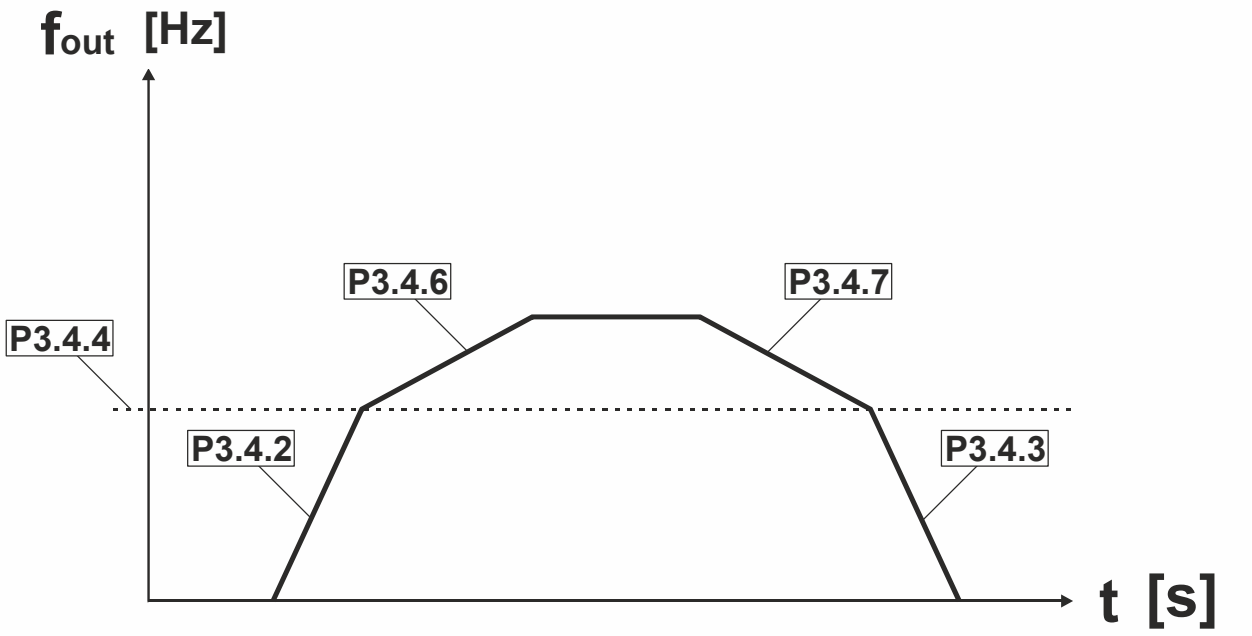


Fig. 19. Ramp 2 activation when the output frequency goes above the threshold level. (P.3.4.4 = Ramp 2 threshold, P3.4.2 = Acc. time 1, P3.4.6 = Acc. time 2, P3.4.3 =Dec. time 1, P3.4.7 = Dec. time 2)

P3.4.5 FORME DE LA RAMPE 2 (ID 501)

P3.4.5 RAMP 2 SHAPE (ID 501)

You can use this parameter to make the start and the end of the acceleration and deceleration ramps smoother.

Using the parameter Ramp 2 Shape, you can smooth the start and the end of the acceleration and deceleration ramps. If you set the value to *0*, you get a linear ramp shape. The acceleration and deceleration act immediately to the changes in the reference signal.

When you set the value between 0.1 and 10 s, you get an S-shaped acceleration or deceleration ramp. You can use this function to reduce mechanical erosion of the parts and current spikes when the reference changes. You can modify the acceleration time with parameters P3.4.6 (Acceleration Time 2) and P3.4.7 (Deceleration Time 2).

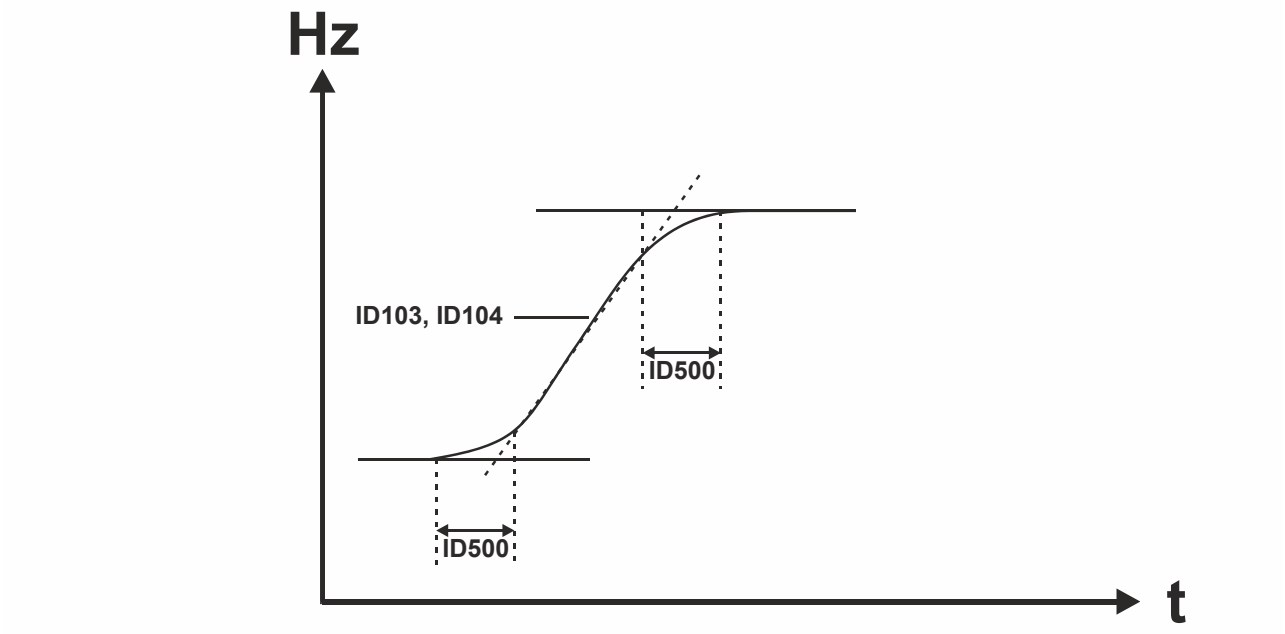


Fig. 20. The acceleration/deceleration curve (S-shaped)

P3.4.6 ACCELERATION TIME 2 (ID 502)

You can use this parameter to set the time that is necessary for the output frequency to increase from zero frequency to maximum frequency.

P3.4.7 DECELERATION TIME 2 (ID 503)

You can use this parameter to set the time that is necessary for the output frequency to decrease from maximum frequency to zero frequency.

P3.4.8 RAMP TIME OPTIMIZER (ID 1808)

You can use this parameter to enable increase of the ramp time if voltage/current limit is reached.

If the ramp time optimizer is enabled, the deceleration time is increased by the percentage defined in parameter P3.4.9 Ramp optimizing percentage every time the overvoltage controller is reached during deceleration. Similarly, the acceleration time is increased when the current limit is reached during acceleration. There is also a parameter for setting a max. limit for the ramp (P3.4.10). The ramp optimizer does not stretch the ramps above this limit.

NOTE: The ramp time optimizer only affects the settings of Ramp 1. Thus, Ramp 2 will not be modified.

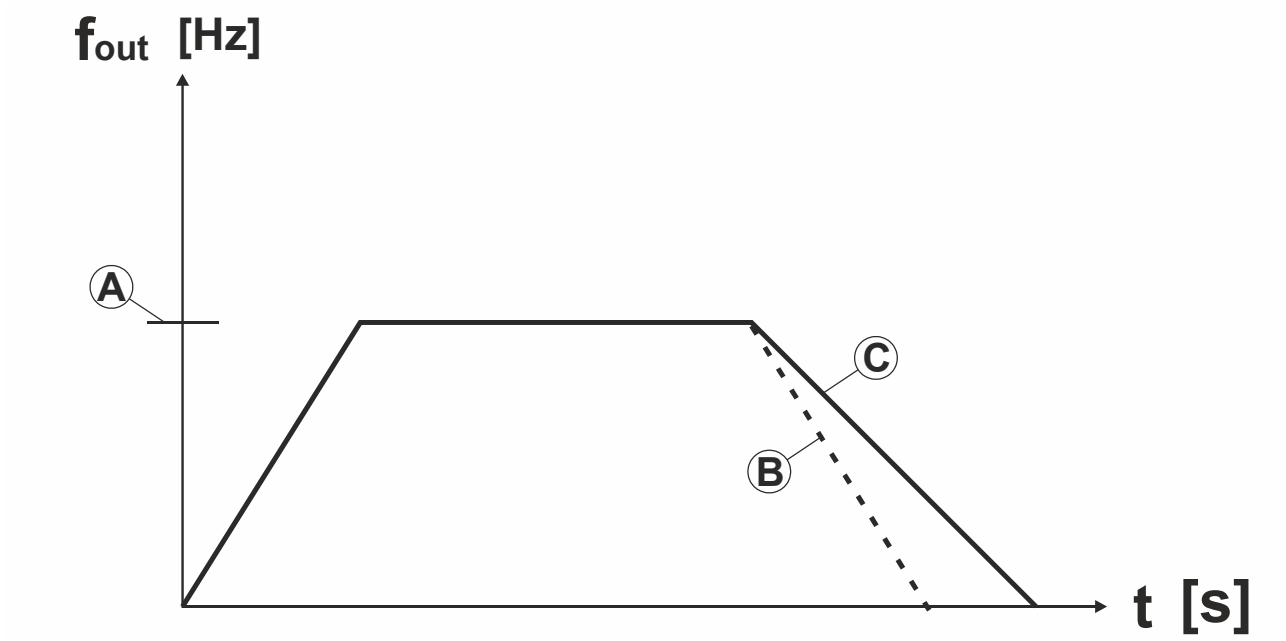


Fig. 21. Ramp Time Optimizer

Legend

A.	Maximum frequency.	**C.**	New deceleration time (Old optimizing percentage).
B.	Old deceleration time.		

P3.4.9 RAMP TIME OPT. %-STEP (ID 1809)

You can use this parameter to set the step range of acceleration/deceleration ramp for ramp time optimizer to increase the ramp when the limit is reached.

10.0% means that when running against the overvoltage controller at ramp down, the deceleration time is increased with 10.0% of the momentary value.

P3.4.10 RAMP OPTIM. MAX TIME (ID 1810)

You can use this parameter to set the maximum time for the ramp optimizer.

P3.4.11 START MAGNETISING TIME (ID 516)

You can use this parameter to set the time during which the DC current is fed to the motor before the acceleration starts.

P3.4.12 START MAGNETISING CURRENT (ID 517)

You can use this parameter to set the DC current that is fed into the motor at the start. If the value of this parameter is set to *0*, the Start Magnetizing function is disabled.

P3.4.13 DC BRAKING TIME AT STOP (ID 508)

You can use this parameter to set the braking is ON or OFF and to give the braking time when the motor stops. If the value of this parameter is set to *0*, the DC Brake function is disabled.

P3.4.14 DC BRAKE CURRENT (ID 507)

You can use this parameter to set the current that is fed into the motor during DC braking. If the value of this parameter is set to *0*, the DC Brake function is disabled.

P3.4.15 FREQUENCY TO START DC BRAKING AT RAMP STOP (ID 515)

You can use this parameter to set the output frequency at which the DC braking starts.

P3.4.16 FLUX BRAKING (ID 520)

You can use this parameter to enable the Flux Braking function.

You can use flux braking as an alternative to DC braking. Flux braking increases the braking capacity in conditions where additional brake resistors are not necessary. When braking is necessary, the system decreases the frequency and increases the flux in the motor. This increases the capacity of the motor to brake. The motor speed is controlled during braking. You can enable and disable Flux Braking.

CAUTION!

Use the braking only intermittently. Flux braking converts energy into heat and can cause damage to the motor.

P3.4.17 FLUX BRAKING CURRENT (ID 519)

You can use this parameter to set the current level for the flux braking.

10.5 I/O Configuration

10.5.1 Programming Digital and Analog Inputs

The programming of inputs of the HVAC drive is flexible. You can freely use the available inputs of the standard and optional I/O for different functions. Use the formats below to give the value for the programmable parameters:

- DigIN SlotA.1 / AnIN SlotA.1.

Programming digital and analog inputs

Selection number	Selection name	Description
Input type	DigIN	= Digital input; AnIN = Analog input.
Slot number	Slot A	Slot identification: A / B = HVAC400 standard embedded boards. C / D / E = optional boards. 0 = Parameter not in use.
Terminal number	1	The number of the terminal on the selected board.

For example, "DigIN SlotA.1" or "dI A.1" shows that the DIN1 on the standard board is connected in the board slot A.

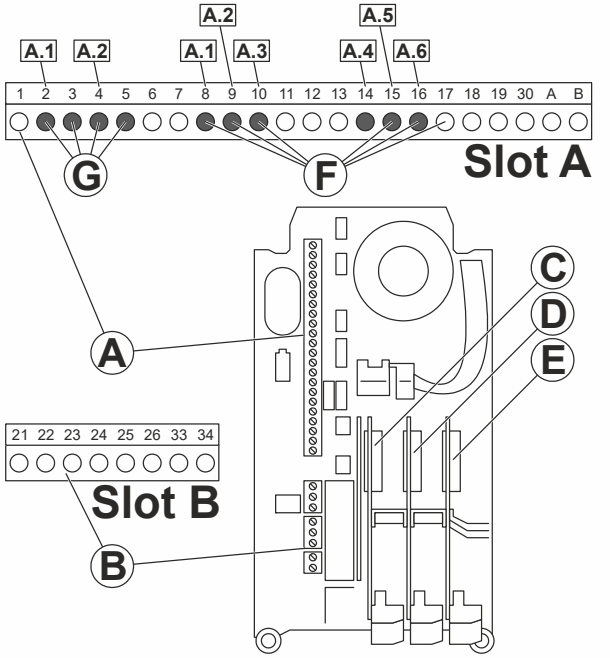


Fig. 22. The option board slots and programmable inputs

Legend

A.	Standard board slot A and its terminals.	**E.**	Option board slot E.
B.	Standard board slot B and its terminals.	**F.**	Programmable digital inputs (DI).
C.	Option board slot C.	**G.**	Programmable analog inputs (AI).
D.	Option board slot D.		

10.5.1.1 Programming Digital Inputs

You can find the applicable functions for digital inputs as parameters in parameter group M3.5.1. To give a digital input to a function, set a value to the correct parameter. For the list of applicable functions, see Table 18. Digital input settings.

Example:

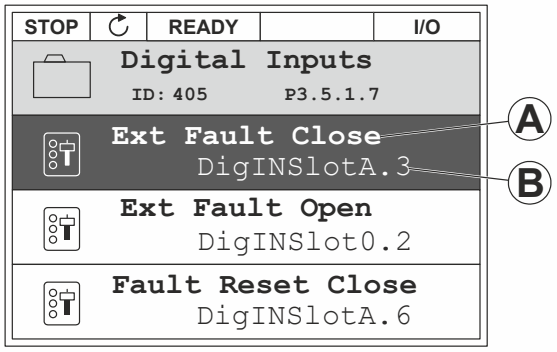


Fig. 23. The digital inputs menu in the graphical display

Legend

A.	Name and function of the parameter.	**B.**	Digital input set for this parameter.

Six digital inputs are available in the standard I/O board compilation: the slot A terminals 8, 9, 10, 14, 15 and 16.

LOCATION OF THE I/O TERMINALS ON THE BOARDS

Input type	Slot	Input #	Explanation
DigIN	A	1	Digital input #1 (terminal 8) embedded in slot A (standard I/O board)
DigIN	A	2	Digital input #2 (terminal 9) embedded in slot A (standard I/O board)
DigIN	A	3	Digital input #3 (terminal 10) embedded in slot A (standard I/O board)
DigIN	A	4	Digital input #4 (terminal 14) embedded in slot A (standard I/O board)
DigIN	A	5	Digital input #5 (terminal 15) embedded in slot A (standard I/O board)
DigIN	A	6	Digital input #6 (terminal 16) embedded in slot A (standard I/O board)

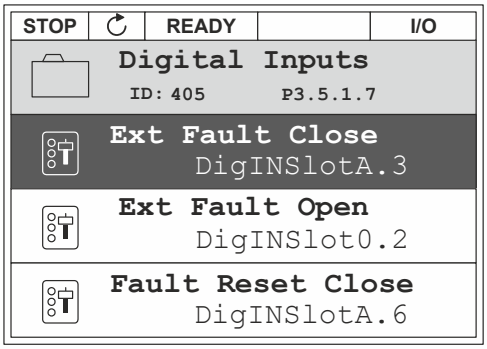
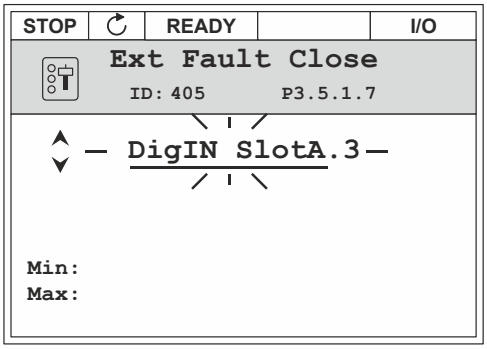
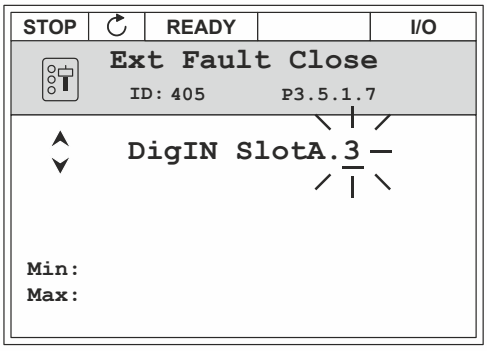
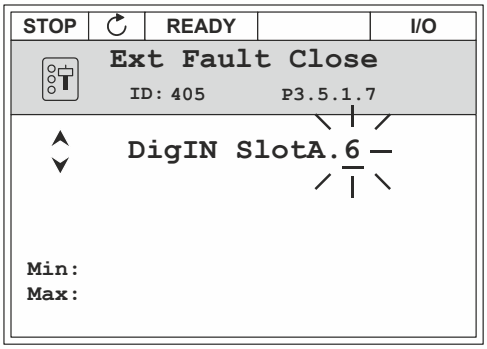
The function External Fault Close, the location of which is the menu M3.5.1, is parameter P3.5.1.7. It gets the default value DigIN SlotA.3 in the graphical display. By default, DI3 is selected and it will trigger a default if the contact on terminal 10 is closed.

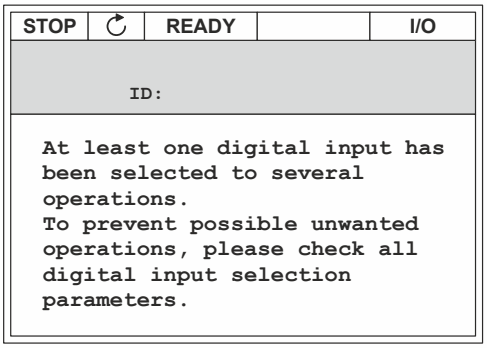
LOCATION OF THE I/O TERMINALS ON THE BOARDS

Parameter	Function	Default	ID	Description
P3.5.1.7	External Fault Close	DigINSlot.3	405	OPEN = OK CLOSED = External fault

To change the input from DI3 to, e.g., DI6 (terminal 16) on the standard I/O, proceed according to the following instructions.

PROGRAMMING IN THE GRAPHICAL DISPLAY

1. Select a parameter. To go into the Edit mode, push the RIGHT arrow button.	
2. In the Edit mode, the slot value *DigIN SlotA* is underlined and blinks. If you have more digital inputs available in your I/O, e.g., because of option boards in slots C, D or E, make a selection of them.	
3. To enter into the parameter, press the OK button, which will then start to blink.	
4. To change the terminal to 6, push the UP arrow button three times. Accept the change using the OK button.	

5. If the digital input DI6 is already in use for some other function, a message will appear in the display.	

After the steps, a digital signal to the digital input DI6 controls the function External Fault Close.

The value of a function can be *DigIN Slot0.1*. In these conditions, you did not give a terminal to the function, or the the input was set to be always OPEN. This is the default value of most of parameters in the group M3.5.1.

On the other hand, some inputs have the default value always CLOSED. Their value shows DigIN Slot0.2 in the graphical display and dI 0.2 in the text display.

NOTE: You can also give time channels to digital inputs. See also Table 18. Digital input settings.

Table 67. Description signal sources

Source	Function
AnINSlot0 (not in use)	1 = Always OPEN. 2-9 = Always CLOSED.
SlotA	Number agrees with a digital input in slot A.
SlotB	Number agrees with a digital input in slot B.
SlotC	Number agrees with a digital input in slot C.
SlotD	Number agrees with a digital input in slot D.
SlotE	Number agrees with a digital input in slot E.
TimeChannel (tCh)	1= TimeChannel1, 2= TimeChannel2, 3= TimeChannel3.

10.5.2 Digital Inputs

The parameters are functions that you can connect to a digital input terminal. The text *DigIn Slot A.2* means the second input on the slot A. It is also possible to connect the functions to time channels. The time channels work as terminals.

You can monitor the statuses of the digital inputs and the digital outputs in the Multimonitoring view.

P3.5.1.1 CONTROL SIGNAL 1 A (ID 403)

You can use this parameter to select the digital input signal (Control Signal 1) that starts and stops the drive when the control place is I/O A (FWD).

P3.5.1.2 CONTROL SIGNAL 2 A (ID 404)

You can use this parameter to select the digital input signal (Control Signal 2) that starts and stops the drive when the control place is I/O A (REV).

P3.5.1.3 CONTROL SIGNAL 1 B (ID 423)

You can use this parameter to select the digital input signal (Control Signal 1) that starts and stops the drive when the control place is I/O B.

P3.5.1.4 CONTROL SIGNAL 2 B (ID 424)

You can use this parameter to select the digital input signal (Control Signal 2) that starts and stops the drive when the control place is I/O B.

P3.5.1.5 I/O B CONTROL FORCE (ID 425)

You can use this parameter to select the digital input signal that switches the control place from I/O A to I/O B.

P3.5.1.6 I/O B REFERENCE FORCE (ID 343)

You can use this parameter to select the digital input signal that switches the frequency reference source from I/O A to I/O B.

P3.5.1.7 EXTERNAL FAULT CLOSE (ID 405)

You can use this parameter to select the digital input signal that activates an external fault.

P3.5.1.8 EXTERNAL FAULT OPEN (ID 406)

You can use this parameter to select the digital input signal that activates an external fault.

P3.5.1.9 FAULT RESET CLOSE (ID 414)

You can use this parameter to select the digital input signal that resets all active faults.

Active faults are reset when the state of the digital input changes from open to closed (rising edge).

P3.5.1.10 RUN ENABLE (ID 407)

You can use this parameter to select the digital input signal that sets the drive to Ready state.

When the contact is OPEN, the start of the motor is disabled.

When the contact is CLOSED, the start of the motor is enabled.

To stop, the drive obeys the value of P3.2.5 Stop Function.

If you open Run Enable during the operation of the drive, the drive stops.

NOTE: The state of the drive remains in 'Not Ready' if the state of this signal is 'opened'.

P3.5.1.11 RUN INTERLOCK 1 (ID 1041)

You can use this parameter to select the digital input signal that prevents to start the drive.

The drive can be ready but start is not possible when the state of the interlock signal is 'open' (damper interlock).

If an interlock is active, the drive cannot start.

You can use this function to prevent the start of the drive when the damper is closed. If you activate an interlock during the operation of the drive, the drive stops.

P3.5.1.12 RUN INTERLOCK 2 (ID 1042)

You can use this parameter to select the digital input signal that prevents to start the drive.

The drive can be ready but start is not possible when the state of the interlock signal is 'open' (damper interlock).

If an interlock is active, the drive cannot start.

You can use this function to prevent the start of the drive when the damper is closed. If you activate an interlock during the operation of the drive, the drive stops.

P3.5.1.13 ACC/DEC TIME SELECTION (ID 408)

You can use this parameter to select the digital input signal that switches to the ramp 2 instead of the standard ramp 1.

P3.5.1.14 MOTOR PREHEAT ON (ID 1044)

You can use this parameter to select the digital input signal that activates Motor Preheat function. The Motor Preheat function feeds DC-current to the motor when the drive is in the stop state.

P3.5.1.15 FIRE MODE ACTIVATION OPEN (ID 1596)

You can use this parameter to select the digital input signal that activates the Fire Mode function.

P3.5.1.16 PRESET FREQUENCY SELECTION 0 (ID 419)

You can use this parameter to set the digital input signal that selects the preset frequencies.

P3.5.1.17 PRESET FREQUENCY SELECTION 1 (ID 420)

You can use this parameter to select the digital input signal that is used as a selector for the preset frequencies.

P3.5.1.18 PRESET FREQUENCY SELECTION 2 (ID 421)

You can use this parameter to select the digital input signal that is used as a selector for the preset frequencies.

To apply Preset frequencies 1 to 7, connect a digital input to these functions according to the instructions in Chapter 10.5.1 Programming of digital and analog inputs. See more data in Table 66. SELECTING PRESET FREQUENCIES WHEN P3.3.10 = Binary coded, Table 16. Control reference settings, and Table 18. Digital input settings.

P3.5.1.19 TIMER 1 (ID 447)

You can use this parameter to select the digital input signal that starts the timer. The timer starts when this signal is deactivated (falling edge). The output is deactivated when the time defined in the duration parameter has elapsed.

P3.5.1.20 TIMER 2 (ID 448)

You can use this parameter to select the digital input signal that starts the timer. The timer starts when this signal is deactivated (falling edge). The output is deactivated when the time defined in the duration parameter has elapsed.

P3.5.1.21 TIMER 3 (ID 449)

You can use this parameter to select the digital input signal that starts the timer. The timer starts when this signal is deactivated (falling edge). The output is deactivated when the time defined in the duration parameter has elapsed.

P3.5.1.22 PID1 SETPOINT BOOST (ID 1046)

You can use this parameter to set the digital input signal that selects the PID setpoint value to be used.

P3.5.1.23 PID1 SETPOINT SELECTION (ID 1047)

You can use this parameter to set the digital input signal that selects the PID setpoint value to be used.

P3.5.1.24 PID2 START SIGNAL (ID 1049)

You can use this parameter to select the digital input signal that starts and stops the external PID controller.

P3.5.1.25 PID2 SETPOINT SELECTION (ID 1048)

You can use this parameter to set the digital input signal that selects the PID setpoint value to be used.

P3.5.1.26 MOTOR 1 INTERLOCK (ID 426)

You can use this parameter to select the digital input signal that is used as interlock signal for the Pump and Fan Cascade system.

P3.5.1.27 MOTOR 2 INTERLOCK (ID 427)

You can use this parameter to select the digital input signal that is used as interlock signal for the Pump and Fan Cascade system.

P3.5.1.28 MOTOR 3 INTERLOCK (ID 428)

You can use this parameter to select the digital input signal that is used as interlock signal for the Pump and Fan Cascade system.

P3.5.1.29 MOTOR 4 INTERLOCK (ID 429)

You can use this parameter to select the digital input signal that is used as interlock signal for the Pump and Fan Cascade system.

P3.5.1.30 MOTOR 5 INTERLOCK (ID 430)

You can use this parameter to select the digital input signal that is used as interlock signal for the Pump and Fan Cascade system.

P3.5.1.31 MAINTCOUNTER 1 RESET (ID 490)

You can use this parameter to select the digital input that resets the value of Maintenance counter 1.

P3.5.1.32 MAIN COUNTER 2 RESET (ID 491)

You can use this parameter to select the digital input that resets the value of Maintenance counter 2.

P3.5.1.33 MAIN COUNTER 3 RESET 2 (ID 492)

You can use this parameter to select the digital input that resets the value of Maintenance counter 3.

P3.5.1.36 MOTOR POTENTIOMETER UP (ID 418)

You can use this parameter to increase the output frequency with a digital input signal. The motor potentiometer reference INCREASES until the contact is open.

P3.5.1.37 MOTOR POTENTIOMETER DOWN (ID 417)

You can use this parameter to decrease the output frequency with a digital input signal. The motor potentiometer reference DECREASES until the contact is open.

P3.5.1.38 FIRE MODE PRESET FREQUENCY SELECTION 0 (ID 15531)

You can use this parameter to select the digital input signal that is used as a selector for fire mode preset frequencies.

P3.5.1.39 FIRE MODE PRESET FREQUENCY SELECTION 1 (ID 15532)

You can use this parameter to select the digital input signal that is used as a selector for fire mode preset frequencies.

P3.5.1.40 FIRE MODE ACTIVATION CLOSE (ID 1619)

You can use this parameter to select the digital input signal that activates the Fire Mode function.

P3.5.1.41 FIRE MODE REVERSE (ID 1618)

You can use this parameter to select the digital input signal that gives a command for reverse rotation direction during the Fire Mode. This function has no effect in normal operation.

P3.5.1.42 FIELDBUS CONTROL (ID 411)

You can use this parameter to select the digital input signal that switches the control place and the frequency reference source to Fieldbus (from I/O A, I/O B, or Local control).

P3.5.1.43 KEYPAD CONTROL (ID 410)

You can use this parameter to select the digital input signal that switches the control place and the frequency reference source to Keypad (from any control place).

P3.5.1.44 RESET KWH TRIP COUNTER (ID 1053)

You can use this parameter to select the digital input signal that resets the kWh Trip Counter.

P3.5.1.45 PARAMETER SET 1/2 SELECTION (ID 496)

You can use this parameter to set the digital input that selects the parameter set to be used.

The parameter gives the digital input which is used to select Parameter Set 1 or Set 2. The function is enabled if other slots than DigIN Slot0 are selected to this parameter. The selection of the parameter set can be made and the set changes only when the drive is stopped.

- Contact Open = Parameter Set 1 is set as the active set
- Contact Closed = Parameter Set 2 is set as the active set

NOTE: Parameter values are stored to Set 1 and Set 2 with parameters B6.5.6 Save to Set 1.

P3.5.1.46 FAULT RESET OPEN (ID 213)

You can use this parameter to select the digital input signal that resets all active faults. Active faults are reset when the state of the digital input changes from closed to open (falling edge).

P3.5.1.47 DISABLE TIMER FUNCTION (ID 1499)

You can use this parameter to select the digital input signal that enables/disables all timer functions.

10.5.3 Analog Inputs

P3.5.2.1 AI1 SIGNAL SELECTION (ID 377)

You can use this parameter to connect the AI signal to the analog input of your choice. Connect the AI signal to the analog input of your choice with this parameter.

P3.5.2.2 AI1 FILTER TIME (ID 378)

You can use this parameter to filter out disturbances in the analog input signal. This parameter gives the filtering time for the analog signal. The filtering function is disabled when the filtering time is *0*.

P3.5.2.3 AI1 SIGNAL RANGE (ID 379)

You can use this parameter to change the range of the analog signal. The value of this parameter is bypassed if the custom scaling parameters are used in P3.5.2.4 and P3.5.2.5.

P3.5.2.4 AI1 CUSTOM MIN (ID 380)

You can use this parameter to adjust the range of the analog input signal between -160% and 160%.

P3.5.2.5 AI1 CUSTOM MAX (ID 381)

You can use this parameter to adjust the range of the analog input signal between -160% and 160%.

P3.5.2.6 AI1 SIGNAL INVERSION (ID 387)

You can use this parameter to invert the analog input signal.

10.5.4 Digital Outputs

P3.5.3.2.1 BASIC RO1 FUNCTION (ID 11001)

You can use this parameter to select a function or a signal that is connected to the relay output.

Table 68. The output signals through RO1

Selection number	Selection name	Description
0	Not used	The output is not used.
1	Ready	The HVAC drive is ready to operate.
2	Run	The HVAC drive operates (the motor runs).
3	General fault	A fault trip occurred.
4	General fault inverted	A fault trip did not occur.
5	General alarm	
6	Reversed	The *Reverse* command is given.
7	At speed	The output frequency has become the same as the set frequency reference.
8	Motor regulator activated	One of the limit regulators (for example current limit or torque limit) is activated.
9	Preset Frequency active	The selection of preset frequency was made with digital input signals.
10	Keypad control active	The selection is keypad control (the active control place is keypad).
11	/O control B active	The selection is I/O control place B (the active control place is I/O B).
12	Limit supervision 1	The limit supervision activates if the signal value goes below or above the set supervision limit (P3.8.3 or P3.8.7).
13	Limit supervision 2	
14	Start command active	*Start* command is active.
15	Reserved	
16	Fire mode ON	
17	RTC timer 1	Time channel 1 is in use.
18	RTC timer 2	Time channel 2 is in use.
19	RTC timer 3	Time channel 3 is in use.
20	FB Control WordB 13	
21	FB Control WordB 14	
22	FB Control WordB 15	
23	PID in Sleep mode	The drive is in the sleep mode.

continued: The output signals through RO1

Selection number	Selection name	Description
24	Reserved	
25	PID1 supervision limits	The feedback value of PID1 controller is not in the supervision limits.
26	PID2 supervision limits	The feedback value of PID2 controller is not in the supervision limits.
27	Motor 1 control	The contactor control for the Multi-pump function.
28	Motor 2 control	The contactor control for the Multi-pump function.
29	Motor 3 control	The contactor control for the Multi-pump function.
30	Motor 4 control	The contactor control for the Multi-pump function.
31	Motor 5 control	The contactor control for the Multi-pump function.
32	Reserved	(Always OPEN.)
33	Reserved	(Always OPEN.)
34	Maintenance warning	WARNING: Time elapsed maintenance must be scheduled.
35	Maintenance fault	Alarm: Time elapsed maintenance must be performed.
36	Thermistor Fault	A thermistor fault occurred.
37	Motor switch	The Motor Switch function has detected that the switch between the drive and the motor is open.
38	PreHeat	
39	kWh Pulse Output	
40	Run Indication	
41	Selected Param.Set	The selected active parameter will trigger the relay.

P3.5.3.2.2 RO1 ON DELAY (ID 11002)

You can use this parameter to set the ON delay for the relay output.

P3.5.3.2.3 RO1 OFF DELAY (ID 11003)

You can use this parameter to set the OFF delay for the relay output.

10.5.5 Analog Outputs

P3.5.4.1.1 AO1 FUNCTION (ID 10050)

You can use this parameter to select a function or a signal that is connected to the analog output.

Table 69. P3.5.4.1.1 AO1 FUNCTION (ID 10050)

Selection number	Selection name	Description
0	Test 0% (not used)	The analog output is set to 0% or 20% so that it agrees with parameter P3.5.4.1.3.
1	TEST 100%	The analog output is set to 100% of the signal (10V / 20mA).
2	Output frequency	The actual output frequency from 0 to Maximum frequency reference.
3	Frequency reference	The actual frequency reference from 0 to Maximum frequency reference.
4	Motor speed	The actual motor speed from 0 to Motor nominal speed.
5	Motor current	The output current of the drive from 0 to Motor nominal current.
6	Motor torque	The actual motor torque from 0 to motor nominal torque (100%).
7	Motor power	The actual motor power from 0 to Motor nominal power (100%).
8	Motor voltage	The actual motor voltage from 0 to Motor nominal voltage.
9	-link voltage	The actual DC-link voltage 0…1000V.
10	PID1 output	The output of the PID controller 1 (0…100%).
11	PID2 output	The output of the PID controller 2 (0…100%).
12	Process Data In 1	Process Data In 1: 0…10000 (this agrees with 0…100.00%).
13	Process Data In 2	Process Data In 2: 0…10000 (this agrees with 0…100.00%).
14	Process Data In 3	Process Data In 3: 0…10000 (this agrees with 0…100.00%).
15	Process Data In 4	Process Data In 4: 0…10000 (this agrees with 0…100.00%).
16	Process Data In 5	Process Data In 5: 0…10000 (this agrees with 0…100.00%).
17	Process Data In 6	Process Data In 6: 0…10000 (this agrees with 0…100.00%).
18	Process Data In 7	Process Data In 7: 0…10000 (this agrees with 0…100.00%).
19	Process Data In 8	Process Data In 8: 0…10000 (this agrees with 0…100.00%).

NOTE: For ProcessDataIn, use a value without a decimal separator, e.g., 5000 =50.00%.

P3.5.4.1.2 AO1 FILTER TIME (ID 10051)

You can use this parameter to set the filtering time for the analog signal.

The filtering function is disabled when the filtering time is 0.

P3.5.4.1.3 AO1 MINIMUM (ID 10052)

You can use this parameter to change the range of the analog output signal.

For example, if '4mA' is selected, the range of analog output signal is 4…20mA.

Select the signal type (current/voltage) using the dip switches.

P3.5.4.1.4 AO1 MINIMUM SCALE (ID 10053)

You can use this parameter to scale the analog output signal.

The scaling values (min and max) are given in the process unit that is specified by the selection of the AO function.

P3.5.4.1.5 AO1 MAXIMUM SCALE (ID 10054)

You can use this parameter to scale the analog output signal.

The scaling values (min and max) are given in the process unit that is specified by the selection of the AO function.

For example, you can make a selection of the output frequency of the drive for the contents of the analog output signal, and set parameters P3.5.4.1.4 and P3.5.4.1.5 between 10 and 40 Hz. Then the output frequency of the drive changes between 10 and 40 Hz, and the analog output signal changes between 0 and 20 mA.

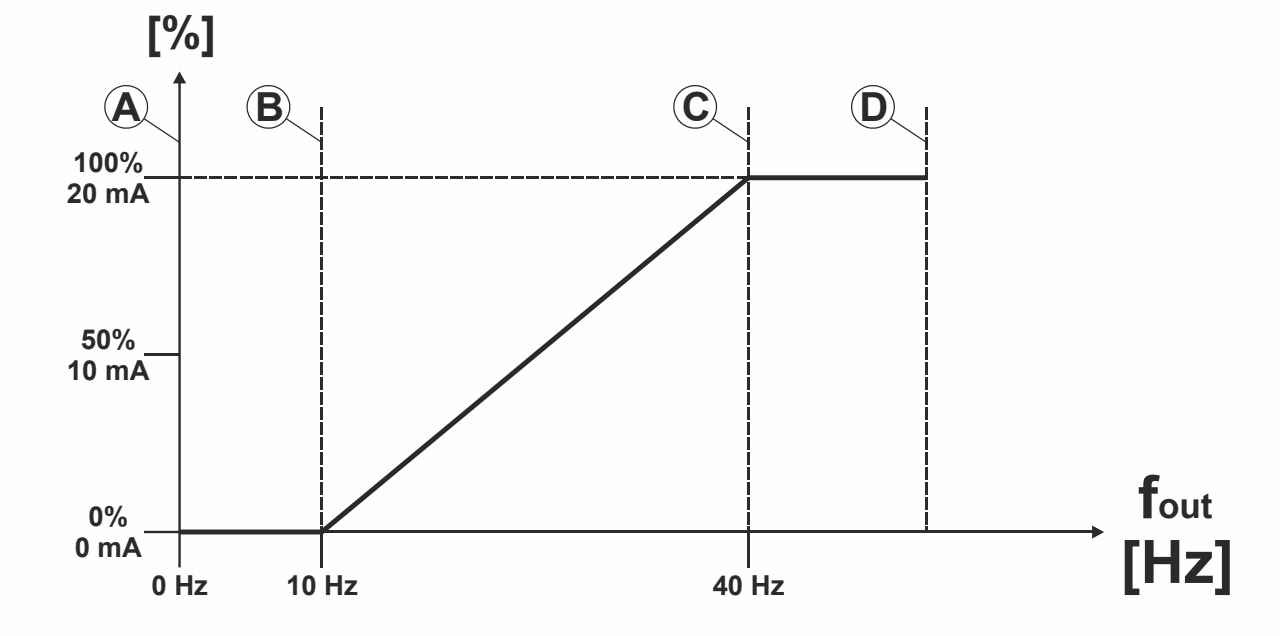


Fig. 24. The scaling of the AO1 signal

Legend

A.	Analog output signal.	**C.**	AO max scale.
B.	AO min scale.	**D.**	Max freq reference.

10.6 Fieldbus Data

P3.6.1 FB DATAOUT 1 SELECTION (ID 852)

You can use this parameter to select the data that is sent to the fieldbus with the ID number of the parameter or monitor value.

The data is scaled to an unsigned 16-bit format according to the format on the control panel.

For example, value 25.5 on the display equals 255.

P3.6.2 FB DATAOUT 2 SELECTION (ID 853)

You can use this parameter to select the data that is sent to the fieldbus with the ID number of the parameter or monitor value.

The data is scaled to an unsigned 16-bit format according to the format on the control panel.

For example, value 25.5 on the display equals 255.

P3.6.3 FB DATAOUT 3 SELECTION (ID 854)

You can use this parameter to select the data that is sent to the fieldbus with the ID number of the parameter or monitor value.

The data is scaled to an unsigned 16-bit format according to the format on the control panel.

For example, value 25.5 on the display equals 255.

P3.6.4 FB DATAOUT 4 SELECTION (ID 855)

You can use this parameter to select the data that is sent to the fieldbus with the ID number of the parameter or monitor value.

The data is scaled to an unsigned 16-bit format according to the format on the control panel.

For example, value 25.5 on the display equals 255.

P3.6.5 FB DATAOUT 5 SELECTION (ID 856)

You can use this parameter to select the data that is sent to the fieldbus with the ID number of the parameter or monitor value.

The data is scaled to an unsigned 16-bit format according to the format on the control panel.

For example, value 25.5 on the display equals 255.

P3.6.6 FB DATAOUT 6 SELECTION (ID 857)

You can use this parameter to select the data that is sent to the fieldbus with the ID number of the parameter or monitor value.

The data is scaled to an unsigned 16-bit format according to the format on the control panel.

For example, value 25.5 on the display equals 255.

P3.6.7 FB DATAOUT 7 SELECTION (ID 858)

You can use this parameter to select the data that is sent to the fieldbus with the ID number of the parameter or monitor value.

The data is scaled to an unsigned 16-bit format according to the format on the control panel.

For example, value 25.5 on the display equals 255.

P3.6.8 FB DATAOUT 8 SELECTION (ID 859)

You can use this parameter to select the data that is sent to the fieldbus with the ID number of the parameter or monitor value.

The data is scaled to an unsigned 16-bit format according to the format on the control panel.

For example, value 25.5 on the display equals 255.

10.7 Prohibit Frequencies

In some processes, it may be necessary to avoid some frequencies because they make problems of mechanical resonance. Using the Prohibit frequencies function, it is possible to prevent the usage of these frequencies. When the input frequency reference increases, the internal frequency reference stays at the low limit, until the input frequency reference is above the high limit.

P3.7.1 PROHIBIT FREQUENCY RANGE 1 LOW LIMIT (ID 509)

You can use this parameter to prevent the drive operating on the prohibited frequencies.

In some processes, it may be necessary to avoid some frequencies because they cause mechanical resonance.

P3.7.2 PROHIBIT FREQUENCY RANGE 1 HIGH LIMIT (ID 510)

You can use this parameter to prevent the drive operating on the prohibited frequencies.

In some processes, it may be necessary to avoid some frequencies because they cause mechanical resonance.

P3.7.3 PROHIBIT FREQUENCY RANGE 2 LOW LIMIT (ID 511)

You can use this parameter to prevent the drive operating on the prohibited frequencies.

In some processes, it may be necessary to avoid some frequencies because they cause mechanical resonance.

P3.7.4 PROHIBIT FREQUENCY RANGE 2 HIGH LIMIT (ID 512)

You can use this parameter to prevent the drive operating on the prohibited frequencies.

In some processes, it may be necessary to avoid some frequencies because they cause mechanical resonance.

P3.7.5 PROHIBIT FREQUENCY RANGE 3 LOW LIMIT (ID 513)

You can use this parameter to prevent the drive operating on the prohibited frequencies.

In some processes, it may be necessary to avoid some frequencies because they cause mechanical resonance.

P3.7.6 PROHIBIT FREQUENCY RANGE 3 HIGH LIMIT (ID 514)

You can use this parameter to prevent the drive operating on the prohibited frequencies.

In some processes, it may be necessary to avoid some frequencies because they cause mechanical resonance.

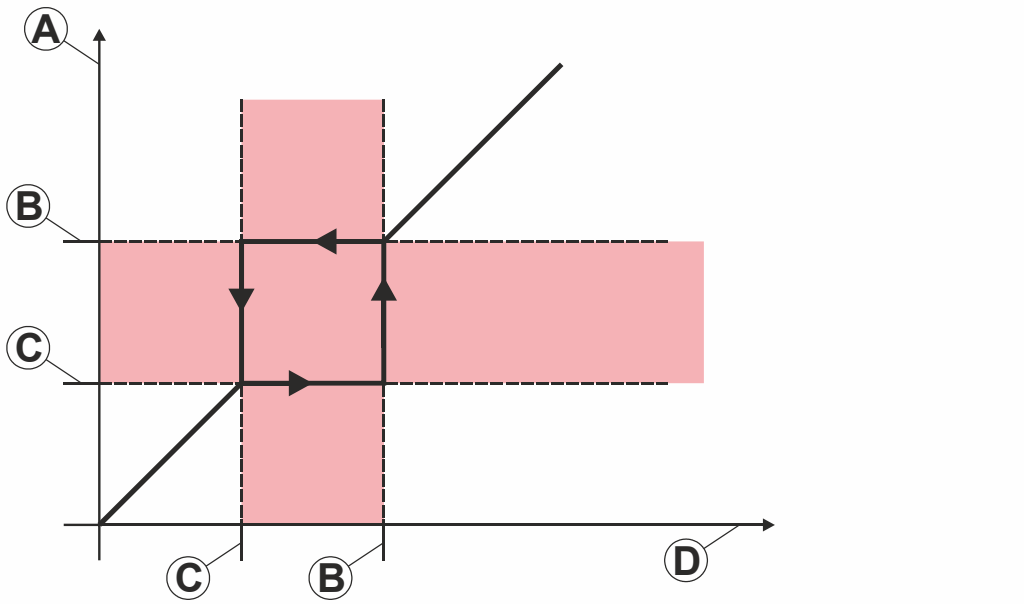


Fig. 25. The prohibited frequencies

Legend

A.	Actual Reference.	**C.**	Low lim.
B.	High Lim.	**D.**	Requested Reference.

P3.7.7 RAMP TIME FACTOR (ID 518)

You can use this parameter to set the multiplier of the selected ramp times when the output frequency of the drive is between the prohibited frequency limits.

The Ramp Time Factor sets the acceleration and the deceleration time when the output frequency is in a prohibited frequency range. The value of the Ramp Time Factor is multiplied with the value of P3.4.2 (Acceleration Time 1) or P3.4.3 (Deceleration Time 1). For example, the value 0.1 makes the acceleration/deceleration time ten times shorter.

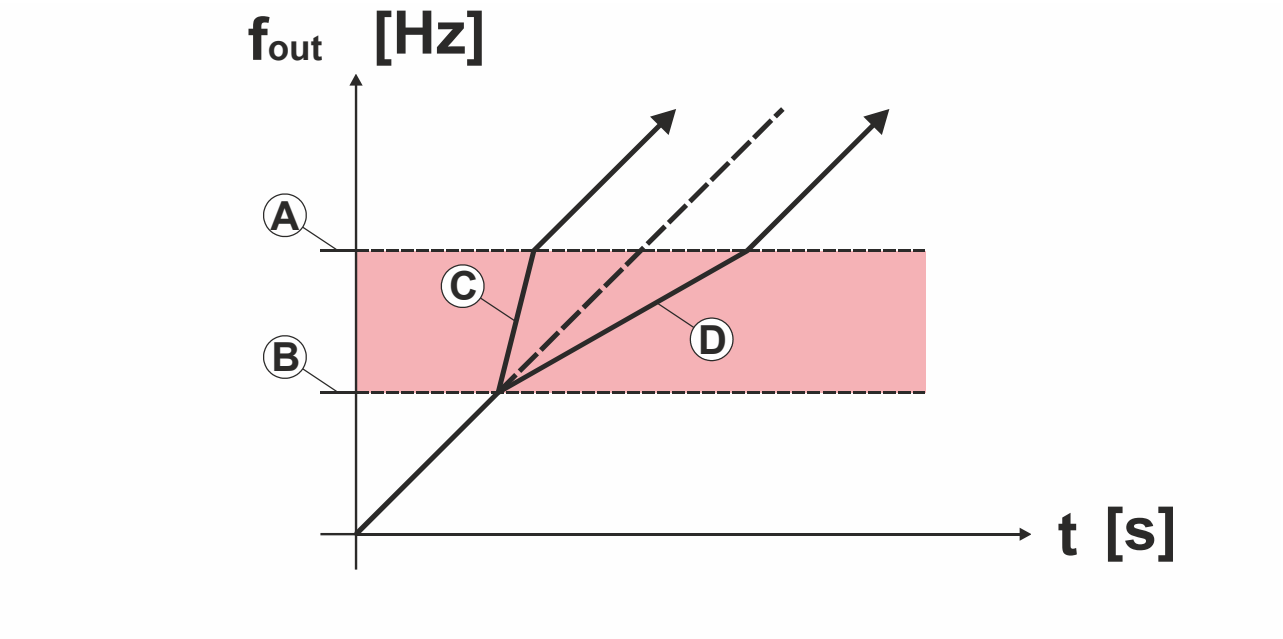


Fig. 26. The parameter Ramp Time Factor

Legend

A.	High Lim.	**C.**	Ramp Time Factor = 0.3.
B.	Low Lim.	**D.**	Ramp Time Factor = 2.5.

P3.7.8 RESOSWEEP RAMP (ID 1812)

You can use this parameter to set how fast the resonance sweep sweeps through the frequency range.

P3.7.9 RESONANCE SWEEP (ID 1811)

You can use this parameter to activate the Resonance Sweep function.

The anti-resonance function slowly sweeps through frequencies from MinFreq to MaxFreq and back to MinFreq with the ramp times set with this parameter. During this sweep, press the OK-button every time passing a resonance range in order to tag where the range starts and ends.

If everything is fine the Prohibit frequency range parameters (in Prohibited Frequencies menu) are provided with right information. If there is a different amount of tags during ramp-up compared to ramp-down, only an info message is shown. The same will happen if the bands are not reasonable.

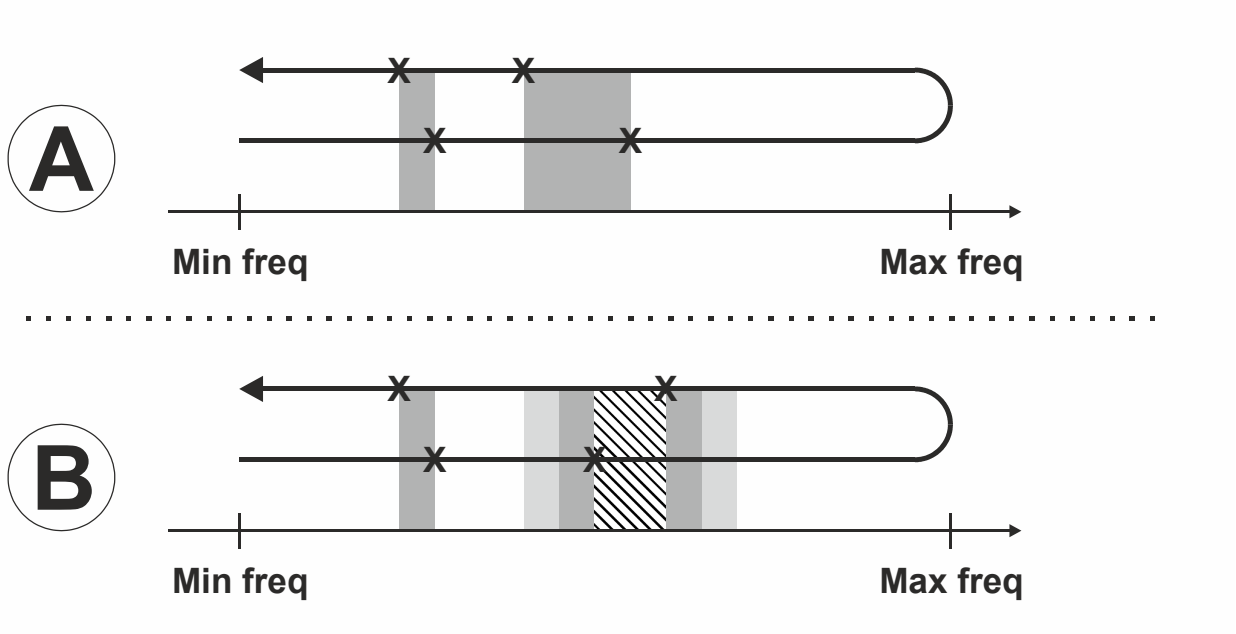


Fig. 27. Resonance Sweep

Legend

A.	Successful!	**X.**	Tagged using OK button.
B.	FAILED!		

10.8 Limit Supervisions

P3.8.1 SUPERVISION #1 ITEM SELECTION (ID 1431)

You can use this parameter to select the supervision value.

P3.8.2 SUPERVISION #1 MODE (ID 1432)

You can use this parameter to set the supervision mode.

When the 'Low limit' mode is selected, the output of the supervision function is active when the signal is below the supervision limit.

When the 'High limit' mode is selected, the output of the supervision function is active when the signal is above the supervision limit.

P3.8.3 SUPERVISION #1 LIMIT (ID 1433)

You can use this parameter to set the supervision limit for the selected item.

The unit shows automatically.

P3.8.4 SUPERVISION #1 LIMIT HYSTERESIS (ID 1434)

You can use this parameter to set the supervision limit hysteresis for the selected item.

The unit shows automatically.

P3.8.5 SUPERVISION #2 ITEM SELECTION (ID 1435)

You can use this parameter to select the supervision item.

The output of the supervision function can be selected to the relay output.

P3.8.6 SUPERVISION #2 MODE (ID 1436)

You can use this parameter to set the supervision mode.

When the 'Low limit' mode is selected, the output of the supervision function is active when the signal is below the supervision limit.

When the 'High limit' mode is selected, the output of the supervision function is active when the signal is above the supervision limit.

P3.8.7 SUPERVISION #2 LIMIT (ID 1437)

You can use this parameter to set the supervision limit for the selected item.

The unit shows automatically.

P3.8.8 SUPERVISION #2 LIMIT HYSTERESIS (ID 1438)

You can use this parameter to set the supervision limit hysteresis for the selected item.

The unit shows automatically.

10.9 Protections

P3.9.1 RESPONSE TO Analog INPUT LOW FAULT (ID 700)

You can use this parameter to select the response of the drive to an 'AI Low' fault.

If the analog input signal becomes less than 50% of the minimum signal for 500ms, an AI Low fault occurs.

P3.9.2 RESPONSE (IF AN ACTION IS SELECTED IN P3.9.1) TO EXTERNAL FAULT (ID 701)

You can use this parameter to select the response of the drive to an 'External fault'.

If a fault occurs, the drive can show a notification of it on the display of the drive. An external fault is activated with a digital input signal. The default digital input is DI3. You can also program the response data into a relay output.

P3.9.3 INPUT PHASE FAULT (ID 730)

You can use this parameter to select the supply phase configuration of the drive.

NOTE: If you use the 1-phase supply, the value of this parameter must be set to *1-phase support*.

P3.9.4 UNDERVOLTAGE FAULT (ID 727)

You can use this parameter to select if undervoltage faults are saved to the fault history or not.

P3.9.5 RESPONSE TO OUTPUT PHASE FAULT (ID 702)

You can use this parameter to select the response of the drive to an *Output Phase* fault.

If the measurement of the motor current detects that there is no current in 1 motor phase, an output phase fault occurs.

See P3.9.2 for more information.

10.9.1 Motor Thermal Protections

The motor thermal protection prevents the motor from becoming too hot.

The HVAC drive can supply a current that is higher than the nominal current. However, the high current can be required by the application, in which case it must be used. Under these conditions, there is a risk of a thermal overload. Low frequencies have a higher risk. At low frequencies, the cooling effect and the capacity of the motor decrease. If the motor has an external fan, the load reduction at low frequencies is small.

The motor thermal protection is based on calculations. The protection function uses the output current of the drive to know what the load on the motor is. If the control board is not energized, the calculations are reset.

To adjust the thermal protection of the motor, use the parameters from P3.9.6 to P3.9.10.

The thermal current IT tells the load current above which the motor is overloaded. This current limit is a function of the output frequency.

NOTE: If you use long motor cables (max. 100 m) with small drives (≤ 1.5 kW (≤ 2.0 hp)), the motor current that the drive measures can be much higher than the actual motor current. This is because there are capacitive currents in the motor cable.

CAUTION!

Make sure that the airflow to the motor is not blocked. If the airflow is blocked, the function does not protect the motor, and the motor can become too hot. This can cause damage to the motor.

P3.9.6 MOTOR THERMAL PROTECTION (ID 704)

You can use this parameter to select the response of the drive to a 'Motor Overtemperature' fault.

If the motor thermal protection function detects that the temperature of the motor is too high, a motor overtemperature fault occurs.

P3.9.7 MOTOR AMBIENT TEMPERATURE FACTOR (ID 705)

You can use this parameter to set the ambient temperature where the motor is installed.

The temperature value is given in degrees Celsius or Fahrenheit.

P3.9.8 MOTOR THERMAL ZERO SPEED COOLING (ID 706)

You can use this parameter to set the cooling factor at 0 speed in relation to the point where the motor operates at nominal speed without external cooling.

When the speed is 0, this function calculates the cooling factor in relation to the point where the motor operates at a nominal speed without external cooling.

The default value is set for conditions where there is no external fan. If you use an external fan, you can set the value higher than without the fan, for example at 90%.

If you change parameter P3.1.1.4 (Motor Nominal Current), parameter P3.9.8 is automatically set to its default value.

Although you change this parameter, it does not have an effect on the maximum output current of the drive. Only parameter P3.1.1.7 Motor Current Limit can change the maximum output current.

The corner frequency for the thermal protection is 70% of the value of the parameter P3.1.1.2.

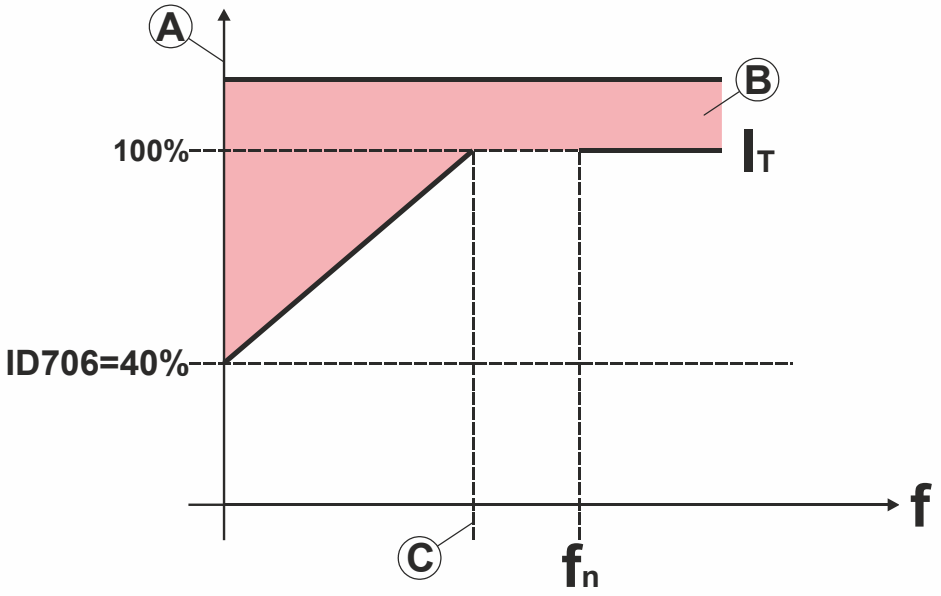


Fig. 28. The motor thermal current I_T curve

Legend

A.	$P_{cooling}$.	**C.**	Corner frequency.
B.	Overload area.		

P3.9.9 MOTOR THERMAL TIME CONSTANT (ID 707)

You can use this parameter to set the motor thermal time constant.

The time constant is the time during which the calculated warming curve becomes 63% of its target value. The length of the time constant is in relation with the dimension of the motor.

The bigger the motor, the longer the time constant.

In different motors, the motor thermal time constant is different. It also changes between different motor manufacturers. The default value of the parameter changes from dimension to dimension.

The t6-time is the time in seconds that the motor can safely operate at six times the rated current. It is possible that the motor manufacturer gives the data with the motor. If you know the t6 of the motor, you can set the time constant parameter with its help. Usually, the motor thermal time constant in minutes is 2*t6. When the drive is in the STOP state, the time constant is internally increased to three times the set parameter value because the cooling operates based on convection. See Fig. 29. Calculation of the motor temperature.

P3.9.10 MOTOR THERMAL LOADABILITY (ID 708)

You can use this parameter to set the thermal loadability of the motor.

For example, if you set the value to 130%, the motor goes to the nominal temperature with 130% of the motor nominal current.

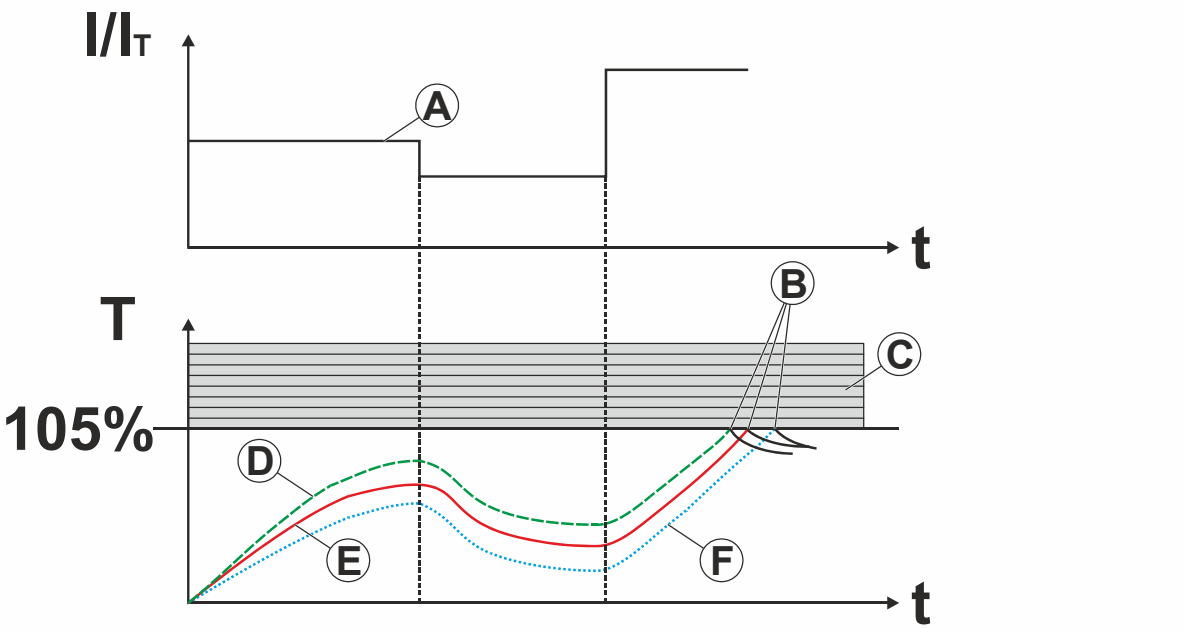


Fig. 29. Calculation of the motor temperature

Legend

A.	Current.	**D.**	Loadability 80%.
B.	Fault / Alarm.	**E.**	Loadability 100%.
C.	Trip area.	**F.**	Loadability 130%.

10.9.2 Motor Stall Protection

The motor stall protection function gives protection to the motor against short overloads. An overload can be caused, e.g., by a stalled shaft. It is possible to set the reaction time of the stall protection shorter than that of the motor thermal protection.

The stall status of the motor is specified with parameters P3.9.12 Stall Current and P3.9.14 Stall Frequency Limit. If the current is higher than the limit, and the output frequency is lower than the limit, the motor is in a stall status.

The stall protection is a type of overcurrent protection.

NOTE: If you use long motor cables (max. 100 m) with small drives (≤ 1.5 kW (≤ 2.0 hp)), the motor current that the drive measures can be much higher than the actual motor current. This is because there are capacitive currents in the motor cable.

P3.9.11 MOTOR STALL FAULT (ID 709)

You can use this parameter to select the response of the drive to a 'Motor Stall' fault.

If the stall protection detects that the shaft of the motor is stalled, a motor stall fault occurs.

P3.9.12 STALL CURRENT (ID 710)

You can use this parameter to set the limit above which the current of the motor must stay for a stall stage to occur.

You can set the value of this parameter between 0.0 and 2*IL. For a stall status to occur, the current must be higher than this limit. If parameter P3.1.1.7 Motor Current Limit changes, this parameter is automatically calculated to 90% of the current limit.

NOTE: The value of the Stall Current must be below the motor current limit.

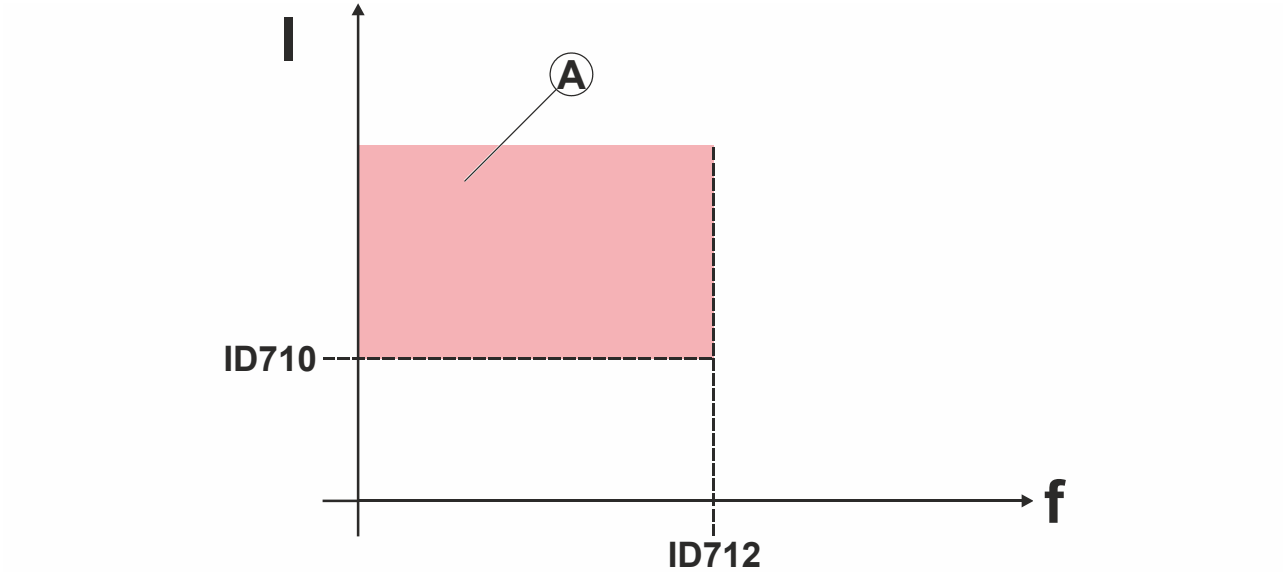


Fig. 30. The stall characteristics settings

Legend

A.	Stall area.

P3.9.13 STALL TIME LIMIT (ID 711)

You can use this parameter to set the maximum time for a stall stage.

You can set the value of this parameter between 1.0 and 120.0 s. This is the maximum time for the stall status to be active. An internal counter counts the stall time.

If the stall time counter value goes above this limit, the protection causes the drive to trip.

P3.9.14 STALL FREQUENCY LIMIT (ID 712)

You can use this parameter to set the limit below which the output frequency of the drive must stay for a stall stage to occur.

NOTE: For a stall state to occur, the output frequency must be below this limit for a certain time.

10.9.3 Underload (Dry Pump) Protection

The motor underload protection makes sure that there is a load on the motor when the drive operates. If the motor loses the load, a problem can occur in the process. For example, a belt can break or a pump become dry.

You can adjust the motor underload protection with parameters P3.9.16 (Underload Protection: Field Weakening Area Load) and P3.9.17 (Underload Protection: Zero Frequency Load). The underload curve is a squared curve between the zero frequency and the field weakening point. The protection is not active below 5 Hz. The underload time counter does not operate below 5 Hz.

The values of the underload protection parameters are set in percentage of the nominal torque of the motor. To find the scaling ratio for the internal torque value, use the data in the name plate data of the motor, the motor nominal current and the nominal current of the drive IL. If you use another current than the nominal motor current, the precision of the calculation decreases.

NOTE: If you use long motor cables (max. 100 m) with small drives (≤ 1.5 kW (≤ 2.0 hp)), the motor current that the drive measures can be much higher than the actual motor current. This is because there are capacitive currents in the motor cable.

P3.9.15 UNDERLOAD FAULT (ID 713)

You can use this parameter to select the response of the drive to an 'Underload' fault.

If the underload protection function detects that there is not a sufficient load on the motor, an underload fault occurs.

P3.9.16 UNDERLOAD PROTECTION: FIELD WEAKENING AREA LOAD (ID 714)

You can use this parameter to set the minimum torque that the motor needs when the output frequency of the drive is higher than the frequency of the weakening point.

You can set the value of this parameter between 10.0 and 150.0% x TnMotor. This value is the limit for the minimum torque when the output frequency is above the field weakening point.

If you change parameter P3.1.1.4 (Motor Nominal Current), this parameter goes automatically back to its default value. See 5.9 Group 3.9: Protections.

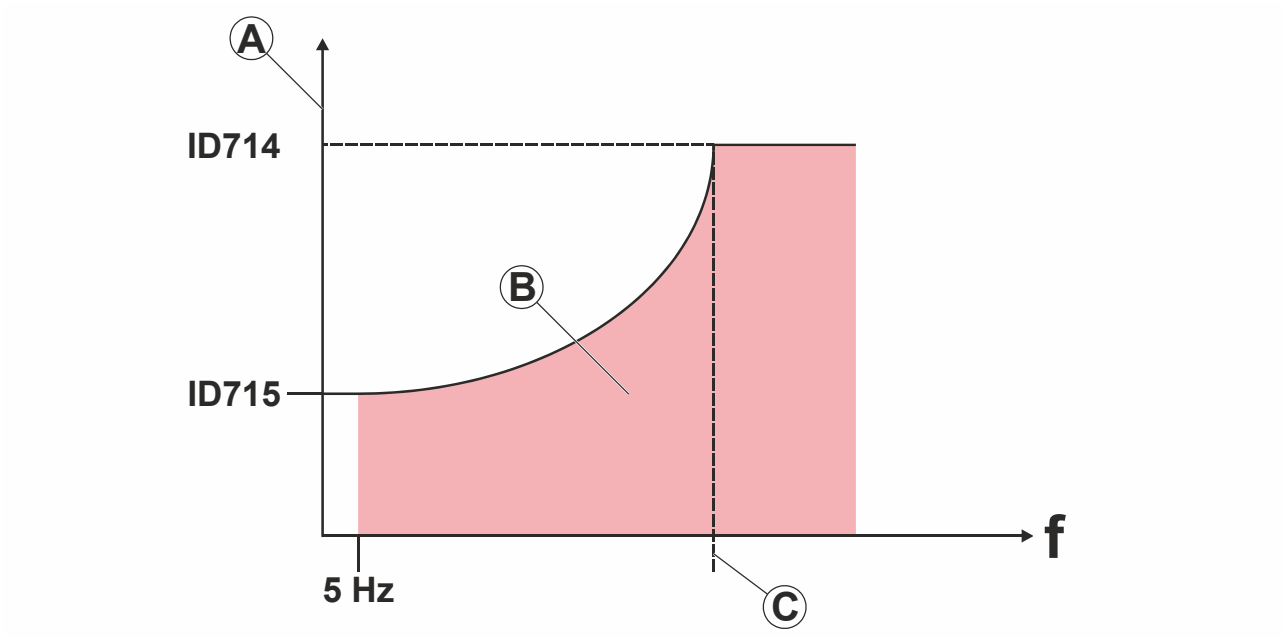


Fig. 31. Setting of the minimum load

Legend

A.	Torque.	**C.**	Field weakening point.
B.	Underload area.		

P3.9.17 UNDERLOAD PROTECTION: ZERO FREQUENCY LOAD (ID 715)

You can use this parameter to set the minimum torque that the motor needs when the output frequency of the drive is 0.

P3.9.18 UNDERLOAD PROTECTION: TIME LIMIT (ID 716)

You can use this parameter to set the maximum time for an underload state.

You can set the time limit between 2.0 and 600.0 s.

This is the maximum time for an underload status to be active. An internal counter counts the underload time. If the value of the counter goes above this limit, the protection causes the drive to trip. The drive trips as is set in parameter P3.9.15 Underload Fault. If the drive stops, the underload counter goes back to 0.

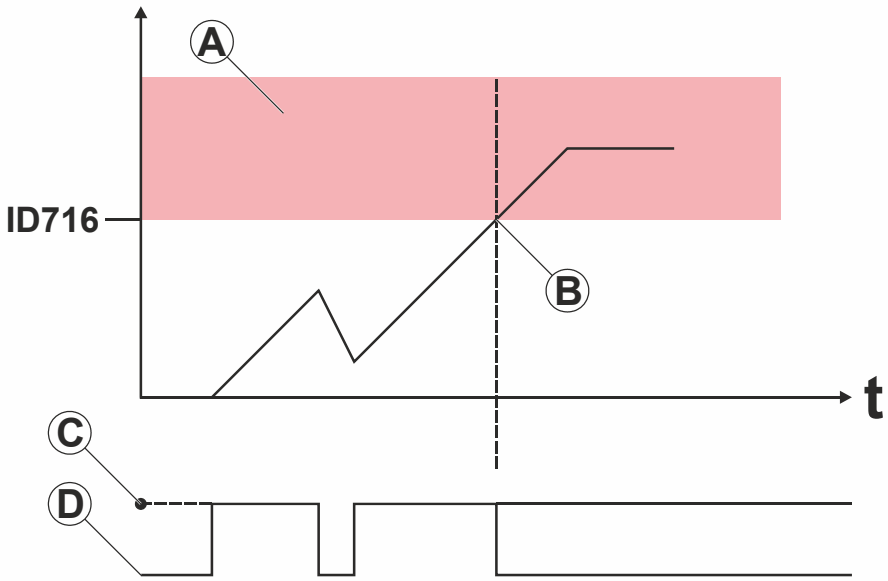


Fig. 32. The Underload time counter function

Legend

A.	Trip area.	**C.**	Underload.
B.	Trip / warning ID713.	**D.**	No underload.

P3.9.19 RESPONSE TO FIELDBUS COMMUNICATION FAULT (ID 733)

You can use this parameter to select the response of the drive to a 'Fieldbus Timeout' fault.

If the data connection between the master and the fieldbus board is defective, a fieldbus fault occurs.

P3.9.20 SLOT COMMUNICATION FAULT (ID 734)

You can use this parameter to select the response of the drive to a 'Slot Communication' fault.

If the drive detects a defective option board, a slot communication fault occurs.

P3.9.21 THERMISTOR FAULT (ID 732)

You can use this parameter to select the response of the drive to a 'Thermistor' fault.

If the thermistor detects too high temperature, a thermistor fault occurs.

P3.9.22 SOFTFILL TIMEOUT (ID 748)

You can use this parameter to select the response of the drive to a 'PID Soft Fill' fault.

If the PIDFeedback value does not reach the set level within the time limit, a soft fill fault occurs.

P3.9.23 RESPONSE TO PID1 SUPERVISION FAULT (ID 749)

You can use this parameter to select the response of the drive to a 'PID Supervision' fault.

If the PID feedback value is not in the supervision limits for longer than the supervision delay, a PID supervision fault occurs.

P3.9.24 RESPONSE TO PID2 SUPERVISION FAULT (ID 757)

You can use this parameter to select the response of the drive to a 'PID Supervision' fault.

If the PID feedback value is not within the supervision limits for longer than the supervision delay, a PID supervision fault occurs.

P3.9.25 TEMPERATURE SIGNAL 1 (ID 739)

You can use this parameter to select the temperature input signals that are supervised.

The maximum value is taken from the set signals and used for alarm and fault triggering.

P3.9.26 ALARM LIMIT 1 (ID 741)

You can use this parameter to set the temperature alarm limit.

If the measured temperature goes above this limit, a temperature alarm occurs.

P3.9.27 FAULT LIMIT 1 (ID 742)

You can use this parameter to set the temperature fault limit.

If the measured temperature goes above this limit, a temperature fault occurs.

P3.9.28 TEMP FAULT RESPONSE (ID 740)

You can use this parameter to select the response of the drive to 'Temperature' fault.

P3.9.29 STO FAULT

This parameter is inactive.

10.10 Automatic Reset

P3.10.1 AUTOMATIC RESET (ID 731)

You can use this parameter to enable the Automatic reset function.

To select faults that are reset automatically, give the value *yes* or *no* to parameters from P3.10.6 to P3.10.14.

NOTE: The automatic reset function is available only for some fault types.

P3.10.2 RESTART FUNCTION (ID 719)

You can use this parameter to select the start mode for the Automatic reset function.

P3.10.3 WAIT TIME (ID 717)

You can use this parameter to set the wait time before the first reset is done.

P3.10.4 AUTOMATIC RESET: TRIAL TIME (ID 718)

You can use this parameter to set the trial time for the automatic reset function.

During the trial time, the automatic reset function tries to reset the faults that occur. The time count starts from the first automatic reset. The next fault starts the trial time count again.

P3.10.5 NUMBER OF TRIALS (ID 759)

You can use this parameter to set the total number of autoreset trials.

If the number of trials during the trial time is more than the value of this parameter, a permanent fault shows. If not, the fault goes out of view after the trial time is completed.

With parameter P3.10.5, you can set the maximum number of automatic reset trials during the trial time set in P3.10.4. The fault type does not have an effect on the maximum number.

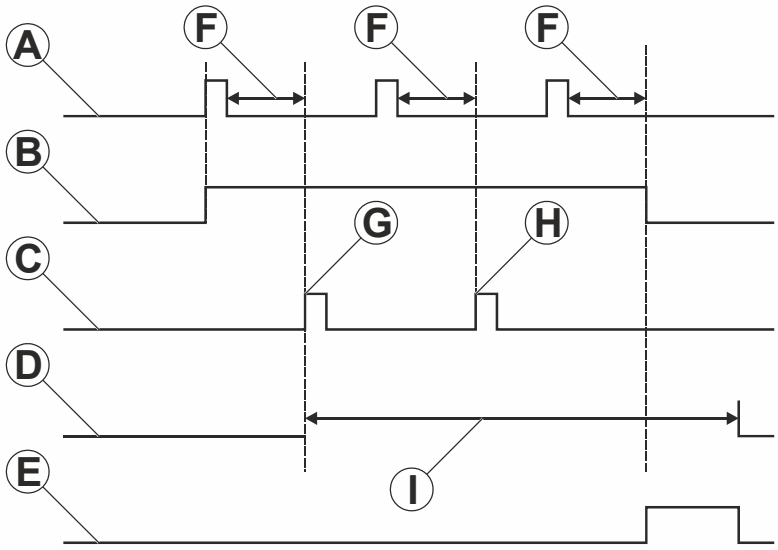


Fig. 33. The Automatic reset function: (ID759 = 2))

Legend

A.	Fault trigger.	**F.**	Wait time ID717.
B.	Alarm.	**G.**	Reset 1.
C.	Autoreset.	**H.**	Reset 2.
D.	Trial time.	**I.**	Trial time ID718
E.	Fault active.		

P3.10.6 AUTORESET: UNDERVOLTAGE (ID 720)

You can use this parameter to enable the automatic reset after an undervoltage fault.

P3.10.7 AUTORESET: OVERVOLTAGE (ID 721)

You can use this parameter to enable the automatic reset after an overvoltage fault.

P3.10.8 AUTORESET: OVERCURRENT (ID 722)

You can use this parameter to enable the automatic reset after an overcurrent fault.

P3.10.9 AUTORESET: AI LOW (ID 723)

You can use this parameter to enable the automatic reset after a fault caused by low AI signal.

P3.10.10 AUTORESET: UNIT OVERTEMPERATURE (ID 724)

You can use this parameter to enable the automatic reset after a fault caused by unit overtemperature.

P3.10.11 AUTORESET: MOTOR OVERTEMPERATURE (ID 725)

You can use this parameter to enable the automatic reset after a fault caused by motor overtemperature.

P3.10.12 AUTORESET: EXTERNAL FAULT (ID 726)

You can use this parameter to enable the automatic reset after an external fault.

P3.10.13 AUTORESET: UNDERLOAD FAULT (ID 738)

You can use this parameter to enable the automatic reset after an underload fault.

P3.10.14 AUTORESET: PID SUPERVISION FAULT (ID 15538)

You can use this parameter to select if autoreset is permitted for the fault.

10.11 Application Settings

P3.11.1 °C/°F SELECTION (ID 1197)

You can use this parameter to set the temperature measuring unit.

The system shows all the temperature-related parameters and monitoring values in the set unit.

P3.11.2 KW/HP SELECTION (ID 1198)

You can use this parameter to set the power measuring unit.

The system shows all the power-related parameters and monitoring values in the set unit.

P3.11.3 LOC/REM BUTTON CONFIGURATION (ID 1195)

You can use this parameter to set the values of the LOC/REM button.

This parameter tells which selections show when you push the LOC/REM button.

- Local / Remote
- Control Page
- Change Direction (only visible in keypad control)

P3.11.4 PASSWORD (ID 1900)

You can use this parameter to set the administrator password.

10.12 Timer Functions

10.12.1 Timer Functions

Timer functions include five intervals and three timers (time channels). The timer functions make it possible for the internal RTC (Real-Time Clock) to control functions. All the functions that can be controlled with a digital input, can also be controlled with the RTC, with time channels 1-3. It is not necessary to have an external PLC to control a digital input. You can program the closed and opened intervals of the input internally.

To get the best results of the timer functions, install a battery, and make the settings of the Real-Time Clock carefully in the Start-up wizard.

NOTE: We do not recommend that you use the timer functions without an auxiliary battery. If the RTC has no battery, the time and date settings of the drive will be reset at each power-down.

TIME CHANNELS

You can assign the output of the interval and/or timer functions to time channels 1-3. You can use the time channels to control on/off type functions, for example relay outputs or digital inputs. To configure the on/off logic of the time channels, assign intervals and/or timers to them. A time channel can be controlled by many different intervals or timers (P3.5.x time channels).

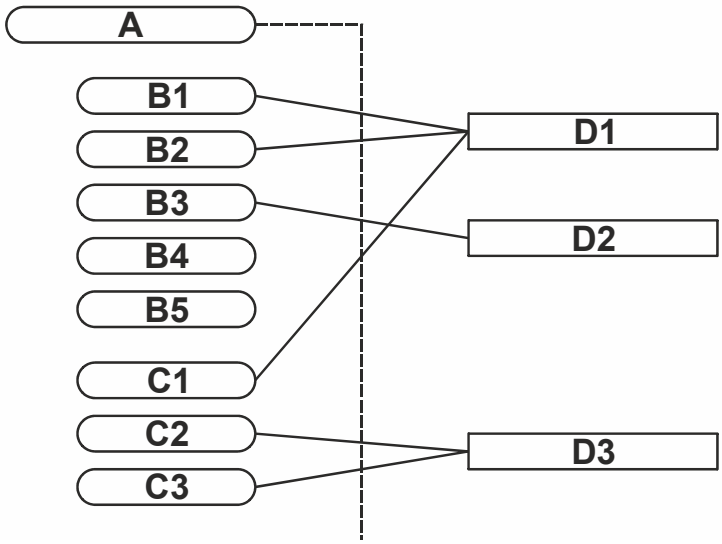


Fig. 34. Assigning intervals and timers to time channels is flexible. Every interval and timer has a parameter with which you can assign them to a time channel

Legend

A.	P │ Assign to channel.	**C1…3**	Timer 1…3.
B1…5	Interval 1…5.	**D1…3**	TimeChannel 1…3.

INTERVALS

Use parameters to give each interval an ON Time and OFF Time. It is the daily active time of the interval during the days set with parameters From Day and To Day. For example, with the parameter settings below, the interval is active from 7 am to 9 am from Monday to Friday.

The time channel is like a digital input, but virtual.

ON Time: 07:00:00

OFF Time: 09:00:00

From Day: Monday

To Day: Friday

TIMERS

You can use the timers to set a time channel as active for a period with a command from a digital input or a time channel.

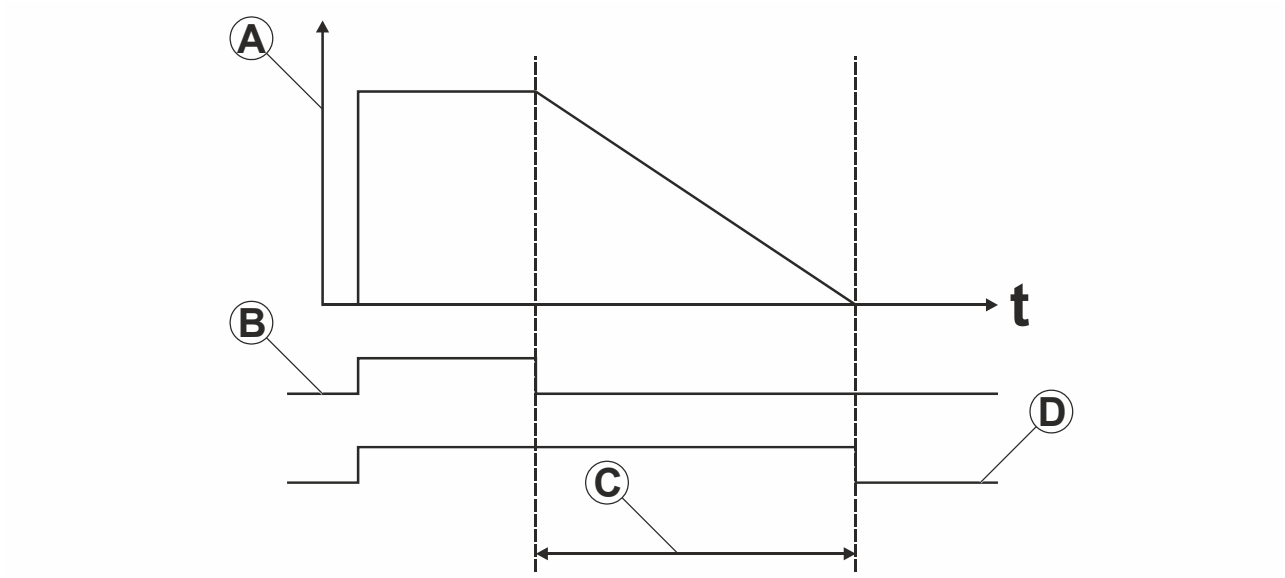


Fig. 35. The activation signal comes from a digital input or a virtual digital input, like a time channel. The timer counts down from the falling edge

Legend

A.	Remaining time.	**C.**	Duration.
B.	Activation.	**D.**	OUT.

Example:

Problem:

The HVAC drive is in a warehouse and controls air conditioning. It must operate between 7 am and 5 pm on weekdays and between 9 am and 1 pm on weekends. It is also necessary for the drive to operate outside these hours, if there are personnel in the building and the digital signal is OFF. The drive must continue to operate 30 minutes after the personnel has left.

Solution:

Set two intervals, one for weekdays and one for weekends. A timer is also necessary to activate the process outside the set hours. See the configuration below.

Real-Time Clock

Set the date and time in P5.5x.

Digital Inputs P3.5.1.x

Liberate DigINSlotA4 P3.5.1.16 from Preset Freq Sel 0: DigINSlot0.1

Assign DigINSlotA.4 to P3.5.1.19.

Interval 1

P3.12.1.1: ON Time: 07:00:00.

P3.12.1.2: OFF Time: 17:00:00.

P3.12.1.3: From Day: 1 (= Monday).

P3.12.1.4: To Day: 5 (= Thursday).

P3.12.1.5: Assign to channel: TimeChannel1.

Interval 2

P3.12.2.1: ON Time: 09:00:00.

P3.12.2.2: OFF Time: 13:00:00.

P3.12.2.3: From Day: Saturday.

P3.12.2.4: To Day: Sunday.

P3.12.2.5: Assign to channel: TimeChannel1.

Timer 1

You can start the motor with digital input 4 on slot A during times other than those specified with the intervals. In this case, the timer specifies the duration that the motor runs.

P3.12.6.1: Duration: 1800 s (30 min).

P3.12.6.2: Assign to channel: TimeChannel1.

P3.5.1.19: Timer 1: DigIn SlotA.4 (The parameter located in the digital inputs menu).

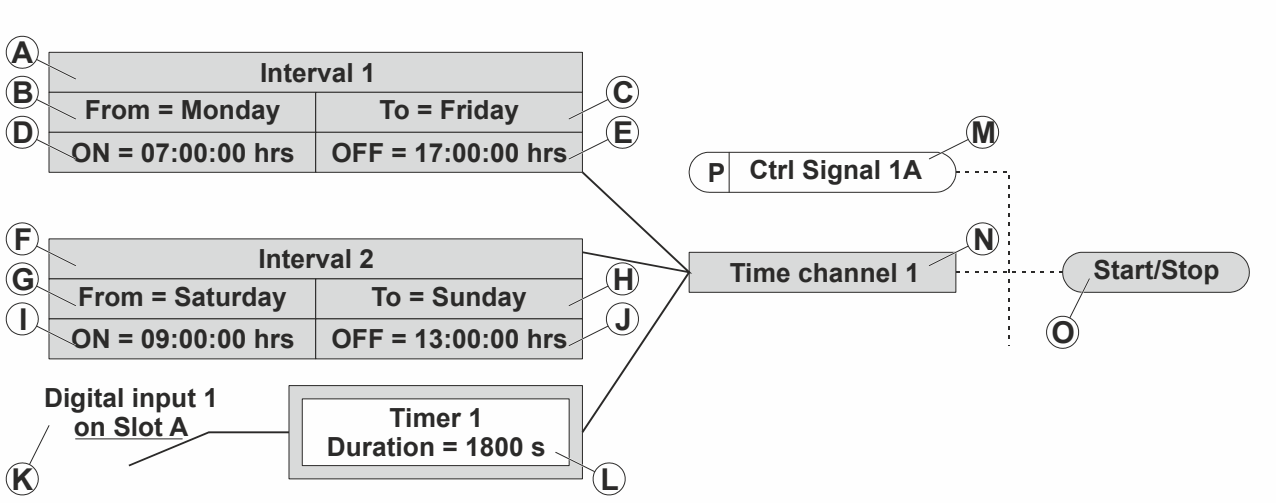


Fig. 36. TimeChannel1 is used as the control signal for the *Start* command instead of a digital input

Legend

A.	Interval 1.	**I.**	ON = 09:00:00 hrs.
B.	From = Monday.	**J.**	OFF = 13:00:00 hrs.
C.	To Thursday.	**K.**	Digital input 1 on Slot A.
D.	ON = 07:00:00 hrs.	**L.**	Timer 1, Duration = 1800 s
E.	OFF = 17:00:00 hrs.	**M.**	Signal Ctrl 1A.
F.	Interval 2.	**N.**	TimeChannel1.
G.	From Saturday.	**O.**	Start/Stop.
H.	To Sunday.		

P3.12.1.1 ON TIME (ID 1464)

You can use this parameter to set the time of day when the output of the interval function is activated.

P3.12.1.2 OFF TIME (ID 1465)

You can use this parameter to set the time of day when the output of the interval function is deactivated.

P3.12.1.3 FROM DAY (ID 1466)

You can use this parameter to set the day when the output of the interval function is activated.

P3.12.1.4 TO DAY (ID 1467)

You can use this parameter to set the day when the output of the interval function is deactivated.

P3.12.1.5 ASSIGN TO CHANNEL (ID 1468)

You can use this parameter to select the time channel where the output of the interval function is assigned.

You can use the time channels to control the on/off type functions, for example relay outputs or any functions that can be controlled by a DI signal.

P3.12.6.1 DURATION (ID 1489)

You can use this parameter to set the duration that the timer runs when the activation signal is removed (Off-delay).

P3.12.6.2 ASSIGN TO CHANNEL (ID 1490)

You can use this parameter to select the time channel where the output of the timer function is assigned.

You can use the time channels to control the on/off type functions, for example relay outputs or any functions that can be controlled by a DI signal.

P3.12.6.3 MODE (ID 15527)

You can use this parameter to select if timer delay should work with rising or falling edge.

10.13 PID Controller 1

10.13.1 Basic Settings

P3.13.1.1 PID GAIN (ID 118)

You can use this parameter to adjust the gain of the PID controller.

If this parameter is set to 100%, a change of 10% in the error value causes the controller output to change by 10%.

P3.13.1.2 PID INTEGRATION TIME (ID 119)

You can use this parameter to adjust the integration time of the PID controller.

If this parameter is set to 1.00 s, a change of 10% in the error value causes the controller output to change by 10.00%/s.

P3.13.1.3 PID DERIVATION TIME (ID 132)

You can use this parameter to adjust the derivation time of the PID controller.

If this parameter is set to 1.00 s, a change of 10% in the error value during 1.00 s causes the controller output to change by 10.00%.

P3.13.1.4 PROCESS UNIT SELECTION (ID 1036)

You can use this parameter to select the unit for the feedback and the setpoint signals of the PID controller.

Make a selection of the unit for the actual value.

P3.13.1.5 PROCESS UNIT MIN (ID 1033)

You can use this parameter to set the minimum value of the PID feedback signal.

For example, an analog signal of 4...20 mA corresponds to the pressure of 0...10 bar.

P3.13.1.6 PROCESS UNIT MAX (ID 1034)

You can use this parameter to set the maximum value of the PID feedback signal.

For example, an analog signal of 4...20 mA corresponds to the pressure of 0...10 bar.

P3.13.1.7 PROCESS UNIT DECIMALS (ID 1035)

You can use this parameter to set the number of decimals for the process unit values.

For example, an analog signal of 4...20 mA corresponds to the pressure of 0...10 bar.

P3.13.1.8 ERROR INVERSION (ID 340)

You can use this parameter to invert the error value of the PID controller.

P3.13.1.9 DEAD BAND HYSTERESIS (ID 1056)

You can use this parameter to set the dead band area around the PID setpoint value.

The value of this parameter is given in the selected process unit. The output of the PID controller is locked if the feedback value stays in the dead band area for the set time.

P3.13.1.10 DEAD BAND DELAY (ID 1057)

You can use this parameter to set the time that the feedback value must stay in the dead band area before the output of the PID controller is locked.

If the actual value stays in the dead band area for a time set in Dead Band Delay, the PID controller output will be locked. This function prevents wear and unwanted movements of the actuators, e.g., valves.

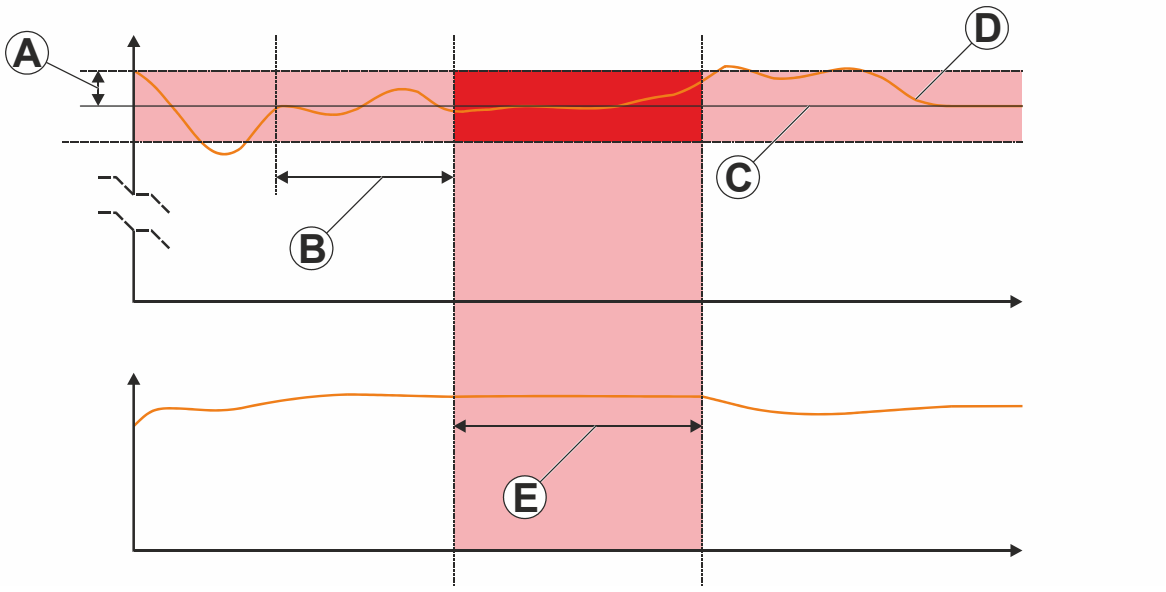


Fig. 37. The Dead band function

Legend

A.	Dead band (ID1056).	**D.**	Actual value.
B.	Dead band delay (ID1057).	**E.**	Output locked.
C.	Reference.		

10.13.2 Setpoints

P3.13.2.1 KEYPAD SETPOINT 1 (ID 167)

You can use this parameter to set the setpoint value of the PID controller when the setpoint source is *Keypad SP*.

The value of this parameter is given in the selected process unit.

P3.13.2.2 KEYPAD SETPOINT 2 (ID 168)

You can use this parameter to set the setpoint value of the PID controller when the setpoint source is *Keypad SP*.

The value of this parameter is given in the selected process unit.

P3.13.2.3 SETPOINT RAMP TIME (ID 1068)

You can use this parameter to set the rising and falling ramp times for the setpoint changes.

Ramp time is the time that is necessary for the setpoint value to change from minimum to maximum. If the value of this parameter is set to 0, no ramps are used.

P3.13.2.4 SETPOINT SOURCE 1 SELECTION (ID 332)

You can use this parameter to select the source of the PID setpoint signal.

P3.13.2.5 SETPOINT 1 MINIMUM (ID 1069)

You can use this parameter to set the minimum value of the setpoint signal.

P3.13.2.6 SETPOINT 1 MAXIMUM (ID 1070)

You can use this parameter to set the maximum value of the setpoint signal.

P3.13.2.7 SLEEP FREQUENCY LIMIT 1 (ID 1016)

You can use this parameter to set the limit below which the output frequency of the drive must stay for a set time before the drive goes to the sleep state.

P3.13.2.8 SLEEP DELAY 1 (ID 1017)

You can use this parameter to set the minimum duration that the output frequency of the drive must stay below the set limit before the drive goes to the sleep state.

P3.13.2.9 WAKE-UP LEVEL 1 (ID 1018)

You can use this parameter to set the level at which the drive wakes up from the sleep state.

SETPOINT KEYPAD 2

To do the SP2 settings PC2 P3.13.2.11…P3.13.2.17, see P3.13.2.3…P3.13.2.10.

P3.13.2.18 WAKE-UP MODE PC1 (ID 15539)

You can use this parameter to define the deadband to be an absolute or a relative value.

The drive might wake up from the sleep mode when the value of PID Feedback is outside the dead band.

This parameter defines if wake-up mode is used as a static absolute level or as a relative level which follows PID setpoint value.

Selection 0 = Absolute level (The wake-up level is a static level that does not follow the setpoint value.)

Selection 1 = Relative setpoint (The wake-up level is an offset below the actual setpoint value.

The wake-up level follows the actual setpoint.)

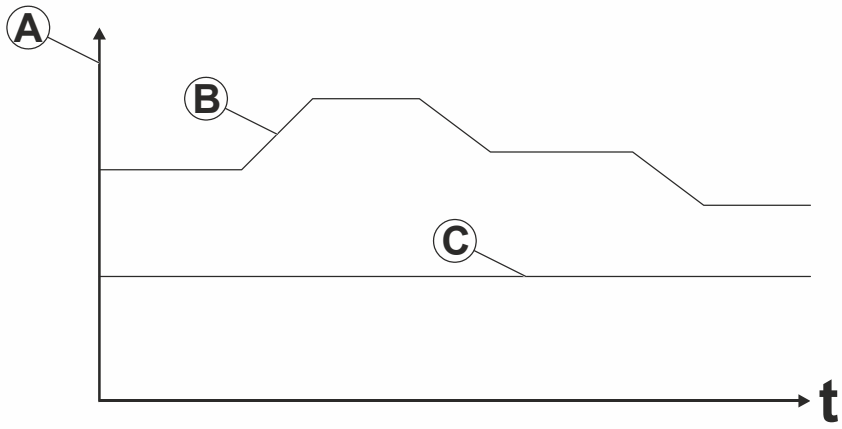


Fig. 38. Wake-up Mode: absolute level

Legend

A.	Setpoint.	**C.**	Wake-up level.
B.	PID setpoint.		

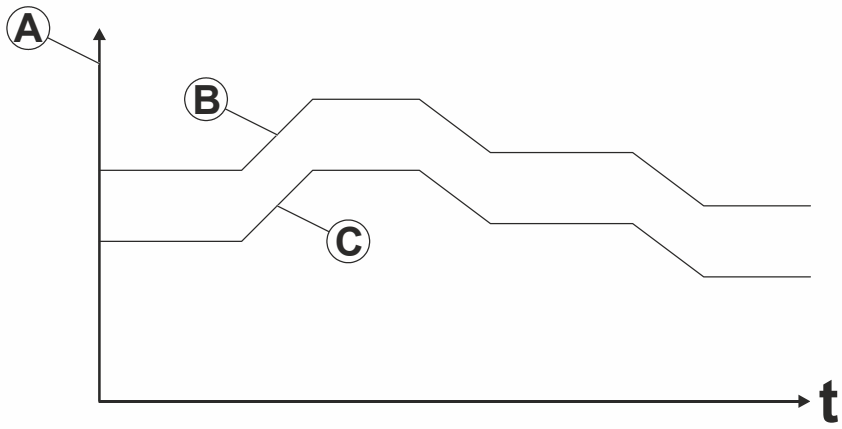


Fig. 39. Wake-up Mode: relative setpoint

Legend

A.	Setpoint.	**C.**	Wake-up level.
B.	PID setpoint.		

P3.13.2.10 SETPOINT 1 BOOST (ID 1071)

You can use this parameter to set the multiplier for the setpoint boost function.

When the *Setpoint boost* command is given, the setpoint value is multiplied with the factor that is set with this parameter. The parameter is linked to P3.5.1.22.

10.13.3 Feedback

P3.13.3.1 FEEDBACK FUNCTION (ID 333)

You can use this parameter to select if the feedback value is taken from a single signal or combined from two signals.

You can select the mathematical function that is used when the two feedback signals are combined.

P3.13.3.2 FEEDBACK FUNCTION GAIN (ID 1058)

You can use this parameter to adjust the gain of the feedback signal.

This parameter is used, e.g., with the value *2* in Feedback Function.

P3.13.3.3 FEEDBACK 1 SOURCE SELECTION (ID 334)

You can use this parameter to select the source of the PID feedback signal.

The AIs and the ProcessDataIn are handled as percentages (0.00-100.00%) and scaled according to the feedback minimum and maximum.

NOTE: The ProcessDataIn signals use 2 decimals.

If temperature inputs are selected, you must set the values of parameters P3.14.1.7 Process Unit Min and P3.14.1.8 Process Unit Max to correspond to the scale of the temperature measurement board: ProcessUnitMin = -50 °C and ProcessUnitMax = 200 °C.

P3.13.3.4 FEEDBACK 1 MINIMUM (ID 336)

You can use this parameter to set the minimum value of the feedback signal.

P3.13.3.5 FEEDBACK 1 MAXIMUM (ID 337)

You can use this parameter to set the maximum value of the feedback signal.

10.13.4 Feedforward

P3.13.4.1 FEEDFORWARD FUNCTION (ID 1059)

You can use this parameter to select if the feedforward value is taken from a single signal or combined from two signals.

Accurate process models are usually necessary for the Feedforward function. Under some circumstances, a gain and offset type of feedforward is sufficient. The feedforward part does not use the feedback measurements of the actual controlled process value. The feedforward control uses other measurements that have an effect on the controlled process value.

EXAMPLE:

You can control the water level of a tank with flow control. The target water level is set as a setpoint. The control signal monitors the incoming flow.

The outflow is like a disturbance that you can measure. According to the inflow and outflow into the tank it is possible to control the water level on the condition that there is no leakage with a feedforward control (gain and offset) that you add to the PID output. The PID controller reacts much faster to changes in the outflow than when you measure only the level.

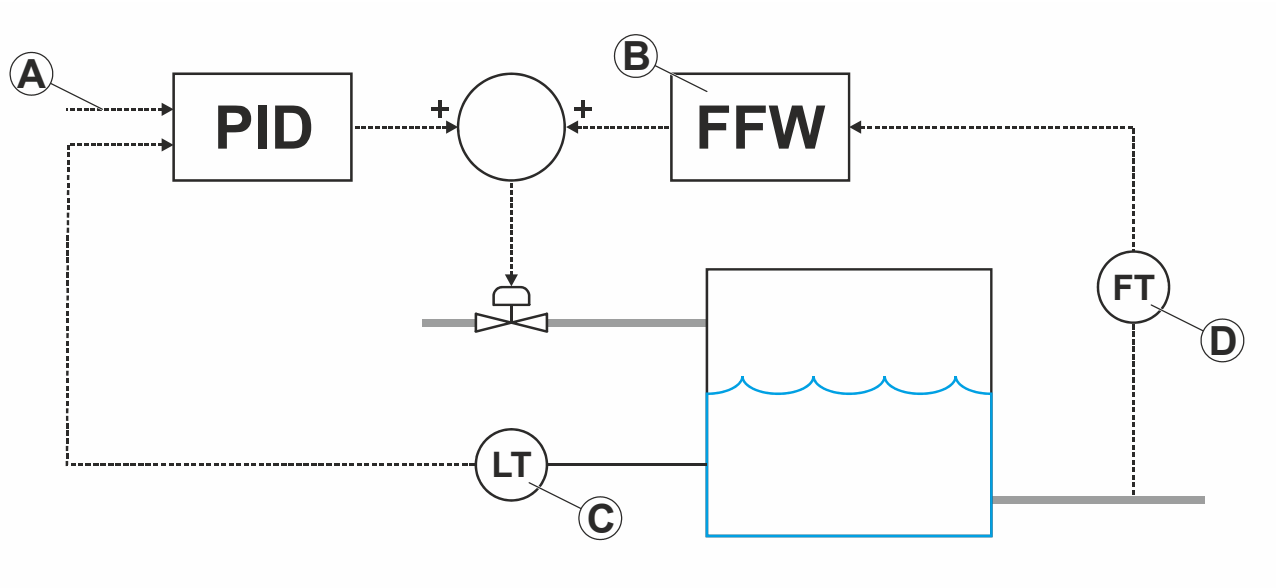


Fig. 40. The feedforward control

Legend

A.	Level ref.	**C.**	Level control.
B.	FFW.	**D.**	Outflow control.

P3.13.4.2 FEEDFORWARD GAIN (ID 1060)

You can use this parameter to adjust the gain of the feedforward signal.

P3.13.4.3 FEEDFORWARD 1 SOURCE SELECTION (ID 1061)

You can use this parameter to select the source of the PID feedforward signal.

P3.13.4.4 FEEDFORWARD 1 MINIMUM (ID 1062)

You can use this parameter to set the minimum value of the feedforward signal.

P3.13.4.5 FEEDFORWARD 1 MAXIMUM (ID 1063)

You can use this parameter to set the maximum value of the feedforward signal.

10.13.5 Process Supervision

Use the process supervision to make sure that the PID Feedback value (the process value or the actual value) stays in the set limits. With this function, you can, e.g., find a pipe break and stop the flooding.

P3.13.5.1 ENABLE PROCESS SUPERVISION (ID 735)

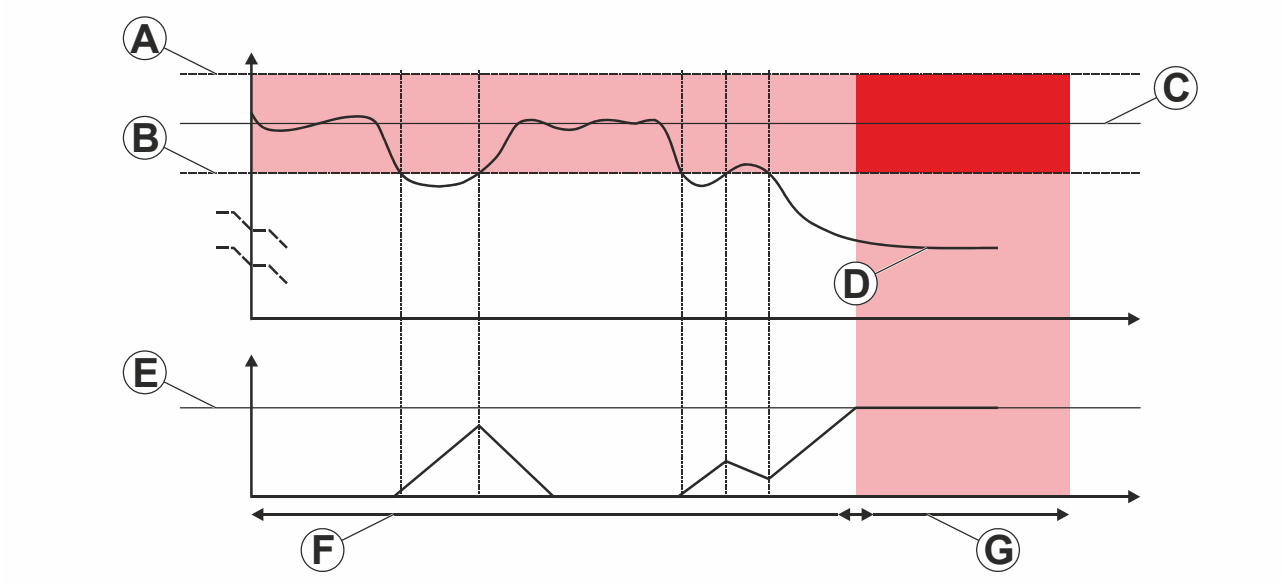


Fig. 41. The Feedback supervision function

Legend

A.	Upper limit (ID736).	**E.**	Delay (ID737).
B.	Lower limit (ID758).	**F.**	Regulating mode.
C.	Reference.	**G.**	Alarm or fault.
D.	Actual value.		

You can use this parameter to enable the feedback supervision function.

Set the upper limit and the lower limit around the reference. When the actual value is less or more than the limits, a counter starts to count up. When the actual value is between the limits, the counter counts down. When the counter gets a value that is higher than the value of P3.13.5.4 Delay, an alarm or a fault shows.

P3.13.5.2 UPPER LIMIT (ID 736)

You can use this parameter to set the high limit for the PID feedback signal.

If the value of the PID feedback signal goes above this limit for longer than the set time, a feedback supervision fault occurs.

P3.13.5.3 LOWER LIMIT (ID 758)

You can use this parameter to set the low limit for the PID feedback signal.

If the value of the PID feedback signal goes below this limit for longer than the set time, a feedback supervision fault occurs.

P3.13.5.4 DELAY (ID 737)

You can use this parameter to set the maximum time for the PID feedback signal to stay outside the supervision limits before the feedback supervision fault occurs.

If the target value is not reached in this time, a fault or alarm shows.

10.13.6 Pressure Loss Compensation

When you pressurize a long pipe that has many outlets, the best position for the sensor is in the middle of the pipe (the position 2 in the figure). You can also put the sensor directly after the pump. This gives the right pressure directly after the pump, but farther in the pipe, the pressure drops with the flow.

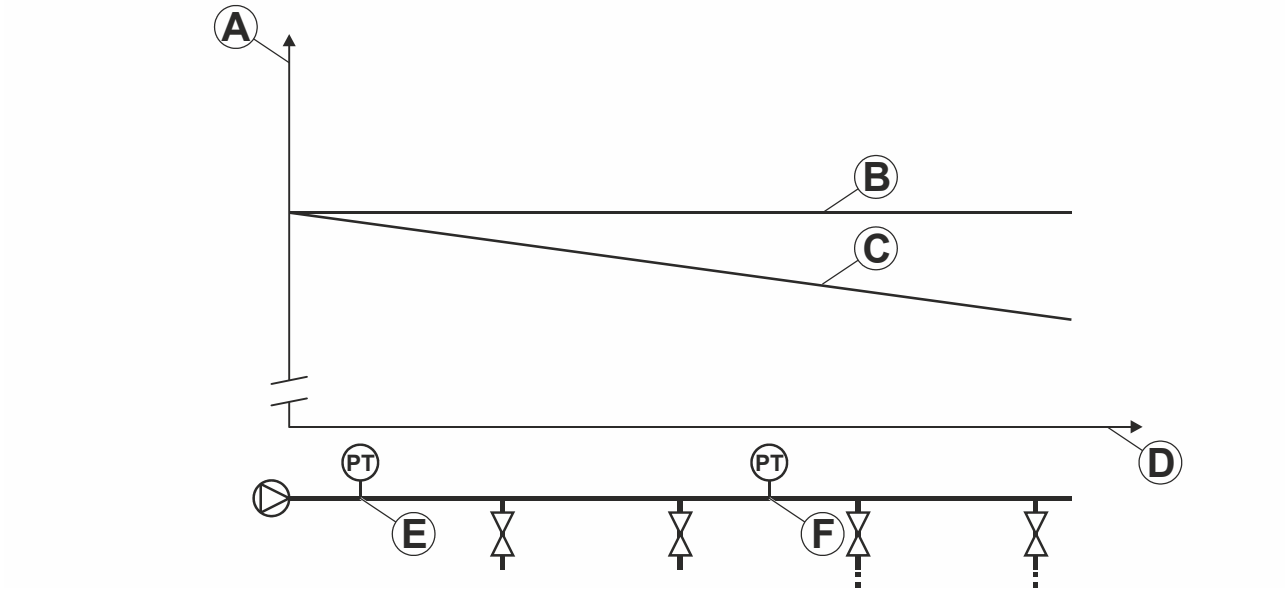


Fig. 42. The position of the pressure sensor

Legend

A.	Pressure.	**D.**	Pipe length.
B.	No flow.	**E.**	Position 1.
C.	With flow.	**F.**	Position 2.

P3.13.6.1 ENABLE SETPOINT 1 (ID1189)

You can use this parameter to enable the pressure loss compensation in the pump system.

P3.13.6.2 SETPOINT 1 MAX COMPENSATION (ID 1190)

You can use this parameter to set the maximum compensation for PID setpoint value that is applied when the output frequency of the drive is at the maximum frequency.

The sensor is put in position 1. The pressure in the pipe stays constant when there is no flow.

But with flow, the pressure decreases farther in the pipe. To compensate for this, lift the setpoint as the flow increases. Then the output frequency makes an estimate of the flow, and the setpoint increases linearly with the flow.

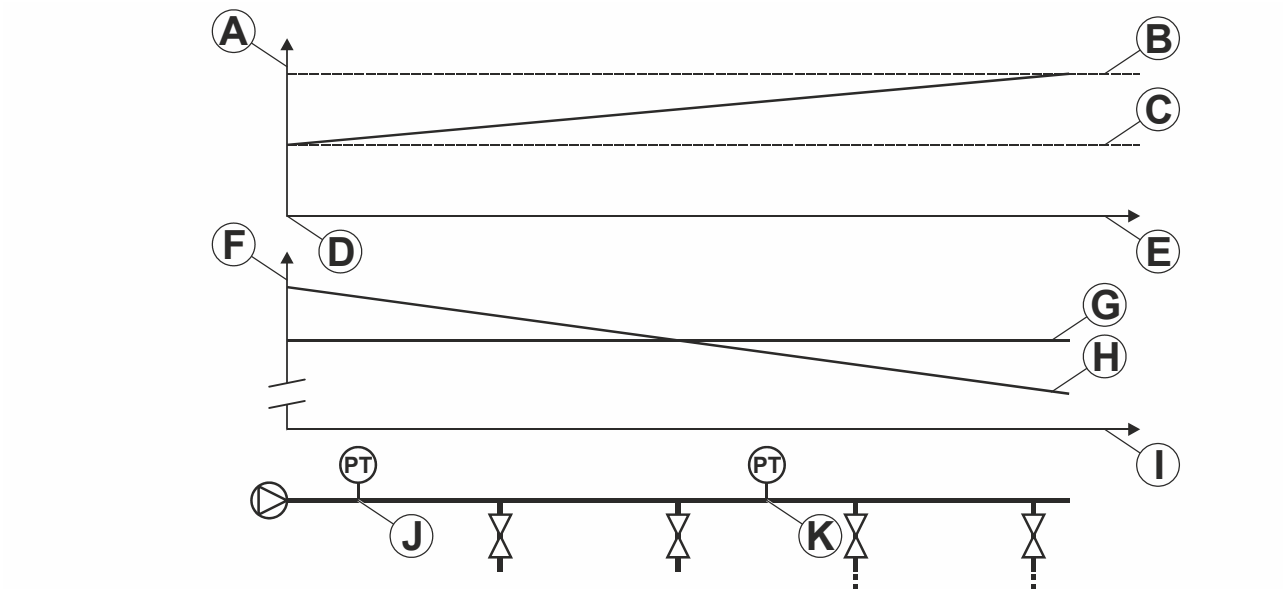


Fig. 43. Enable setpoint 1 for pressure loss compensation

Legend

A.	Setpoint.	**G.**	No flow.
B.	Setpoint + max. compensation.	**H.**	With flow and compensation.
C.	Setpoint.	**I.**	Pipe length.
D.	Min. frequency and flow.	**J.**	Position 1.
E.	Max. frequency and flow.	**K.**	Position 2.
F.	Pressure.		

10.13.7 Soft Fill

The Soft fill function is used to move the process to a set level at a slow speed before the PID controller starts to control. If the process does not go to the set level during the timeout, a fault shows.

You can use the function to fill an empty pipe slowly and prevent strong currents of water that could break the pipe.

We recommend that you always use the Soft fill function when you use the Pump and Fan Cascade function.

P3.13.7.1 ENABLE SOFT FILL (ID 1094)

You can use this parameter to enable the Soft Fill function.

P3.13.7.2 SOFT FILL FREQUENCY (ID 1055)

You can use this parameter to set the frequency reference of the HVAC drive when the Soft Fill function is used.

P3.13.7.3 SOFT FILL LEVEL (ID 1095)

You can use this parameter to set the level below which the soft fill control is enabled when starting the drive.

The drive operates at the PID start frequency until the feedback reaches the set value. Then the PID controller starts to control the drive.

This parameter is applied if the soft fill function is set to 'Enabled (Level)'.

P3.13.7.4 SOFT FILL TIMEOUT (ID 1096)

You can use this parameter to set the timeout time for the Soft Fill function. When the soft fill function is set to Enabled (Level), this parameter gives the timeout for the soft fill level, after which the soft fill fault occurs. When the

soft fill function is set to 'Enabled, Timeout', the drive operates at the soft fill frequency until the time set by this parameter expires.

If you selected the option Enabled (Timeout) in parameter P3.13.7.1 Soft Fill Function, parameter Soft Fill Timeout gives the quantity of time that the drive operates at the constant soft fill frequency (P3.13.7.2 Soft Fill Frequency) before the PID controller starts the regulation.

10.14 PID controller 2

NOTE: See 10.13 PID Controller 1 for other PID controller parameters.

10.14.1 Basic Settings

P3.14.1.1 ENABLE PID (ID 1630)

You can use this parameter to enable the PID controller.

NOTE: This controller is for external use only. It can be used with an analog output.

P3.14.1.2 OUTPUT IN STOP (ID 1100)

You can use this parameter to set the output value of the PID controller as a percentage of its maximum output value when it is stopped from a digital output.

10.15 Pump and Fan Cascade Function

The Pump and Fan Cascade function lets you control a maximum of four motors, pumps, or fans with the PID controller.

The HVAC drive is connected to a motor, which is the regulating motor. The regulating motor connects and disconnects the other motors to/from the mains with relays. This is done to keep the right setpoint. The Autochange function controls the sequence in which the motors start to make sure that they wear equally. You can include the regulating motor in the autochange and interlock logic, or set it to always be Motor 1. It is possible to remove motors momentarily with the Interlock function, for example for maintenance.

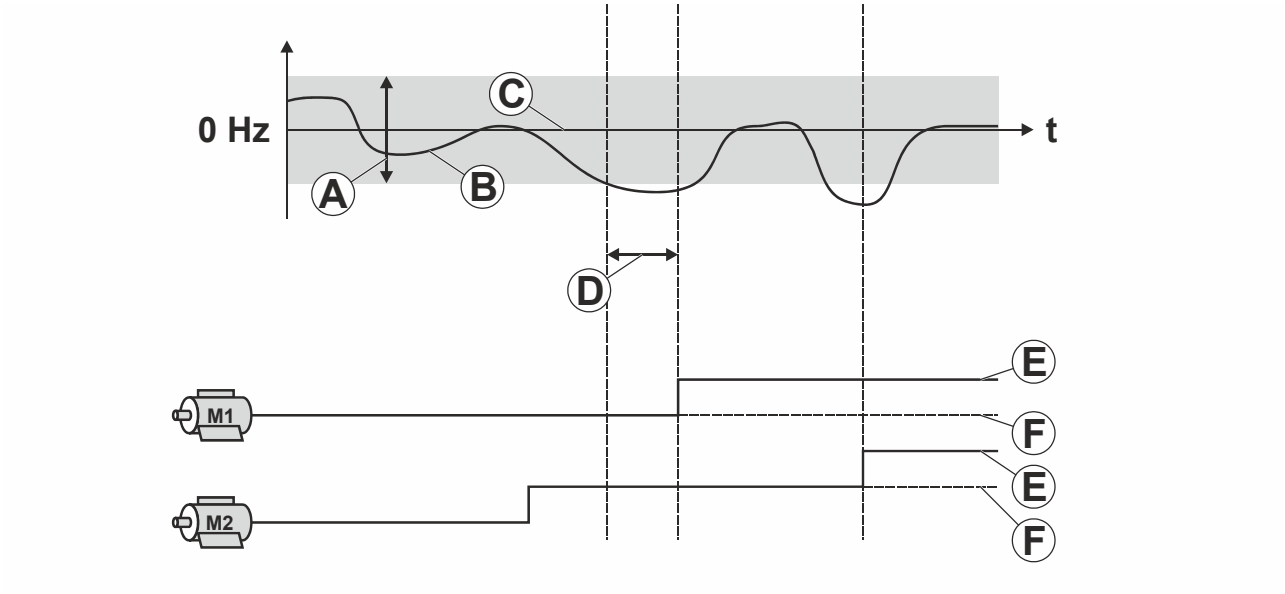


Fig. 44. The Pump and Fan Cascade function

Legend

A.	Bandwidth.	**D.**	Delay.
B.	Feedback.	**E.**	ON.
C.	Setpoint.	**F.**	OFF.

When to connect and/or add motors:

- The feedback value is not in the bandwidth area.
- The regulating motor operates at a close to maximum frequency (-2 Hz).
- The conditions above are true for longer than the bandwidth delay.
- There are more motors available

When to disconnect and/or remove motors:

- The feedback value is not in the bandwidth area.
- The regulating motor operates at a close to minimum frequency (+2 Hz).
- The conditions above are true for longer than the bandwidth delay.
- There are more motors that operate than the regulating one.

P3.15.1 NUMBER OF MOTORS (ID 1001)

You can use this parameter to set the total number of motors/pumps used with the Pump and Fan Cascade system.

P3.15.2 INTERLOCK FUNCTION (ID 1032)

You can use this parameter to enable or disable the interlocks.

The interlocks tell the Pump and Fan Cascade system that a motor is not available. This can occur when the motor is removed from the system for maintenance or bypassed for manual control.

To use the interlocks, enable the parameter P3.15.2. Make a selection of the status for each motor with a digital input (the parameters from P3.5.1.25 to P3.5.1.28). If the value of the input is *CLOSED*, that is, active, the motor is available for the Pump and Fan Cascade system.

If not, the Pump and Fan Cascade logic will not connect it.

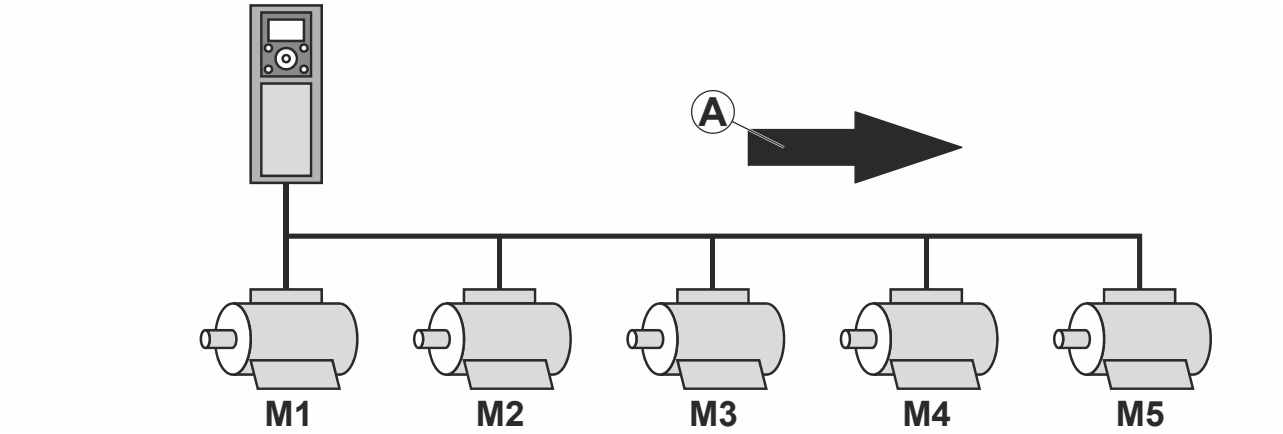


Fig. 45. The interlock logic 1

Legend

A.	Starting order of motors.		

The sequence of the motors is 1, 2, 3, 4, 5.

If you remove the interlock of Motor 3, that is, you set the value of P3.5.1.28 is set to OPEN, the sequence changes to 1, 2, 4, 5.

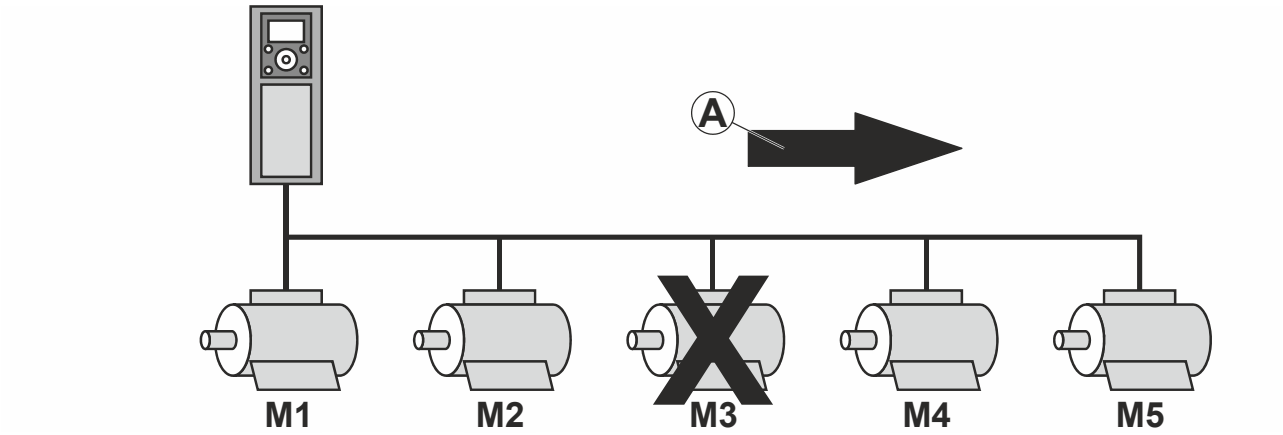


Fig. 46. The interlock logic 2 (ID428 = FALSE)

Legend

A.	Starting order of motors.		

If you add Motor 3 again (you set the value of P3.5.1.28 to CLOSED), the system puts Motor 3 last in the sequence: 1, 2, 4, 5, 3. The system does not stop, but rather continues to operate.

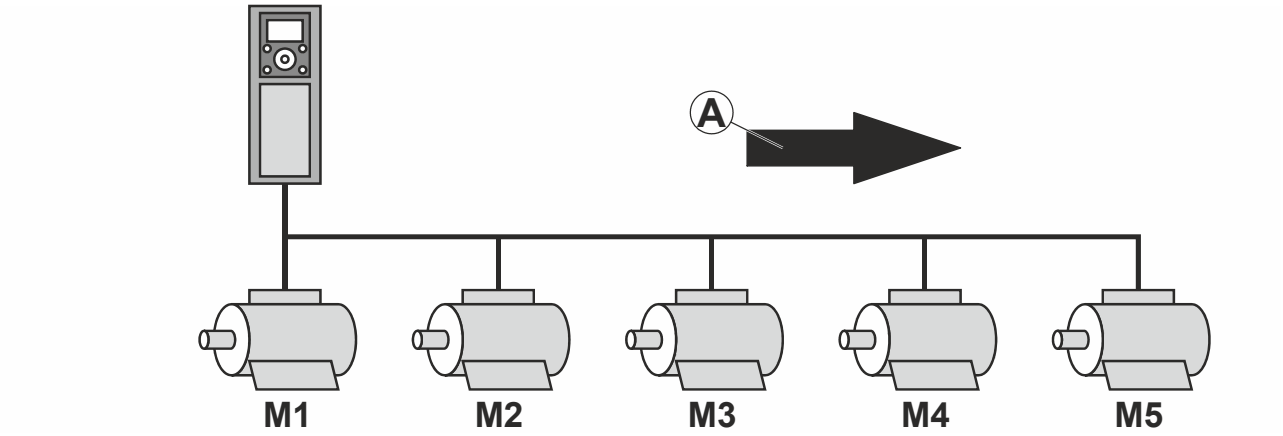


Fig. 47. The interlock logic 3

Legend

A.	New starting order of motors.		

When the system stops or goes to sleep mode for the next time, the sequence changes back to 1, 2, 3, 4, 5.

P3.15.3 INCLUDE FC (ID 1028)

You can use this parameter to include the controlled motor/pump in the autochange and interlock system.

P3.15.3 INCLUDE THE VFD-CONTROLLED MOTOR IN THE AUTOCHANGE (ID 1028)

Selection number	Selection name	Description
0	Disabled	The drive is always connected to Motor 1. The interlocks do not have an effect on Motor 1. Motor 1 is not included in the autochange logic.
1	Enabled	It is possible to connect the drive to any of the motors in the system. The interlocks have an effect on all the motors. All the motors are included in the autochange logic.

WIRING

The connections are different for the parameter values 0 and 1.

SELECTION 0, DISABLED

The drive is directly connected to Motor 1. The other motors are auxiliary motors. They are connected to the mains by contactors, and controlled by relays of the drive. The autochange or the interlock logic have no effect on Motor 1.

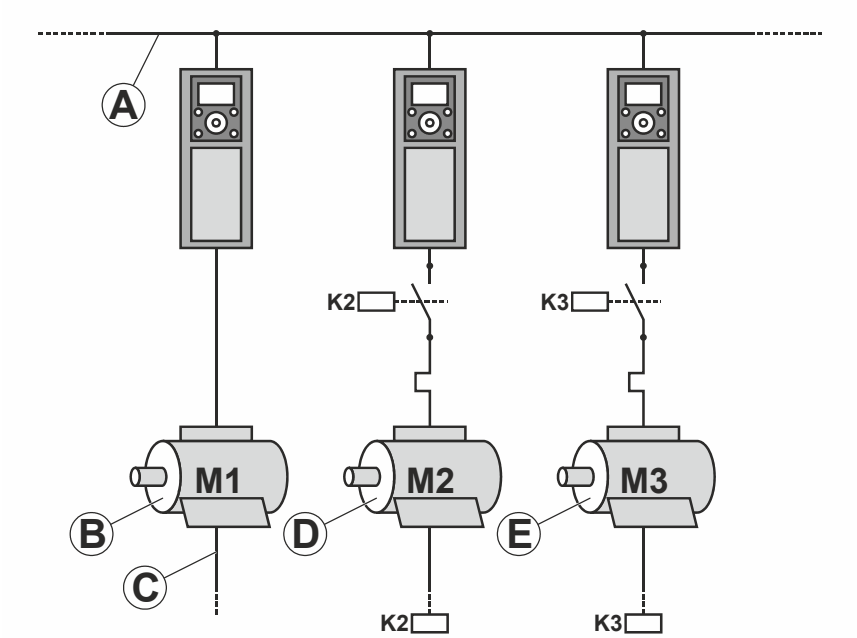


Fig. 48. Selection 0

Legend

A.	Mains.	**D.**	Motor 2 control from relay.
B.	Motor 1 control from relay.	**E.**	Motor 3 control from relay.
C.	Not used.		

SELECTION 1, ENABLED

To include the regulating motor in the autochange or in the interlock logic, follow the instructions in the figure below. One relay controls each motor. The contactor logic always connects the first motor to the drive, and the next motors to the mains.

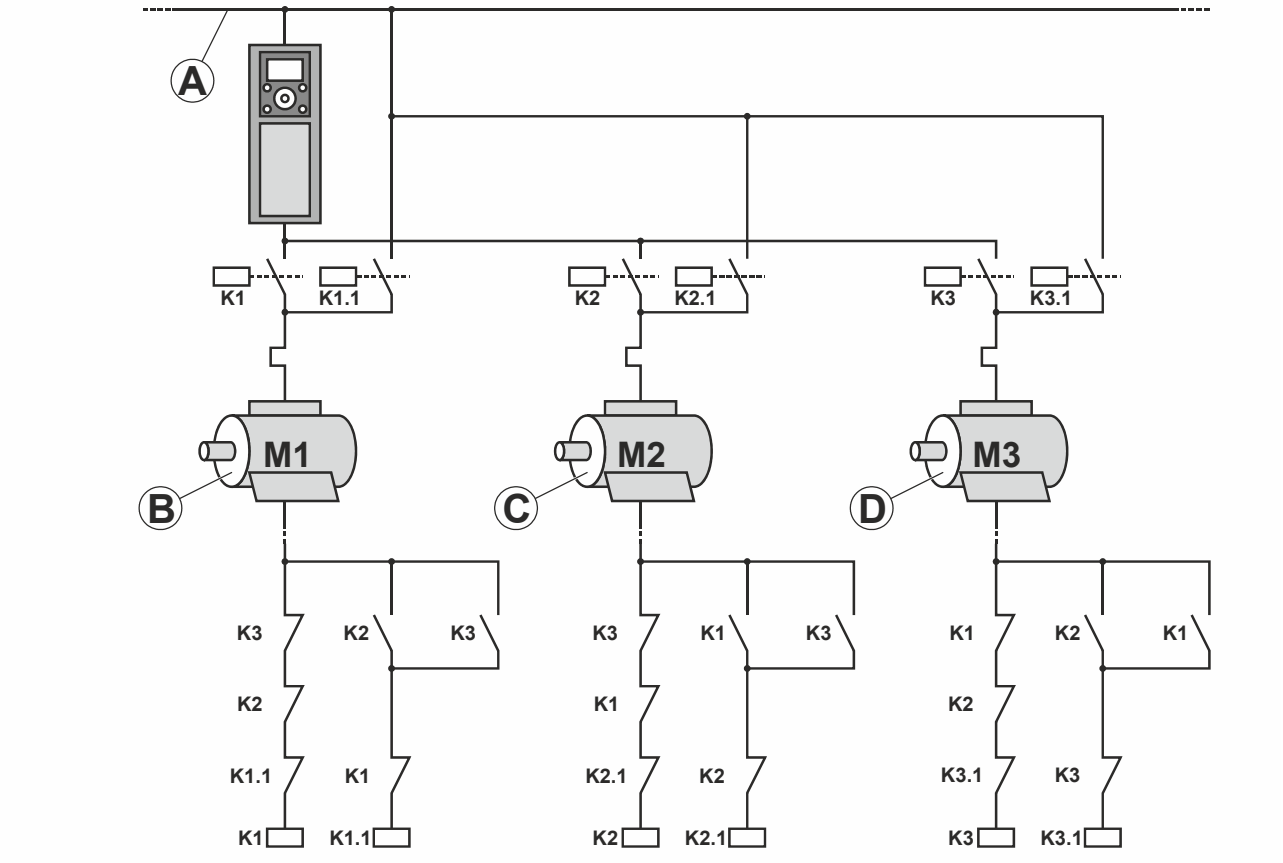


Fig. 49. Selection 1

Legend

A.	Mains.	**C.**	Motor 2 control from relay.
B.	Motor 1 control from relay.	**D.**	Motor 3 control from relay.

P3.15.4 AUTOCHANGE (ID 1027)

You can use this parameter to enable or disable the rotation of the start sequence and the priority of motors.

P3.15.4 AUTOCHANGE (ID 1027)

Selection number	Selection name	Description
0	Disabled	In normal operation, the sequence of the motors is always 1, 2, 3, 4, 5. The sequence can change during the operation if you add or remove interlocks. After the drive stops, the sequence always changes back.
1	Enabled	The system changes the sequence at intervals to wear the motors equally. You can adjust the intervals of the autochange.

To adjust the intervals of the autochange, use P3.15.5 Autochange Interval. You can set the maximum number of motors that can operate with parameter Autochange: Motor Limit (P3.15.7). You can also set the maximum frequency of the regulating motor (Autochange: Frequency Limit P3.15.6).

When the process is in the limits that are set with parameters P3.15.6 and P3.15.7, the autochange occurs. If the process is not in these limits, the system will wait until the process is in the limits, and do the autochange after that. This prevents sudden pressure drops during the autochange when a high capacity at a pump station is necessary.

EXAMPLE

After an autochange, the first motor is put last. The other motors move up one position.

The start sequence of the motors: 1, 2, 3, 4, 5

--> Autochange -->

The start sequence of the motors: 2, 3, 4, 5, 1

--> Autochange -->

The start sequence of the motors: 3, 4, 5, 1, 2

P3.15.5 AUTOCHANGE INTERVAL (ID 1029)

You can use this parameter to adjust the autochange intervals.

This parameter defines how often to rotate the starting order of the motors/pumps. The autochange is done when the number of running motors is below the autochange motor limit and the frequency is below the autochange freq limit.

When the autochange interval has elapsed, the autochange occurs if the capacity is below the level set with P3.15.6. and P3.15.7.

P3.15.6 AUTOCHANGE: FREQUENCY LIMIT (ID 1031)

You can use this parameter to set the autochange frequency limit.

An autochange is done when the autochange interval has elapsed, the number of running motors is less than autochange motor limit and the controlling drive is running below autochange frequency limit.

P3.15.7 AUTOCHANGE: MOTOR LIMIT (ID 1030)

You can use this parameter to set the number of pumps used in Pump and Fan Cascade function.

An autochange is done when the autochange interval has elapsed, the number of running motors is less than autochange motor limit and the controlling drive is running below autochange frequency limit.

P3.15.8 BANDWIDTH (ID 1097)

You can use this parameter to set the bandwidth area around the PID setpoint for starting and stopping of the auxiliary motors.

When the PID feedback value stays in the bandwidth area, the auxiliary motors do not start or stop. The value of this parameter is given as a percentage of the setpoint.

P3.15.9 BANDWIDTH DELAY (ID 1098)

You can use this parameter to set the duration before the auxiliary motors start or stop.

When the PID feedback is not in the bandwidth area, the time that is set with this parameter must go before the auxiliary motors start or stop. The number of pumps that operate increases or decreases, if the PID controller cannot keep the process value (feedback) in the specified bandwidth around the setpoint.

The bandwidth area is specified as a percentage of the PID setpoint. When the PID feedback value stays in the bandwidth area, it is not necessary to increase or decrease the number of pumps that operate.

When the feedback value goes out of the bandwidth area, the quantity of time specified by parameter P3.15.8 must go before the number of pumps that operate increases or decreases. More pumps must be available.

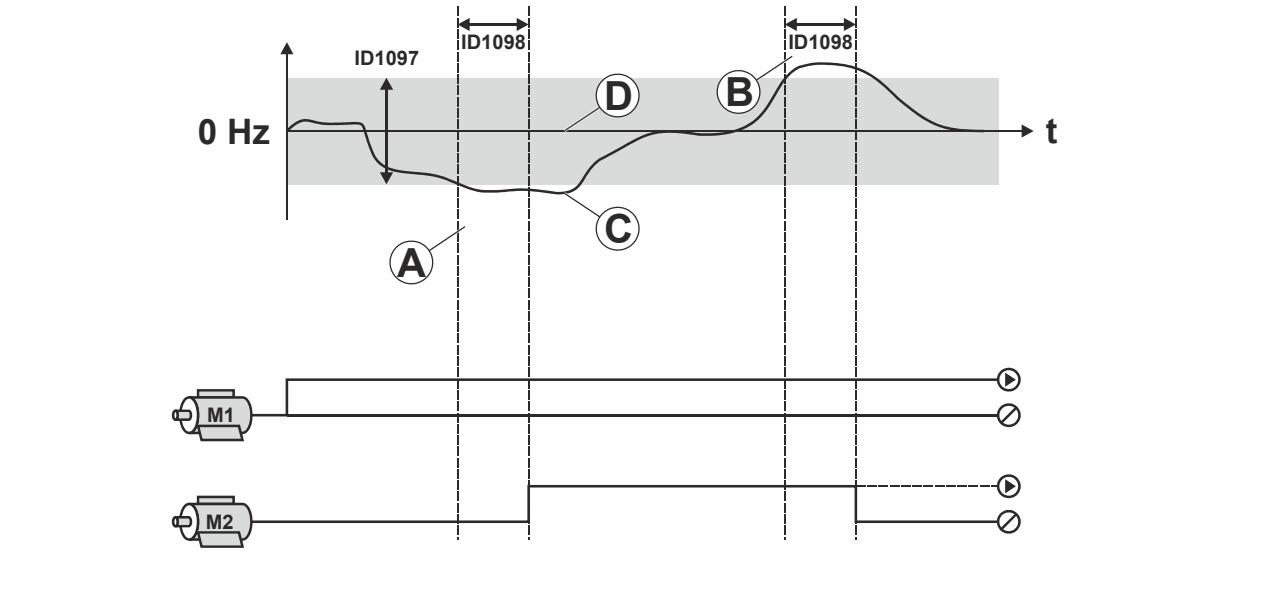


Fig. 50. The start or stop of the auxiliary pumps (P3.15.8 = Bandwidth, P3.14.9 = Bandwidth delay)

Legend

A.	The pump that controls the system operates at a frequency that is near the maximum (-2Hz). This increases the number of pumps that operate.	**C.**	The number pumps that operate increases or decreases, if the PID controller cannot keep the process value feedback in the specified bandwidth around the setpoint.
B.	The pump that controls the system operates at a frequency that is near the minimum (+2Hz). This decreases the number of pumps that operate.	**D.**	The specified bandwidth around the setpoint.

10.16 Maintenance Counters

A maintenance counter tells you that maintenance must be done. For example, it is necessary to replace a belt or to replace the oil in a gearbox. There are two different modes for the maintenance counters, hours or revolutions*1000. The value of the counters increases only during the RUN status of the drive.

WARNING!

Do not perform maintenance if you are not authorized. Only authorized electricians are allowed to perform maintenance. There is a risk of injury.

NOTE: The revolutions mode uses motor speed, which is only an estimate. The drive measures the speed every second.

When the value of a counter is more than its limit, an alarm or a fault shows. You can connect the alarm and fault signals to a digital output or a relay output.

When the maintenance is completed, reset the counter with a digital input or parameter P3.16.4 Counter 1 Reset.

NOTE: Only Counter 1 parameters are listed below. In addition, there are similar Counter 2 and Counter 3 parameters. See 5.16 Group 3.16: Maintenance Counters for a complete list.

P3.16.1 COUNTER 1 MODE (ID 1104)

You can use this parameter to enable the maintenance counter.

A maintenance counter tells you that the maintenance must be done when the counter value goes above the set limit.

P3.16.2 COUNTER 1 ALARM LIMIT (ID 1105)

You can use this parameter to set the alarm limit for the maintenance counter.

When the value of the counter goes above this limit, a maintenance alarm occurs.

P3.16.3 COUNTER 1 FAULT LIMIT (ID 1106)

You can use this parameter to set the fault limit for the maintenance counter.

When the value of the counter goes above this limit, a maintenance fault occurs.

P3.16.4 COUNTER 1 RESET (ID 1107)

You can use this parameter to reset the maintenance counter.

10.17 Fire Mode

When Fire mode is active, the drive resets all faults that occur and continues to operate at the same speed until it is not possible. The drive ignores all commands from the keypad, fieldbuses, and the PC tool.

The Fire mode function has 2 modes, the Test mode and the Enabled mode. To make a selection of a mode, write a password in parameter P3.17.1 (Fire Mode Password). In the Test mode, the drive does not automatically reset the faults, and the drive stops when a fault occurs.

NOTE: This input is normally closed.

When you activate the Fire mode function, an alarm shows on the display.

CAUTION!

The warranty is void if the Fire mode function is activated! You can use Test mode to test the Fire mode function and the warranty will remain valid.

P3.17.1 FIRE MODE PASSWORD (ID 1599)

You can use this parameter to enable the Fire Mode function.

NOTE: All other Fire Mode parameters will be locked when the Fire Mode is enabled and correct password is set in this parameter.

P3.17.1 FIRE MODE PASSWORD (ID 1599)

Selection number	Selection name	Description
1001	Enabled	The drive resets all the faults and continues to operate at the same speed until it is not possible.
1234	Test mode	The drive does not automatically reset the faults, and the drive stops when a fault occurs.

P3.17.2 FIRE MODE ACTIVATION ON OPEN (ID 1596)

You can use this parameter to select the digital input signal that activates the Fire Mode function.

If this digital input signal is activated, an alarm shows on the display, and the warranty becomes void. The type of this digital input signal is NC (normally closed).

It is possible to try the Fire mode with the password that activates the Test mode. Then the warranty stays valid.

NOTE: If Fire mode is enabled, and you give the correct password to the parameter Fire Mode Password, all the Fire mode parameters become locked. To change the Fire mode parameters, first change the value of P3.17.1 Fire Mode Password to *0*.

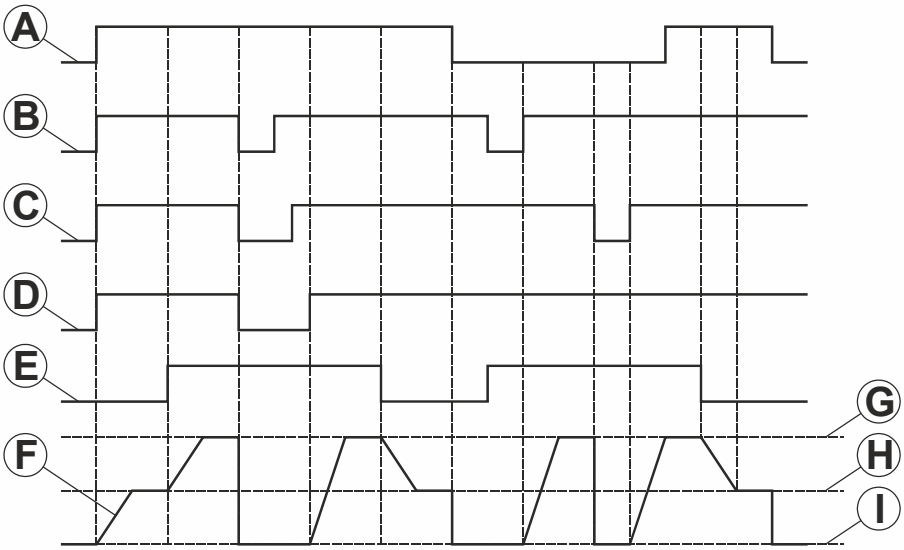


Fig. 51. The Fire mode function

Legend

A.	Normal start.	**F.**	Motor speed.
B.	Run enable.	**G.**	Fire Mode speed.
C.	Run Interlock 1.	**H.**	Normal speed.
D.	Run Interlock 2.	**I.**	Stopped.
E.	Fire Mode activation (contact CLOSED).		

P3.17.3 FIRE MODE ACTIVATION ON CLOSE (ID 1619)

You can use this parameter to select the digital input signal that activates the Fire Mode function.

This digital input signal is of the type N.O. (normally open).

P3.17.4 FIRE MODE FREQUENCY (ID 1598)

You can use this parameter to set the frequency that is used when Fire mode is active.

The drive uses this frequency when the value of parameter P3.17.5 Fire Mode Frequency Source is *Fire Mode Frequency*.

P3.17.5 FIRE MODE FREQUENCY SOURCE (ID 1617)

You can use this parameter to select the frequency reference source when the Fire mode is active.

This parameter enables the selection of, e.g., the AI1 or the PID controller as the reference source when you operate the Fire mode.

P3.17.6 FIRE MODE REVERSE (ID 1618)

You can use this parameter to select the digital input signal that gives a command for reverse rotation direction during the Fire Mode.

During normal operation, this parameter has no effect.

If it is necessary for the motor to operate always FORWARD or always REVERSE in Fire Mode, make a selection of the correct digital input.

DigIn Slot0.1 = always FORWARD

DigIn Slot0.2 = always REVERSE

P3.17.7 FIRE MODE PRESET FREQUENCY 1 (ID 15535)

You can use this parameter to set the preset frequency for Fire Mode.

V3.17.10 FIRE MODE STATUS (ID 1597)

This monitoring value shows the status of the Fire mode function.

V3.17.11 FIRE MODE COUNTER (ID 1679)

This monitoring value shows the number of the fire mode activations.

NOTE: You cannot reset the counter.

P3.17.12 FIRE MODE RUN INDICATION CURRENT (ID 15580)

You can use this parameter to set the current limit for digital output run indication signal.

This parameter has only effect if ’Run indication’ is selected as the option for a relay output and the Fire mode is active. The ‘Run indication’ relay output functionality tells quickly if current is supplied to the motor during a fire.

The value of this parameter is the percentage counted from the motor nominal current. If there is a fire and the current that is supplied to the motor is more than the nominal current times the value of this parameter, the relay output closes.

For example, if the Motor nominal current is 5 A, and you set the default value 20 % for this parameter, the relay output closes and Fire Mode activates when the output current goes to 1 A.

NOTE: This parameter does not have an effect if the Fire mode is not active. In normal operation, if you select ’Run indication’ as the option for a relay output, the result is the same as when ‘Run’ is selected for the relay output.

10.18 kWh Pulse Output

P3.18.1 KWH PULSE LENGTH (ID 15534)

You can use this parameter to set the length of kWh pulse in milliseconds.

P3.18.2 KWH PULSE RESOLUTION (ID 15533)

You can use this parameter to set the kWh interval between triggering of pulses.

11 FAULT TRACING

When the control diagnostics of the HVAC drive find an unusual condition in the operation of the drive, the drive shows a notification about it. You can see the notification on the display of the control panel. The display shows the code, the name and a short description of the fault or alarm.

The source info tells you the source of the fault, what caused it, where it occurred, and other data.

There are three different types of notification.

- An info does not have an effect the operation of the drive. You must reset the info.
- An alarm informs you of unusual operation on the drive. It does not stop the drive. You must reset the alarm.
- A fault stops the drive. You must reset the drive and find a solution to the problem.

You can program different responses for some faults in the application. See more in 5.9 Group 3.9: Protections.

Reset the fault with the Reset button on the keypad, or through the I/O terminal, fieldbus or the PC tool. The faults stay in the Fault history where you can go and examine them. See the different fault codes in 11.3 Fault Codes.

Before you contact the distributor or the factory because of unusual operation, prepare some data. Write down all the texts on the display, the fault code, the fault ID, the source info, the Active Faults list and the Fault History.

11.1 A Fault Comes into View

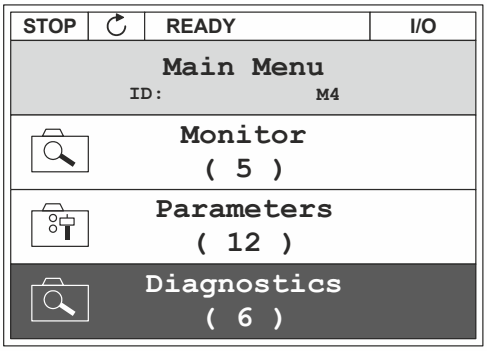
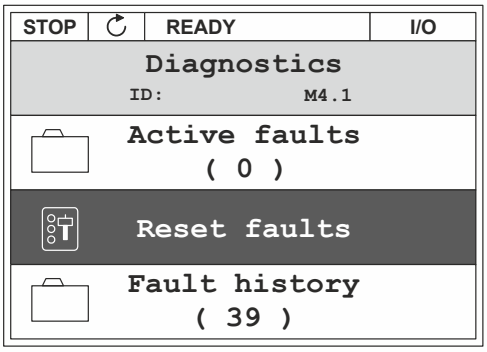
When the drive shows a fault and stops, examine the cause of fault, and reset the fault.

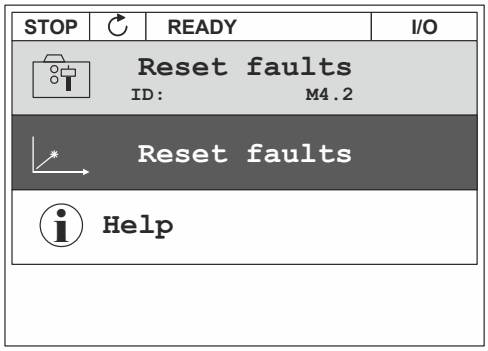
There are two procedures to reset a fault: with the Reset button and with a parameter.

RESETTING WITH THE RESET BUTTON

1. Push the Reset button on the keypad for 2 seconds.

RESETTING WITH A PARAMETER WITH THE HMI

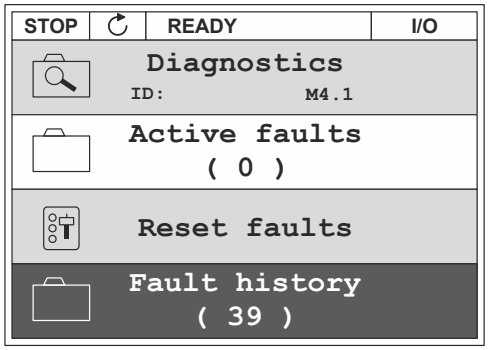
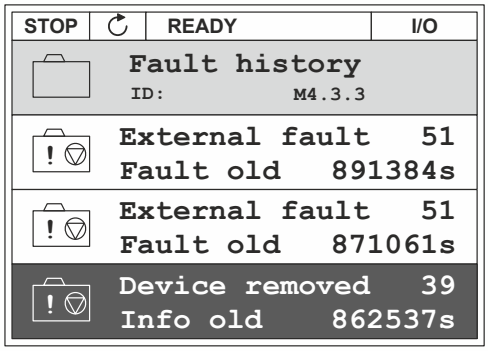
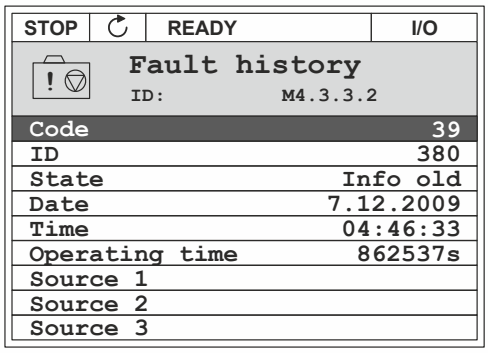
1. Go to the *Diagnostics* Menu.	
2. Go to the submenu *Reset faults*.	

3. Reset faults.	

11.2 Fault History

In the Fault history, you can find more data on the faults. There is a maximum number of 40 faults in the Fault history.

EXAMINING THE FAULT HISTORY USING THE HMI

1. To see more data on a fault, go to *Fault history*.	
2. To examine the data of a fault, push the RIGHT Arrow button.	
3. You see the data in a list.	

11.3 Fault Codes

Table 70. Fault codes

Fault code	Fault ID	Fault name	Possible cause	Remedy
1	1	Overcurrent (hardware fault)	Its cause can be one of these. • a sudden heavy load increase; • a short circuit in the motor cables; • the motor is not the correct type.	Check the loading. Check the motor. Check the cables and connections. Check the ramp times.
	2	Overcurrent (software fault)		
2	10	Overvoltage (hardware fault)	The DC-link voltage is higher than the limits. • too short a deceleration time; • high overvoltage spikes in the supply; • Start/Stop sequence too fast.	Set the deceleration time longer. Activate the overvoltage controller. Check the input voltage.
	11	Overvoltage (software fault)		
3	20	Earth fault (hardware fault)	The measurement of current tells that the sum of the motor phase current is not zero. • an insulation malfunction in the cables or the motor.	Check the motor cables and the motor.
	21	Earth fault (software fault)		
5	40	Charging switch	The charging switch is open, when the *Start* command is given. • operation malfunction; • defective component.	Reset the fault and restart the drive. If the fault occurs again, ask instructions from the distributor near to you.
7	60	Saturation	Defective component	This fault cannot be reset from the control panel. Switch off the power. DO NOT RESTART THE DRIVE or CONNECT THE POWER! Ask instructions from the factory. If this fault shows together with F1, check the motor cables and motor.

continued: Fault codes

Fault code	Fault ID	Fault name	Possible cause	Remedy
8	600	System fault	There is no communication between the control board and the power.	Reset the fault and restart the drive. If the fault occurs again, ask instructions from the distributor
	601		Communication between the near to you. control board and the power unit has interference but is still working (ALARM).	
	602		Watchdog has reset the CPU.	
	603		The voltage of auxiliary power in the power unit is too low.	
	604		Output phase voltage does not agree to the reference.	
	605		Fault in CPLD, but there is no detailed information about the fault.	
	606		The software of the control unit is not compatible with the software of the power unit.	Download the latest software from Honeywell site http://hwll.co/inverter . Update the drive with it. If the fault occurs again, ask instructions from the distributor near to you.
	607		The software version cannot be read. There is no software in the power unit.	Update the power unit software. If the fault occurs again, ask instructions from the distributor near to you.
	608		A CPU overload. A part of the software (for example application) has caused an overload situation.	Reset the fault and restart. If the fault occurs again, ask instructions from the distributor near to you.
	609		Access to the memory is failed. For example, the retain variables could not be restored.	
	610		Necessary device properties cannot be read.	

continued: Fault codes

Fault code	Fault ID	Fault name	Possible cause	Remedy
8	647	System fault	Software error.	Download the latest software from the Honeywell site http://hwll.co/inverter . Update the drive with it. If the fault occurs again, ask instructions from the distributor near to you.
	648		Invalid function block is used in the application. The system software is not compatible with the application.	
	649		A resource overload. A parameter loading, restoring or saving malfunction.	
9	80	Undervoltage (fault)	The DC-link voltage is lower than the limits. • too low a supply voltage; • HVAC drive internal fault; • a defective input fuse; • the external charge switch is not closed. **NOTE:** This fault becomes active only if the drive is in Run state.	If there is a temporary supply voltage break, reset the fault and restart the drive. Check the supply voltage. If the supply voltage is sufficient, there is an internal fault. Ask instructions from the distributor near to you.
	81	Undervoltage (alarm)		
10	91	Input phase	The input line phase is missing.	Check the supply voltage, the fuses, and supply cable.
11	100	Output phase supervision	The measurement of current indicates that there is no current in 1 motor phase.	Check the motor cable and the motor.
12	110	Brake chopper supervision (hardware fault)	There is no brake resistor installed. The brake resistor is broken. Brake chopper failure.	Check the cabling of the brake resistor. If it is OK, the chopper is faulty. In this case, refer to your local distributor.
	111	Brake chopper saturation alarm		
13	120	Drive undertemperature (fault)	Too low a temperature in the heatsink of the power unit or in the power board. The heatsink temperature is under -10 °C.	
	121	Drive undertemperature (alarm)		

continued: Fault codes

Fault code	Fault ID	Fault name	Possible cause	Remedy
14	130	drive overtemperature (fault, heatsink)	Too high a temperature in the heatsink of the power unit or in the power board. The heatsink temperature is over 100 °C.	Check the actual quantity and flow of cooling air. Examine the heatsink for dust. Check the ambient temperature. Make sure that the switching frequency is not too high in relation to the ambient temperature and the motor load.
	131	drive overtemperature (alarm, heatsink)		
	132	drive overtemperature (fault, board)		
	133	drive overtemperature (alarm, board)		
15	140	Motor stalled	The motor stalled.	Check the motor and the load.
16	150	Motor overtemperature	There is too heavy a load on the motor.	Decrease the motor load. If there is no motor overload, check the temperature model parameters.
17	160	Motor underload	There is not a sufficient load on the motor.	Check the load.
19	180	Power overload (short-time supervision)	The power of the drive is too high.	Decrease the load.
	181	Power overload (longtime supervision)		
25		Motor control fault	A malfunction in the start angle identification. A generic motor control fault	
32	312	Fan cooling	The fan life time is complete.	Replace the fan and reset the life time counter of the fan.
33		Fire mode enabled	The Fire mode of the drive is enabled. The protections of the drive are not used.	
37	360	Device changed (same type)	The option board was replaced by a new one that you have used before in the same slot. The parameters are available in the drive.	The device is ready for use. The drive starts to use the old parameter settings.
38	370	Device added (same type)	The option board was added. You have used the same option board before in the same slot. The parameters are available in the drive.	The device is ready for use. The drive starts to use the old parameter settings.

continued: Fault codes

Fault code	Fault ID	Fault name	Possible cause	Remedy
39	380	Device removed	An option board was removed from the slot.	The device is not available. Reset the fault.
40	390	Device unknown	An unknown device was connected (the power unit / option board).	The device is not available.
41	400	IGBT temperature	The calculated IGBT temperature (unit temperature + I2T) is too high.	Check the loading. Check the motor size.
44	430	Device changed (different type)	The option board was replaced by a new one that you have not used before in the same slot. No parameter settings are saved.	Set the power unit parameters again.
45	440	Device added (different type)	There is a new option board of a different type. No parameters are available in the settings.	Set the power unit parameters again.
50	1050	AI low fault	One or more of the available analog input signals is below 50% of the minimum signal range. A control cable is defective or loose. A malfunction in a signal source.	Replace the defective parts. Check the analog input circuit. Make sure that parameter AI1 Signal Range is set correctly.
51	1051	External fault	The digital input signal that is set with parameter P3.5.1.7 or P3.5.1.8 was activated.	Check the input signal.
52	1052	Keypad communication fault	The connection between the control panel and the drive is defective.	Check the control panel connection and the control panel cable.
	1352			
53	1053	Fieldbus communication fault	The data connection between the fieldbus master and the fieldbus board is defective.	Check the installation and fieldbus master.
54	1354	Slot A fault	Fault A defective option board or slot.	Check the board and the slot.
	1454	Slot B fault		
	1554	Slot C fault		
	1654	Slot D fault		
	1754	Slot E fault		

continued: Fault codes

Fault code	Fault ID	Fault name	Possible cause	Remedy
65	1065	PC communication fault	The data connection between the PC and the drive is defective.	
66	1066	Thermistor fault	The motor temperature is too high.	Check the motor cooling and the load. Check the thermistor connection. If the thermistor input is not used, you have to short-circuit it.
68	1301	Maintenance counter 1 alarm	Maintenance counter has reached the alarm limit.	Carry out the needed maintenance and reset the counter.
	1302	Maintenance counter 1 fault	Maintenance counter has reached the fault limit.	
	1303	Maintenance counter 2 alarm	Maintenance counter has reached the alarm limit.	
	1304	Maintenance counter 2 fault	Maintenance counter has reached the fault limit.	
	1305	Maintenance counter 3 alarm	Maintenance counter has reached the alarm limit.	
	1306	Maintenance counter 3 fault	Maintenance counter has reached the fault limit.	
69	1310	Fieldbus mapping error	The ID number that is used to map the values to Fieldbus Process Data Out is not valid.	Check the parameters in the Fieldbus Data Mapping menu
	1311		It is not possible to convert one or more values for Fieldbus Process Data Out.	The type of the value is undefined. Check the parameters in the Fieldbus Data Mapping menu.
	1312		There is an overflow when the values for Fieldbus Process Data Out (16-bit) are mapped and converted.	
101	1101	Process supervision fault (PID1)	The PID controller: The feedback value is not in the supervision limits and the delay, if you set the delay.	
105	1105	Process supervision fault (PID2)	The PID controller: The feedback value is not in the supervision limits and the delay, if you set the delay.	
110	1110	Speed lowered	The drive lowers the current limit to protect itself from overheating. This decreases also the output frequency.	

Honeywell

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